A

Booklet No. :

GVR3

Mechanical Engineering

Duration of Test : 2 Hours **Max. Marks : 100**

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1. This Question Booklet consists of **100** multiple choice objective type questions to be answered in **2** hours.
2. Every question in this booklet has 4 choices marked (A), (B), (C) and (D) for its answer.
3. Each question carries **one** mark. There are no negative marks for wrong answers.
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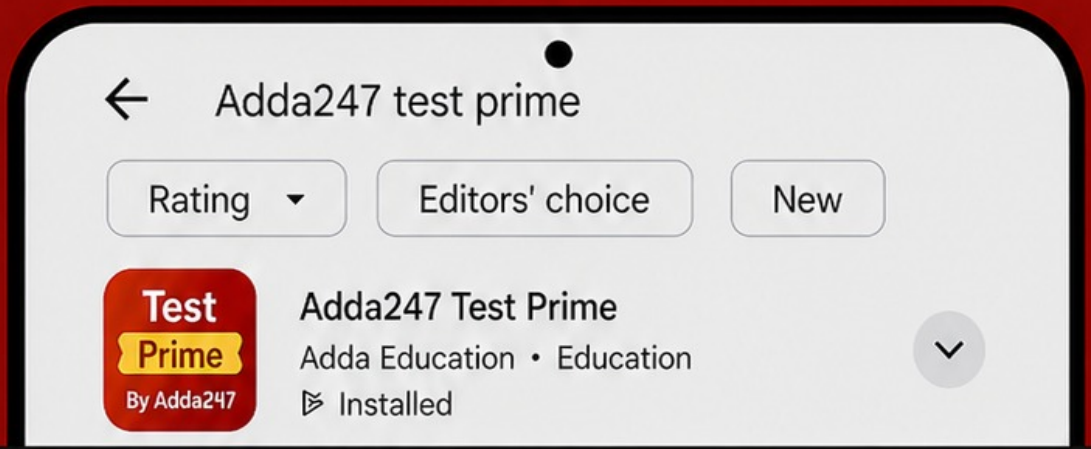

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MECHANICAL ENGINEERING (ME)
PART – A

1. The strain energy corresponding to the stress at the elastic limit is known as _____

(A) Modulus of resilience (B) Toughness
(C) Proof resilience (D) Resilience

2. The radius of a Mohr's circle indicates_____

(A) Maximum principal stress (B) Minimum principal stress
(C) Maximum shear stress (D) Shear stress at an angle θ

3. What is the maximum deflection in a cantilever beam carrying a uniformly distributed load of w per unit length ? (L-length of the beam, EI- flexural rigidity of the section of the beam)

(A) $\frac{wL^4}{3EI}$ (B) $\frac{wL^3}{192\,EI}$ (C) $\frac{5wL^4}{384\,EI}$ (D) $\frac{wL^4}{8EI}$

4. Which of the following are correct ?

P. Slenderness ratio is defined as the ratio of the length of the column to the radius of gyration.
Q. Euler's formula is applicable for short columns
R. Rankine's constant for a mild steel column is 1/7500
(A) Only P and Q are correct (B) Only Q and R are correct
(C) Only P and R are correct (D) P, Q and R are correct

5. Match the following:

P. Point of contraflexure	i. Bending moment changes sign
Q. Intensity of loading	ii. Shear force changes sign
	iii. Rate of change of bending moment
	iv. Rate of change of shear force

(A) P-i, Q-iv (B) P-ii, Q-iv (C) P-i, Q-iii (D) P-ii, Q-iii

6. If two solid shafts having the diameters D and D/2 are made of the same material, what is the ratio of the strength of bigger shaft to that of smaller shaft in torsion ?

