Engineering Services Examination-2013

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T.B.C. : B-FRF-M-LBA

Test Booklet Series

Serial No.

TEST BOOKLET

MECHANICAL ENGINEERING
Paper I

A

Time Allowed : Two Hours

Maximum Marks : 200

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. PLEASE NOTE THAT IT IS THE CANDIDATE'S RESPONSIBILITY TO ENCODE AND FILL IN THE ROLL NUMBER AND TEST BOOKLET SERIES CODE A, B, C OR D CAREFULLY AND WITHOUT ANY OMISSION OR DISCREPANCY AT THE APPRO-PRIATE PLACES IN THE *OMR* ANSWER SHEET. ANY OMISSION/DISCREPANCY WILL RENDER THE ANSWER SHEET LIABLE FOR REJECTION.

3. You have to enter your Roll Number on the Test Booklet in the Box provided alongside. *DO NOT* write *anything else* on the Test Booklet.

4. This Test Booklet contains **120** items (questions). Each item comprises four responses (answers). You will select the response which you want to mark on the Answer 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. You have to mark your responses *ONLY* on the separate Answer Sheet provided. See directions in the Answer Sheet.

6. All items carry equal marks.

7. Before you proceed to mark in the Answer Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per instructions sent to you with your Admission Certificate.

8. After you have completed filling in all your responses on the Answer Sheet and the examination has concluded, you should hand over to the Invigilator *only the Answer Sheet*. You are permitted to take away with you the Test Booklet.

9. Sheets for rough work are appended in the Test Booklet at the end.

10. **Penalty for wrong answers :**
    THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY A CANDIDATE.
    (i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **one-third (0·33)** of the marks assigned to that question will be deducted as penalty.
    (ii) If a candidate gives more than one answer, it will be treated as **wrong answer** even if one of the given answers happens to be correct and there will be same penalty as above to that question.
    (iii) If a question is left blank i.e., no answer is given by the candidate, there will be **no penalty** for that question.

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1. The value of an extensive property is essentially dependent on

   (a) mass of the system

   (b) interaction of the system with its surroundings

   (c) path followed by the system in going from one state to another

   (d) nature of boundaries, rigid or flexible

2. The expression $\int_1^2 pdv$ gives the measure of work during

   (a) non flow reversible process

   (b) steady flow reversible process

   (c) open system and any process

   (d) any system and any process

3. The displacement work done by a system is given by $\int pdv$. It is valid for

   (a) any process

   (b) a quasi-static process

   (c) an isentropic process

   (d) a non quasi-static process

4. If power developed by a turbine in a certain steam power plant is 1200 kW. Heat supplied to boiler is 3360 kJ/kg. The heat rejected by the system to cooling water is 2520 kJ/kg, and feed pump work required to condensate back into boiler is 6 kW, then the mass rate of flow through the cycle will be

   (a) 1·421 kg/s

   (b) 14·21 kg/s

   (c) 0·1421 kg/s

   (d) 0·01421 kg/s

5. An electric power plant produces 10 MW of power consuming 90×10^6 kJ/hour of fuel energy. The heat rejected by the power plant is

   (a) 5 MW

   (b) 10 MW

   (c) 15 MW

   (d) 20 MW

6. Which thermodynamics law predicts correctly, the degree of completion of chemical reaction ?

   (a) Zeroth law

   (b) First law

   (c) Second law

   (d) Third law

7. In a cyclic heat engine operating between a source temperature of 600°C and sink temperature of 20°C, the least rate of heat rejection per kW net output of engine is

   (a) 0·588 kW

   (b) 0·650 kW

   (c) 0·505 kW

   (d) 0·460 kW

8. A Carnot engine rejects 50% of heat absorbed from a source to a sink at 27°C. What is the source temperature ?

   (a) 54°C

   (b) 150°C

   (c) 327°C

   (d) 600°C

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9. A non flow quasi-static (reversible) process occurs for which

$P = (-3V + 16)$ bar,

where V is volume in m^3. What is work done when V changes from 2 to 6 m^3 ?

(a) 16×10^5 J

(b) 16.5×10^5 J

(c) 16×10^3 J

(d) 16.5×10^2 J

10. A refrigeration unit has a COP of 4 and extracts 10 kJ of heat from the cold reservoir. If this machine works as a heat pump, how much heat will it deliver to the environment ?

