

पुस्तिका में पृष्ठों की संख्या : 16
 Number of Pages in Booklet : 16
 पुस्तिका में प्रश्नों की संख्या : 100
 No. of Questions in Booklet : 100

NEAP-25

इस प्रश्न-पुस्तिका को तब तक न खोलें जब तक
 कहा न जाए। Do not open this Question
 Booklet until you are asked to do so.


Paper Code : 37
Sub : Mechanical Engineering

प्रश्न-पुस्तिका संख्या व बारकोड /

Question Booklet No. & Barcode

समय : 02:00 घण्टे + 10 मिनट अतिरिक्त*
अधिकतम अंक : 200
Time : 02:00 Hours + 10 Minutes Extra*
Maximum Marks : 200

प्रश्न-पुस्तिका के पेपर की सील/पोलिथीन बैग को खोलने पर प्रश्न-पत्र हल करने से पूर्व परीक्षार्थी यह सुनिश्चित कर लें कि :

- प्रश्न-पुस्तिका संख्या तथा ओ.एम.आर. उत्तर-पत्रक पर अंकित बारकोड संख्या समान हैं।
- प्रश्न-पुस्तिका एवं ओ.एम.आर. उत्तर-पत्रक के सभी पृष्ठ व सभी प्रश्न सही मुद्रित हैं। समस्त प्रश्न, जैसा कि ऊपर वर्णित है, उपलब्ध हैं तथा कोई भी पृष्ठ कम नहीं है/ मुद्रण त्रुटि नहीं है। किसी भी प्रकार की विसंगति या दोषपूर्ण होने पर परीक्षार्थी वीक्षक से दूसरा प्रश्न-पत्र प्राप्त कर लें। यह सुनिश्चित करने की जिम्मेदारी अभ्यर्थी की होगी। परीक्षा प्रारम्भ होने के 5 मिनट पश्चात् ऐसे किसी दावे/आपत्ति पर कोई विचार नहीं किया जायेगा।

On opening the paper seal/polythene bag of the Question Booklet before attempting the question paper, the candidate should ensure that :

- Question Booklet Number and Barcode Number of OMR Answer Sheet are same.
- All pages & Questions of Question Booklet and OMR Answer Sheet are properly printed. All questions as mentioned above are available and no page is missing/misprinted.

If there is any discrepancy/defect, candidate must obtain another Question Booklet from Invigilator. Candidate himself shall be responsible for ensuring this. No claim/objection in this regard will be entertained after five minutes of start of examination.

परीक्षार्थियों के लिए निर्देश

1. प्रत्येक प्रश्न के लिये एक विकल्प भरना अनिवार्य है।
2. सभी प्रश्नों के अंक समान हैं।
3. प्रत्येक प्रश्न का मात्र एक ही उत्तर दीजिए। एक से अधिक उत्तर देने की दशा में प्रश्न के उत्तर को गलत माना जाएगा।
4. OMR उत्तर-पत्रक इस प्रश्न-पुस्तिका के अन्दर रखा है। जब आपको प्रश्न-पुस्तिका खोलने को कहा जाए, तो उत्तर-पत्रक निकाल कर ध्यान से केवल नीले बॉल पॉइंट पेन से विवरण भरें।
5. कृपया अपना रोल नम्बर ओ.एम.आर. उत्तर-पत्रक पर सावधानीपूर्वक सही भरें। गलत रोल नम्बर भरने पर परीक्षार्थी स्वयं उत्तरदायी होगा।
6. ओ.एम.आर. उत्तर-पत्रक में करेक्शन पेन/व्हाइटनर/सफेदा का उपयोग निषिद्ध है।
7. प्रत्येक गलत उत्तर के लिए प्रश्न अंक का 1/3 भाग काटा जायेगा। गलत उत्तर से तात्पर्य अशुद्ध उत्तर अथवा किसी भी प्रश्न के एक से अधिक उत्तर से है।
8. प्रत्येक प्रश्न के पाँच विकल्प दिये गये हैं, जिन्हें क्रमशः 1, 2, 3, 4, 5 अंकित किया गया है। अभ्यर्थी को सही उत्तर निर्दिष्ट करते हुए उनमें से केवल एक गोले (बबल) को उत्तर-पत्रक पर नीले बॉल पॉइंट पेन से गहरा करना है।
9. यदि आप प्रश्न का उत्तर नहीं देना चाहते हैं तो उत्तर-पत्रक में पाँचवें (5) विकल्प को गहरा करें। यदि पाँच में से कोई भी गोला गहरा नहीं किया जाता है, तो ऐसे प्रश्न के लिये प्रश्न अंक का 1/3 भाग काटा जायेगा।
- 10.* प्रश्न-पत्र हल करने के उपरान्त अभ्यर्थी अनिवार्य रूप से ओ.एम.आर. उत्तर-पत्रक जाँच लें कि समस्त प्रश्नों के लिये एक विकल्प (गोला) भर दिया गया है। इसके लिये ही निर्धारित समय से 10 मिनट का अतिरिक्त समय दिया गया है।
11. यदि अभ्यर्थी 10% से अधिक प्रश्नों में पाँच विकल्पों में से कोई भी विकल्प अंकित नहीं करता है तो उसको अयोग्य माना जायेगा।
12. मोबाइल फोन अथवा अन्य किसी इलेक्ट्रॉनिक यंत्र का परीक्षा हॉल में प्रयोग पूर्णतया वर्जित है। यदि किसी अभ्यर्थी के पास ऐसी कोई वर्जित सामग्री मिलती है तो उसके विरुद्ध आयोग द्वारा नियमानुसार कार्यवाही की जायेगी।

