Booklet Series

A

Booklet No.

782257

AEUD

QUESTION BOOKLET

MECHANICAL ENGINEERING

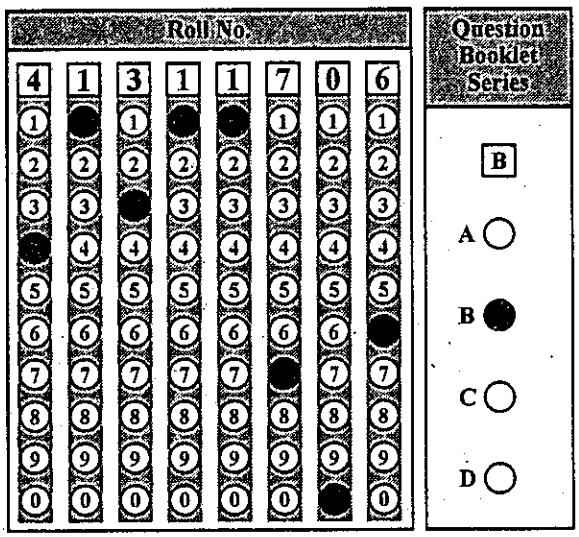
PAPER - I (04)

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

INSTRUCTIONS FOR CANDIDATES

1. Please do not open this Question Booklet until you are told to do so.
2. Candidate must fill up the necessary informations in the space provided on the OMR answer sheet before commencement of the examination.
3. Answer sheet will be processed by electronic device. Invalidation of answer sheet due to incomplete / incorrect filling of relevant circle of Roll No. and Question Booklet Series in the OMR answer sheet shall result in cancellation of candidature. Any deficiency in filling up OMR answer sheet will be the sole responsibility of the candidate.
4. An example is given below how to fill / mark (darken) Roll No. 41311706 and Question Booklet Series - B. Accordingly, you have to fill / mark (darken) the Roll No. and Question Booklet Series given to you in your OMR answer sheet.

EXAMPLE



5. For marking the correct answer, darken one circle by **BLUE BALLPOINT PEN** only.
6. Please do not mark (darken) more than one circle. Darkening more than one circle against an answer will be treated as wrong answer.
7. Do not detach any leaf from this Question Booklet. After the examination, hand over the OMR answer sheet to the Room Invigilator. You are allowed to take the Question Booklet and carbon copy of the OMR answer sheet after examination is over.
8. Each question carries 2 marks. There is no negative marking for any wrong answer.
9. Possession and use of Calculator, Mobile Phone, Pager or any other electronic gadget is strictly prohibited in the Examination Hall.
10. Please abide by the instructions above and those given on the OMR answer sheet, failure to comply these instructions will be sole responsibility of the candidates.

1. In reciprocating air compressor the method of controlling the quantity of air delivered is done by
   (A) Throttle control
   (B) Blow-off control
   (C) Clearance control
   (D) All of the above

2. Heat transfer takes place according to the following law of thermodynamics
   (A) Zeroth
   (B) First
   (C) Second
   (D) Third

3. Heat transfer in liquid and gases is essentially due to
   (A) Conduction
   (B) Convection
   (C) Radiation
   (D) Conduction and Radiation

4. Which mode(s) of heat transfer does (do) not need a material medium ?
   (A) Conduction
   (B) Convection
   (C) Radiation
   (D) Convection and Radiation

5. As the temperature increases, the thermal conductivity of a gas
   (A) increases
   (B) decreases
   (C) remains constant
   (D) increase upto a certain temperature and then decrease

6. Heat conduction in gases is due to
   (A) motion of electrons
   (B) elastic impact of molecules
   (C) mixing motion of the different layers of the gas
   (D) electromagnetic waves