(a) 2 kJ

(b) 2.5 kJ

(c) 12.5 kJ

(d) 25 kJ

11. When a hydrocarbon fuel burns in deficit air, Orsat analyzer will show the presence of following gases in the engine exhaust

(a) CO_2, N_2 and O_2

(b) CO, CO_2, N_2 and O_2

(c) CO, CO_2 and N_2

(d) CO_2, CO, N_2, O_2 and H_2O

12. Joule's experiment states that for a cycle

(a) change of pressure is proportional to temperature change

(b) change of volume is proportional to temperature change

(c) change of internal energy is proportional to temperature change

(d) sum of all heat transfers is proportional to sum of all work transfers

13. An insulated container is divided into two compartments A and B by a thin diaphragm. While A contains a mass of gas at pressure P and temperature T, B is evacuated. The diaphragm is punctured and the gas in A rushes into B. The process is called

(a) adiabatic

(b) isentropic

(c) constant internal energy

(d) free expansion

14. A gas is flowing through an insulated nozzle. If the inlet velocity of gas is negligible and there is an enthalpy drop of 45 kJ/kg, the velocity of gas leaving the nozzle is

(a) 100 m/s

(b) 200 m/s

(c) 300 m/s

(d) 350 m/s

15. The entropy of universe tends to

(a) become zero

(b) remain constant

(c) be maximum

(d) attain a certain finite minimum value

16. If the time taken by a system to execute a process through a finite gradient is infinitely large, the process

(a) becomes reversible

(b) is irreversible

(c) becomes isothermal

(d) is adiabatic

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17. Which of the following processes are irreversible ?

   1. Heat transfer through a finite temperature difference

   2. Free expansion

   3. Transfer of electricity through a resistor

  (a) 1, 2 and 3

  (b) 1 and 2 only

  (c) 2 and 3 only

  (d) 1 and 3 only

18. Which of the following processes are thermodynamically irreversible ?

   1. Gradual heating of water from a hot source

   2. Isothermal expansion in a Stirling cycle

   3. Mixing of two ideal gases at constant pressure

  (a) 1, 2 and 3

  (b) 1 and 2 only

  (c) 2 and 3 only

  (d) 1 and 3 only

19. Consider a gas turbine supplied with gas at 1000 K and 5 bar to expand adiabatically to a 1 bar. The mean specific heat at constant pressure is 1·0425 kJ/kgK and constant volume is 0·7662 kJ/kgK. Calculate power developed in kW/kg of gas per second and exhaust gas temperature

  (a) 462 kW/kg and 647 K

  (b) 362 kW/kg and 653 K

  (c) 462 kW/kg and 653 K

  (d) 362 kW/kg and 647 K

20. It is very useful in predicting the properties of gases for which more precise data are not available, but their critical properties are known.

  (a) van der Waals' equation of state

  (b) Breattie-Bridgeman equation of state

  (c) Redlich-Kwong equation of state

  (d) Generalized compressibility chart

21. If a pure substance is below the triple point temperature, the solid on being heated will only

  (a) solidify or freeze

  (b) liquefy

  (c) vaporize or sublimate

  (d) have its temperature increased

22. A 70 kg person walks on snow with a total foot implint area of 500 cm². What pressure does he exert on snow ?

  (a) 0·5 kPa

  (b) 12·5 kPa

  (c) 13·73 kN/m²

  (d) 137·3 kN/m²

23. A reversible engine has ideal thermal efficiency of 30%. When it is used as a refrigerating machine with all conditions unchanged, the coefficient of performance will be

  (a) 3·33

  (b) 3·00

  (c) 2·33

  (d) 1·33

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24. For a heat engine working on an air-standard Diesel cycle the efficiency will

(a) increase as the fuel cut-off ratio is increased

(b) not change as the fuel cut-off ratio is increased

(c) decrease as the fuel cut-off ratio is increased

(d) change as the fuel cut-off ratio is increased

25. For a given compression ratio, which of the following ideal cycles have equal thermal efficiency ?

(a) Diesel and Stirling

(b) Stirling and Otto

(c) Otto and Joule

(d) Joule and Diesel

26. In gas cycle refrigeration, an engine is used instead of a throttle valve for pressure drop of the refrigerant, because

(a) enough cooling or temperature drop is not obtained by throttling

(b) there can be even heating of the gas if the temperature before throttling is not below the maximum inversion temperature

(c) there is inadequate content of temperature

(d) there can be leakage of gas

27. An air standard Otto cycle has volumetric compression ratio of 6, the lowest cycle pressure of 0·1 MPa and operates between temperature limits of 27°C and 1569°C. What is the temperature after isentropic expansion if ratio of specific heats is 1·4 ?

