

14/PD/M-2025-03



Candidate's Roll Number

--	--	--	--	--	--

Booklet Series

I

Serial No.
4220241

Question Booklet

AUTOMOBILE ENGINEERING
PAPER - II

Time Allowed : 2 Hours

Maximum Marks : 100

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

IMPORTANT INSTRUCTIONS

1. This Question Booklet contains 100 questions in all.
2. All questions carry equal marks.
3. An Answer Sheet has been supplied inside the Question Booklet to mark the answers. You must write your Roll Number and encode it and write other particulars in the space provided in the Answer Sheet, failing which your Answer Sheet will not be evaluated.
4. Immediately after commencement of the examination, you should check up your Question Booklet and attached answer sheet and ensure that the Question Booklet Series is printed on the top right hand corner of the Booklet and the series encoded in answer sheet are same. Also please check that the Booklet contains 16 printed pages including two pages (Page Nos. 15 and 16) for Rough Work and no page or question is missing or unprinted or torn or repeated or question booklet and answer sheet have different series. If you find any defect in this Booklet and attached answer sheet, get it replaced Immediately by a complete Booklet with OMR sheet of the same series.
5. You must write your Roll Number in the space provided on the top of this page. Do not write anything else on the Question Booklet.
6. Questions and their responses are printed in English version in this Booklet. Each question comprises of four responses - (A), (B), (C) and (D). You are to select ONLY ONE correct response and mark it in your Answer Sheet. In case you feel that there are more than one correct response, mark the response which you consider the best. In any case choose ONLY ONE response for each question.
7. In the Answer Sheet, there are four circles - (A), (B), (C) and (D) against each question. To answer the questions, you are to mark with **Black/Blue ink ballpoint pen ONLY ONE circle** of your choice for each question. Select only one response for each question and mark it in your Answer Sheet. If you mark more than one circle for one question, the answer will be treated as wrong. **Use Black/Blue ink ballpoint pen only to mark the answer in the Answer Sheet. Any erasure or change is not allowed.**
8. You should not remove or tear off any sheet from the Question Booklet. You are not allowed to take this Question Booklet and the Answer Sheet out of the Examination Hall during the examination. **After the examination has concluded, you must hand over your Answer Sheet to the Invigilator.** Thereafter, you are permitted to take away the Question Booklet with you.
9. Failure to comply with any of the above instructions will render you liable to such action or penalty as the Commission may decide at their discretion.
10. Candidates must assure before leaving the Examination Hall that their Answer Sheets will be kept in Self Adhesive LDPE Bag and completely packed/sealed in their presence.

PD-303

1. Consider the following statements:

1. State of plane stress occurs at the surface
2. State of plane strain occurs at the surface
3. State of plane stress occurs in the interior part of the plate
4. State of plane strain occurs in the interior part of the plate

Which of these statements are correct?

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

2. In a tensile test, near the elastic limit zone

- (A) tensile stress increases at a faster rate
- (B) tensile stress decreases at a faster rate
- (C) tensile stress increases in linear proportion to the stress
- (D) tensile stress decreases in linear proportion to the stress

3. Two steel rods of identical length and material properties are subjected to equal axial loads. The first rod is solid with diameter d and the second is a hollow one with external diameter D and internal diameter is half of D . If the two rods experience equal extensions, the ratio of d/D is

- (A) $\frac{3}{4}$
- (B) $\frac{1}{2}$
- (C) $\frac{\sqrt{3}}{2}$
- (D) $\frac{1}{4}$

4. If a piece of material neither expands nor contracts in volume when subjected to stress, then the Poisson's ratio must be

- (A) Zero
- (B) 0.25
- (C) 0.33
- (D) 0.5

5. Which one of the following statements is correct?

- (A) The strain produced per unit volume is called resilience.
- (B) The maximum strain produced per unit volume is called proof resilience.
- (C) The least strain energy stored in a unit volume is called proof resilience.
- (D) The greatest strain energy stored in a unit volume of a material without permanent deformation is called proof resilience.

