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KPCL (Mechanical Engineering – JE)

GENERAL INSTRUCTIONS

Time: 2 hrs

Max. Marks: 100

EXAMPLE	
Wrong Methods	
1	
2	
3	
4	
CORRECT METHOD	
1	

1. Completely darken only one oval corresponding to the answer of your choice.
2. Use Black ink Ball-Point Pen only, to darken the oval to indicate your choice. Oval should be darkened completely so that the alphabet inside the oval is not visible
3. Mark your answer as shown in the example.

1. The question paper is in two parts. PART-A containing 70 questions of **ONE** mark each is compulsory. PART-B has two sections. Each section contains 30 questions of **ONE** mark each. Attempt only one section in PART-B.
2. All questions are of objective type. There is no negative marking.
3. Questions must be answered on a special machine gradable **Objective Response Sheet (ORS)** by darkening the appropriate oval (marked A, B, C, D). **See box above.**
4. Enter your application number on the left top side of the **ORS** by darkening the appropriate oval with a Black ink Ball-Point Pen.
5. Write your name and the application number on the right top side of the **ORS** in the specified locations in black ink and affix your signature in the box provided.
6. No charts or tables are provided in the examination hall. Calculators, cell phones and other types of electronic gadgets are strictly forbidden in the examination hall.
7. Use the blank pages provided at the end of the question paper for rough work. No extra sheets will be provided.
8. After completing the examination, you must hand over both the question paper and the **ORS** answer sheet to the invigilator.
9. A candidate found violating the instructions given above and/or those given by the invigilator, will be disqualified. Furthermore, a candidate giving assistance to any other candidate or seeking/receiving help from any source in answering questions or copying in any manner in the test, will forfeit his/her chance of being considered for selection.

PART- A

This part, containing 70 questions of ONE mark each, is to be attempted by all the candidates.

1. $\frac{\log_a b}{\log_a c} =$
(A) $\log_c a$ (B) $\log_b c$ (C) $\log_b a$ (D) $\log_c b$
2. The sum of the interior angles of a convex polygon of n sides is:
(A) 4 right angles (B) $(2n-4)$ right angles
(C) $2n$ right angles (D) $(n+2)$ right angles
3. The equation of a straight line is $3x-2y+12=0$. The intercept made by the straight line on the x -axis is:
(A) -4 (B) -2 (C) 3 (D) 12
4. The scalar product of the vectors $2\hat{i}+3\hat{j}$ and $3\hat{i}-2\hat{j}$ is:
(A) -2 (B) 0 (C) 2 (D) 3
5. One of the solutions of the equation $3\tan^2 x - 8\tan x + 5 = 0$ is:
(A) 0 (B) $1/\sqrt{2}$ (C) $\pi/4$ (D) $(\sqrt{3})/2$
6. From the Descartes's rule of signs, the number of negative roots of the equation $x^3 - 23x^2 + 62x - 40 = 0$ is:
(A) 0 (B) 1 (C) 2 (D) 3
7. $\lim_{n \rightarrow \infty} \left(1 + \frac{1}{n}\right)^n =$
(A) 0 (B) 1 (C) e (D) π
8. The perimeter of a rectangle is P . If the area of the rectangle is to be a maximum, its sides will be:
(A) $P/10, 4P/10$ (B) $P/8, 3P/8$ (C) $P/6, 2P/6$ (D) $P/4, P/4$
9. If $f(x, y) = \ln \sqrt{x^2 + y^2}$, the partial derivative $\frac{\partial f}{\partial x} =$
(A) $\frac{x}{x^2 + y^2}$ (B) $\frac{y}{x^2 + y^2}$ (C) $\frac{x}{\sqrt{x^2 + y^2}}$ (D) $\frac{y}{\sqrt{x^2 + y^2}}$