(a) 600 K

(b) 700 K

(c) 900 K

(d) 1000 K

28. In SI engines for higher thermal efficiency

(a) compression ratio should be high

(b) heat liberation during combustion should be maximum

(c) surface to volume ratio should be high

(d) long flame travel distance

29. The object of providing masked inlet valve in the air passage of compression ignition engines is to

(a) enhance flow rate

(b) control air flow

(c) induce primary swirl

(d) induce secondary turbulence

30. Which one of the following types of swirls is generated by a precombustion chamber in the diesel engine ?

(a) Squish

(b) Compression swirl

(c) Induction swirl

(d) Combustion induced swirl

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31. In an SI engine the first stage of combustion takes 1 ms and the second stage 2 ms at 1000 rpm of the engine. The spark timing is set at 15°C btdc. What will be the new spark timing required if the engine speed is doubled ?

(a) 15°C btdc

(b) 21°C btdc

(c) 27°C btdc

(d) 39°C btdc

32. Increase in the compression ratio in Otto cycle may cause

(a) misfiring

(b) detonation

(c) knocking

(d) longer ignition delay

33. Which of the following increase the diesel knocking tendency ?

1. Decreased compression ratio

2. Decreased engine speed

3. Retarded injection timing

4. Supercharging

(a) 1 only

(b) 2 only

(c) 2 and 3

(d) 3 and 4

34. Pre-ignition in SI engines results in :

1. Increase in the work of compression

2. Increase in the network of the process cycles

3. Decrease in fuel efficiencies

4. Decrease in fuel loss from the engine

(a) 1, 2 and 3

(b) 1, 3 and 4

(c) 1 and 3 only

(d) 2 and 4 only

35. Which of the following statements are correct for 'Diesel knock' ?

1. A long ignition delay period increases tendency of Diesel knock.

2. The Diesel knock occurs near the end of combustion.

3. The rate of pressure rise in Diesel knock is lower than in detonation in spark ignition engines.

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1 and 3 only

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36. Which of the following remarks pertaining to supercharging of IC engines are correct ?

1. Ideal supercharging increases the output, but decreases the thermal efficiency slightly

2. The indicated mean effective pressure and mechanical efficiency increase with supercharging

3. The permissible amount of supercharging depends on the compression ratio, air-fuel mixture and design of engine

4. Engine friction losses increase with supercharging

(a) 1, 2, 3 and 4

(b) 1, 2 and 3 only

(c) 1, 2 and 4 only

(d) 2, 3 and 4 only

37. Which of the following statements are correct for turbo-prop powered aircrafts ?

1. The propulsion efficiency of turbo-prop is higher than that of turbo-jet and rockets for low speeds up to about 800 km/hr.

2. For the same thrust the turbine in the turbo-prop aircraft is smaller than in the turbo-jet aircraft.

3. For the turbo-prop the flight velocity cannot exceed the jet velocity.

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1 and 3 only

38. If absolute jet exit velocity from a jet engine is 2800 m/s and forward flight velocity is 1400 m/s, then propulsive efficiency is

(a) 33·33%

(b) 40%

(c) 66·66%

(d) 90%

39. An air-breathing aircraft is flying at an altitude where the air density is half the value at ground level. With reference to the ground level, the air-fuel ratio at this altitude will be

(a) $\frac{1}{2}$

(b) 1

(c) 2

(d) 4

40. Which of the following statements are correct for rockets ?

1. Unlike the turbo-jet aircraft, in rockets the flight velocity can exceed the jet velocity.

2. In rockets gases having lower molecular weight increase the specific thrust.

3. In rockets the gases are expanded in the nozzle up to the atmosphere pressure.

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1 and 3 only

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41. The purpose of a thermostat in an engine cooling system is to

   (a) prevent the coolant from boiling

   (b) allows the engine to warm up quickly

   (c) pressurize the system to raise the boiling point

   (d) indicate to the driver, the coolant temperature

42. When water emulsion is used as the fuel in SI engine the emission of nitrogen oxides reduces significantly, this is due to

   (a) water reacts with nitrogen oxides

   (b) water does not contain nitrogen

   (c) the combustion temperature decreased

   (d) the combustion temperature increased

43. In spark ignition petrol engines maximum emission of NO_x takes place when the air fuel ratio (A/F) is

   (a) very weak mixture and A/F ratio about 19

   (b) weak mixture and A/F ratio about 17

   (c) chemically correct mixture and A/F ratio about 15

   (d) rich mixture and A/F ratio about 13

44. In an experiment to determine the higher calorific value of a fuel with bomb calorimeter, a few drops of water is dropped into the bomb before sealing. This is to