7. Indicate the metal with highest thermal conductivity
   (A) Steel
   (B) Silver
   (C) Copper
   (D) Aluminium

8. Identify the very good insulator
   (A) Saw dust
   (B) Glass wool
   (C) Cork
   (D) Asbestos sheet

9. The unit of thermal diffusivity is
   (A) $m^2/hr\ °C$
   (B) $kcal/m^2\text{-}hr$
   (C) $m/hr\ °C$
   (D) m^2/hr

10. Critical thickness of insulation for spheres is given by
   (A) K/h
   (B) $K/4\pi h$
   (C) h/2K
   (D) 2K/h

11. Fins are provided on heat transforming surface in order to increase
(A) heat transfer area
(B) heat transfer coefficient
(C) temperature gradient
(D) mechanical strength of equipment

12. Finned surfaces have improved rate of heat dissipation due to
(A) decrease in ambient temperature.
(B) increase in the surface area exposed to the surrounding.
(C) increase in the corrective film coefficient.
(D) All of the above

13. An increase in fin effectiveness is caused by high value of
(A) convective coefficient
(B) thermal conductivity
(C) circumference
(D) (B) and (C)

14. Transient conduction means
(A) very little heat transfer.
(B) heat transfer for a short time.
(C) heat transfer with a very small temperature difference.
(D) conduction when the temperature at a point varies with time.

15. In the lumped parameter model, the temperature variation with time is
(A) Linear
(B) Cubic
(C) Exponential
(D) Sinusoidal

16. Heat transfer by Radiation is encountered least in
(A) Boiler furnace
(B) Insulated steam pipe
(C) Electric bulb
(D) Nuclear reactor

17. Absorptivity of a body is equal to its emissivity
(A) for a polished body
(B) under thermal equilibrium condition
(C) at one particular temperature
(D) at shorter wavelengths

18. The emissivity is likely to be higher in case of
(A) Rubber
(B) Paper
(C) Carbon
(D) Iron oxide

19. The emissivity and the absorptivity of a real surface are equal for radiation with identical temperature and wavelength. This law is referred as
(A) Lambert's law
(B) Krichoff's law
(C) Planck's law
(D) Wien's displacement law

20. Which parameter should be highest for a radiation shield ?
(A) Absorptivity
(B) Reflectivity
(C) Transmissivity
(D) Emissivity

21. The gray body shape factor for radiant heat exchange between a small body (emissivity 0.4) in a large enclosure (emissivity 0.5) is
(A) 0.1
(B) 0.2
(C) 0.4
(D) 0.5

22. Free convection heat flow depends on all of the following, except :
(A) Density
(B) Coefficient of viscosity
(C) Gravitational force
(D) Velocity

23. The ratio of kinematic viscosity to thermal diffusivity is known as
(A) Prandtl number
(B) Nusselt number
(C) Pedet number
(D) Schmidt number

24. The Prandtl number will be lowest for
(A) Water
(B) Liquid metal
(C) Aqueous solution
(D) Lube oil

25. Dropwise condensation usually occurs on
(A) Glazed surface
(B) Smooth surface
(C) Oily surface
(D) Coated surface

26. In Bell-Colemann refrigerator for the same temperature range
(A) COP of dense air system is higher than COP of open air system.
(B) COP of dense air system is lower than COP of open air system.
(C) COP of dense air system is equal to COP of open air system.
(D) COP of dense air system may be higher or lower than COP of open air system depending upon pressure ratio.

27. Heat is rejected by the refrigerant, during vapour compression refrigeration cycle in
(A) Condenser
(B) Evaporator
(C) Throttle valve
(D) Compressor

28. A domestic refrigerator capacity may be approximately
(A) 1 ton
(B) 0.1 ton
(C) 1.5 ton
(D) 10 ton

29. In a domestic vapour compression refrigerator the refrigerant used is
(A) CO_2
(B) Freon-12
(C) Ammonia
(D) All of the above

30. In vapour compression refrigeration system, if expansion cylinder is used in place of throttle valve, the COP will
(A) increase
(B) decrease
(C) will remain same
(D) not be predictable unless refrigerant used is known

31. If a hydraulic press has a ram of 12.5 cm diameter and plunger of 1.25 cm diameter, what force would be required on the plunger to raise a mass of 1 tonne on the ram ?
(A) 981 N
(B) 98.1 N
(C) 9.81 N
(D) 0.98 N