10. The differential equation of the family of curves $y^2 = 4ax$ is:
 (A) $\frac{dy}{dx} = \frac{4a}{y^2}$ (B) $\frac{dy}{dx} = \frac{y^2}{4a}$ (C) $\frac{dy}{dx} = \frac{2a}{y}$ (D) $\frac{dy}{dx} = \frac{y}{2a}$
11. If the generator in a hydel power station is a 6-pole machine, to obtain a frequency of 50 Hz, the generator is to be run at a synchronous speed of:
 (A) 50 rpm (B) 300 rpm (C) 600 rpm (D) 1000 rpm
12. If the specific resistance of a material is ρ , the resistance R of a wire of cross-sectional area A and length L , in consistent units, is:
 (A) $R = \rho A/L$ (B) $R = A/(\rho L)$ (C) $R = \rho L/A$ (D) $R = L/(\rho A)$
13. The calorific value of a fuel is determined using a:
 (A) bomb calorimeter (B) watt-hour meter (C) megger (D) variac
14. The power consumed in kW by a resistive load of 52.9Ω connected across 230 V supply is:
 (A) 0.01 (B) 0.1 (C) 1 (D) 10
15. A rotameter is an instrument used for measuring:
 (A) rotational speed (B) frequency (C) flow rate (D) heat flux
16. The material pair in a Type-T thermocouple is:
 (A) cadmium-sulphur (B) copper-constantan
 (C) iron-constantan (D) chromel-alumel
17. For the heating of buildings in cold climates, the most economical method is to use a:
 (A) steam-heating coil (B) heat pump
 (C) electrical heating coil (D) furnace fired with oil
18. The refrigerant commonly used in domestic refrigerators and freezers at the present time is:
 (A) R11 (B) R12 (C) R123 (D) R134a
19. For an ideal gas, the constant pressure and constant volume specific heats are:
 (A) constants
 (B) functions of pressure alone
 (C) functions of temperature alone
 (D) functions of pressure and temperature
20. Of the following quantities, the quantity that is a path function is:
 (A) internal energy (B) heat
 (C) pressure (D) enthalpy

21. Zeroth law of thermodynamics permits the measurement of the following quantity with a calibrated measuring instrument:
 (A) pressure (B) specific volume
 (C) temperature (D) dryness fraction
22. The law of conservation of energy of mechanics is a special case of the first law of thermodynamics for a system when:
 (A) the heat and work interactions are zero (B) the heat interaction is zero
 (C) the work interaction is zero (D) the working medium is an ideal gas
23. A perfect gas of mass 2 kg undergoes an isothermal expansion. If the heat supplied to the gas in this process is 4 kJ, the work output from the process in kJ is:
 (A) 0.5 (B) 1 (C) 2 (D) 4
24. In a reversible constant pressure heating process carried out at 2.5 bar, the change in enthalpy of a substance is found to be 25 kJ. The heat supplied in kJ is:
 (A) 2.5 (B) 10 (C) 25 (D) 62.5
25. When 180 kJ of heat is supplied to 5 kg of gas contained in a closed vessel, the gas rises in temperature from 25°C to 75°C. The constant volume specific heat of the gas, treated as constant, in kJ/(kg.K) is:
 (A) 0.68 (B) 0.72 (C) 0.76 (D) 0.80
26. A gas undergoes expansion from a pressure of 5 bar and specific volume 0.24 m³/kg to a pressure of 1 bar and specific volume 0.83 m³/kg. The polytropic index of expansion is:
 (A) 1.2 (B) 1.3 (C) 1.4 (D) 1.6
27. If the thermal efficiency of a Carnot engine working between the temperature limits 600 K and 300 K is to be raised by 20%, the source temperature is to be increased to:
 (A) 650 K (B) 750 K (C) 800 K (D) 850 K
28. An ice block of temperature 273 K and of mass 1 kg melts and becomes water at 273 K. If the latent of fusion of ice is 336 kJ/kg, the entropy change in this process in kJ/(kg.K) is:
 (A) 0.81 (B) 1.23 (C) 1.62 (D) 2.46
29. For a thermodynamic cycle consisting of irreversible processes, the second law, with the integral sign below denoting cyclic integral, can be expressed, with usual notation, as:
 (A) $\int (dQ/T) < 0$ (B) $\int (dQ/T) = 0$ (C) $\int (dQ/T) > 0$ (D) $\int (dQ/T) \leq 0$