चेतावनी : अगर कोई अभ्यर्थी नकल करते पकड़ा जाता है या उसके पास से कोई अनधिकृत सामग्री पाई जाती है, तो उस अभ्यर्थी के विरुद्ध पुलिस में प्राथमिकी दर्ज कराते हुए राजस्थान सार्वजनिक परीक्षा (भर्ती) में अनुचित साधनों की रोकथाम अध्यापक अधिनियम, 2022 तथा अन्य प्रभावी कानून एवं आयोग के नियमों-प्रावधानों के तहत कार्यवाही की जाएगी। साथ ही आयोग ऐसे अभ्यर्थी को भविष्य में होने वाली आयोग की समस्त परीक्षाओं से विवर्जित कर सकता है।

INSTRUCTIONS FOR CANDIDATES

1. It is mandatory to fill one option for each question.
2. All questions carry equal marks.
3. Only one answer is to be given for each question. If more than one answers are marked, it would be treated as wrong answer.
4. The OMR Answer Sheet is inside this Question Booklet. When you are directed to open the Question Booklet, take out the Answer Sheet and fill in the particulars carefully with Blue Ball Point Pen only.
5. Please correctly fill your Roll Number in OMR Answer Sheet. Candidates will themselves be responsible for filling wrong Roll No.
6. Use of Correction Pen/Whitener in the OMR Answer Sheet is strictly forbidden.
7. 1/3 part of the mark(s) of each question will be deducted for each wrong answer. A wrong answer means an incorrect answer or more than one answers for any question.
8. Each question has five options marked as 1, 2, 3, 4, 5. You have to darken only one circle (bubble) indicating the correct answer on the Answer Sheet using BLUE BALL POINT PEN.
9. If you are not attempting a question then you have to darken the circle '5'. If none of the five circles is darkened, one third (1/3) part of the marks of question shall be deducted.
- 10.* After solving question paper, candidate must ascertain that he/she has darkened one of the circles (bubbles) for each of the questions. Extra time of 10 minutes beyond scheduled time, is provided for this.
11. A candidate who has not darkened any of the five circles in more than 10% questions shall be disqualified.
12. Mobile Phone or any other electronic gadget in the examination hall is strictly prohibited. A candidate found with any of such objectionable material with him/her will be strictly dealt with as per rules.

Warning : If a candidate is found copying or if any unauthorized material is found in his/her possession, F.I.R. would be lodged against him/her in the Police Station and he/she would be liable to be prosecuted under Rajasthan Public Examination (Measures for Prevention of Unfair means in Recruitment) Act, 2022 & any other laws applicable and Commission's Rules-Regulations. Commission may also debar him/her permanently from all future examinations.