32. A liquid mass readjusts itself and undergoes a rigid body type of motion when it is subjected to a
(A) constant angular velocity
(B) constant angular acceleration
(C) linearly varying velocity
(D) linearly varying acceleration

33. The thickness of laminar boundary layer at a distance 'X' from the leading edge over a flat plate varies as
(A) X
(B) $X^{1/2}$
(C) $X^{1/5}$
(D) $X^{4/5}$

34. If the diameter of a capillary tube is doubled, the capillary rise will become
(A) $\sqrt{2}$ times less
(B) double
(C) half
(D) $\sqrt{2}$ times more

35. A metallic piece weighs 80 N in air and 60 N in water. The relative density of the metallic piece is about
(A) 8
(B) 6
(C) 4
(D) 2

36. Flow separation is caused by
(A) thinning of boundary layer thickness to zero.
(B) a negative pressure gradient.
(C) a positive pressure gradient.
(D) reduction of pressure to local vapour pressure.

37. The magnus effect is defined as
(A) The generation of lift per unit drag force.
(B) The circulation induced in an aircraft wing.
(C) The separation of boundary layer near the trailing edge of a slender body.
(D) The generation of lift on a rotating cylinder in a uniform flow.

38. The drag coefficient for laminar flow varies with Reynolds Number (Re) as
(A) $Re^{1/2}$
(B) Re
(C) Re^{-1}
(D) $Re^{-1/2}$

39. The square root of the ratio of inertia force to gravity force is called
(A) Reynold's number
(B) Froude number
(C) Mach number
(D) Euler number

40. The Bernoulli's equation refers to conservation of
(A) Mass
(B) Linear momentum
(C) Angular momentum
(D) Energy

41. Velocity distribution in a turbulent boundary layer follows :
(A) Logarithmic law
(B) Parabolic law
(C) Linear law
(D) Cubic law

42. Flow separation is likely to take place when the pressure gradient in the direction of flow is
(A) Zero
(B) Adverse
(C) Slightly favourable
(D) Strongly favourable

43. In a rotameter as the flow rate increases, the float
(A) rotates at higher speed
(B) rotates at lower speed
(C) rises in the tube
(D) drops in the tube

44. A nozzle has velocity head at outlet of 10 m. If it is kept vertical the height reached by the stream is
(A) 100 m
(B) 10 m
(C) $\sqrt{10}$ m
(D) $\frac{1}{\sqrt{10}}$ m

45. Laminar sub-layer may develop during flow over a flat plate. It exists in
(A) Laminar zone
(B) Transition zone
(C) Turbulent zone
(D) Laminar & Transition zone

46. In rough turbulent-flow in a pipe, the friction factor would depend upon
(A) Velocity of flow
(B) Pipe diameter
(C) Type of fluid flowing
(D) Pipe condition and pipe diameter

47. The differential manometer connected to pitot static tube used for measuring fluid velocity gives
(A) static pressure
(B) total pressure
(C) dynamic pressure
(D) difference between total pressure & dynamic pressure

48. Shear stress in a turbulent flow is due to
(A) the viscous property of the fluid
(B) the fluid density.
(C) fluctuation of velocity in the direction of flow.
(D) fluctuation of velocity in the direction of flow as well as transverse to it.

49. Surface tension is due to
(A) Viscous forces
(B) Cohesion
(C) Adhesion
(D) The difference between adhesive and cohesive forces

50. Newton's law of viscosity depends upon the
(A) stress and strain in a fluid
(B) shear stress, pressure and velocity
(C) shear stress and rate of strain
(D) viscosity and shear stress

51. Which phenomenon will occur when the valve at the discharge end of a pipe connected to a reservoir is suddenly closed ?
(A) Cavitation
(B) Erosion
(C) Hammering
(D) Surging

52. Which one of the dimensionless number identifies the compressibility effect of a fluid ?
(A) Euler number
(B) Froude number
(C) Mach number
(D) Weber number

53. In the boundary layer, the flow is
(A) viscous and rotational
(B) inviscid and irrotational
(C) inviscid and rotational
(D) viscous and irrotational

54. The head loss in turbulent flow in pipes varies
(A) Directly as the velocity.
(B) Inversely as the square of the velocity.
(C) Inversely as the square of the diameter.
(D) Approximately as the square of the velocity.

