



ZONE TECH
Best Institute For Assistant & Junior Engineer

Mechanical Engineering

RPSC A.En. (Pre) Paper - 2025

Answer key **PAPER CODE : 37**

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|---------|---------|
| 1. (3) | 26. (4) |
| 2. (4) | 27. (2) |
| 3. (3) | 28. (2) |
| 4. (3) | 29. (2) |
| 5. (2) | 30. (*) |
| 6. (2) | 31. (2) |
| 7. (1) | 32. (4) |
| 8. (1) | 33. (3) |
| 9. (2) | 34. (1) |
| 10. (2) | 35. (3) |
| 11. (3) | 36. (4) |
| 12. (1) | 37. (3) |
| 13. (1) | 38. (3) |
| 14. (2) | 39. (2) |
| 15. (3) | 40. (3) |
| 16. (*) | 41. (2) |
| 17. (4) | 42. (2) |
| 18. (1) | 43. (3) |
| 19. (1) | 44. (4) |
| 20. (1) | 45. (4) |
| 21. (4) | 46. (3) |
| 22. (3) | 47. (4) |
| 23. (2) | 48. (2) |
| 24. (2) | 49. (3) |
| 25. (4) | 50. (3) |

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|---------|----------|
| 51. (2) | 76. (1) |
| 52. (1) | 77. (4) |
| 53. (3) | 78. (3) |
| 54. (1) | 79. (3) |
| 55. (1) | 80. (3) |
| 56. (3) | 81. (3) |
| 57. (3) | 82. (4) |
| 58. (4) | 83. (1) |
| 59. (3) | 84. (4) |
| 60. (3) | 85. (4) |
| 61. (1) | 86. (2) |
| 62. (1) | 87. (3) |
| 63. (4) | 88. (2) |
| 64. (2) | 89. (1) |
| 65. (3) | 90. (1) |
| 66. (1) | 91. (4) |
| 67. (3) | 92. (1) |
| 68. (4) | 93. (2) |
| 69. (3) | 94. (*) |
| 70. (1) | 95. (1) |
| 71. (1) | 96. (2) |
| 72. (3) | 97. (4) |
| 73. (4) | 98. (3) |
| 74. (1) | 99. (3) |
| 75. (*) | 100. (1) |

1. Which of the following is not characteristic of solar cell?

- (1) Solar cell changes the light energy into electrical energy.
- (2) Solar cell is made using Silicon.
- (3) Solar cell stores energy.
- (4) Solar cell is a converter.
- (5) Question not attempted

2. Compounding of a steam turbine is done to

- (1) connect the shafts of two turbines
- (2) balance the rotor
- (3) reduce the blade friction
- (4) reduce the rotor speed
- (5) Question not attempted

3. Which of the following is not true for ash in coal?

- (1) It affects the design of boiler.
- (2) It reduces calorific value of coal.
- (3) High ash coal needs less excess air.
- (4) It results in clinker formation.
- (5) Question not attempted

4. The ratio of the number of fissile nuclei produced in a reactor to the number of fissile nuclei consumed is greater than unity in

- (1) Moderator
- (2) Fast Reactor
- (3) Breeder Reactor
- (4) Thermal Reactor
- (5) Question not attempted



5.

A power plant supplies three loads having maximum demands of 40 MW, 50 MW and 30 MW respectively. If load factor is 60% and diversity factor is 1.2, what will be the maximum load on power plant and capacity of power plant respectively?

- (1) 120 MW, 144 MW
- (2) 100 MW, 120 MW
- (3) 120 MW, 100 MW
- (4) 144 MW, 120 MW
- (5) Question not attempted

$$\begin{aligned} \text{Load factor} &= \frac{\text{Supply}}{\text{max}} = \frac{120}{200} \times 100 \\ &= 60\% \\ \text{Diversity factor} &= 1.2 \\ \text{Max load} &= \frac{40 + 50 + 30}{1.2} = 120 \text{ MW} \\ \text{Capacity} &= 120 \times 1.2 = 144 \text{ MW} \end{aligned}$$

6.

In a flat plate collector, the purpose of glazing is to

- (1) Increase the heat loss by convection from the top of the absorber plate.
- (2) transmit short wave length solar radiation and block longer wave length reradiation from absorber plate.
- (3) block short wave length solar radiations and transmit longer wave length reradiation from absorber.
- (4) transmit both short wave length solar radiation and longer wave length reradiation from absorber.
- (5) Question not attempted

7.

Which of the following is related to geothermal steam system?