उत्तर-पत्रक में दो प्रतिवर्तियाँ हैं - मूल प्रति और कार्बन प्रति। परीक्षा समाप्ति पर परीक्षा कक्ष छोड़ने से पूर्व परीक्षार्थी उत्तर-पत्रक की दोनों प्रतिवर्तियाँ वीक्षक को सौंपेंगे, परीक्षार्थी स्वयं कार्बन प्रति अलग नहीं करें। वीक्षक उत्तर-पत्रक की मूल प्रति को अपने पास जमा कर, कार्बन प्रति को मूल प्रति से कट लाइन से मोड़ कर सावधानीपूर्वक अलग कर परीक्षार्थी को सौंपेंगे, जिसे परीक्षार्थी अपने साथ ले जायेंगे। परीक्षार्थी को उत्तर-पत्रक की कार्बन प्रति चयन प्रक्रिया पूर्ण होने तक सुरक्षित रखनी होगी एवं आयोग द्वारा माँगे जाने पर प्रस्तुत करनी होगी।



1. The volume of FCC unit cell in terms of the atomic radius R is given by
 - (1) $8 R^3 \sqrt{2}$
 - (2) $16 R^3 \sqrt{2}$
 - (3) $8 R^3$
 - (4) $27 R^3$
 - (5) Question not attempted
2. The value of the co-ordination numbers are _____, _____, and _____, for simple cubic, BCC & FCC respectively.
 - (1) 3, 6 & 6
 - (2) 1, 2 & 3
 - (3) 1, 2 & 4
 - (4) 6, 8 & 12
 - (5) Question not attempted
3. The Miller index of a plane parallel to one of the co-ordinate axis is -
 - (1) 1
 - (2) 0
 - (3) ∞
 - (4) -1
 - (5) Question not attempted
4. Which of the following is generally the annealing temperature (in $^{\circ}\text{C}$) for Hyper-eutectoid steel ?
 - (1) Lower critical temperature + 50
 - (2) Lower critical temperature +20
 - (3) Power critical temperature +70
 - (4) Lower critical temperature +100
 - (5) Question not attempted
5. Arrange the following iron ore with respect to the iron content in the increasing order :
 - (1) Haematite, Magnetite, Limonite, Siderite
 - (2) Siderite, Limonite, Haematite, Magnetite
 - (3) Siderite, Limonite, Magnetite, Haematite
 - (4) Haematite, Limonite, Siderite, Magnetite
 - (5) Question not attempted
6. Screws are generally made of
 - (1) Chromium steel
 - (2) Free cutting steel
 - (3) Tool steel
 - (4) High speed steel
 - (5) Question not attempted
7. Which of the following elements are present as unwanted impurities in alloy steels ?
 - (1) Sulphur and Phosphorus
 - (2) Silicon and Manganese
 - (3) Carbon and Chromium
 - (4) Nickel and Molybdenum
 - (5) Question not attempted
8. _____ is the temperature, during heating, at which pearlite changes to austenite.
 - (1) Curie temperature
 - (2) Lower critical temperature
 - (3) Upper critical temperature
 - (4) None of these
 - (5) Question not attempted
9. _____ is an intimate mixture of ferrite and cementite.
 - (1) Austenite
 - (2) Ledeburite
 - (3) Pearlite
 - (4) Martensite
 - (5) Question not attempted
10. Phase diagram of zinc (Zn) and lead (Pb) is a/an _____ system.
 - (1) Monotectic
 - (2) Eutectoid
 - (3) Peritectic
 - (4) Eutectic
 - (5) Question not attempted





11. 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) IV	III	I	II
(2) IV	II	III	I
(3) II	III	IV	I
(4) III	IV	II	I

(5) Question not attempted

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

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

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

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

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

(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.

13. A correct way of specifying a grinding wheel is

- (1) A – 60 – V – 5 – K
(2) 60 – A – V – 5 – K
(3) A – 60 – K – 5 – V
(4) K – 60 – A – 5 – V
(5) Question not attempted

14. 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) 15.20 (2) 95.49
(3) 40.1 (4) 60.2
(5) Question not attempted

15. Taylor's tool life equation is _____.

- (1) $TV^n = C$ (2) $CV^n = T$
(3) $VT^n = C$ (4) $VC^n = T$
(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.