55. Resultant pressure of the liquid in case of an immersed body acts through which one of the following ?
(A) Centre of gravity
(B) Centre of pressure
(C) Metacentre
(D) Centre of buoyancy

56. A Pelton wheel is an
(A) axial flow impulse turbine
(B) inward flow impulse turbine
(C) outward flow impulse turbine
(D) All of these

57. An impulse turbine is used for
(A) low head of water
(B) medium head of water
(C) high head of water
(D) Any one of these

58. A double overhung Pelton wheel has
(A) two jets
(B) two runners
(C) Four jets
(D) Four runners

59. In an inward flow reaction turbine, the water
(A) Flows parallel to the axis of the wheel.
(B) Flows at right angles to the wheel.
(C) Enters at the centre of the wheel and then flows towards the outer periphery of the wheel.
(D) Enters the wheel at the outer periphery of the wheel and then flows towards the centre of the wheel.

60. In a Francis turbine, runner, the number of blades are generally
(A) 2 to 4
(B) 4 to 8
(C) 8 to 16
(D) 16 to 24

61. The power produced by a reaction turbine is
(A) directly proportional to H
(B) inversely proportional to H
(C) directly proportional to $\sqrt{H}$
(D) inversely proportional to $\sqrt{H}$

62. Cornish boiler is
(A) Fire tube boiler
(B) High pressure boiler
(C) Water tube boiler
(D) Locomotive boiler

63. Lancashire boiler is
(A) Water tube boiler
(B) Fire tube boiler
(C) High pressure boiler
(D) Locomotive boiler

64. In locomotive boiler, the maximum pressure is of the order of
(A) 5 kgf/cm^2
(B) 10 kgf/cm^2
(C) 20 kgf/cm^2
(D) 100 kgf/cm^2

65. Which of the following as referred to steam boiler are defined as mountings ?
(A) Superheater
(B) Economiser
(C) Preheater
(D) Fusible plug

66. De Laval turbine is
(A) simple single wheel impulse turbine
(B) simple single wheel reaction turbine
(C) velocity compounded impulse turbine.
(D) pressure compounded impulse turbine.

67. The pressure on the two sides of the moving blades of a reaction steam turbine is
(A) same
(B) higher at inlet
(C) lower at inlet
(D) may be higher or lower depending on quality of entry steam

68. For Parson's reaction steam turbine, degree of reaction is
(A) 60%
(B) 50%
(C) 100%
(D) 75%

69. Reheat factor in steam turbines depends on
(A) Stage efficiency only
(B) Initial pressure and temperature only
(C) Exit pressure only
(D) All of the above

70. The value of reheat factor normally varies form
(A) 1.2 to 1.6
(B) 1.02 to 1.06
(C) 0.9 to 0.95
(D) 0.5 to 0.6

71. The clearance volume of a reciprocating compressor directly affects
(A) Piston speed
(B) Noise level
(C) Volumetric efficiency
(D) Temperature of air after compression

72. In a parallel flow gas turbine recuperator, the maximum effectiveness is
(A) 100%
(B) 75%
(C) 50%
(D) between 25% & 45%

73. In aircraft gas turbines, the axial flow compressor is preferred because
(A) of high pressure rise
(B) it is stall free
(C) of low frontal area
(D) of higher thrust

74. For a multistage compressor, the polytropic efficiency is
(A) the efficiency of all stages combined together.
(B) the efficiency of one stage.
(C) constant throughout for all the stages.
(D) a direct consequence of the pressure ratio.