- (1) Single ebb cycle system
- (2) Fossil-superheat Hybrid Systems
- (3) Bio fuels
- (4) Wind mills
- (5) Question not attempted

8. Which of the following statements is not correct about lifting of loads using square threads?

- (1) The maximum efficiency of the screw thread depends upon both the helix angle and the applied load.
- (2) The angle of friction must be more than the helix angle for load not to slide down when the effort is removed.
- (3) The self-locking screws have efficiency less than 50%.
- (4) The efficiency is maximum when the helix angle (α) and the friction angle (ϕ) satisfy the relation $\alpha = 45^\circ - \phi / 2$.
- (5) Question not attempted

9. A turning pair is an example of which kinematic pair?

- (1) Point contact pair
- (2) Lower pair
- (3) Higher pair
- (4) Rolling pair
- (5) Question not attempted

10. A straight link is rotating anticlockwise at a uniform angular velocity of 40 rad/s about a fixed centre with an angular acceleration of 400 rad/s². A block is sliding outwards on the link with a uniform velocity of 2.5 m/s. What will be the absolute acceleration of a point on the block when it is at a distance of 0.25 m from the centre of rotation of the link?

- (1) 300 m/s² (2) 500 m/s²
- (3) 400 m/s² (4) 200 m/s²
- (5) Question not attempted

11. Which of the following is not an inversion of a single slider crank chain?

- (1) Crank and slotted link type quick return motion mechanism
- (2) Whitworth quick return motion
- (3) Scotch yoke
- (4) Rotary engine
- (5) Question not attempted

12. If a governor has same equilibrium speed for all radii of rotation of balls, then such a governor is called

- (1) Isochronous governor
- (2) Stable governor
- (3) Inertia governor
- (4) Sensitive governor
- (5) Question not attempted

13. In the statement "An eccentric mass rotating at 3000 rpm will create X times more unbalanced force than 50% of the same mass rotating at 300 rpm", 'X' stands for

- (1) 200 (2) 10
- (3) 50 (4) 100
- (5) Question not attempted

14. Degrees of freedom for a planar mechanism with 4 links and 4 lower pairs is

- (1) 0
- (2) 1
- (3) 2
- (4) 3
- (5) Question not attempted

15. Helical gears are used to connect two parallel shafts. The driver gear has a right-hand helix angle of 30°. The helix angle and hand of teeth on the driven gear shall be respectively

- (1) 60° and left-hand
- (2) 30° and right-hand
- (3) 30° and left-hand
- (4) 60° and right-hand
- (5) Question not attempted

16. In a Hartnell governor, the mass of each ball is 2.5 kg. Maximum and minimum centrifugal forces on the balls are 2000 N and 100 N corresponding to radii 20 cm and 15 cm respectively. Lengths of vertical and horizontal arms of the bell crank levers are the same, then the spring stiffness (in N/cm) is

- (1) 120 (2) 380
- (3) 420 (4) 100
- (5) Question not attempted

$\frac{1-5r^2}{1+m}$

$v = r \times \omega$

$v = r \cdot \omega^2$

$v = I \cdot \omega^2$

$\frac{F_1^2 - F_2^2}{30}$

$F_1 - F_2$

$$b^3 = \frac{90 \times 10^6}{1600} \times \frac{3 \times 10^3}{4} \times 1.6 \text{ kV}$$

$$\sigma = \frac{6M}{bd^2} = \frac{6 \times 10^3}{6 \times 10^3} = \frac{6 \times 30}{2 \times 10^3} = \frac{180}{2000} = 0.09$$

17. What are the stresses induced in the 'pin' of the knuckle joint when it is subjected to tensile load?

- (1) Direct shear, bending and crushing stress
- (2) Tensile and torsional shear stress
- (3) Bending and torsional shear stress
- (4) Tensile, direct shear and crushing stress
- (5) Question not attempted

18. A 1 m long simply supported beam of rectangular section, with height twice of its width, is loaded with a vertically downward load of 1 kN at a distance of 200 mm from the left support. If the allowable bending stress is 30 MPa, what will be the width of the beam?

- (1) 20 mm
- (2) 15 mm
- (3) 30 mm
- (4) 10 mm
- (5) Question not attempted

19. An external gear with 60 teeth meshes with a pinion of 20 teeth, module being 6 mm. What is the centre distance in mm?

- (1) 240
- (2) 200
- (3) 340
- (4) 400
- (5) Question not attempted

20. A spring-mass-damper system has a stiffness of 10 N/m and the mass is 10 kg. What would be the critical value of damping coefficient so that mass comes to equilibrium position without any periodic motion?