(A) 8 (B) 16 (C) 64 (D) 4

7. Which of the following springs are subjected to both the torsion and bending ?

P. Closed coil helical spring subjected to axial force
Q. Closed coil helical spring subjected to axial couple
R. Open coil helical spring subjected to axial force
S. Open coil helical spring subjected to axial torque
(A) Only P and Q (B) Only Q and R (C) Only R and S (D) P, Q and R

8. Newton's law of viscosity states that ___

(A) the shear stress is proportional to the pressure gradient

(B) the shear stress is proportional to the velocity gradient

(C) the shear stress is inversely proportional to the pressure gradient

(D) the shear stress is proportional to the square of the velocity gradient

9. The centre of pressure of any submerged plane surface is ____

(A) always below the centroid of the surface

(B) always above the centroid of the surface

(C) always coincident with the centroid of the surface

(D) above or below the centroid depending on the area of the surface

10. Stream line is defined as_____

(A) the line that shows the instantaneous positions of all fluid particles that have passed through a given point

(B) an imaginary line, the tangent to which at any point indicates the direction of motion at that point

(C) the line joining the points of equal potential on adjacent flow lines

(D) an imaginary line, the normal to which at any point indicates the direction of motion at that point

11. The Reynolds number for turbulent flow in pipes is _____

(A) less than 2000 (B) greater than 4000

(C) less than 1000 (D) between 1000 and 2000

12. The head loss due to friction in a pipe is proportional to

(A) velocity of flow (B) square of the velocity of flow

(C) square of the diameter of the pipe (D) diameter of the pipe

13. Propeller turbine is suitable for

(A) low head installation upto 30 m

(B) high head installation above 180 m

(C) medium head installations between 20 m and 180 m

(D) all types of heads

14. Which of the following types of pumps is suitable for pumping viscous fluids ?

(A) Centrifugal pump (B) Reciprocating pump

(C) Air lift pump (D) Screw pump

15. Which of the following uses the water hammer effect to lift water ?

(A) Hydraulic accumulator (B) Hydraulic intensifier
(C) Hydraulic ram (D) Hydraulic pump

16. Tempering of hardened steel is necessary to improve

(A) corrosion resistance (B) ductility
(C) texture (D) hardness

17. Solder metal is an alloy of

(A) Copper and Lead (B) Lead and Silver
(C) Lead and Tin (D) Lead and Iron

18. Which of the following is a line defect found in metal crystals ?

(A) Grain boundary (B) Cracks
(C) Vacancy (D) Dislocation

19. In L-D steel making, the nature of final slag can be described as

(A) Oxidizing (B) Basic
(C) Oxidizing and basic (D) Reducing and basic

20. Annealing of white cast iron produces

(A) grey cast iron (B) nodular iron
(C) malleable iron (D) wrought iron

21. Due to space constraint 5 coils are to be cut and removed from a spring with 25 active coils. Which one among the following is correct with respect to stiffness ?

(A) 1.25 times that of original spring.
(B) 80 percent of that of original spring.
(C) The same for both springs.
(D) Five percent less than that of original spring.

22. Self locking is not possible in case of

(A) simple block brake (B) simple band brake
(C) differential band brake (D) internal expanding shoe brake

23. In a 20^0 pressure angle involute gear, how can interference be avoided ?

(A) Using more than 8 teeth
(B) Cutting involute profile accurately
(C) Using more than 20 teeth
(D) Using as small number of teeth as possible

24. The dynamic capacity of 6205 bearing is 10.8 kN. Then the dynamic capacity of 6305 bearing is

(A) 10 kN (B) 8 kN (C) 5 kN (D) 16.2 kN

25. A thin cylinder of 4 m diameter has a wall thickness of 50 mm. It is subjected to an internal pressure of 2 MPa. What is the maximum shear stress induced in an element considered on the inner surface ?

(A) 80 MPa (B) 41 MPa (C) 40 MPa (D) 160 MPa

26. Autofretting means

(A) a type of corrosion (B) method to reduce stress concentration

(C) a type of pre-stressing (D) a type of heat treatment

27. The purpose of rubber bushing in flexible coupling is to

(A) allow proper fixation of pin (B) avoid wear of pin

(C) avoid failure of C.I flanges (D) allow small misalignment of the shaft

28. If a planar mechanism with six links and seven lower pairs, each lower pair is having one degree of freedom, then the degrees of freedom of the mechanism is

(A) 1 (B) 2 (C) 3 (D) 0

29. A flywheel should supply an energy of 400 Nm at a mean speed of 20 rad/s. What is the mass moment of inertia if the total fluctuation of speed is not to exceed ±2%.