6. A shaft with a circular cross-section is subjected to pure torsion. The ratio of the maximum shear stress to the maximum principal stress is

- (A) 2.0
- (B) 1.0
- (C) 0.5
- (D) 0



7. If Mohr's circle is drawn for the shear stress developed because of torque applied over a shaft, then the maximum shear developed will be equal to
- diameter of the Mohr's circle
 - radius of the Mohr's circle
 - half of the radius of Mohr's circle
 - π times radius of the Mohr's circle
8. Beams of uniform strength vary in section such that
- bending moment remains constant
 - deflection remains constant
 - maximum bending stress remains constant
 - shear force remains constant
9. What is the nature of distribution of shear stress in a rectangular beam?
- Linear
 - Parabolic
 - Hyperbolic
 - Elliptic
10. Which one of the following alloys exhibits season cracking?
- Brass
 - Iron
 - Aluminium
 - Steel
11. Which of the following elements given below determine(s) the maximum attainable, hardness in steel?
- Chromium
 - Manganese
 - Carbon
 - Molybdenum
- Select the correct answer using the code given below:
- 1 only
 - 1 and 2
 - 3 only
 - 2 and 4
12. Coefficient of Expansion is practically nil in a particular alloy. What is this alloy?
- Hadfield Manganese Steel
 - Invar
 - Vitallium
 - Satellite
13. Which one of the following is correct? Babbitts are used for
- gears
 - bearings
 - bolts
 - clutch liners



14. The correct composition of austenitic stainless steel used for domestic utensils is
- 0.08% C, 18% Cr, 8% Ni, 2% Mn, 1% Si
 - 0.08% C, 24% Cr, 12% Ni, 2% Mn, 1% Si
 - 0.15% C, 12% Cr, 0.5% Ni, 1% Mn, 1% Si
 - 0.30% C, 12% Cr, 0.4% Ni, 1% Mn, 1% Si
15. The centre of gravity of the coupler link in a 4-bar mechanism would experience
- no acceleration
 - only linear acceleration
 - only angular acceleration
 - both linear and angular accelerations
16. Match List-1 with List-2 and select the correct answer using the codes given below the lists:
- | List-1 | | List-2 | |
|--|--|-------------------------------|--|
| A. Oldham coupling | | M. Single slider crank chain | |
| B. Oscillating cylinder engine mechanism | | N. Double slider crank chain | |
| C. Ackermann steering mechanism | | O. Crossed slider crank chain | |
| D. Rapson's slide | | P. Quadratic cycle chain | |
-
- | | A | B | C | D |
|-----|---|---|---|---|
| (A) | N | M | P | O |
| (B) | M | N | O | P |
| (C) | P | O | N | M |
| (D) | O | P | M | N |
17. An involute pinion and gear are in mesh. If both have the same size of addendum, then there will be an interference between the
- tip of the gear tooth and flank of pinion
 - tip of the pinion and flank of gear
 - flanks of both gear and pinion
 - tips of both gear and pinion
18. In an involute toothed gear, involute starts from
- base circle
 - addendum circle
 - dedendum circle
 - pitch circle
19. A helical gear has the active face width equal to b , pitch p and helix angle α . What should be the minimum value of b in order that contact is maintained across the entire active face of the gear?
- $p \cos \alpha$
 - $p \sec \alpha$
 - $p \tan \alpha$
 - $p \cot \alpha$
20. When the mass of a critically damped single degree of freedom system is deflected from its equilibrium position and released, it will
- return to equilibrium position without oscillation
 - oscillate with increasing time period
 - oscillate with decreasing amplitude
 - oscillate with constant amplitude



21. The power of a governor is the work done at
(A) the governor balls for change of speed
(B) the sleeve for zero change of speed
(C) each governor ball for given percentage change of speed
(D) the sleeve for a given rate of change of speed
22. A transmission shaft subjected to bending loads must be designed based on
(A) maximum shear stress theory
(B) maximum normal stress theory
(C) maximum normal stress and maximum shear stress theories
(D) fatigue strength
23. The bearing characteristic number in a hydrodynamic bearing depends upon
(A) Length, width and load
(B) Length, width and speed
(C) Viscosity, speed and load
(D) Viscosity, speed and bearing pressure
24. _____ exhibit a certain shear stress at zero shear strain rate followed by a straight line relationship between shear stress and shear strain rate.
(A) Newtonian fluids
(B) Ideal Bingham plastic fluids
(C) Pseudo-plastic fluids
(D) Dilatant fluids
25. If the angle of contact of a drop of liquid is acute then
(A) adhesion is more than cohesion
(B) cohesion is more than adhesion
(C) cohesion is equal to adhesion
(D) adhesion and cohesion have no bearing with angle of contact
26. With increase in pressure, the bulk modulus of elasticity
(A) Decreases
(B) Increases
(C) Remains constant
(D) None of the above
27. For laminar flow through a round pipe, the shear stress
(A) Remains constant over the cross-section
(B) Varies linearly with the radial distance
(C) Must be zero at all points
(D) Varies parabolically with radial distance