- (1) 20 N.s/m
- (2) 10 N.s/m
- (3) 40 N.s/m
- (4) 100 N.s/m
- (5) Question not attempted

21. In bending, the maximum tensile & compressive stresses occur:

- (1) Uniformly across the section
- (2) At the centroid
- (3) At the neutral axis
- (4) At the extreme fibers
- (5) Question not attempted

22.

The principal stresses at a point inside a solid object are $\sigma_1 = 100$ MPa, $\sigma_2 = 100$ MPa and $\sigma_3 = 0$. If the yield strength of the material in tension is 200 MPa, the factor of safety calculated using Tresca (maximum shear stress) theory will be

- (1) 2.5
- (2) 1
- (3) 2
- (4) 1.5
- (5) Question not attempted

23. A large part with complex shape and cavities is required to be designed to serve as base of a machine. The most suitable material and the method of manufacturing will be respectively

- (1) Mild steel and forging
- (2) Cast iron and sand casting
- (3) Cast iron and forging
- (4) Mild steel and machining
- (5) Question not attempted

24. The stresses at a point in a part are 80. MPa (tensile) and 30. MPa (shear). The yield stress in simple tensile test is 210 MPa. If the factor of safety is 2, pick the correct statement about the safety of the part according to 'A' as maximum principal stress and 'B' as maximum shear stress theories.

- (1) The part is safe as per 'B' only.
- (2) The part is safe from both 'A' and 'B'.
- (3) The part is unsafe from both 'A' and 'B'.
- (4) The part is safe as per 'A' only.
- (5) Question not attempted

$$m = \frac{D_1}{T_1} = \frac{6 \times 60}{360} = \frac{180}{360} = 0.5$$

$$m = \frac{D_2}{T_2} = \frac{6 \times 60}{360} = \frac{180}{360} = 0.5$$

$$m = \frac{D}{T}$$

$$m_1 = m_2 = \frac{\sigma_1 - \sigma_2}{2\tau} = \frac{80 - 30}{2 \times 30} = \frac{50}{60} = 0.83$$

$$\frac{\sigma_1}{T_1} = \frac{\sigma_2}{T_2} = \frac{80}{60} = \frac{4}{3}$$

T M=60

$$\int M d\theta = \int 6400 \cos 36^\circ$$

25. A mild steel shaft is subjected to a torque of 80 N.m and a bending moment of 60 N.m at its critical section. The shaft can be designed as if it is subjected to only a twisting moment of

- (1) 160 N.m (2) 140 N.m
(3) 70 N.m (4) 100 N.m
(5) Question not attempted

26. An engine cylinder is 300 mm in diameter and gas pressure is 0.5 N/mm². The cylinder head is held by 8 studs. What core diameter of the stud (in mm) will be required if the permissible stress for the stud material is 25 MPa?

- (1) 25 (2) 10
(3) 100 (4) 15
(5) Question not attempted

27. If k_b = stiffness of the bolt, k_m = stiffness of the bolted members, P = external tensile load on the bolted members, and F_i = preload in the bolt, then what will be the total load carried by the bolt?

- (1) $F_b = F_i - \frac{k_m P}{k_b + k_m}$
(2) $F_b = F_i + \frac{k_b P}{k_b + k_m}$
(3) $F_b = F_i - \frac{k_b P}{k_b + k_m}$
(4) $F_b = F_i + \frac{k_m P}{k_b + k_m}$
(5) Question not attempted

28. The radius of neutral axis of a curved beam of rectangular cross section having depth h , and inner and outer radii as R_i and R_o , respectively is

- (1) $\frac{h}{\log_e \left(\frac{R_i}{R_o} \right)}$
(2) $\frac{h}{\log_e \left(\frac{R_o}{R_i} \right)}$
(3) $\frac{\log_e \left(\frac{R_o}{R_i} \right)}{h}$
(4) $\frac{\log_e \left(\frac{R_i}{R_o} \right)}{h}$
(5) Question not attempted



29. The fulcrum pin of the lever gets broken into three pieces during the application. The possible cause of the failure is

- (1) crushing stress
(2) double shear stress
(3) bending
(4) bearing pressure
(5) Question not attempted



30. If there is only one atom located at the each lattice point, the number of atoms per unit cell would be _____ for the simple cubic, body-centered cubic, and face-centered cubic unit cells respectively.