(A) 50 Kg-m^2 (B) 25 Kg-m^2 (C) 125 Kg-m^2 (D) 100 Kg-m^2

30. The spring stiffness of an automobile suspension system is 3.6 kN/m and the damping constant of the damper is 400 Ns/m. The mass is 50 Kg. What is the damped natural frequency ?

(A) 8.48 Hz (B) 1.4 Hz (C) 1.19 Hz (D) 7.48 Hz

31. Suggest the gearing arrangement for a stirrer to run at 36 rpm being driven by a motor running at 1440 rpm.

(A) Helical gear (B) Differential gear

(C) Spur gear (D) Worm gear

32. In a simple quick return mechanism, the quick return ratio is to 2:1. The radius of crank is 125 mm. Find the distance between the points where the crank and the lever are pivoted.

(A) 250 mm (B) 125 mm (C) 145 mm (D) 220 mm

33. What is the mechanical advantage for a four bar linkage in toggle position ?
(A) 1 (B) infinity (C) 0 (D) 0.5

34. The details of two crossed helical gears used for speed reduction is as follows. Pitch circle diameter in the plane of rotation for one gear is 80 mm and the helix angle is 30°. For the other gear pitch circle diameter in the plane of rotation is 120 mm and the helix angle is 22.5°. If the input speed is 1440 rpm, what is the output speed ?
(A) 700 rpm (B) 800 rpm (C) 1200 rpm (D) 900 rpm

35. In supercharged IC engines, the volumetric efficiency is
(A) 80% (B) 90% (C) 100% (D) More than 100%

36. To mix air and petrol in the required proportion and to supply it to the engine during suction stroke, ... is employed.
(A) Injector (B) Carburettor (C) Fuel pump (D) Spark plug

37. The chemical name of Freon 22 is
(A) CCl_3F (B) CH_3Cl (C) $CHClF_2$ (D) CCl_2F_2

38. Higher octane number of a spark ignition fuel indicate
(A) lower volatility (B) longer ignition delay
(C) higher flash point (D) higher heating value

39. The brake power of a diesel engine, keeping other parameters constant, can be increased by
(A) decreasing the density of intake air
(B) increasing the temperature of intake air
(C) decreasing the pressure of intake air
(D) increasing the pressure of intake air

40. In larger industrial vapour compression refrigeration systems, the refrigerant widely used is
(A) R-12 (B) Carbon dioxide
(C) Ammonia (D) Sulphur dioxide

41. While designing the refrigeration system of an aircraft, the prime consideration is that the
(A) mass of the refrigeration equipment is low
(B) system has high C.O.P.
(C) power per Ton of Refrigeration is low
(D) mass of the refrigerant circulated in the system is low

42. The unit of Stefan Boltzmann constant is

(A) $W/cm^2\ K^2$ (B) $W^2/cm\ K^4$

(C) $W/cm^2\ K^3$ (D) $W/cm^2\ K^4$

43. Absorptivity of a body will be equal to its emissivity

(A) at all temperatures

(B) at one particular temperature

(C) at critical temperature

(D) when the system is under thermal equilibrium

44. In a four stage compressor, if the pressure at the first and third stage are 1 bar and 16 bar, then the delivery pressure at the fourth stage will be

(A) 1 bar (B) 16 bar (C) 64 bar (D) 256 bar

45. SI engines are governed by

(A) Qualitative Governing (B) Quantitative Governing

(C) Hit and miss Governing (D) Combination of (A) and (B)