30. In an irreversible isothermal process carried out at a temperature of 500 K, the heat supplied is 1000 J. The difference between the final and initial entropies in J/K is:
 (A) less than 1 (B) less than or equal to 2
 (C) less than 2 (D) greater than 2
31. Regenerative feed water heating is employed in a thermal power plant in order to:
 (A) improve the turbine work output (B) increase the dryness fraction of steam
 (C) decrease the pump power input (D) improve the thermal efficiency
32. In the Rankine cycle, the reason for employing dry expansion is that:
 (A) wet expansion does not result in sufficiently lower pressures
 (B) wet expansion has practical problems
 (C) wet expansion superheats the exit steam
 (D) wet expansion decreases the efficiency
33. The main advantage of the binary vapour cycle is the:
 (A) increased pump work (B) increased thermal efficiency
 (C) increased vacuum after expansion (D) heat supply at constant volume
34. The blade passages in the latter stages of a steam turbine are larger mainly because of the:
 (A) larger mass flow rate (B) lower speed of rotation
 (C) larger specific volume (D) lower vacuum in the condenser
35. The boiler feed pump in a thermal power plant is usually of the following type:
 (A) multistage axial flow (B) single stage mixed flow
 (C) multi-vane (D) multistage centrifugal
36. The number of feed water heaters employed in a steam power plant is usually:
 (A) 4-8 (B) 12-16 (C) 20-25 (D) 40-50
37. Air with a density of 1.2 kg/m^3 enters the inlet of a compressor through a cross-sectional area of 20 cm^2 and with a velocity of 5 m/s. At the outlet to the compressor, the cross-sectional area is 5 m^2 and the velocity is 4 m/s. The density of air at the outlet in kg/m^3 is:
 (A) 1.2 (B) 4 (C) 5 (D) 6
38. The space between two parallel plates is filled with a fluid. The force required to drag one of the plates at a velocity of 1 m/s parallel to the other plate which is fixed is found to be 1 N per m^2 area of the plate. If the plate separation distance is 1 mm, the dynamic viscosity of the fluid in Pa.s is:
 (A) 0.001 (B) 0.01 (C) 0.1 (D) 1

39. A streamline is a line at every point of which is:
 (A) the velocity perpendicular to the line
 (B) the vorticity tangential to the line
 (C) the velocity tangential to the line
 (D) the circulation tangential to the line
40. Where fluid movement is effected with external agents like pumps and blowers, the magnitude of the following dimensionless number tells us whether the fluid flow is laminar or turbulent:
 (A) Marangoni number (B) Grashof number
 (C) Reynolds number (D) Rayleigh number
41. In a duct at a cross-section, the pressure, velocity and elevation (with reference to a datum) are respectively 100 kPa, 10 m/s and 4 m, respectively. If the density of the fluid is 1000 kg/m^3 and gravitational acceleration is 10 m/s^2 , the total head in m at this location is:
 (A) 5 (B) 19 (C) 100 (D) 1000
42. A force of 100 kN is applied to a plate to punch a square hole of side 10 mm in a plate of thickness 5 mm. The average shear stress in the plate in kN/mm^2 is:
 (A) 0.01 (B) 0.5 (C) 5 (D) 500
43. Assuming that the action of an axial load on a bar of area A , length L and modulus of elasticity E is like a force applied to a tension spring, the stiffness of the bar is:
 (A) ELA (B) EL/A (C) LA/E (D) EA/L
44. The solution of problems related to statically indeterminate structures requires, apart from the equations of equilibrium, additional equations related to the:
 (A) stresses (B) displacements
 (C) moduli of elasticity (D) Poisson's ratios
45. A bar of uniform cross-sectional area A and length L is subjected to an axial tensile stress σ . The bar undergoes a longitudinal strain of ϵ . The strain energy stored in the bar is:
 (A) $(\sigma\epsilon AL)/2$ (B) $(\sigma^2 AL)/(A\epsilon)$ (C) $2\sigma\epsilon AL$ (D) $(\sigma^2 AL)/(2A\epsilon)$
46. Cantilever-1 carries a triangular load that increases from zero at the fixed end to a maximum at the free end. Cantilever-2 is also loaded with a similar triangular load except that the load decreases linearly from the fixed to the free end. Then the maximum bending moment occurs at the:
 (A) centre of the beam for cantilever-1 (B) fixed end of cantilever-1
 (C) fixed end of cantilever-2 (D) centre of the beam for cantilever-2