- (1) 2, 4 & 8 (2) 2, 4 & 6
(3) 1, 2 & 3 (4) 1, 2 & 4
(5) Question not attempted

SC = 1
BCC = 2
FCC = 4

$a = 2$
 $a = \frac{40}{\sqrt{2}}$

6, 8, 12, 12, 6

31. Which of the following is generally the annealing temperature (in $^{\circ}\text{C}$) for Hyper-eutectoid steel ?

- (1) Lower critical temperature + 100
- (2) Lower critical temperature + 50
- (3) Lower critical temperature + 20
- (4) Power critical temperature + 70
- (5) Question not attempted

32. Arrange the following iron ore with respect to the iron content in the increasing order :

- (1) Haematite, Limonite, Siderite, Magnetite
- (2) Haematite, Magnetite, Limonite, Siderite
- (3) Siderite, Limonite, Haematite, Magnetite
- (4) Siderite, Limonite, Magnetite, Haematite
- (5) Question not attempted

33. The volume of FCC unit cell in terms of the atomic radius R is given by

- (1) $27 R^3$
- (2) $8 R^3 \sqrt{2}$
- (3) $16 R^3 \sqrt{2}$
- (4) $8 R^3$
- (5) Question not attempted



34. The value of the co-ordination numbers are _____, _____, and _____, for simple cubic, BCC & FCC respectively.

- (1) 6, 8 & 12
- (2) 3, 6 & 6
- (3) 1, 2 & 3
- (4) 1, 2 & 4
- (5) Question not attempted

35. The Miller index of a plane parallel to one of the co-ordinate axis is -

- (1) -1
- (2) 1
- (3) 0
- (4) ∞
- (5) Question not attempted



V-First

36. _____ is an intimate mixture of ferrite and cementite.

- (1) Martensite
- (2) Austenite
- (3) Ledeburite
- (4) Pearlite
- (5) Question not attempted

37. Phase diagram of zinc (Zn) and lead (Pb) is a/an _____ system.

- (1) Eutectic
- (2) Monotectic
- (3) Eutectoid
- (4) Peritectic
- (5) Question not attempted

38. Screws are generally made of

- (1) High speed steel
- (2) Chromium steel
- (3) Free cutting steel
- (4) Tool steel
- (5) Question not attempted

39. Which of the following elements are present as unwanted impurities in alloy steels ?

- (1) Nickel and Molybdenum
- (2) Sulphur and Phosphorus
- (3) Silicon and Manganese
- (4) Carbon and Chromium
- (5) Question not attempted

40. _____ is the temperature, during heating, at which pearlite changes to austenite.

- (1) None of these
- (2) Curie temperature
- (3) Lower critical temperature
- (4) Upper critical temperature
- (5) Question not attempted

41. The actual duty cycle of electric arc welding machine is _____

(1) $T_a = \left(\frac{I_a}{T}\right)^2 I$ ✗

✓ (2) $T_a = \left(\frac{I}{I_a}\right)^2 T$

(3) $T_a = \left(\frac{I_a}{I}\right)^2 T$ ✗

(4) $T_a = \left(\frac{T}{I_a}\right)^2 I$

(5) Question not attempted

where T = Rated duty cycle ✓

I = Rated current at the rated duty cycle. ✗

I_a = Maximum current at the rated duty cycle. ✓

$\left(\frac{I}{I_a}\right)$



42. Match the items in column I & column II related to a single point cutting tool

Column I

Column II

(P) Flank

I.

Intersection of the flank & the base of the tool

(Q) Face

II.

Point where the side cutting edge & end cutting edge intersect

(R) Heel

III.

The surface on which the chip slides

(S) Nose

IV.

The surface or surfaces below & adjacent to the cutting edge

P Q R S

(1) III IV II I

✓ (2) IV III I II

(3) IV II III I

(4) II III IV I

(5) Question not attempted

43. The angle between the face and a line parallel to the drill axis is known as _____

✓ (1) Point angle

(2) Helix angle

✗ (3) Rake angle

(4) Lip clearance angle

(5) Question not attempted



44. _____ is a mechanical metal removal process for brittle materials by using high frequency oscillations of a shaped tool using abrasive slurry.

(1) Abrasive water jet machining ✗

(2) Electrochemical grinding

(3) Laser beam machining ✗

✓ (4) Ultrasonic machine

(5) Question not attempted

45. A correct way of specifying a grinding wheel is

✓ (1) K - 60 - A - 5 - V ✓

✗ (2) A - 60 - V - 5 - K

(3) 60 - A - V - 5 - K

✓ (4) A - 60 - K - 5 - V

(5) Question not attempted ✓

46. A 100-mm diameter cutter having 8 teeth is cutting steel at 30 m/min. The depth of cut is taken as 4 mm and the table feed rate is 150 mm/min. The width of the workpiece is 120 mm. Find the spindle speed in rev./min.