28. Joule's experiment states that for a cycle
- (A) change of pressure is proportional to temperature change
 - (B) change of volume is proportional to temperature change
 - (C) change of internal energy is proportional to temperature change
 - (D) sum of all heat transfer is proportional to sum of all work transfer
29. The break-even point can be lowered by
- (A) Increasing the fixed costs
 - (B) Increasing the variable costs
 - (C) Decreasing the slope of the income line
 - (D) Reducing the variable cost
30. In a quantity discount model of inventory control, the relevant costs are
- (A) Annual purchase cost
 - (B) Annual order cost and annual carrying cost
 - (C) Annual purchase cost, annual order cost and annual carrying cost
 - (D) Annual order cost
31. What type of frame is most commonly used in commercial vehicles?
- (A) Monocoque frame
 - (B) Ladder frame
 - (C) Tubular frame
 - (D) Integral frame
32. The component that helps accommodate shaft length variations in the propeller shaft is the:
- (A) Final drive
 - (B) Slip joint
 - (C) Clutch plate
 - (D) Gear lever
33. Which of the following correctly describes the function of a final drive?
- (A) Filters exhaust gases
 - (B) Connects engine to the battery
 - (C) Reduces rotational speed and increases torque to the wheels
 - (D) Supports the body weight
34. A driver complains of vibration while driving at high speeds. What could be a possible cause in the transmission line?
- (A) Overinflated tyres
 - (B) Worn slip joint
 - (C) Misaligned universal joint
 - (D) Old engine oil



35. If a manufacturer wants to design a vehicle with high safety and better energy absorption in a crash, which chassis frame is more appropriate?
- Ladder frame
 - Monocoque frame
 - Tubular frame
 - Channel section frame
36. During a vehicle test, engineers observe that the transmission system fails under high torque. Which modification can best resolve this?
- Use aluminium gear casing
 - Replace ladder frame with tubular frame
 - Use high-strength steel gears and reinforced joints
 - Increase tyre diameter
37. An electric car requires a lightweight structure with minimal mechanical transmission losses. What layout and transmission approach should be adopted?
- Front-engine rear-wheel-drive with ladder frame
 - Rear-engine layout with manual gear box
 - In-wheel motor system with monocoque chassis
 - Mid-engine layout with sliding mesh gearbox
38. Which part of the engine converts reciprocating motion into rotary motion?
- Crankshaft
 - Piston
 - Cylinder
 - Spark plug
39. If an engine is overheating, which of the following components should be checked first?
- Air filter
 - Clutch plate
 - Piston ring
 - Radiator and coolant level
40. In a diesel engine, the fuel is injected:
- Before compression
 - At the end of compression stroke
 - During exhaust stroke
 - During intake stroke
41. While designing a high-speed engine, which component's weight reduction would most improve efficiency without compromising strength?
- Radiator
 - Crankshaft
 - Piston and connecting rod
 - Oil sump