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

- (1) Helix angle
(2) Rake angle
(3) Lip clearance angle
(4) Point angle
(5) Question not attempted

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

- (1) Electrochemical grinding
(2) Laser beam machining
(3) Ultrasonic machine
(4) Abrasive water jet machining
(5) Question not attempted



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

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



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

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

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

21. The size of a shaper is given by

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

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

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

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

24. 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) 2.20 min (2) 2.60 min
- (3) 2.45 min (4) 2.40 min
- (5) Question not attempted



25. Cost of insurance and obsolescence is a type of –

- (1) Inventory ordering cost
- (2) Inventory holding cost
- (3) Inventory back ordering cost
- (4) Inventory stock out cost
- (5) Question not attempted

26. 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) Roller Conveyor
- (2) Screw Conveyor
- (3) Belt Conveyor
- (4) Chain Conveyor
- (5) Question not attempted



27. Which of the following business sector generally doesn't follow co-operative society model in India ?

- (1) Dairy industry
- (2) Sugar industry
- (3) Information technology
- (4) Agriculture industry
- (5) Question not attempted

28. 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) 436,433,435,430,432,427
- (2) 436,430,435,433,432,427
- (3) 432,430,433,435,436,427
- (4) 432,433,435,430,436,427
- (5) Question not attempted

29. 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) 2.2
- (2) 4.4
- (3) 6.6
- (4) 8.8
- (5) Question not attempted

30. The load-distance method is related to

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

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

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

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

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



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



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

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

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

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

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

37. 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) (a), (b) are true.
- (2) (a), (b), (c) are true.
- (3) (a), (b), (d) are true.
- (4) (b), (c), (d) are true.
- (5) Question not attempted

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

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



39. 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) $\frac{k_1 \cdot k_2}{k_1 + k_2}$ (2) $\frac{k_1 \cdot k_2}{2(k_1 + k_2)}$

(3) $\frac{2k_1}{k_1 + k_2}$ (4) $\frac{2k_1 \cdot k_2}{k_1 + k_2}$

(5) Question not attempted

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

(1) k/h (2) $k/4h$

(3) $h/2k$ (4) $2k/h$

(5) Question not attempted

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

(1) Fourier Number

(2) Biot Number

(3) Nusselt Number

(4) Stanton Number

(5) Question not attempted

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

(1) which appears gray to the eye.

(2) whose emissivity is independent of wavelength.

(3) which has reflectivity equal to zero.

(4) whose behaviour is not governed by Stefan Boltzman law.

(5) Question not attempted

43. Which of the following statement is incorrect ?

(1) In filmwise condensation, heat transfer rate is reduced.

(2) In dropwise condensation, heat transfer rates are much higher.

(3) In filmwise condensation, the liquid wets the surface and a thin layer of liquids forms over the surface.

(4) In dropwise condensation, there is very high resistance for heat flow between the vapour and the surface.

(5) Question not attempted

44. 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 | 2 | 5 | 4 |
| (2) | 2 | 1 | 4 | 5 |
| (3) | 3 | 2 | 4 | 5 |
| (4) | 3 | 1 | 5 | 4 |

(5) Question not attempted



45. 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) 67.5 kW
 - (2) 4.44 kW
 - (3) 12 kW
 - (4) 8 kW
 - (5) Question not attempted
46. Which of the following is not the required condition for high COP of a system ?
- (1) The critical temperature of refrigerant should be high.
 - (2) The critical pressure of refrigerant should be low.
 - (3) The refrigerant should operate above its freezing point in the cycle.
 - (4) The freezing point of the refrigerant should be higher than system temperatures.
 - (5) Question not attempted
47. Vapour absorption refrigeration system works using the
- (1) Ability of a vapour to get compressed or expanded.
 - (2) Ability of a substance to get easily condensed or evaporated.
 - (3) Affinity of absorbing a substance for another substance.
 - (4) Ability to compress a low pressure refrigerant vapour.
 - (5) Question not attempted
48. Which of the following is classified as Secondary refrigerant ?
- (1) Ammonia
 - (2) Solid Carbon dioxide
 - (3) Carbon dioxide
 - (4) Sulphur dioxide
 - (5) Question not attempted
49. Which of the following is not a desirable property of a good refrigerant ?
- (1) Low specific heat
 - (2) High specific volume of vapour
 - (3) Large latent heat at evaporator pressure
 - (4) High critical temperature
 - (5) Question not attempted
50. Chemical formula of the refrigerant designated as 'R134a' is
- (1) CH_3CHF_2
 - (2) $\text{CF}_3\text{CH}_2\text{F}$
 - (3) CF_3CHClF
 - (4) CF_3CHF_2
 - (5) Question not attempted
51. The sensing bulb of the thermostatic expansion valve is located at the
- (1) Inlet of evaporator
 - (2) Outlet end of evaporator
 - (3) Exit of compressor
 - (4) Inlet of condenser
 - (5) Question not attempted

