10/CME/M–2025-07

Question Booklet

MECHANICAL ENGINEERING

Paper – V

Booklet Serial No.

3480536

Booklet Series

I

Candidate's Roll Number

Time Allowed : 01 Hour

Maximum Marks : 100

Read the following instructions carefully before you begin to answer the questions.

IMPORTANT INSTRUCTIONS

1. This Question Booklet contains **50** questions in all.
2. **All** questions carry equal marks.
3. Attempt **all** questions.
4. An Answer Sheet has been supplied inside the question booklet to mark the answers. **You must write your Roll Number and encode it and write other particulars in the space provided in the Answer Sheet, failing which your Answer Sheet will not be evaluated.**
5. **Immediately after commencement of the examination, you should check up your Question Booklet and attached answer sheet and ensure that the Question Booklet Series is printed on the top left-hand corner of the Booklet and the series encoded in answer sheet are same. Also please check that the Booklet contains 12 printed pages including two pages (Page Nos. 11 and 12) for Rough Work and no page or question is missing or unprinted or torn or repeated or question booklet and answer sheet have different series. If you find any defect in this Booklet and attached answer sheet, get it replaced immediately by a complete Booklet with OMR sheet of the same series.**
6. You must write your Roll Number in the space provided on the top of this page. Do not write anything else on the Question Booklet.
7. Questions and their responses are printed in English version in this Booklet. Each question comprises of **four** responses — (A), (B), (C) and (D). You are to select ONLY ONE correct response and mark it in your Answer Sheet. In case you feel that there are more than one correct response, mark the response which you consider the best. In any case, choose ONLY ONE response for each question. Your total marks will depend on the number of correct responses marked by you in the Answer Sheet.
8. In the Answer Sheet, there are **four** circles — Ⓐ, Ⓑ, Ⓒ and Ⓓ against each question. To answer the questions, you are to mark with **Black/Blue ink ballpoint pen ONLY ONE circle** of your choice for each question. Select only one response for each question and mark it in your Answer Sheet. If you mark more than one circle for one question, the answer will be treated as wrong. **Use Black/Blue ink ballpoint pen only to mark the answer in the Answer Sheet. Any erasure or change is not allowed.**
9. You should not remove or tear off any sheet from the Question Booklet. You are not allowed to take this Question Booklet and the Answer Sheet out of the Examination Hall during the examination. **After the examination has concluded, you must hand over your Answer Sheet to the Invigilator**. Thereafter, you are permitted to take away the Question Booklet with you.
10. Failure to comply with any of the above instructions will render you liable to such action or penalty as the Commission may decide at their discretion.
11. Candidates must assure before leaving the Examination Hall that their Answer Sheets will be kept in Self Adhesive LDPE Bag and completely packed/sealed in their presence.

1. An economiser is fitted with a boiler to

(A) Heat the fuel of low calorific value

(B) Heat the air entering the fire grate

(C) Heat the feed water by exhaust flue gases

(D) Increase the steam pressure

2. In reciprocating air compressor, the method of controlling the quantity of air delivered is done by

(A) Blow-off control

(B) Throttle control

(C) Clearance control

(D) All of the above

3. Reheat cycle is essential in a steam power plant to

(A) Heat the feed water on its way to boiler

(B) Increase the plant efficiency

(C) Restrict the moisture content in the low pressure stages of turbine within the limit of 10% – 12%

(D) Utilize the heat of flue gas

4. Heat transfer from higher temperature to lower temperature takes place according to

(A) First law of thermodynamics

(B) Second law of thermodynamics

(C) Zeroth law of thermodynamics

(D) Fourier law

5. All of the following factors promote detonation in S.I. engines, except

(A) Higher compression ratio

(B) High self ignition temperature of fuel

(C) Advanced spark timing

(D) Increase in inlet pressure and temperature of charges

6. The thermal conductivity is expressed as

(A) W/m^2K

(B) W/hmK

(C) W/h^2m^2K

(D) W/mK

7. Which of the following bends will cause maximum head loss ?

(A) 60° bend

(B) 90° bend

(C) U-bend

(D) 30° bend

8. Which of the following units increase the work ratio in a gas turbine plant ?

1. Regenerator
2. Intercooler
3. Reheater

Select the correct answer.