47. A bar of diameter d and modulus of elasticity E is placed over a solid cylinder of diameter D such that their axes are at right angles and is bent such that part of the bar deforms into a circular arc. The bending stress in the bent portion of the bar is:
 (A) $E(D+d)/d$ (B) $E(D+d)/D$ (C) $ED/(D+d)$ (D) $Ed/(D+d)$
48. A cantilever beam of flexural rigidity EI and length L carries a load P at the free end. The angle of rotation of the free end is:
 (A) $PL^2/(2EI)$ (B) $2PL^2/(3EI)$ (C) $\pi PL^2/(2EI)$ (D) $\pi PL^2/(3EI)$
49. The polar moment of inertia of a very thin hollow tube of average radius r and wall thickness t is approximately:
 (A) $2\pi r t^3$ (B) $2\pi r^2 t^2$ (C) $2\pi r^3 t$ (D) $2\pi r^{3/2} t^{1/2}$
50. The Young's modulus for a steel is 200 GPa and the Poisson's ratio is 0.25. The modulus of rigidity of steel in GPa will be:
 (A) 20 (B) 40 (C) 60 (D) 80
51. Compared to a solid shaft transmitting power, a hollow shaft of the same length, same outer radius and the same material will have:
 (A) more shear stress but much more reduction in weight
 (B) less shear stress and higher angle of rotation
 (C) less shear stress and lower angle of rotation
 (D) less shear stress and lower weight
52. A body of mass m moving at a velocity of v collides with a body of the same mass at rest. After the impact, the two bodies adhere to each other and move. The loss of kinetic energy in the collision is:
 (A) $(mv^2)/8$ (B) $(mv^2)/6$ (C) $(mv^2)/4$ (D) $(mv^2)/2$
53. The angle of an inclined plane on which a block is resting is gradually increased. If the coefficient of friction between the block and the plane is μ , the angle of the inclined plane at which the block will start sliding is:
 (A) $\tan^{-1}\mu$ (B) $\tan^{-1}(1/\mu)$ (C) $\sin^{-1}\mu$ (D) $\sin^{-1}(1/\mu)$
54. A disc of polar mass moment of inertia I , spinning in a vertical plane at an angular velocity ω , precesses with an angular velocity ω_p in the horizontal plane. The torque being applied to the shaft carrying the disc is:
 (A) $I\omega^{3/2}\omega_p^{1/2}$ (B) $I\omega_p^2/\omega$ (C) $I\omega^2/\omega_p$ (D) $I\omega\omega_p$
55. If the side thrust on the guide is to be limited to the frictional force between the cam and follower surfaces, this can be done by using a:
 (A) flat-face follower (B) knife-edge follower
 (C) follower with circular roller (D) follower with elliptical roller
56. A gear wheel of module 8 mm has 64 teeth. The pitch circle diameter in mm is:
 (A) 8 (B) 64 (C) 512 (D) 4096

57. When a governor is in equilibrium for only one radius of rotation of the governor balls, the governor is said to be:
 (A) hunting (B) over-sensitive (C) isochronous (D) stable
58. If a balancing mass cannot be introduced in the same plane of rotation of the disturbing mass, then:
 (A) four balancing masses are to be introduced in another plane
 (B) three balancing masses must be introduced in three other planes
 (C) two balancing masses can be introduced in two other planes
 (D) the system cannot be balanced
59. With reference to a locomotive wheel, the term "hammer-blow" refers to:
 (A) unbalanced force resulting from the reciprocating parts of the engine
 (B) unbalanced force resulting from the rotating parts of the engine
 (C) the maximum variation of the wheel load from the mean
 (D) the maximum load that can be supported by the suspension system
60. The frequency of transverse vibrations of a shaft due to its own weight is 1000 per minute. The frequency under the action of a load on a weightless shaft is 1500 vibrations per minute. The frequency in vibrations per minute when the load acts on the shaft is:
 (A) 832 (B) 964 (C) 998 (D) 1096
61. A specimen is to be tested for hardness with a Brinell's hardness tester. If the diameter of the ball is 10 mm and the material of the test specimen is steel, the approximate load to be employed in kN is:
 (A) 10 (B) 20 (C) 30 (D) 40
62. The carbon precipitating from austenite upon slow cooling is in the form of:
 (A) diamond (B) graphite (C) sodium carbonate (D) cementite
63. A plain carbon steel containing more than 0.83% of carbon is called:
 (A) hypo-eutectic (B) hyper-eutectic (C) hypo-eutectoid (D) hyper-eutectoid
64. A cast iron in which the graphite is present in the form of spherical particles is:
 (A) nodular cast iron (B) grey cast iron (C) white cast iron (D) fluid iron
65. Admiralty brass is made by alloying standard brass with the following metal:
 (A) aluminium (B) tin (C) magnesium (D) zinc
66. A drilling machine in which the spindle can be positioned over a work fastened to a stationary base is called:
 (A) a radial drilling machine (B) a fixed bed drilling machine
 (C) a vertical drilling machine (D) an upright drilling machine