52. In a window air-conditioner, the expansion device used is
- (1) Automatic expansion valve
 - (2) Thermostatic expansion device
 - (3) Float valve
 - (4) Capillary tube
 - (5) Question not attempted

53. The heat load from the occupants in air conditioning load calculation is a source of

- (1) Sensible heat only
- (2) Latent heat only
- (3) Both sensible and latent heat
- (4) Sensible or latent heat, whichever is higher.
- (5) Question not attempted



54. Ratio of mass of water vapour in a given volume of mixture to the mass of water vapour in the same volume of saturated mixture at the same temperature & pressure is known as

- (1) Specific humidity
- (2) Humidity ratio
- (3) Relative humidity
- (4) Degree of saturation
- (5) Question not attempted

55. The latent heat load in an auditorium is 25% of sensible heat load. The value of sensible heat factor is then equal to

- (1) 0.25
- (2) 0.50
- (3) 0.80
- (4) 1.00
- (5) Question not attempted

56. Which of the following is not correct for Viscosity ?

- (1) Viscosity is a qualitative measure of a fluid's resistance to flow.
- (2) Viscosity determines the fluid strain rate that is generated by a given applied shear stress.
- (3) Viscosity of air is lower than water.
- (4) Viscosity characterize specific fluid mechanical behaviour.
- (5) Question not attempted

57. Consider the following relationship between the shear stress ' τ ' and the rate of shear strain ' du/dy '

$$\tau = \mu \left(\frac{du}{dy} \right)^n$$

When the exponent 'n' is greater than 1, the fluid is known as

- (1) Bingham plastic
- (2) Dilatent fluid
- (3) Newtonian fluid
- (4) Pseudo plastic fluid
- (5) Question not attempted

58. A stream function is given by $\psi = 3x^2 - y^3$. Determine the velocity components at the point (2,1).

- (1) 3, 12
- (2) 4, 15
- (3) 5, 30
- (4) 1, 1
- (5) Question not attempted



59. 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, B, C
- (2) B, D, C
- (3) A, B, D
- (4) A, C, D
- (5) Question not attempted



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

- (1) constant across pipe.
- (2) zero at the boundary and increases linearly towards centre.
- (3) maximum at the centre and decreases linearly towards centre.
- (4) zero at the centre and increases linearly towards pipe wall.
- (5) Question not attempted

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

- (1) $p_1 - p_2 = (64\mu VL) / D^2$
- (2) $p_1 - p_2 = (128\mu VL) / D^2$
- (3) $p_1 - p_2 = (32\mu VL) / D^2$
- (4) $p_1 - p_2 = (16\mu VL) / D^2$
- (5) Question not attempted

62. Maximum efficiency of transmission of power through pipe is

- (1) 33.3%
- (2) 75%
- (3) 25%
- (4) 66.7%
- (5) Question not attempted

63. 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

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

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

$$(3) \theta = \int_0^{\delta} \frac{u}{U} \left(1 - \frac{u^2}{U^2}\right) dy$$

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

- (5) Question not attempted

64. 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) 1
- (2) $\frac{1}{2}$
- (3) $\frac{1}{\sqrt{2}}$
- (4) $\sqrt{2}$

- (5) Question not attempted

65. Which of the following is not an axial flow turbine ?

- (1) Kaplan turbine
- (2) Jonval turbine
- (3) Girard turbine
- (4) Fourneyron turbine
- (5) Question not attempted