(1) 60.2

(2) 15.20

(3) 95.49

(4) 40.1

(5) Question not attempted

47. Taylor's tool life equation is _____

(1) $VC^n = T$ (2) $TV^n = C$

(3) $CV^n = T$ (4) $VT^n = C$

(5) Question not attempted

where, T is the tool life in minutes.

V is the cutting speed in m/min, and C & n are constants.

$t = \frac{L}{V \times N}$ $\frac{1}{150 \times N}$

48. The size of a shaper is given by

- (1) Depth of cut
- (2) Maximum length of stroke
- (3) Cutting speed
- (4) MRR
- (5) Question not attempted

49. _____ are basically internal ruptures caused by the improper cooling of the large forgings.

- (1) Scale Pits
- (2) Unfilled sections
- (3) Flakes
- (4) Die Shift
- (5) Question not attempted

50. Which of the following statements is incorrect in relation to the investment casting?

- (1) Parts produced by investment casting do not require machining.
- (2) It uses wax patterns & Refractory slurry.
- (3) The process is not suitable for small size with intricate details.
- (4) It is not suitable for large production run.
- (5) Question not attempted

51. In an orthogonal cutting operation, the cutting force is F_c , the thrust force is F_t and the shear angle is ψ , then the expression of shear force (F_s) is given by

- (1) $F_s = F_c \cot \psi - F_t \sin \psi$
- (2) $F_s = F_c \cos \psi - F_t \sin \psi$
- (3) $F_s = F_c \cos \psi + F_t \sin \psi$
- (4) $F_s = F_c \sin \psi - F_c \cos \psi$
- (5) Question not attempted

52. The net requirements in MRP is recorded in the inventory status file as

- (1) Net requirements = Projected gross requirements - (Inventory on hand + Scheduled receipts)
- (2) Net requirements = Projected gross requirements - (Scheduled receipts - Inventory in hand)
- (3) Net requirements = Inventory on hand - (Scheduled receipts + Projected gross requirements)
- (4) Net requirements = Scheduled receipts - (Inventory on hand + Projected gross requirements)
- (5) Question not attempted

53. Plant location case of a company has the following information:

Location A would result in annual cost of ₹ 3,00,000, variable costs of ₹ 63 per unit, & revenues of ₹ 68 per unit.

Annual fixed costs at location B are ₹ 8,00,000; variable costs are ₹ 32 per unit, & revenues are ₹ 68 per unit. Sales volume is estimated to be 25,000 units per year.

Which location is more attractive?

- (1) Neither A nor B
- (2) Location A
- (3) Location B
- (4) Location A & B both
- (5) Question not attempted

54. A time study of a restaurant activity yielded a cycle time of 2.00 minutes, and the waitress was rated at performance rating = 96 percent. The restaurant chain has a 20 percent allowance factor. Following will be the standard time -

- (1) 2.40 min
- (2) 2.20 min
- (3) 2.60 min
- (4) 2.45 min
- (5) Question not attempted

$$25000 = \frac{3,00,000 + P}{5}$$

$$75,000$$

37

(36)

$$F_s = F_c \sin \psi - F_t \cos \psi$$

$$F_s = 0.96$$

9-96%

$$1.92$$

$$1.92$$

55. A manufacturing co-ordinator has the following shop orders due to be shipped a week (5 working days) from now :

Shop order number	427	430	432	433	435	436
Number of days of work remaining	2	4	7	6	5	3

Which of the following is the correct jobs sequence according to critical ratio priority ?

- (1) 432,433,435,430,436,427
 (2) 436,433,435,430,432,427
 (3) 436,430,435,433,432,427
 (4) 432,430,433,435,436,427
 (5) Question not attempted
56. Cost of insurance and obsolescence is a type of –
 (1) Inventory stock out cost
 (2) Inventory ordering cost
 (3) Inventory holding cost
 (4) Inventory back ordering cost
 (5) Question not attempted
57. Which of the following conveyor consists of a tube through which a shaft mounted helix revolves to push loose material forward in a horizontal or an inclined – direction ?
 (1) Chain Conveyor
 (2) Roller Conveyor
 (3) Screw Conveyor
 (4) Belt Conveyor
 (5) Question not attempted
58. Which of the following business sector generally doesn't follow co-operative society model in India ?
 (1) Agriculture industry
 (2) Dairy industry
 (3) Sugar industry
 (4) Information technology
 (5) Question not attempted

59. Automobile assembly plants, food processing plants, and cafeterias are examples of _____ layouts.

- (1) Fixed position
 (2) Batch processing
 (3) Line
 (4) Job shop
 (5) Question not attempted

60. Jordan Tucker works for a production facility that makes aspirin. His job is to fill the bottles of aspirin, and he is expected to process 200 bottles in an hour. The facility where Jordan works uses a Kanban production system in which each container holds 25 bottles. It takes 30 minutes for Jordan to receive the bottles he needs from the previous work station. The factory sets safety stock at 10 percent of demand during lead time. How many Kanbans are needed for the filling process ?