42. Evaluate the effect of excessive oil pressure during engine testing.
- (A) Reduces wear and improves performance
 - (B) Leads to oil leakage and seal damage
 - (C) Improves cooling
 - (D) Increases fuel combustion rate
43. An engineer wants to improve volumetric efficiency of an IC engine. Which of the following is the most effective solution?
- (A) Use of exhaust gas recirculation
 - (B) Installation of turbocharger or supercharger
 - (C) Rich air-fuel mixture
 - (D) Increase in oil grade
44. While testing a multi-cylinder engine, one cylinder shows reduced power output. What should be checked first?
- (A) Radiator cap
 - (B) Fuel tank level
 - (C) Injector or spark plug of that cylinder
 - (D) Gearbox oil level
45. Which type of steering mechanism provides easy control and better turning radius in cars?
- (A) Recirculating ball
 - (B) Rack and pinion
 - (C) Worm gear
 - (D) Chain drive
46. What type of suspension is typically used in high-performance or luxury vehicles?
- (A) Leaf spring
 - (B) Rigid axle
 - (C) Air suspension
 - (D) Cantilever spring
47. Which of the following is not a function of the HVAC system in a car?
- (A) Heating cabin air
 - (B) Ventilating fresh air
 - (C) Adjusting headlight focus
 - (D) Cooling cabin air
48. During HVAC system testing, the air is not cooling even though the compressor runs. What could be the likely cause?
- (A) Clogged heater core
 - (B) Faulty thermostat
 - (C) Weak battery
 - (D) Leaked refrigerant or clogged evaporator
49. To improve aerodynamic performance in a sports car, which design change is most effective?
- (A) Add heavy bumpers
 - (B) Increase tyre size
 - (C) Lower body height and smoothen body shape
 - (D) Use larger mirrors
50. A customer reports poor ride comfort and excessive bouncing over bumps. What is the most likely fault?
- (A) Flat tyre
 - (B) Weak shock absorbers or damaged suspension springs
 - (C) Overfilled AC system
 - (D) Faulty air filter



51. A new vehicle design must balance safety, aesthetics, and fuel efficiency. Which engineering consideration is most important for body design?
- Expensive paint
 - Complex control wiring
 - Lightweight materials and streamlined shape
 - Large headlamps
52. Which material property is depicted in a stress-strain diagram?
- Color
 - Elasticity
 - Magnetism
 - Heat capacity
53. In design classification, adaptive design involves:
- Copying an old design
 - Developing entirely new design
 - Modifying existing design
 - None of these
54. A brittle material shows which of the following behavior on a stress-strain curve?
- Long plastic region
 - Large elongation before fracture
 - Sudden fracture after elastic limit
 - No linear region
55. In chassis design, which of the following is most important?
- Color and painting
 - Torsional stiffness and strength
 - Transmission gear ratio
 - Fuel injection
56. A solid circular shaft has a diameter of 40mm and is subjected to a torque of 300 Nm. Find the maximum shear stress. (Use: $\tau = 16T/\pi d^3$)
- 29.84 MPa
 - 23.87 MPa
 - 15.42 MPa
 - 10.16 MPa
57. In designing an I-section chassis frame for a heavy-duty truck, which design factor should be prioritized most?
- Cost
 - Appearance
 - Weight-to-strength ratio
 - Paint resistance
58. An engine connecting rod is subjected to fluctuating axial load. What is the best design approach?
- Static load design
 - Thermal expansion design
 - Compressive buckling design
 - Fatigue failure design
59. If a machine element experiences both axial and bending load, how should it be analyzed?
- Only by tensile formula
 - By maximum shear theory
 - Using combined loading theory
 - By strain energy method



60. Which component helps in reducing harmful emissions?
- (A) Intercooler
 - (B) Turbocharger
 - (C) Catalytic converter
 - (D) Radiator
61. What is the primary function of computer-controlled fuel injection?
- (A) Increase exhaust noise
 - (B) Reduce power output
 - (C) Remove carbon deposits
 - (D) Optimize air-fuel mixture for efficiency
62. In the combustion process of SI engines, knocking occurs due to:
- (A) Too much lubrication
 - (B) Delayed fuel injection
 - (C) Pre-ignition of air-fuel mixture
 - (D) Excessive cooling
63. Why is hydrogen considered a clean fuel for internal combustion engines?
- (A) It reduces torque
 - (B) It emits only water vapor
 - (C) It burns at lower temperatures
 - (D) It increases NOx emissions
64. Which of the following is the best choice for engine downsizing while maintaining power and reducing emissions?
- (A) Naturally aspirated CI engine
 - (B) Large displacement SI engine
 - (C) Turbocharged SI engine with GDI
 - (D) Supercharged carbureted engine
65. Given the trend towards low-emission zones, which hybrid fuel technology best balances cost, availability, and emission control?
- (A) LPG-only engines
 - (B) Biodiesel hybrid systems
 - (C) Plug-in electric vehicles
 - (D) Flex-fuel (ethanol/gasoline) engines
66. You are designing an emission control system for a CI engine operating in high-altitude areas. What should be your primary concern?
- (A) Cooling system design
 - (B) Reduced air density affecting combustion
 - (C) Turbo lag issues
 - (D) Larger fuel tanks
67. You're assigned to reduce NOx emissions in a high-compression diesel engine without affecting performance. What solution should be implemented?
- (A) Use Exhaust Gas Recirculation (EGR)
 - (B) Retard the injection timing
 - (C) Lower the compression ratio
 - (D) Use leaner air-fuel mixture
68. Which of the following is a biodegradable waste?
- (A) Plastic
 - (B) Glass
 - (C) Vegetable peels
 - (D) Metal