67. In an engine lathe, the dead center is used in the spindle of the:
(A) headstock (B) tailstock (C) feed screw (D) thread cutting mechanism
68. An arbor is to cutting tools is as a mandrel is to:
(A) work (B) bed (C) knee (D) arm
69. The following operation is done to provide a proper hand grip on cylindrical parts:
(A) spot-facing (B) undercutting (C) knurling (D) overcutting
70. The purpose of providing a back rake angle in a cutting tool is:
(A) to control the feed of the tool (B) to fix the tool to its holder
(C) to prevent rubbing of work and tool (D) to guide the chip flow

PART – B

In Part B, there are TWO Sections. Each Section contains 30 questions of ONE mark each. Attempt only ONE of these two Sections (Section A is expected to be answered by the Mechanical Engineering candidates and Section B by the Automobile Engineering candidates).
Indicate the Section attempted by darkening the appropriate bubble in the Answer Sheet.

SECTION A: MECHANICAL ENGINEERING

71. Air of mass 1 kg is heated from 300 K to 600 K in a constant pressure process. The constant pressure specific heat for air may be taken as 1 kJ/(kg.K). The change in entropy during this process in kJ/(kg.K) is:
(A) -0.693 (B) -0.301 (C) 0.301 (D) 0.693
72. For air, the characteristic gas constant is 287 J/(kg.K) and the ratio of specific heats is 1.4. The velocity of sound in air at a temperature of 14.6°C, in m/s, is:
(A) 280 (B) 300 (C) 320 (D) 340
73. If a dye particle injected into an unsteady flow field is photographed with a continuous exposure camera, the image of the particle will be:
(A) streamline (B) pathline (C) streakline (D) vortex line
74. At a location, duct-1 branches into duct-2 and duct-3 discharging into the same chamber. Duct-2 is of larger length than duct-3 but is of the same cross-sectional area as duct-3. If Q_1 , Q_2 and Q_3 are the volumetric flow rates of an incompressible fluid through the corresponding ducts, the following is true:
(A) $Q_2 < Q_3 < Q_1$ (B) $Q_1 < Q_2 < Q_3$ (C) $Q_2 < Q_1 < Q_3$ (D) $Q_3 < Q_2 < Q_1$
75. The surface tension of soap solution is 0.025 N/m. The pressure excess in a soap bubble of diameter 0.1 m, over that of the atmosphere, in Pa, is:
(A) 0.0025 (B) 0.1 (C) 0.25 (D) 1
76. In tank towing experiments carried out to find the resistance to ships, the following number is important:
(A) Froude number (B) Weber number
(C) Jacob number (D) Mach number
77. A tank has an orifice of area $4 \times 10^{-4} \text{ m}^2$. The head of water above the orifice is 2 m. Neglecting friction, the discharge through the orifice in m^3/s will be:
(A) 5×10^{-4} (B) 2.5×10^{-3} (C) 5×10^{-3} (D) 0.025
78. In a circular pipe, the axial velocity is found to vary with radius as $u = C_1 r^2 + C_2$ where C_1 and C_2 are constants. The flow in the pipe is:
(A) turbulent (B) steady laminar (C) unsteady (D) time-periodic