46. The work done in an adiabatic process between two given end states depends on

(A) particular adiabatic process (B) value of index, n

(C) mass of the system (D) the end states

47. The cycle consisting of two constant pressure processes and two adiabatic processes are

(A) Atkinson cycle (B) Stirling cycle

(C) Joule cycle (D) Otto cycle

48. A Carnot engine discharges 3J of heat into low temperature reservoir for every 2J of work output. If sink temperature is 27 °C then the value of source temperature is

(A) 20.5 °C (B) 40.5 °C (C) 60.5 °C (D) 80.5 °C

49. In a nozzle super heated steam expanding from 10 bar to 2 bar, the pressure at the throat will be

(A) 1.66 bar (B) 3.26 bar (C) 5.46 bar (D) 8.26 bar

50. The impulse turbine blade efficiency is $\cos^2\alpha$, where α is the nozzle exit angle, if

(A) blade solidity is 0.65

(B) blades are equiangular

(C) blades are equiangular and frictionless

(D) blade velocity coefficient is unity

51. The ratio of the cumulative heat drop to the isentropic heat drop is

(A) Stage efficiency (B) Internal efficiency

(C) Rankine efficiency (D) Reheat factor

52. Which of the following has the highest thermal diffusivity ?

(A) Iron (B) Concrete (C) Wood (D) Lead

53. The isentropic enthalpy drop in fixed blades is one fourth of the isentropic enthalpy drop in moving blades of a turbine. The degree of reaction is

(A) 0.25 (B) 0.50 (C) 0.75 (D) 0.85

54. Gas turbine cycle with regenerator improves

(A) work ratio (B) power output

(C) thermal efficiency (D) exhaust pressure

55. The increase in entropy of a system represents

(A) increase in availability of energy (B) degradation of energy

(C) increase in temperature (D) decrease in pressure

56. A company produced 15,000 quantity of a product whose selling price is ₹ 300. At that quantity, if the fixed cost is ₹ 15.2 lakhs and total variable cost ₹ 21 lakhs, then the breakeven quantity for the product is

(A) 4,000 (B) 7,800 (C) 8,400 (D) 9,500

57. Which of the following statement is INCORRECT ?

(A) Assignment model is a special case of a linear programming problem.

(B) In queuing models, Poisson arrivals and exponential services are assumed.

(C) In transportation problems, the non-square matrix is made square by adding a dummy row or dummy column.

(D) In linear programming, dual of a dual is primal.

58. The correct sequence of the following processes in increasing order of their welding temperature is

1. Gas welding
2. Thermit welding
3. Arc welding
4. Resistance welding

(A) 1, 3, 4, 2 (B) 1, 2, 3, 4 (C) 4, 3, 1, 2 (D) 4, 1, 3, 2

59. Match the following:

P.	Quick return mechanism	1.	Lathe
Q.	Apron mechanism	2.	Milling machine
R.	Indexing mechanism	3.	Shaper
S.	Regulating wheel	4.	Centerless grinding

(A) P-3, Q-2, R-1, S-4 (B) P-2, Q-3, R-4, S-1

(C) P-3, R-1, R-2, S-4 (D) P-4, Q-2, R-3, S-1

60. Which of the following is the reason for crater wear to form at some distance from the tool tip ?

(A) Cutting fluid cannot penetrate that region.

(B) Stress on rake face is maximum in that region.

(C) Tool strength is minimum in that region.

(D) Tool temperature is maximum in that region.

61. Match the following :

Components used in jigs and fixtures		**Function**
i. Jack pin	1.	To guide the drill bit during machining.
ii. V-locator	2.	For accommodating the variation in the distance of a hole from a plane surface.
iii. Bushes	3.	To locate the circular or semicircular objects in a jig or fixture.
iv. Diamond pin	4.	To locate workpiece whose dimensions are subject to variation.