   (a) help absorption of carbon dioxide gas

   (b) absorb latent heat of steam formed by combustion of hydrogen

   (c) saturate the air inside with water vapour initially

   (d) avoid overheating of the contents by burnt gases

45. The unit of the following property is not m^2/s

   (a) thermal diffusivity

   (b) kinematic viscosity

   (c) dynamic viscosity

   (d) mass diffusivity

46. In an ideal vapour compression refrigeration cycle the refrigeration effect is 80 kJ/kg of refrigerant flow. The COP is 4. If the flow of the refrigerant is 2 kg/s, the heat rejected in the condenser is

   (a) 50 kW

   (b) 100 kW

   (c) 150 kW

   (d) 200 kW

47. In the expansion valve of a refrigerator, the following property remains constant

   (a) entropy

   (b) enthalpy

   (c) internal energy

   (d) product pv

48. The Poisson's equation of general conduction heat transfer applies to the case

(a) steady state heat conduction with heat generation

(b) steady state heat conduction without heat generation

(c) unsteady state heat conduction without heat generation

(d) unsteady state heat conduction with heat generation

49. A plane slab of 100 mm thickness generates heat. It is observed that the temperature drop between the centre and its surface to be 50°C. If the thickness is increased to 20 cm the temperature difference will be

(a) 100°C

(b) 200°C

(c) 400°C

(d) 600°C

50. Three fins of equal length and diameter but made of aluminium, brass and cast-iron are heated to 200°C at one end. If the fins dissipate heat to the surrounding air at 25°C the temperature at the free end will be least in case of

(a) aluminium fin

(b) brass fin

(c) cast-iron fin

(d) each fin will have the same temperature at the free end

51. The saturation temperature of water vapour at its partial pressure is equal to

(a) wet bulb temperature

(b) dew point temperature

(c) adiabatic saturation temperature

(d) dry bulb temperature

52. Hot air at 150°C flows over a flat plate maintained at 50°C. If the forced convection heat transfer coefficient is 75 W/m^{2}K, the heat gain rate by the plate through an area of 2 m^2 will be

(a) 15 kW

(b) 22·5 kJ/S

(c) 7·5 kJ/S

(d) None of the above

53. Which of the following statements are correct for a blackbody ?

1. A blackbody continues to emit radiation even when it is in thermal equilibrium with its surroundings

2. A blackbody is a perfect emitter

3. Absorptivity, $\alpha = 1$ represent a black surface

(a) 1 and 2 only

(b) 1 and 3 only

(c) 1, 2 and 3

(d) 2 and 3 only

54. What is next radiant interchange per square meter for two very large plates at temperature 800 K and 500 K respectively ? Emissivities of hot and cold plates are 0·8 and 0·6 and Stefan-Boltzmann constant is 5·67 × 10 W/m^2·K^4

(a) 1026 kW/m^2

(b) 10·26 kW/m^2

(c) 102·6 kW/m^2

(d) 1·026 kW/m^2

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55. Uniform heat generation takes place in a symmetric slab so that heat flows towards both sides in contact with fluid. The zero-gradient boundary condition $\frac{\partial T}{\partial x} = 0$ occurs at

(a) left wall of slab

(b) right wall of slab

(c) centerline of slab

(d) nowhere in slab

56. A refrigerator operating on standard vapour compression cycle has COP = 5·5 and is driven by 40 kW compressor. Saturated liquid and saturated vapour enthalpies at condensing temperature of 30°C are 69·55 kJ/kg and 201·45 kJ/kg respectively. Saturated refrigerant vapour leaving the evaporator has enthalpy of 187·53 kJ/kg. Find refrigerant temperature at compressor discharge. (Take c_p of refrigerant vapour as 0·6155 kJ/kg K.

(a) 40·2°C

(b) 41·2°C

(c) 42·2°C

(d) 43·2°C

57. In a 3 ton capacity water cooler, water enters at 30°C and leaves at 15°C steadily. What is the water flow rate per hour ?