66. Which one of the following statements is true ?

- (1) The air vessel is fitted both on suction and delivery side of a reciprocating pump.
- (2) The air vessel is fitted both on suction and delivery side of a centrifugal pump.
- (3) The air vessel is fitted only on suction side of reciprocating pump.
- (4) The air vessel is fitted only on suction side of centrifugal pump.
- (5) Question not attempted

67. The speed of flame propagation in SI engines,

- (1) Increases for lean mixture.
- (2) Reduces for increased compression ratio.
- (3) Increases with intake temperature increase.
- (4) Reduces with increasing load.
- (5) Question not attempted

68. 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) 3 kg/IHP hr
- (2) 0.3 kg/IHP hr
- (3) 10 kg/IHP hr
- (4) 30 kg/IHP hr
- (5) Question not attempted

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

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

70. The two reference fuels used for cetane rating are

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

71. Compounding of a steam turbine is done to
- (1) balance the rotor
 - (2) reduce the blade friction
 - (3) reduce the rotor speed
 - (4) connect the shafts of two turbines
 - (5) Question not attempted
72. Which of the following is not true for ash in coal ?
- (1) It reduces calorific value of coal.
 - (2) High ash coal needs less excess air.
 - (3) It results in clinker formation.
 - (4) It affects the design of boiler.
 - (5) Question not attempted
73. 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) Fast Reactor
 - (2) Breeder Reactor
 - (3) Thermal Reactor
 - (4) Moderator
 - (5) Question not attempted
74. Which of the following is not characteristic of solar cell ?
- (1) Solar cell is made using Silicon.
 - (2) Solar cell stores energy.
 - (3) Solar cell is a converter.
 - (4) Solar cell changes the light energy into electrical energy.
 - (5) Question not attempted

75. 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) 100 MW, 120 MW
 - (2) 120 MW, 100 MW
 - (3) 144 MW, 120 MW
 - (4) 120 MW, 144 MW
 - (5) Question not attempted
76. In a flat plate collector, the purpose of glazing is to
- (1) transmit short wave length solar radiation and block longer wave length reradiation from absorber plate.
 - (2) block short wave length solar radiations and transmit longer wave length reradiation from absorber.
 - (3) transmit both short wave length solar radiation and longer wave length reradiation from absorber.
 - (4) Increase the heat loss by convection from the top of the absorber plate.
 - (5) Question not attempted
77. Which of the following is related to geothermal steam system ?
- (1) Fossil-superheat Hybrid Systems
 - (2) Bio fuels
 - (3) Wind mills
 - (4) Single ebb cycle system
 - (5) Question not attempted



78. A turning pair is an example of which kinematic pair ?
(1) Lower pair
(2) Higher pair
(3) Rolling pair
(4) Point contact pair
(5) Question not attempted
79. 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) 500 m/s² (2) 400 m/s²
(3) 200 m/s² (4) 300 m/s²
(5) Question not attempted
80. Which of the following is not an inversion of a single slider crank chain ?
(1) Whitworth quick return motion
(2) Scotch yoke
(3) Rotary engine
(4) Crank and slotted link type quick return motion mechanism
(5) Question not attempted
81. Which of the following statements is not correct about lifting of loads using square threads ?
(1) The angle of friction must be more than the helix angle for load not to slide down when the effort is removed.
(2) The self-locking screws have efficiency less than 50%.
(3) The efficiency is maximum when the helix angle (α) and the friction angle (ϕ) satisfy the relation $\alpha = 45^\circ - \phi / 2$.
(4) The maximum efficiency of the screw thread depends upon both the helix angle and the applied load.
(5) Question not attempted
82. Degrees of freedom for a planar mechanism with 4 links and 4 lower pairs is
(1) 1 (2) 2
(3) 3 (4) 0
(5) Question not attempted
83. 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) 30° and right-hand
(2) 30° and left-hand
(3) 60° and right-hand
(4) 60° and left-hand
(5) Question not attempted
84. 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) 380 (2) 420
(3) 100 (4) 120
(5) Question not attempted
85. If a governor has same equilibrium speed for all radii of rotation of balls, then such a governor is called
(1) Stable governor
(2) Inertia governor
(3) Sensitive governor
(4) Isochronous governor
(5) Question not attempted
86. 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) 10 (2) 50
(3) 100 (4) 200
(5) Question not attempted