(A) i-3, ii-4, iii-1, iv-2 (B) i-3, ii-4, iii-2, iv-1

(C) i-4, ii-3, iii-1, iv-2 (D) i-4, ii-3, iii-2, iv-1

62. Which one of the following combinations results in a press fit ?

(A) G7-h6 (B) F7-n6 (C) H7-h6 (D) F7-j6

63. Match the following:

Process		**Products**
i. Die casting	1.	Phenol formaldehyde
ii. Shell molding	2.	CI pipes
iii. CO_2 molding	3.	Non-ferrous alloys
iv. Centrifugal casting	4.	Sodium silicate

(A) i-1, ii-3, iii-4, iv-2 (B) i-3, ii-1, iii-4, iv-2

(C) i-3, ii-1, iii-2, iv-4 (D) i-1, ii-3, iii-2, iv-4

64. Which of the following statement is CORRECT ?

(A) No flux is used in gas welding of mild steel.

(B) Borax is the commonly used flux coating on welding electrodes.

(C) Laser beam welding uses a vacuum chamber instead of a shielding method.

(D) Alternating current can be used in Gas Tungsten arc welding.

65. Which of the following statements are CORRECT about forward extrusion process:

1. The ram and the extruded product travel in the same direction.
2. The ram and the extruded product travel in opposite direction.
3. The speed of travel of the extruded product is same as that of the ram.
4. The speed of travel of the extruded product is greater than that of the ram.

(A) 1 and 3 (B) 2 and 3 (C) 1 and 4 (D) 2 and 4

66. In the rolling process, the roll separating force can be decreased by

(A) Reducing the roll diameter

(B) Increasing the roll diameter

(C) Providing back-up rolls

(D) Increasing friction between rolls and the metal

67. In an orthogonal machining experiment, cutting force is found to be 1,000 N and thrust force is 500 N. What is the co-efficient of friction at the tool-chip interface if rake angle is zero ?

(A) 1/2 (B) 2 (C) $1/\sqrt{2}$ (D) $\sqrt{2}$

68. In a tool wear study experiment, it is found that doubling cutting speed reduces the tool life to 1/8 th of the original. The Taylor's tool life index is

(A) 1/2 (B) 1/3 (C) 1/4 (D) 1/8

69. Which of the following stresses are important for chip formation ?

1. Tensile stress
2. Shear stress
3. Compressive stress
4. Bending stress

(A) 2 and 3 are true (B) 3 and 4 are true

(C) 4 and 1 are true (D) 1 and 2 are true

70. If α is the rake angle of cutting, ϕ is the shear angle and V is the cutting velocity, the velocity of chip sliding along the shear plane is

(A) $\frac{V\cos\alpha}{\cos(\phi-\alpha)}$ (B) $\frac{V\sin\alpha}{\cos(\phi-\alpha)}$ (C) $\frac{V\cos\alpha}{\sin(\phi-\alpha)}$ (D) $\frac{V\sin\alpha}{\sin(\phi-\alpha)}$

PART – B

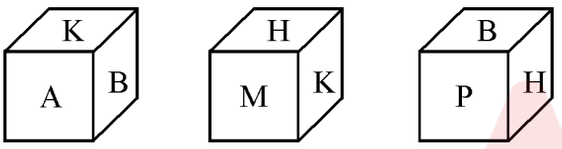
71. A sum of ₹ 700 has to be used to give seven cash prizes to the students of a school for their overall academic performance. If each prize is ₹ 20 less than its preceding prize, then what is the least value of the prize?

(A) ₹ 30 (B) ₹ 40 (C) ₹ 60 (D) ₹ 80

72. In a class of 45 students, a boy is ranked 20^{th}. When two boys joined, his rank was dropped by one. What is his new rank from the end ?

(A) 25^{th} (B) 26^{th} (C) 27^{th} (D) 28^{th}

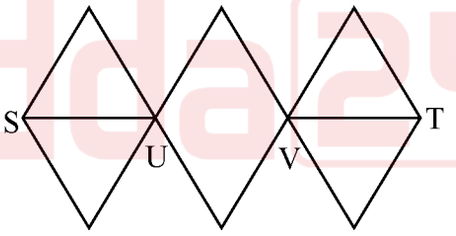
73. Three views of the cube are given below:



What is letter opposite to A?