(a) 60 kg

(b) 100 kg

(c) 602 kg

(d) 2520 kg

58. In a vapour compression cycle, a good refrigerant should have a

(a) large latent heat of vaporization at condenser pressure

(b) large latent heat of evaporator pressure

(c) condenser pressure close to critical pressure

(d) low critical pressure

59. It is not a cause for discouragement of the use of Chlorofluorocarbon (CFC) refrigerants in domestic refrigerators and air-conditioners for

(a) their ozone depletion potential

(b) their global warming potential

(c) their tendency to migrate to the upper atmosphere by molecular diffusion

(d) their toxicity and non-availability

60. The room sensible heat loss is 30,000 kJ/h and the latent heat loss is 20,000 kJ/h. Then the sensible heat factor is

(a) −0·6

(b) 0·6

(c) 0·3

(d) 3·0

61. When unsaturated air is adiabatically saturated, which of the following properties decrease ?

1. Dry bulb temperature
2. Wet bulb temperature
3. Relative Humidity
4. Specific Humidity

(a) 1 only

(b) 1 and 2 only

(c) 2 and 3 only

(d) 3 and 4 only

62. It is desired to condition the outside air from 80% relative humidity and 45°C dry bulb temperature to 55% relative humidity and 25°C dry bulb temperature. The practical arrangement will be

(a) heating and humidification

(b) heating and dehumidification

(c) cooling and humidification

(d) cooling and dehumidification .

63. Which parameters are the independent variables in the construction of psychometric plot for a particular value of barometric pressure ?

(a) Dry bulb temperature and specific humidity

(b) Wet bulb temperature and relative humidity

(c) Dry bulb temperature and wet bulb temperature

(d) Dry bulb temperature and enthalpy

64. If air at 20°C is heated to 25°C using heater with a surface temperature of 30°C then, the by-pass factor is

(a) 2·0

(b) 0·5

(c) 1·0

(d) None of the above

65. The atmospheric air at dry bulb temperature 15°C enters a heating coil maintained at 40°C. If the air leaves the heating coil at 30°C, the coil efficiency is equal to

(a) 0·2

(b) 0·4

(c) 0·6

(d) 0·75

66. In the air-conditioned space, fan load is considered as

(a) latent heat gain

(b) sensible heat gain

(c) both sensible and latent heat gain

(d) Not considered as load

67. Equal friction method for designing air-conditioning duct

(a) ensures constant static pressure at all terminals in the duct

(b) ensures same velocity in the duct all through in all branches

(c) automatically reduces the air velocity in the duct in the direction of flow

(d) does none of the above

68. In a differential manometer a head of 0·6 m of fluid A in limb 1 is found to balance a head of 0·3 m of fluid B in limb 2. The ratio of specific gravities of A to B is

(a) 2

(b) 0·5

(c) 0·3

(d) 0·18

69.
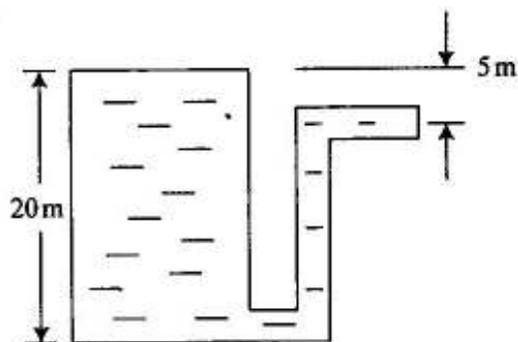
The velocity at the exit of the pipe as shown in the above figure will be

(a) 9·9 m/s

(b) 14·0 m/s

(c) 17·1 m/s

(d) 19·8 m/s

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70. The centre of pressure of a plane submerged surface
    (a) is a point on the submerged area at which the resultant hydrostatic force is supposed to act
    (b) should always coincide within the centre of submerged area
    (c) should be at the centre of gravity of the plane surface
    (d) is always below the centroid of area

71. A piece of metal of specific gravity 7 floats in mercury of specific gravity 13·6, what fraction of its volume is under mercury ?
    (a) 0·5
    (b) 0·4
    (c) 0·515
    (d) Fully immersed

72. The streamline equation passing through the point (2, 3) will be
    (The two dimensional flow is given by $u = a$ and $v = a$)
    (a) $x + y = 1$
    (b) $y = x + 1$
    (c) $2x + y = 1$
    (d) None of the above

73. A right circular cylinder, open at the top, is filled with a liquid of specific gravity 1·2, and rotated about its vertical axis at such a speed that half of the liquid spills out. The pressure at the centre of the bottom is
    (a) zero
    (b) one-fourth its value when the cylinder was full
    (c) one-third its value when the cylinder was full
    (d) three-fourth its value when the cylinder was full

74. Consider the following statements about velocity potential :
    1. Velocity potential is a vector function similar to stream function .