(A) 2 and 3

(B) 1 and 3

(C) 1, 2 and 3

(D) 1 and 2

9. A venturimeter is used for measuring

(A) Flow rate

(B) Total energy

(C) Piezometric head

(D) Pressure

10. In a pulverized fuel fired large power boiler, the heat transfer from the burning fuel to the walls of the furnace takes place

(A) By convection only

(B) By conduction and convection

(C) Predominantly by radiation

(D) By conduction only

11. Newton's law of viscosity is given by the relation

(A) $\tau = \mu^{1/2}\, du/dy$

(B) $\tau = \mu\, du/dy$

(C) $\tau = \mu^{3/2}\, du/dy$

(D) $\tau = \mu^{2}\, du/dy$

12. Which one of the following is ***not*** a positive displacement type compressor ?

(A) Screw type compressor

(B) Rotor blower

(C) Vane type compressor

(D) None of these

13. Which of the following process is ***not*** involved in a Rankine cycle ?

(A) Isothermal

(B) Isochoric

(C) Adiabatic

(D) Isobaric

14. The thermal resistance for heat conduction through a hollow sphere of inner radius r_1, and outer resistance r_2 is (Where k is the thermal conductivity of the material of the sphere.)

(A) $(r_2 - r_1)r_1r_2/4\pi k$

(B) $4\pi k(r_2 - r_1) / r_1r_2$

(C) $k(r_2 - r_1)/4\pi r_1r_2$

(D) $(r_2 - r_1)/4\pi kr_1r_2$

15. A floating body is in stable equilibrium when

(A) The metacentre is above the centre of gravity

(B) The metacentric height is zero

(C) Its centre of gravity is below the centre of buoyancy

(D) The metacentre is below the centre of gravity

16. Which of the following pairs of materials is used as moderators in nuclear reactors ?

(A) Zirconium and beryllium

(B) Cadmium and beryllium

(C) Heavy water and beryllium

(D) Heavy water and zirconium

17. For supersaturated adiabatic flow through a nozzle, the pressure p and volume v are related by the expression

(A) $pv^{1.3} = C$

(B) $pv^{1.135} = C$

(C) $pv^{1.15} = C$

(D) $pv = C$

18. In case of reaction steam turbine

(A) There is enthalpy drop only in fixed blades

(B) There is enthalpy drop both in fixed and moving blades

(C) There is enthalpy drop only in moving blades

(D) None of the above

19. The efficiency of Carnot cycle may be equal to which of the following cycle running between same temperature limits ?

(A) Rankine cycle

(B) Stirling cycle

(C) Brayton cycle

(D) None of the above

20. In a heat exchanger, the hot liquid enters with a temperature of 180°C and leaves at 160°C. The cooling fluid enters at 30°C and leaves at 110°C. The capacity ratio of the heat exchanger is