(A) H (B) P (C) B (D) M

74. With reference to the figure given below, the number of different routes from S to T without retracing from U and/or V, is



(A) 3 (B) 6 (C) 9 (D) 18

75. Two sets of 4 consecutive positive integers have exactly one integer in common. The sum of the integers in the set with greater numbers is how much greater than the sum of the integers in the other set ?

(A) 4 (B) 7 (C) 8 (D) 12

76. X can do a work in 10 days and Y in 20 days. If they work on it together for 4 days, then the fraction of the work that is left is

(A) 1/5 (B) 2/5 (C) 3/5 (D) 4/5

77. You're giving someone verbal feedback about some work they have completed which isn't up to standard. What should you do ?

(A) Point out everything that they did wrong

(B) Base your feedback on what you have heard from others

(C) Criticize them for their poor work

(D) Suggest where improvements can be made and agree on a plan

78. Which of the following will NOT help you to be more persuasive ?

(A) Mirror body language and tone

(B) Use words that the other person agrees with

(C) Talk about your own interests and goals

(D) Make your aims appear to put the other person at an advantage

79. 5, 12, 17, 29, 46, 75, 121, ?

(A) 185 (B) 196

(C) 192 (D) 188

80. 

(A) 

(B) 

(C) 

(D) 

81. Verve: Enthusiasm

(A) Loyalty : Duplicity (B) Devotion : Reverence

(C) Intensity : Colour (D) Eminence : Anonymity

82. Out of the natural numbers upto 127, how many are even numbers ?

(A) 62 (B) 63

(C) 64 (D) 65

83. Nurse Kemp has worked more night shifts in a row than Nurse Rogers, who has worked five. Nurse Miller has worked fifteen night shifts in a row, more than Nurses Kemp and Rogers combined. Nurse Calvin has worked eight night shifts in a row, less than Nurse Kemp. How many night shifts in a row has Nurse Kemp worked?

(A) Eight (B) Nine (C) Ten (D) Eleven

84. Find the odd number among the following :

(A) 7 (B) 11 (C) 27 (D) 29

85. The school principal has received complaints from parents about bullying in the school yard during recess. He wants to investigate and end this situation as soon as possible, so he has asked the recess aides to watch closely. Which situation should the recess aides report to the principal ?

(A) A girl is sitting glumly on a bench reading a book and not interacting with her peers.

(B) Four girls are surrounding another girl and seem to have possession of her backpack.

(C) Two boys are playing a one-on-one game of basketball and are arguing over the last basket scored.

(D) Three boys are huddled over a handheld video game, which isn't supposed to be on school grounds.

86. 'n' is a natural number. If n^5 is odd, which of the following is true ?

(I) n is odd. (II) n^3 is odd. (III) n^4 is even.

(A) I only (B) II only (C) III only (D) I and II

87. What will be the next number in the sequence 6, 11, 21, 36, 56, ___ ?

(A) 76 (B) 72 (C) 81 (D) 91

88. Here are some words translated from an artificial language.
dionot means oak tree

blyonot means oak leaf

blycrin means maple leaf

Which word could mean "maple syrup"?

(A) blymuth (B) hupponot (C) patricrin (D) crinweel

89. A is B's sister. C is B's mother. D is C's father. E is D's mother. Then, how is A related to D ?

(A) Grandfather (B) Grandmother (C) Daughter (D) Granddaughter

90. Two bus tickets from city A to B and three tickets from city A to C cost ₹ 77 but three tickets from city A to B and two tickets from city A to C cost ₹ 73. What are the fares for cities B and C from A?

(A) ₹ 4, ₹ 23 (B) ₹ 13, ₹ 17 (C) ₹ 15, ₹ 14 (D) ₹ 17, ₹ 13

91. There are six persons A, B, C, D, E and F. C is the brother of F. B is the brother of E's husband. D is the father of A and grandfather of F. There are two fathers, three brothers and a mother in the group. Who is the mother?