2. It is a fully three dimensional function and not limited to two coordinates
3. Velocity potential does not exist at stagnation points
4. Velocity potential exists only if the flow is Irrotational
    Which of these statements are correct ?
    (a) 1, 2 and 3
    (b) 1, 2 and 4
    (c) 1, 3 and 4
    (d) 2, 3 and 4

75. The velocity potential function in a two dimensional flow field is given by $\phi = x^2 - y^2$. The magnitude of velocity at point $P(1, 1)$ is
    (a) zero
    (b) 2
    (c) $2\sqrt{2}$
    (d) 8

76.
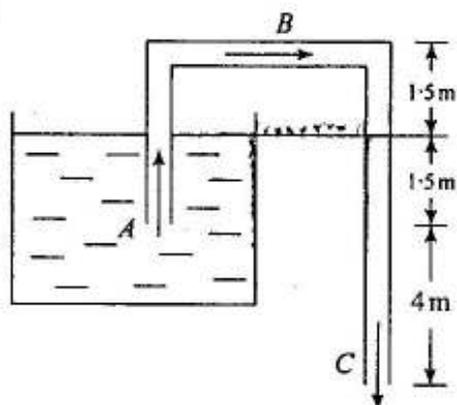
A tube is used (as shown in the above figure) as a siphon to discharge an oil of specific gravity 0·8 from a large open vessel into a drain at atmospheric pressure. The velocity of oil through the siphon will be
    (a) 1·5 m/s
    (b) 6·7 m/s
    (c) 8·8 m/s
    (d) 10·4 m/s

77. Water flows through a vertical contraction from a pipe of diameter d to another of diameter of $\frac{d}{2}$. Inlet velocity at inlet to contraction is 2 m/s and pressure 200 kN/m². If height of contraction measures 2 m, the pressure at exit of contraction will be nearly to

(a) 192 kN/m²

(b) 150 kN/m²

(c) 165 kN/m²

(d) 175 kN/m²

78. In flow through a pipe, the transition from laminar to turbulent flow does not depend on

(a) density of fluid

(b) length of pipe

(c) diameter of pipe

(d) velocity of the fluid

79. A 0·20 m diameter pipe 20 km long transports oil at a flow rate of 0·01 m³/s. Calculate power required to maintain flow if dynamic viscosity and density of oil is 0·08 Pas and 900 kg/m³ respectively

(a) 4·064 kW

(b) 3·074 kW

(c) 5·064 kW

(d) 4·074 kW

80. Pressure loss for laminar flow through pipeline is dependent

(a) inversely on flow of velocity

(b) directly on square of pipe radius

(c) directly on length of pipe

(d) inversely on viscosity of flowing medium

81. Fanno line flow is a flow in a constant area duct.

(a) with friction and heat transfer but in the absence of work

(b) with friction and heat transfer accompanied by work

(c) with friction but in the absence of heat transfer or work

(d) without friction but accompanied by heat transfer and work

82. In an adiabatic flow with friction through a constant area duct, the following phenomenons are predicted :

1. The flow downstream tends to be sonic irrespective of the Mach-number upstream

2. In the case of initially supersonic flow, any increase in duct length beyond choked flow would make the exit flow subsonic

3. In the case of initially subsonic flow, increase in duct length will not change sonic flow at the exit

4. The optimum pipe length for sonic outlet in supersonic flow is considerably longer than that of subsonic flow for the same flow rate

Which of these are correct ?

(a) 1, 2, 3 and 4

(b) 1, 2 and 3 only

(c) 1, 3 and 4 only

(d) 2, 3 and 4 only

83. In a reciprocating pump, air vessels are used to

(a) smoothen the flow

(b) reduce suction head

(c) increase delivery head

(d) reduce acceleration head

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84. Consider the following statements pertaining to centrifugal pumps :

1. The inlet to the impeller of a centrifugal pump is always axial, while the outlet may be radial or inclined.

2. The impeller may be shrouded on both sides with an eye at the centre and vanes curved backwards.

3. Impeller of double entry type has a balanced radial thrust.

4. Un-shrouded and part shrouded impeller are used only where high efficiency is unimportant.

Which of these statements are correct ?

(a) 1, 2, 3 and 4

(b) 1, 2 and 3 only

(c) 1, 2 and 4 only

(d) 2, 3 and 4 only

85. A centrifugal pump is fully primed, but on starting it fails to deliver fluid. The probable reasons are listed below :

1. Leaky foot valve or suction line

2. Suction head is very low

3. Insufficient motor speed

4. Damaged or closed delivery valve

Which of these reasons are correct ?