79. Pipe-2 carries twice the volumetric flow rate of water compared to pipe-1. The cross-sectional areas of both the pipes are the same. Assuming turbulent flow and rough pipes, if the pressure drop in both the pipes is to be the same, the length of pipe-2 is to be:
 (A) one-fourth that of pipe-1 (B) one-half that of pipe-1
 (C) twice that of pipe-1 (D) four times that of pipe-1
80. Head losses in valves and fittings are often expressed in terms of a:
 (A) static pressure head (B) velocity head
 (C) elevation head (D) total head
81. In a rotodynamic machine, the losses occurring in the impeller and in the casing due to friction and separation are accounted for by the following efficiency:
 (A) mechanical efficiency (B) overall efficiency
 (C) impeller efficiency (D) hydraulic efficiency
82. A centrifugal pump of impeller diameter 0.5 m runs at 500 rpm. The volume flow rate through a geometrically similar pump of impeller diameter 0.25 m and running at 1000 rpm will be:
 (A) 25% of the former (B) 50% of the former
 (C) equal to that of the first pump (D) 150% of the former
83. For maximum hydraulic efficiency of a Pelton turbine, the ratio of the absolute jet velocity to the bucket speed should be:
 (A) 0.25 (B) 0.5 (C) 1 (D) 2
84. In a Pelton wheel working under a head of 30 m, the absolute jet velocity is 24.3 m/s, the bucket speed is 12.1 m/s and the angle of deflection of the jet is 160° . The hydraulic efficiency is:
 (A) 93% (B) 95% (C) 97% (D) 99%
85. In practice, the maximum number of jets that can be used in a Pelton turbine installation is limited to typically:
 (A) 2 (B) 6 (C) 9 (D) 12
86. If a reaction water turbine is to be installed above the tail race without loss of effective head, it should be fitted with:
 (A) a speed governor (B) a draft tube
 (C) inlet guide vanes (D) a chain and sprocket mechanism
87. The term "blowby" refers to:
 (A) backflow of the refrigerant in the AC system into the condenser
 (B) fuel-air mixture leaking past the piston rings into the crank case
 (C) exhaust leaving the muffler into the atmosphere
 (D) blast of air used for making the glass panels of the automobile

88. In the power stroke of a spark ignition engine, the force coming on the piston in kN is typically:
 (A) 15 (B) 45 (C) 75 (D) 100
89. In a compression ignition engine, the maximum pressure difference in atmospheres to which the piston rings are subjected is typically:
 (A) 10 (B) 25 (C) 40 (D) 70
90. In an internal combustion engine, the lubricant splashed on to the cylinder walls is scraped off by:
 (A) Neoprene O-rings (B) compression rings
 (C) Teflon rings (D) oil control rings
91. The air cycle refrigeration works on reversed:
 (A) Carnot cycle (B) Ericsson's cycle (C) Joule's cycle (D) Stirling cycle
92. In modern V-engines, the angle (in degrees) between the two cylinder rows is typically:
 (A) 30 (B) 45 (C) 60 (D) 90
93. In an adiabatic engine, some of the parts exposed to high temperature gas are coated with:
 (A) ceramic (B) cadmium (C) lead (D) solder
94. The typical air-fuel ratio for a diesel engine working at full load is:
 (A) 5:1 (B) 10:1 (C) 15:1 (D) 20:1
95. During a test, an engine runs at an angular speed of 250 radians per second when the brake load is 200 N and the arm radius is 0.5 m. The brake power of the engine in kW under this condition is:
 (A) 5 (B) 20 (C) 25 (D) 50
96. The axial spring force in a plate clutch is 5 kN and the coefficient of friction is 0.3. If the mean radius of the friction surface is 0.1 m and the angular speed of transmission is 200 rad/s, the power transmitted in kW is:
 (A) 10 (B) 20 (C) 30 (D) 50
97. A spark-ignition engine with a normal compression ratio is likely to use a fuel with an octane rating of:
 (A) 74 (B) 87 (C) 93 (D) 101

98. The following is true with regard to the octane and cetane ratings of internal combustion engine fuels:
- (A) the fuel burns faster as the octane and cetane numbers increase
 - (B) the fuel burns slower as the octane and cetane numbers increase
 - (C) the fuel burns faster as the octane number decreases and cetane number increases
 - (D) the fuel burns slower as the octane number decreases and cetane number increases
99. In an engine, the heat rejection rate to the cooling water is 35 kW, while the flow rate of water is 1.5 kg/s. The difference between the inlet and outlet water temperatures, in degrees Celsius, is:
- (A) 5.6 (B) 15.1 (C) 18.9 (D) 25.6
100. The pour-point of a fuel is the temperature at which:
- (A) the fuel gives off vapours that ignite (B) the water in the fuel evaporates
- (C) the fuel ceases to flow freely (D) the fuel produces deposits on the valves