75. In turbo machine used to circulate refrigerant in large refrigeration plant is
(A) a centrifugal compressor
(B) a radial turbine
(C) an axial compressor
(D) an axial turbine

76. A gas turbine works on which one of the following cycles :
(A) Brayton
(B) Rankine
(C) Stirling
(D) Otto

77. Reheating in a gas turbine
(A) increases the compressor work.
(B) decreases the compressor work.
(C) increases the turbine work.
(D) decreases the turbine work.

78. Blade erosion in steam turbines take place
(A) Due to high temperature steam.
(B) Due to droplets in steam.
(C) Due to high rotational speed.
(D) Due to high flow rate.

79. Reciprocating compressors are provided with
(A) Simple disc plate valve
(B) Poppet valve
(C) Spring-loaded disc valve
(D) Solenoid valve

80. A centrifugal compressor is suitable for, which of the following :
(A) high pressure ratio, low mass flow
(B) low pressure ratio, low mass flow
(C) high pressure ratio, high mass flow
(D) low pressure ratio, high mass flow

81. A thermodynamic system refers to
(A) any defined region in space
(B) a specific mass in fluid flow
(C) a specified region of constant volume
(D) a prescribed and identifiable quantity of matter

82. Which of the following represents a closed system ?
(A) Bomb calorimeter
(B) Boiler
(C) Universe
(D) Centrifugal pump

83. Which amongst the following is not a property of the system ?
(A) Heat
(B) Composition
(C) Specific volume
(D) Thermal conductivity

84. For a heat engine operating in Carnot cycle, the work output is $1/4^{th}$ of heat rejected to the sink. The thermal efficiency of the engine would be
(A) 10%
(B) 20%
(C) 30%
(D) 50%

85. A reversible process requires that
(A) there be no heat transfer.
(B) Newton's law of viscosity be satisfied.
(C) temperature of system and surrounding be equal.
(D) there be no viscous or Coulomb friction in the system.

86. Work done in a free expansion process is
(A) zero
(B) minimum
(C) maximum
(D) positive

87. During throttling process
(A) internal energy does not change
(B) pressure does not change
(C) entropy does not change
(D) enthalpy does not change

88. When a gas is to be stored, the type of compression that would be ideal is
(A) Isothermal
(B) Adiabatic
(C) Polytropic
(D) Constant volume

89. The power produced inside the cylinder of an I-C engine is known as
(A) Indicated power
(B) Brake power
(C) Pumping power
(D) Frictional power

90. Pumping power is equal to
(A) Total power produced
(B) Net power produced
(C) (A) + (B)
(D) None of the above

91. The thermal efficiency of a 2 stroke cycle engine as compared to a 4 stroke cycle engine is

(A) more

(B) less

(C) equal

(D) much less

92. The CR for a petrol engine varies from

(A) 6 to 10

(B) 10 to 15

(C) 15 to 25

(D) 25 to 40

93. The stroke volume is 500 cc. The clearance is 50 cc. The compression Ratio is

(A) 10

(B) 11

(C) 9

(D) 15

94. Carburettor is used for

(A) SI engines

(B) Gas engines

(C) C.I. engines

(D) None of the above

95. Normal heptane content in fuel for S.I. engines

(A) retards auto-ignition

(B) accelerates auto-ignition

(C) does not affect auto-ignition

(D) None of the above

96. The knocking in S.I. engines increases with

(A) increase in inlet air temperature

(B) increase in compression ratio

(C) increase in cooling water temperature

(D) All of the above

97. The ignition quality of fuel for S.I. engine is determined by

(A) Cetane number rating

(B) Octane number rating

(C) Calorific value rating

(D) Volatility of the fuel

98. Octane number of the fuel used commercially for diesel engine in India is in the range of

(A) 80 to 90

(B) 60 to 80

(C) 80 to 85

(D) 40 to 45

99. The work input of air compressor is minimum if the compression law followed is

(A) $PV^{1.35} = C$

(B) Isothermal $PV = C$

(C) Isentropic $PV^{V} = C$

(D) $PV^{1.2} = C$

100. For the same overall pressure ratio, the leakage of air past the piston for multistage compression as compared to single stage compression, is

(A) more

(B) less

(C) constant

(D) may be more or less