(A) A (B) B (C) C (D) E

92. If Z = 52 and ACT = 48, then BAT will be equal to

(A) 39 (B) 41 (C) 44 (D) 46

93. A tailor had a number of shirt pieces to cut from a roll of fabric. He cuts each roll of equal length into 10 pieces. He cuts at the rate of 45 per minute. How many rolls would be cut in 24 minutes ?

(A) 32 rolls (B) 54 rolls (C) 108 rolls (D) 120 rolls

94. 4 men & 6 women can complete a work in 8 days, while 3 men and 7 women can complete it in 10 days. In how many days will 10 women complete it ?

(A) 35 days (B) 40 days (C) 30 days (D) 25 days

95. In a class of 100 students, 50 students passed in Mathematics and 70 passed in English, 5 students failed in both Mathematics and English. How many students passed in both the subjects ?

(A) 50 (B) 40 (C) 35 (D) 25

96. A man on tour travels first 160 km at 64 km/hr and the next 160 km at 80 km/hr. The average speed for the first 320 km of the tour is

(A) 71.11 km/hr (B) 36 km/hr (C) 71 km/hr (D) 36.33 km/hr

97. The length of a rectangular field is thrice its breadth. If the cost of cultivating the field at ₹ 367.20 per square metre is ₹ 27,540, then what is the perimeter of the rectangle ?

(A) 47 m (B) 39 m (C) 52 m (D) 40 m

98. In an examination, a student was asked to find 3/14 of a certain number. By mistake, he found 3/4 of it. His answer was 150 more than the correct answer. Find the given number.

(A) 190 (B) 250 (C) 280 (D) 350

99. A cube with all the sides painted was divided into small cubes of equal measurement. The side of a small cube is exactly one fourth as that of the big cube. Therefore, the number of small cubes with only one side painted is

(A) 64 (B) 36 (C) 24 (D) 12

100. Shyam walks 5 km towards East and then turns left and walks 6 km. Again he turns right and walks 9 km. Finally he turns to his right and walks 6 km. How far is he from the starting point ?

(A) 26 km (B) 21 km (C) 14 km (D) 9 km

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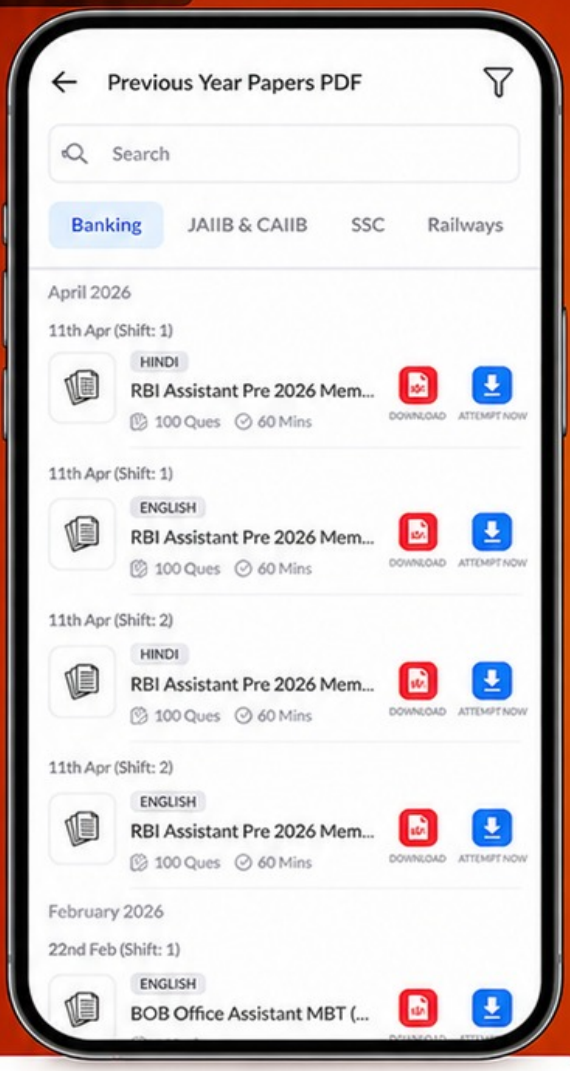

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