SECTION B: AUTOMOBILE ENGINEERING

71. If firing impulse occurs for every 144 degrees of the crankshaft rotation in an automotive engine, the engine is a:
(A) three-cylinder engine (B) four-cylinder engine
(C) five-cylinder engine (D) six-cylinder engine
72. The function of a rocker arm in automotive engine is to:
(A) transmit the motion of the piston to crankshaft
(B) circulate the coolant in the radiator
(C) maintain adhesion between the tyres and road
(D) transmit the motion of the cam to the inlet or outlet valve
73. A firing order usually employed for an inline six-cylinder automotive engine is:
(A) 1-5-3-6-2-4 (B) 1-2-3-6-5-4
(C) 1-2-3-4-5-6 (D) 1-3-2-6-4-5
74. If the firing order of an inline four-cylinder engine is 1-3-4-2, then a piston pair moving together is:
(A) 1-2 (B) 3-4 (C) 1-3 (D) 2-3
75. The need for a suitable firing order in a multi-cylinder automotive engine is to:
(A) achieve better cooling of the cylinder heads and the pistons
(B) to reduce fuel consumption and effect economy in the running cost
(C) to distribute the power strokes evenly along the crankshaft
(D) allow sufficient time delay for the actuation of the firing devices
76. In an adiabatic engine:
(A) both the temperature and efficiency are lower
(B) both the temperature and efficiency are higher
(C) temperature is lower but the efficiency is higher
(D) temperature is higher but the efficiency is lower
77. The brake power outputs of two engines A and B of the same size and operating on the same fuel are 7 and 5 kW, respectively. Then it is likely that:
(A) A is two-stroke, B is four-stroke
(B) A is four-stroke, B is two-stroke
(C) Both A and B are two-stroke
(D) Both A and B are four-stroke
78. If the valves in an engine are actuated by a pushrod, the camshaft is usually located inside the
(A) crankcase (B) cylinder block (C) oil pump (D) outlet manifold

79. In engines burning compressed natural gas, the pressure inside the natural gas storage cylinder in bar is typically:
(A) 2.5 (B) 25 (C) 60 (D) 200
80. To obtain the same power output from an engine burning liquefied petroleum gas as that burning petrol, the compression ratio is usually:
(A) increased by 50% (B) halved
(C) doubled (D) trebled
81. The following engine is a rotary combustion engine:
(A) Ford V-6 engine (B) Volkswagen Beetle
(C) General Motors Chevrolet (D) NSU Wankel
82. The following is a catalyst used in catalytic converters:
(A) magnesium (B) platinum (C) potassium (D) sodium
83. The octane rating of premium petrol is:
(A) 75 (B) 87 (C) 89 (D) 92
84. The approximate chemical formula of petrol is:
(A) C_4H_{10} (B) C_6H_{14} (C) C_8H_{18} (D) $C_{12}H_{26}$
85. In a diesel engine employing a common rail system:
(A) a rail of I-section passes through the length of the engine
(B) the lubricating oil is supplied to all the required parts through a common rail
(C) the fuel is distributed to the injectors from a pressurized common rail
(D) the displacement is common to all the pistons in the various cylinders
86. A spark-ignition engine in which a rich mixture is admitted into the pre-combustion chamber and a lean mixture into the cylinder is called a:
(A) stratified charge engine (B) twin-drive engine
(C) cooperative fuel research engine (D) dual-pressure engine
87. The main feature of a Digital Twin Spark-Ignition (DTSI) engine is that:
(A) two electronic digital controllers are used to control the fuel supply
(B) two spark plugs are used to ignite the charge
(C) two engines with a common crankshaft are tandem-compounded
(D) two fuel injectors direct the fuel onto the inlet valve
88. An engine with a cylinder of stroke 85 mm and bore 100 mm is usually referred to as:
(A) high-octane engine (B) over-heat engine
(C) over-square engine (D) high-bore engine