- (1) 8.8 (2) 2.2
 (3) 4.4 (4) 6.6
 (5) Question not attempted

61. The load-distance method is related to

- (1) Location planning method
 (2) Workforce planning method
 (3) Material planning method
 (4) Machine planning method
 (5) Question not attempted

62. Which of the following is a qualitative forecasting technique ?

- (1) Delphi technique
 (2) Time series
 (3) Regression and correlation
 (4) Exponential smoothing
 (5) Question not attempted

63. Consider the following statements :
- (i) Supply chain management does not consist of the acquisition phase.
 - (ii) Supply chain management consists of the transformation process.
 - (iii) Supply chain management consists of the distribution management.
 - (iv) The bullwhip effect refers to amplified demand variability in a supply chain.

Which of the option is true in the context of above statements ?

- (1) (i) & (iii)
- (2) (i), (ii) & (iii)
- (3) (ii), (iii) & (iv)
- (4) (i), (ii) & (iv)
- (5) Question not attempted

64. Consider the following statements for a thermodynamic property :

- (a) It depends only on state of the system and it does not depend on the path the system follows.
- (b) It's differential is not exact.
- (c) It depends only on path the system follows and does not depend on the state.

Which of the above statement(s) is/are true ?

- (1) (b), (c)
- (2) Only (a)
- (3) (a), (b)
- (4) Only (c)
- (5) Question not attempted

65. The value of exponent $n = \pm \infty$ in the polytropic process $p v^n = C$ is indicative of

- (1) Isentropic process
- (2) Throttling process
- (3) Isochoric process
- (4) Isobaric process
- (5) Question not attempted

66. Brayton cycle with several stages of intercooling & reheating would approximate as :

- (1) Ericsson Cycle
- (2) Otto Cycle
- (3) Diesel Cycle
- (4) Atkinson Cycle
- (5) Question not attempted

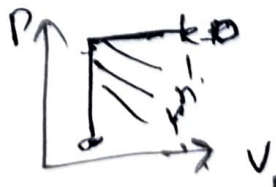
67. Read the following statements :

- (a) Air standard efficiency of Otto cycle increases if ratio of specific heats increases.
- (b) A diesel cycle has one constant pressure process.
- (c) For same compression ratio the Otto cycle is more efficient than the diesel cycle.
- (d) For constant maximum pressure and temperature Otto cycle gives more efficiency.
- (1) (b), (c), (d) are true.
- (2) (a), (b) are true.
- (3) (a), (b), (c) are true.
- (4) (a), (b), (d) are true.
- (5) Question not attempted

68. Which air standard cycle consists of two isothermals connected by two constant volume processes ?

- (1) Atkinson Cycle
- (2) Brayton Cycle
- (3) Ericsson Cycle
- (4) Stirling Cycle
- (5) Question not attempted

$$p \cdot v^\infty = C$$



69. In radiative heat transfer, a gray surface is the one

- (1) whose behaviour is not governed by Stefan Boltzman law.
- (2) which appears gray to the eye.
- (3) whose emissivity is independent of wavelength.
- (4) which has reflectivity equal to zero.
- (5) Question not attempted

70. A composite slab has two layers of different materials joined in series having thermal conductivities as ' k_1 ' and ' k_2 '. If each layer has same thickness, the equivalent thermal conductivity of the slab would be

- (1) $\frac{2 k_1 \cdot k_2}{k_1 + k_2}$
- (2) $\frac{k_1 \cdot k_2}{k_1 + k_2}$
- (3) $\frac{k_1 \cdot k_2}{2 (k_1 + k_2)}$
- (4) $\frac{2k_1}{k_1 + k_2}$
- (5) Question not attempted

71. If ' k ' is thermal conductivity and ' h ' is convective heat transfer coefficient; the critical thickness of insulation for spherical shell is given by -

- (1) $2k/h$
- (2) k/h
- (3) $k/4h$
- (4) $h/2k$
- (5) Question not attempted

72. Which of the following dimensionless numbers give an indication of the ratio of Internal resistance (conduction) to the Surface resistance (convection) ?