69. Which part of the ecosystem absorbs CO_2 during photosynthesis?
- (A) Soil
 - (B) Plants
 - (C) Animals
 - (D) Water
70. Which is the best method to control noise pollution in urban areas?
- (A) Dumping waste
 - (B) Growing trees
 - (C) Constructing flyovers
 - (D) Using loudspeakers
71. If a radiation leak occurs near a residential area, what is the most immediate health effect expected?
- (A) Tooth decay
 - (B) Genetic mutation
 - (C) Hearing loss
 - (D) Skin tanning
72. A community observes frequent fish deaths in a nearby river. Which pollutant is most likely responsible?
- (A) Thermal pollution
 - (B) Light pollution
 - (C) Particulate matter
 - (D) Sound waves
73. Which of the following solid waste disposal methods would best reduce land use in urban areas?
- (A) Land filling
 - (B) Open dumping
 - (C) Incineration
 - (D) Composting
74. A factory releases 120 dB noise every 10 minutes. What would be the best way to evaluate its environmental impact?
- (A) Soil fertility test
 - (B) Air quality index measurement
 - (C) Noise mapping over time and space
 - (D) Water turbidity test
75. Which component is used in ignition systems to increase voltage?
- (A) Battery
 - (B) Spark plug
 - (C) Distributor cap
 - (D) Ignition coil
76. In electronic ignition systems, what replaces the mechanical breaker points?
- (A) Ignition capacitor
 - (B) Ignition module
 - (C) Solenoid switch
 - (D) Flywheel sensor
77. Which component regulates the voltage output from the alternator?
- (A) Starter
 - (B) Rectifier
 - (C) Voltage regulator
 - (D) Ignition coil
78. Why is LED lighting preferred in modern vehicles?
- (A) Higher voltage requirement
 - (B) Less brightness
 - (C) Lower energy consumption and long life
 - (D) Costlier than halogen



79. A vehicle with a push-button start fails to crank. Battery is good. What is the next likely cause?
- (A) Faulty headlight
 - (B) Broken horn circuit
 - (C) Faulty air filter
 - (D) Starter relay or keyless entry system fault
80. Which diagnostic tool can graph live data from various electronic systems in real time?
- (A) Test light
 - (B) Multimeter
 - (C) OBD-II Scanner
 - (D) Relay tester
81. In a modern vehicle, if both headlights fail at the same time, which diagnostic approach is best?
- (A) Replace bulbs immediately
 - (B) Check fuse and headlight relay circuit
 - (C) Replace battery
 - (D) Change alternator
82. While designing an efficient ignition system for high-performance engines, which factor is most critical?
- (A) Cost of the ignition wire
 - (B) Spark plug thread size
 - (C) Coil output voltage and timing accuracy
 - (D) Color of the ignition module
83. Which of the following combinations of Motor Vehicles Act sections best illustrates the government's intent to balance public safety with transport system efficiency?
- (A) Section 3 (Driving License) and Section 39 (Vehicle Registration)
 - (B) Section 112 (Speed limits) and Section 136A (Electronic monitoring)
 - (C) Section 66 (Permit requirement) and Section 88 (Permit control by Central Govt)
 - (D) Section 177 (General Penalty) and Section 210B (Power to issue directions)
84. You are part of a transport audit team. A public transport operator has renewed permits but continues to use worn-out tires and non-functional brake lights. Based on your legal knowledge, what is the most appropriate action?
- (A) Penalize under Section 66 for improper permits
 - (B) Recommend action under Section 84 and CMVR Rule 100 -105
 - (C) File a case under Section 3 for invalid driving license
 - (D) Issue a new fitness certificate with conditions



85. A policy maker wants to propose a law making dashboard cameras mandatory in all commercial vehicles. Which of the following legislative and rule areas should be analyzed to support this proposal constitutionally and technically?