87. 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) 200 (2) 340
 (3) 400 (4) 240
 (5) Question not attempted
88. 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) 10 N.s/m (2) 40 N.s/m
 (3) 100 N.s/m (4) 20 N.s/m
 (5) Question not attempted
89. In bending, the maximum tensile & compressive stresses occur :
 (1) At the centroid
 (2) At the neutral axis
 (3) At the extreme fibers
 (4) Uniformly across the section
 (5) Question not attempted
90. What are the stresses induced in the 'pin' of the knuckle joint when it is subjected to tensile load ?
 (1) Tensile and torsional shear stress
 (2) Bending and torsional shear stress
 (3) Tensile, direct shear and crushing stress
 (4) Direct shear, bending and crushing stress
 (5) Question not attempted
91. 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) 15 mm (2) 30 mm
 (3) 10 mm (4) 20 mm
 (5) Question not attempted
92. 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) 1 (2) 2
 (3) 1.5 (4) 2.5
 (5) Question not attempted
93. 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) Cast iron and sand casting
 (2) Cast iron and forging
 (3) Mild steel and machining
 (4) Mild steel and forging
 (5) Question not attempted
94. 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 from both 'A' and 'B'.
 (2) The part is unsafe from both 'A' and 'B'.
 (3) The part is safe as per 'A' only.
 (4) The part is safe as per 'B' only.
 (5) Question not attempted



95. 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) 140 N.m (2) 70 N.m
(3) 100 N.m (4) 160 N.m
(5) Question not attempted

96. 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) 10 (2) 100
(3) 15 (4) 25
(5) Question not attempted

97. 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) $F_b = F_i + \frac{k_b P}{k_b + k_m}$

(2) $F_b = F_i - \frac{k_b P}{k_b + k_m}$

(3) $F_b = F_i + \frac{k_m P}{k_b + k_m}$

(4) $F_b = F_i - \frac{k_m P}{k_b + k_m}$

- (5) Question not attempted

98. 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) $\frac{h}{\log_e \left(\frac{R_o}{R_i} \right)}$

(2) $\frac{\log_e \left(\frac{R_o}{R_i} \right)}{h}$

(3) $\frac{\log_e \left(\frac{R_i}{R_o} \right)}{h}$

(4) $\frac{h}{\log_e \left(\frac{R_i}{R_o} \right)}$

- (5) Question not attempted

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

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

100. 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 & 6 (2) 1, 2 & 3

- (3) 1, 2 & 4 (4) 2, 4 & 8

- (5) Question not attempted





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(5) Question not attempted

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(1) 2, 4 & 8 (2) 1, 2 & 3

(3) 1, 2 & 4 (4) 2, 4 & 8

(5) Question not attempted

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(5) Question not attempted



RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER

Asstt. Engineer (DOP(A-4/2)) Comb. Comp. (Pre.) Exam 2024

Subject : Mechanical Engineering

Exam Date : 29-09-2025

Model Answer Key Issue Date : 13-10-2025

Answer key as per the Question Paper uploaded on Website

Q. No.	RES	Q. No.	RES
1	2	51	2
2	4	52	4
3	2	53	3
4	1	54	3
5	2	55	3
6	2	56	1
7	1	57	2
8	2	58	1
9	3	59	4
10	1	60	4
11	1	61	3
12	1	62	4
13	3	63	1
14	2	64	2
15	3	65	4
16	2	66	1
17	3	67	3
18	2	68	2
19	2	69	2
20	1	70	4
21	1	71	3
22	4	72	2
23	2	73	2
24	4	74	2
25	2	75	1
26	2	76	1
27	3	77	1
28	4	78	1
29	2	79	1
30	4	80	2
31	4	81	4
32	2	82	1
33	2	83	2
34	1	84	1
35	2	85	4
36	4	86	4
37	2	87	4
38	3	88	4
39	1	89	3
40	4	90	4
41	2	91	4
42	2	92	2
43	4	93	1
44	3	94	1
45	3	95	3
46	4	96	3
47	3	97	1
48	2	98	1
49	2	99	1
50	2	100	3

* Means deleted (if any)