(a) 1, 2, 3 and 4

(b) 1, 2 and 3 only

(c) 2, 3 and 4 only

(d) 1, 3 and 4 only

86. For a given centrifugal pump

(a) head varies inversely as square of speed

(b) discharge varies directly as speed

(c) discharge varies directly as square of speed

(d) power varies directly as fifth power of speed

87. A centrifugal pump is to discharge 0.118 m^3/s at speed of 1450 rpm against a head of 25 m. The impeller diameter is 25 cm, its width at outlet is 5 cm and manometric efficiency is 75%. The vane angle at outer periphery of impeller is

(a) $56.77°C$

(b) $59.77°C$

(c) $61.77°C$

(d) $48.77°C$

88. A turbine is working under a head of 200 m. The power developed by the turbine is 100 kW and discharge through the turbine is 0.125 m^3/s. In such case, the ratio of unit power to unit discharge for the turbine will be

(a) 4000

(b) 16000

(c) 160×10^3

(d) None of the above

89. Two geometrically similar pumps are running at 1000 rpm speed (both). If one pump has impeller diameter of 0.3 m and discharges 20 lps against 20 m head, and the other pump gives half of this discharges rate; calculate head and diameter of second pump

(a) 12.5 m and 0.12 m

(b) 10.5 m and 0.12 m

(c) 10.5 m and 0.23 m

(d) 12.5 m and 0.23 m

90. The component of torque converter that allows torque multiplication is
(a) turbine
(b) impeller
(c) stator
(d) freewheel

91. Which of the following statements are correct with respect to regenerative feed heating in a steam cycle ?
1. It increases cycle efficiency
2. It increases specific output
3. It reduces the condenser load
4. It improves the steam quality at the end of expansion
(a) 1 and 3 only
(b) 2 and 4 only
(c) 2 and 3 only
(d) 1, 2, 3 and 4

92. Consider the following statements :
Isentropic flow through a steam nozzle becomes 'choked' when
1. Discharge is maximum
2. Discharge is zero
3. Nozzle pressure ratio is ≤ critical pressure ratio
4. Throat velocity reaches sonic value
Which of these statements are correct ?
(a) 1, 2, 3 and 4
(b) 1, 2 and 3 only
(c) 2, 3 and 4 only
(d) 1, 3 and 4 only

93. Frictional losses in the nozzle
(a) reduces the enthalpy of the fluid
(b) increases the enthalpy of the fluid
(c) no effect on enthalpy of the fluid
(d) None of the above

94. In a nozzle designed for maximum discharge conditions, the flow velocity in the convergent section of the nozzle is
(a) subsonic
(b) sonic
(c) supersonic
(d) depends on initial pressure and condition of steam

95. The risk of radioactive hazard is greatest in the turbine with following reactor
(a) pressurized water
(b) boiling water
(c) gas cooled
(d) liquid metal cooled

96. Without reducing the fluid flow rate, the speed of an impulse steam turbine can be brought down to practical limits by which of the following methods ?
1. Large flywheel
2. Centrifugal governor
3. Velocity compounding
4. Steam bleeding
(a) 1, 2 and 3
(b) 2, 3 and 4
(c) 2 only
(d) 3 only

97. To improve the quality of steam at turbine exit which of the following will be used ?
1. Reheat cycle
2. Increase the maximum pressure when maximum and minimum temperatures are fixed
3. Use superheated steam, instead of saturated steam when the maximum and minimum pressures are fixed
(a) 1, 2 and 3
(b) 1 and 2 only
(c) 1 and 3 only
(d) 2 and 3 only

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A – B-FRF-M-LBA

98. In the centrifugal compressor the work input is equal to sum of

    (a) pressure head, relative head and dynamic head

    (b) dynamic head, centrifugal head and relative head

    (c) pressure head, centrifugal head and dynamic head

    (d) pressure head, centrifugal head and relative head

99. For a centrifugal compressor with radial vanes, slip factor is the ratio of

    (a) isentropic work to Euler work

    (b) whirl velocity to the blade velocity at the impeller exit

    (c) stagnation pressure to static pressure

    (d) isentropic temperature rise to actual temperature rise

100. The specific speed of a centrifugal compressor is generally

    (a) less than that of reciprocating compressor

    (b) independent of compressor type, but depends only on size of compressor

    (c) higher than that of axial compressor

    (d) more than specific speed of reciprocating compressor but less than axial compressor