- (A) Section 136A, CMVR Rule 125H, and Article 21 of Constitution
- (B) Section 39, Rule 50, and Indian Evidence Act
- (C) Section 66, Rule 115, and Article 370
- (D) Section 84, Rule 126, and Motor Accident Claims Tribunal Act

86. A major benefit of keeping transport records is:

- (A) To make the driver happy
- (B) To entertain passengers
- (C) For financial analysis and audit
- (D) For printing advertisements

87. A commercial fleet owner installs aftermarket LED lights and bull bars on vehicles, claiming improved aesthetics and visibility. As a legal advisor, what would be the most valid regulatory basis to challenge this modification?

- (A) Rule 100-105 and Section 52 of the Motor Vehicles Act
- (B) Section 56 and Rule 115
- (C) Section 66 and Rule 138
- (D) Rule 50 and Section 84

88. Imagine you are drafting a proposal for an AI-based vehicle violation detection system to be deployed by city traffic authorities. Which legal sections and rules must be integrated into your proposal for it to be enforceable?

- (A) Section 88, Rule 126, and IT Act
- (B) Section 136A, Rule 115, and Motor Accident Tribunal Act
- (C) Section 136A, Rule 167, and Section 210B
- (D) Section 3, Rule 100, and IPC Section 304A

89. A driver with a valid transport license is involved in an accident while carrying passengers in a goods vehicle. From a legal and ethical standpoint, which set of legal provisions would best support a penalty and revocation process?

- (A) Section 66A, Rule 62, and Road Transport Act
- (B) Section 3, Section 84, and Section 192A
- (C) Section 88, Rule 126, and Indian Contract Act
- (D) Section 112, Rule 115, and Section 177

90. Which legal provisions are violated if a school bus operates without a speed governor, lacks a First Aid kit, and carries students beyond its seating capacity?

- (A) Section 39 and Rule 100
- (B) Section 66A, Rule 138, and Section 177
- (C) Section 112 and Rule 115
- (D) Section 84, Rule 125C, and Rule 118



91. What is the primary purpose of forging in automotive manufacturing?
- (A) Improve surface finish
 - (B) Reduce production cost
 - (C) Enhance strength and durability of parts
 - (D) Facilitate easier welding
92. What is the purpose of robotic welding in automotive manufacturing?
- (A) Reduce material usage
 - (B) Improve aesthetic appearance
 - (C) Enhance speed and consistency
 - (D) Increase human employment
93. Which surface treatment process involves coating the part with zinc?
- (A) Phosphating
 - (B) Galvanizing
 - (C) Anodizing
 - (D) Electroplating
94. In automotive CNC machining, what is the common tolerance for high-precision parts like pistons?
- (A) ± 1 mm
 - (B) ± 0.1 mm
 - (C) ± 10 mm
 - (D) ± 0.01 mm
95. What is G-code primarily used for in CNC machining?
- (A) Defining the tool path and machine movements.
 - (B) Generating 3D models of parts.
 - (C) Controlling the machine's electrical power supply.
 - (D) Managing inventory of raw materials.
96. Which shape is ideal for small workshops for effective space utilization?
- (A) L-shape
 - (B) Circular
 - (C) Rectangular
 - (D) T-shape
97. Which of the following is a common equipment used in wheel alignment?
- (A) Engine hoist
 - (B) Scan tool
 - (C) Camber gauge
 - (D) Fuel injector tester
98. Which document records all the repairs done on a vehicle?
- (A) Job card
 - (B) Warranty card
 - (C) Insurance form
 - (D) Delivery note
99. What is the recommended periodic maintenance interval for engine oil and filter replacement in most modern passenger cars?
- (A) Only when a warning light illuminates.
 - (B) As per manufacturer's specifications.
 - (C) Never, as modern cars have sealed engines.
 - (D) Every 500 km or 1 month.
100. Performing chassis maintenance, what common problem is associated with worn shock absorbers or struts?
- (A) Loss of power steering.
 - (B) Excessive bouncing and poor ride quality.
 - (C) Difficulty in starting the engine.
 - (D) Overheating engine.