(A) 1.5

(B) 0.33

(C) 0.2

(D) 0.25

21. The draught in locomotive boilers is produced by

(A) Centrifugal fan

(B) Steam jet

(C) Locomotion

(D) Chimney

22. In the window air-conditioner, the expansion device used is

(A) Thermostatic expansion device

(B) Float valve

(C) Automatic expansion valve

(D) Capillary tube

23. The critical pressure ratio for maximum discharge through nozzle is given by

(A) $\left[(n+1)/2\right]^{n/(n-1)}$

(B) $\left[2/(n+1)\right]^{(n-1)/n}$

(C) $\left[1/(n+1)\right]^{n/(n-1)}$

(D) $\left[2/(n+1)\right]^{n/(n-1)}$

24. Which of the following is an intensive property of a thermodynamic system ?

(A) Temperature

(B) Mass

(C) Energy

(D) Volume

25. The comfort air-conditioning and industrial air-conditioning differ in relation to

(A) Equipment used

(B) Indoor requirement

(C) Environmental conditions

(D) Process adopted

26. Steam turbines are governed by the following methods

(A) Nozzle control governing

(B) Throttle governing

(C) By-pass governing

(D) All of the above

27. In flow through a nozzle, the Mach number is more than unity

(A) At the throat

(B) In the divergent section

(C) In any section depending upon the nozzle profile and geometry

(D) In the convergent section

28. For the same maximum pressure and temperature of Otto, Diesel and Dual cycles

(A) Heat supplied will be same

(B) Air-standard efficiency will be same

(C) Heat rejection will be same

(D) Compression ratio will be same

29. For the centrifugal compressor having radial flow blades the stagnation pressure may be given by

(A) $\left[1+C_p.T_{01}/U_2^2\right]^{(\gamma-)/\gamma}$

(B) $\left[1+C_p.T_{01}/U_2^2\right]^{\gamma/(\gamma-)}$

(C) $\left[1+U_2^2/C_p.T_{01}\right]^{\gamma/(\gamma-)}$

(D) None of these

30. Humidity ratio can be given in terms of partial pressure of dry air (p_a) and water vapour pressure (p_v) as

(A) $0.622(p_v/p_a)$

(B) $0.622(p_a/p_v)$

(C) $0.622[p_v/(p_v - p_a)]$

(D) None of these

31. The energy released in the fission of one U – 235 nucleus is approximately

(A) 200 MeV

(B) 300 MeV

(C) 400 MeV

(D) 100 MeV

32. Phenomenon of supersaturation, occurring in nozzle causes

(A) Reduced velocity at exit

(B) Increase in discharge

(C) Increase in dryness fraction and entropy

(D) All of the above

33. The ratio of inertia force to the viscous force is called

(A) Weber number

(B) Reynold number

(C) Mach number

(D) Froude number

34. Working fluid for a closed cycle gas turbine should have high

(A) Specific volume

(B) Adiabatic exponent

(C) Molecular weight

(D) Thermal conductivity

35. Bomb calorimeter is used to determine

(A) Calorific value of gaseous fuels

(B) Ash content of solid fuels

(C) Incombustible matter in solid fuel

(D) Calorific value of solid or liquid fuels

36. In aqua-ammonia and Li-Br water absorption refrigeration system, the refrigerants are respectively

(A) Water and Li-Br

(B) Ammonia and Li-Br

(C) Ammonia and water

(D) Water and water

37. Which one of the following turbine is most efficient at part load operation ?

(A) Propeller

(B) Francis

(C) Pelton

(D) Kaplan

38. A Bell-Coleman cycle is a reversed

(A) Rankine cycle

(B) Atkinson cycle

(C) Ericsson cycle

(D) Brayton cycle

39. Identify the aspect an increase in which promotes the tendency of knocking in C.I. engines

(A) Inlet air temperature

(B) Coolant water temperature

(C) Rate of fuel consumption

(D) Compression ratio

40. Stage efficiency, nozzle efficiency and diagram efficiency can be related as

(A) $\eta_{stage} = \eta_{diagram} \times \eta_{nozzle}$

(B) $\eta_{stage} = \eta_{diagram} / \eta_{nozzle}$

(C) $\eta_{nozzle} = \eta_{stage} \times \eta_{diagram}$

(D) None of these

41. The shear stress distribution in pipe flow is given by

(A) $\tau = r(\partial p/\partial x)$

(B) $\tau = -(\partial p/\partial x)r/2$

(C) $\tau = -2r(\partial p/\partial x)$

(D) None of the above

42. The device in which small quantities of water can be pumped to higher level from the available large quantity of water of low head

(A) Hydraulic intensifier

(B) Hydraulic ram

(C) Air lift pump

(D) Hydraulic accumulator

43. For rocket propulsion, the propulsion efficiency is given by

(A) $\eta_p = 2\sigma/(1 + \sigma)$

(B) $\eta_p = 2\sigma^2/(1 + \sigma^2)$

(C) $\eta_p = \sigma/(1 + 2\sigma)$

(D) $\eta_p = 2\sigma/(1 + \sigma^2)$

44. In centrifugal pumps, cavitation is reduced by

(A) Reducing the discharge

(B) Throttling the discharge

(C) Reducing the suction head

(D) Increasing the flow velocity

45. The shear in turbulent flow is mainly due to

(A) Mass transfer

(B) Heat transfer

(C) Momentum transfer

(D) All of the above

46. In Diesel engines, the injector pressure is of the order of

(A) 10 – 15 MN/m^2

(B) 17.5 – 25 MN/m^2

(C) 40 – 50 MN/m^2

(D) 5 – 8 MN/m^2

47. What is the state of refrigerant before and after the expansion valve in a vapour compression system ?

(A) Saturated liquid; very wet vapour

(B) Superheated vapour; saturated liquid

(C) Fairly dry vapour; superheated vapour

(D) Very wet vapour; fairly dry vapour

48. In a multistage axial flow compressor with equal temperature rise in all stages, the pressure ratio in the subsequent stages

(A) Increases gradually

(B) Decreases

(C) Increases rapidly

(D) Remains constant

49. A jet engine works on the principle of conservation of

(A) Discharge

(B) Energy

(C) Momentum

(D) Mass

50. In a steam turbine the substantial static pressure drop occurs in stationary nozzle and rotor blade passage; the type of turbine may be

(A) Reaction turbine

(B) Impulse turbine

(C) Branca's turbine

(D) None of these

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