- (1) Stanton Number
- (2) Fourier Number
- (3) Biot Number
- (4) Nusselt Number
- (5) Question not attempted

73. Match the lists and select correct option :

- | List I | List II |
|---|--------------------------------------|
| A. Number of transfer units | 1. Recuperative type heat exchanger. |
| B. Periodic heat flow | 2. Regenerator type heat exchanger. |
| C. Chemical additive | 3. A measure of heat exchanger size. |
| D. Deposition on heat exchanger surface | 4. Prolongs dropwise condensation. |
| | 5. Fouling factor. |



- | | A | B | C | D |
|-----|------------------------|---|---|---|
| (1) | 3 | 1 | 5 | 4 |
| (2) | 3 | 2 | 5 | 4 |
| (3) | 2 | 1 | 4 | 5 |
| (4) | 3 | 2 | 4 | 5 |
| (5) | Question not attempted | | | |

74. Which of the following statement is incorrect ?

- (1) In dropwise condensation, there is very high resistance for heat flow between the vapour and the surface.
- (2) In filmwise condensation, heat transfer rate is reduced.
- (3) In dropwise condensation, heat transfer rates are much higher.
- (4) In filmwise condensation, the liquid wets the surface and a thin layer of liquids forms over the surface.
- (5) Question not attempted

$$Nu = \frac{h \cdot D}{k}$$

$$= \frac{\text{Cond}}{\text{Conv.}}$$

$$\frac{L}{h \cdot n} \left(\frac{KA}{L} \right)$$

$$\frac{L \cdot D}{h}$$

$$2 \frac{k}{h}$$

$$\left(\frac{k}{h} \right)$$

275
37
10

(Cov)

75. A refrigeration plant is maintained at -3°C and the surroundings are at 37°C . The leakage of heat into the plant from the surroundings is 30 kW. The actual COP of the refrigeration plant used is one-third that of an ideal plant working between the same temperature limits. Find the power required to drive the plant.

- (1) 8 kW
(2) 67.5 kW
(3) 4.44 kW
(4) 12 kW
(5) Question not attempted

76. Which of the following is not the required condition for high COP of a system?

- (1) The freezing point of the refrigerant should be higher than system temperatures.
(2) The critical temperature of refrigerant should be high.
(3) The critical pressure of refrigerant should be low.
(4) The refrigerant should operate above its freezing point in the cycle.
(5) Question not attempted

77. Vapour absorption refrigeration system works using the

- (1) Ability to compress a low pressure refrigerant vapour.
(2) Ability of a vapour to get compressed or expanded.
(3) Ability of a substance to get easily condensed or evaporated.
(4) Affinity of absorbing a substance for another substance.
(5) Question not attempted

78. The sensing bulb of the thermostatic expansion valve is located at the

- (1) Inlet of condenser
(2) Inlet of evaporator
(3) Outlet end of evaporator
(4) Exit of compressor
(5) Question not attempted

79. Which of the following is classified as Secondary refrigerant?

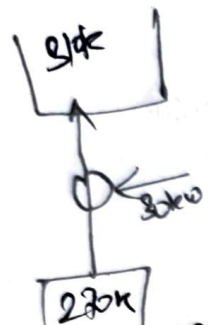
- (1) Sulphur dioxide
(2) Ammonia
(3) Solid Carbon dioxide
(4) Carbon dioxide
(5) Question not attempted

80. Which of the following is not a desirable property of a good refrigerant?

- (1) High critical temperature
(2) Low specific heat
(3) High specific volume of vapour
(4) Large latent heat at evaporator pressure
(5) Question not attempted

81. Chemical formula of the refrigerant designated as 'R134a' is

- (1) CF_3CHF_2
(2) CH_3CHF_2
(3) $\text{CF}_3\text{CH}_2\text{F}$
(4) CF_3CHClF
(5) Question not attempted



$COP = \frac{RE}{W} = \frac{1}{3}$
 $T_2 = 30^\circ\text{C}$
 $T_1 = 37^\circ\text{C}$
 $COP = \frac{T_1}{T_1 - T_2}$

$COP = \frac{RE}{W_{input}}$

(a = -2)

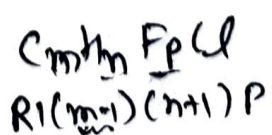
R134-a

12

$2 + 4 + a = 4$

$n + p + q = 2m$

$m = 2, n = 2, p = 4$



C1

89. Which of the following fluid flow is valid for Bernoulli's equation ?

- A. Steady flow ✓
- B. Viscous flow ✗
- C. Incompressible flow ✓
- D. Irrotational flow ✓

(1) A, C, D

(2) A, B, C

(3) B, D, C

(4) A, B, D

(5) Question not attempted

90. For fully developed laminar flow through a horizontal pipe, the shear stress is

(1) zero at the centre and increases linearly towards pipe wall. ✓

(2) constant across pipe.