101. In a centrifugal compressor, the highest Mach number leading to shock wave in the fluid flow occurs at

    (a) diffuser inlet radius

    (b) diffuser outlet radius

    (c) impeller inlet radius

    (d) impeller outlet radius

102. In a centrifugal compressor, an increase in speed at a given pressure ratio causes

    (a) increase in flow and increase in efficiency

    (b) increase in flow and decrease in efficiency

    (c) decrease in flow and increase in efficiency

    (d) decrease in flow and decrease in efficiency

103. In an axial flow compressor, the ratio of pressure rise in the rotor blades to the pressure rise in the compressor in one stage is known as

    (a) pressure coefficient

    (b) work factor

    (c) degree of reaction

    (d) slip factor

104. The thermal efficiency of a simple open gas turbine plant is improved by regeneration as this

    (a) decreases the temperature of the gases at the turbine inlet

    (b) decreases the quantity of heat supplied in combustion chamber

    (c) increases the turbine output

    (d) lowers the work input to compressor

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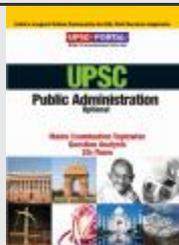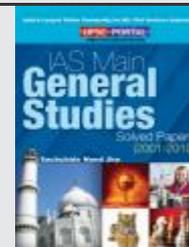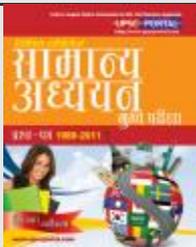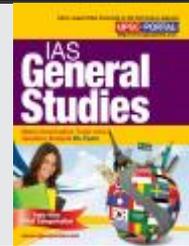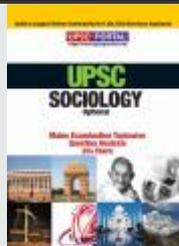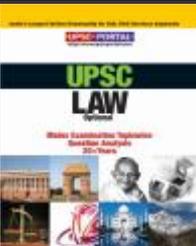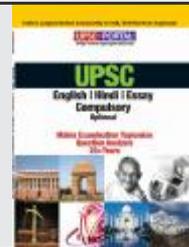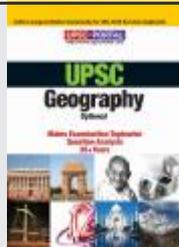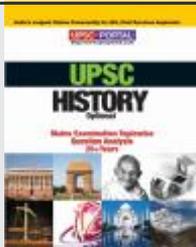
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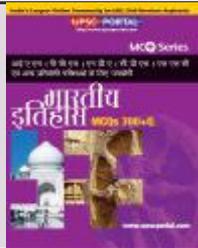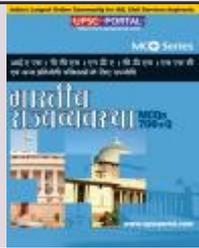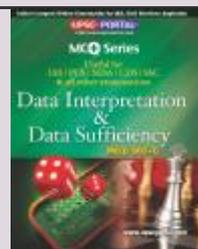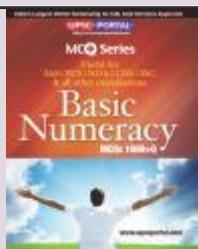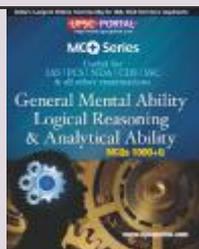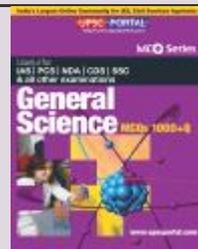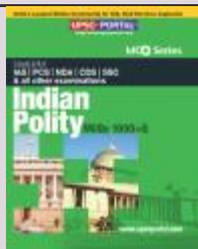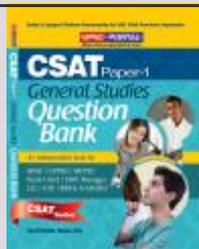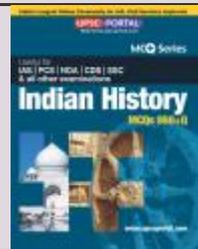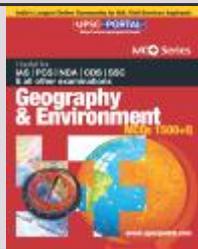
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