89. Sending the air-fuel mixture leaking into the crankcase back through the engine for re-burning is called:
 (A) NO_x emission control (B) crankcase emission control
 (C) leakage control (D) re-burning control
90. A characteristic of petrol-ethanol blend, compared to pure petrol, is that its:
 (A) octane rating is higher (B) calorific value is higher
 (C) flash point is higher (D) flue gas has more carbon monoxide
91. The following springs in the friction disc absorb the shock of engagement, when the clutch is suddenly engaged:
 (A) helical tension springs (B) helical compression springs
 (C) elastic rods (D) cushion springs
92. In an automobile, the torque of the engine is 300 N.m. If the rear-axle reduction ratio is 5 to 1 and the transmission efficiency is 80%, the torque in N.m at the road wheels in the top gear is:
 (A) 48 (B) 75 (C) 1200 (D) 1875
93. The rotational speed of an automobile engine is 3000 revolutions per minute (rpm). If the second gear ratio is 1.5, the speed in rpm of the rear wheels when the vehicle moves in second gear is:
 (A) 1500 (B) 2000 (C) 3000 (D) 4500
94. For an automobile engine working on diesel oil, an acceptable cetane number would be:
 (A) 25 (B) 35 (C) 45 (D) 55
95. When an automobile is negotiating a curve, the torques transmitted to the individual road wheel shafts through a differential are:
 (A) equal
 (B) directly proportional to the speeds of the corresponding shafts
 (C) inversely proportional to the speeds of the corresponding shafts
 (D) directly proportional to the square of the speeds of the corresponding shafts
96. If the steering wheel has to be turned more in the same direction during cornering in order to avoid running out of the curve, the condition is called:
 (A) negotiation of a curve (B) rear angle slipping
 (C) oversteering (D) understeering
97. Application of brakes to rear wheels of car so as to lock them results in:
 (A) swinging round of the rear wheels (B) swinging round of the front wheels
 (C) the car sliding in a straight course (D) the car descending a gradient

98. The percentage of the chemical energy of the fuel that is rejected as heat through the radiator in an automobile is typically:
(A) 10% (B) 30% (C) 60% (D) 80%
99. The life of a common steel-belted radial tyre compared to that of a diagonal bias-ply tyre is about:
(A) the same (B) three times (C) five times (D) seven times
100. An automobile tyre is marked P205/65R15. This means that the tyre is a:
(A) bias ply tyre suitable for a light truck
(B) radial tyre suitable for a light truck
(C) bias ply tyre suitable for a passenger vehicle
(D) radial tyre suitable for a passenger vehicle

****End of the Question Paper****

Answer Key of JEM-MEG

QNO.	ANS	QNO.	ANS	QNO.	ANS	QNO.	ANS
1	D	26	B	51	A	76	A
2	B	27	B	52	C	77	B
3	A	28	B	53	A	78	B
4	B	29	A	54	D	79	A
5	C	30	D	55	A	80	B
6	A	31	D	56	C	81	D
7	C	32	B	57	D	82	A
8	D	33	B	58	C	83	D
9	A	34	C	59	C	84	C
10	C	35	D	60	A	85	B
11	D	36	A	61	C	86	B
12	C	37	D	62	D	87	B
13	A	38	A	63	D	88	A
14	C	39	C	64	A	89	D
15	C	40	C	65	B	90	D
16	B	41	B	66	A	91	C
17	B	42	B	67	B	92	C
18	D	43	D	68	A	93	A
19	C	44	B	69	C	94	C
20	B	45	A	70	D	95	C
21	C	46	B	71	D	96	C
22	A	47	D	72	D	97	B
23	D	48	A	73	B	98	C
24	C	49	C	74	A	99	A
25	B	50	D	75	D	100	C

JE (mech)

Section 'A'

Mechanical
Engg

'U' Series

Verified with original

Amey



Answer Key of JEM-AEG

QNO.	ANS	QNO.	ANS	QNO.	ANS	QNO.	ANS
1	D	26	B	51	A	76	B
2	B	27	B	52	C	77	A
3	A	28	B	53	A	78	B
4	B	29	A	54	D	79	D
5	C	30	D	55	A	80	A
6	A	31	D	56	C	81	D
7	C	32	B	57	D	82	B
8	D	33	B	58	C	83	D
9	A	34	C	59	C	84	C
10	C	35	D	60	A	85	C
11	D	36	A	61	C	86	A
12	C	37	D	62	D	87	B
13	A	38	A	63	D	88	C
14	C	39	C	64	A	89	B
15	C	40	C	65	B	90	A
16	B	41	B	66	A	91	D
17	B	42	B	67	B	92	C
18	D	43	D	68	A	93	C
19	C	44	B	69	C	94	C
20	B	45	A	70	D	95	A
21	C	46	B	71	C	96	D
22	A	47	D	72	D	97	A
23	D	48	A	73	A	98	B
24	C	49	C	74	D	99	B
25	B	50	D	75	C	100	D

JB (meek)
 Section 'B'
 Automobile Engg
 'U' Series

Verified with original

Amey

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