(3) zero at the boundary and increases linearly towards centre.

(4) maximum at the centre and decreases linearly towards centre.

(5) Question not attempted

91. Which of the following equation represents the Hagen-Poiseuille equation for laminar flow in the circular pipes ?

(1) $p_1 - p_2 = (16\mu VL) / D^2$

✓ (2) $p_1 - p_2 = (64\mu VL) / D^2$

(3) $p_1 - p_2 = (128\mu VL) / D^2$

(4) $p_1 - p_2 = (32\mu VL) / D^2$

(5) Question not attempted

92. Maximum efficiency of transmission of power through pipe is

✓ (1) 66.7% (2) 33.3%

(3) 75% (4) 25%

(5) Question not attempted

93. In flow over a plate, if

U = free stream velocity,

u = velocity at distance y , and

δ = boundary layer thickness

then in a boundary layer flow the momentum thickness θ is given by

(1) $\theta = \int_0^{\delta} \left(\frac{u}{U} \right)^2 \left(1 - \frac{u}{U} \right) dy$

✓ (2) $\theta = \int_0^{\delta} \frac{u}{U} \left(1 - \frac{u}{U} \right) dy$

(3) $\theta = \int_0^{\delta} \left(1 - \frac{u}{U} \right) dy$

(4) $\theta = \int_0^{\delta} \frac{u}{U} \left(1 - \frac{u^2}{U^2} \right) dy$

(5) Question not attempted

94. The ratio of normal force of a jet of water on a stationary plate inclined at angle of 30° as compared to that when the plate is normal to jet is

(1) $\sqrt{2}$ (2) 1

(3) $\frac{1}{2}$ ✓ (4) $\frac{1}{\sqrt{2}}$

(5) Question not attempted

$$F_n = \frac{\rho \cdot A \cdot V^2 \cdot \sin^2 \theta}{2} \quad \rho_L = \frac{128 \mu V L}{D^2}$$

95. Which of the following is not an axial flow turbine ?
- (1) Fournayron turbine
 - (2) Kaplan turbine
 - (3) Jonval turbine
 - (4) Girard turbine
 - (5) Question not attempted
96. Which one of the following statements is true ?
- (1) The air vessel is fitted only on suction side of centrifugal pump.
 - (2) The air vessel is fitted both on suction and delivery side of a reciprocating pump.
 - (3) The air vessel is fitted both on suction and delivery side of a centrifugal pump.
 - (4) The air vessel is fitted only on suction side of reciprocating pump.
 - (5) Question not attempted
97. The speed of flame propagation in SI engines,
- (1) Reduces with increasing load.
 - (2) Increases for lean mixture.
 - (3) Reduces for increased compression ratio.
 - (4) Increases with intake temperature increase.
 - (5) Question not attempted

98. A diesel engine consumes 200 HP to overcome friction and delivers 1000 BHP. Air consumption is 90 kg per minute. The air fuel ratio is 15 to 1. Find Indicated Specific Fuel Consumption (ISFC).

- (1) 30 kg/IHP hr
- (2) 3 kg/IHP hr
- (3) 0.3 kg/IHP hr
- (4) 10 kg/IHP hr
- (5) Question not attempted

$$I.P. = 1200$$

$$F.P. = 200 \text{ HP}$$

$$1000 \text{ BHP}$$

$$ISFC = \frac{I.P.}{m_b \times G}$$

$$= \frac{1200}{400 \times 60}$$

$$= \frac{1200}{24000}$$

$$= 0.05$$

$$= 0.3 \text{ kg/IHP hr}$$

99. What works as a compensating device in a carburettor ?

- (1) Idling jet
- (2) Main jet
- (3) Auxillary valve
- (4) Choke
- (5) Question not attempted

100. The two reference fuels used for cetane rating are

- (1) Cetane and α - methyl naphthalene
- (2) Cetane and iso-octane
- (3) Cetane and tetra ethyle lead
- (4) Cetane and n-heptane
- (5) Question not attempted