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T.B.C. : BAC-48

Test Booklet Series

Serial No. 601602

B

TEST BOOKLET
MECHANICAL ENGINEERING

Time Allowed : 2 Hours

Maximum Marks : 300

INSTRUCTIONS TO CANDIDATES

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET **DOES NOT** HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.
2. ENCODE YOUR OPTIONAL SUBJECT CODE AS MENTIONED ON THE BODY OF YOUR ADMISSION CERTIFICATE AND ADVERTISEMENT AT APPROPRIATE PLACES ON THE ANSWER SHEETS.
3. ENCODE CLEARLY THE TEST BOOKLET SERIES A, B, C OR D AS THE CASE MAY BE IN THE APPROPRIATE PLACES IN THE ANSWER SHEET USING HB PENCIL.
4. You have to enter your **Roll No.** on the Test Booklet in the Box provided along side. **DO NOT** write *anything else* on the Test Booklet.
5. This Test Booklet contains **120** items (questions). Each item comprises four responses (answers). You will select the response which you want to mark on the Answer Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose **ONLY ONE** response for each item.
6. You have to mark all your responses **ONLY** on the **separate Answer Sheet** provided by using **HB pencil**. See instruction in the Answer Sheet.
7. All items carry equal marks. All items are compulsory. Your total marks will depend only on the number of correct responses marked by you in the Answer Sheet. For each question for which a wrong answer is given by you, **one fifth (0.20) of the marks assigned to that question will be deducted as penalty.**
8. Before you proceed to mark in the Answer Sheet the responses to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per instructions sent to you with your **Admission Certificate**.
9. After you have completed filling in all your responses on the Answer Sheet and the examination has concluded, you should hand over to the Invigilator the *Answer Sheet*, the Test Booklet issued to you.

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1. An ideal flow is
 - (a) Viscous and compressible
 - (b) Inviscid and compressible
 - (c) Viscous and Incompressible
 - (d) Inviscid and Incompressible

2. Newton's law of viscosity states that
 - (a) stress is proportional to strain
 - (b) stress is proportional to rate of strain
 - (c) stress is inversely proportion to strain
 - (d) stress is inversely proportion to rate of strain

3. Reynolds number is the ratio of
 - (a) $\frac{\text{Inertia force}}{\text{Elastic force}}$
 - (b) $\frac{\text{Inertia force}}{\text{Viscous force}}$
 - (c) $\frac{\text{Buoyancy force}}{\text{Viscous force}}$
 - (d) $\frac{\text{Buoyancy force}}{\text{Inertia force}}$

4. Moody diagram in fluid mechanics shows the relation between
 - (a) Friction factor and Reynolds number
 - (b) Heat transfer coefficient and Reynolds number
 - (c) Drag coefficient and Mach number
 - (d) Coefficient of discharge and Mach number

5. Boundary layer separation is caused by
 - (a) Reduction of pressure in the direction of flow
 - (b) Reduction of the boundary layer thickness
 - (c) Presence of adverse pressure gradient
 - (d) Presence of favourable pressure gradient

6. For laminar flow through a pipe, the discharge varies
 - (a) As the square of diameter
 - (b) As the inverse of viscosity
 - (c) As the square of viscosity
 - (d) Inversely as the square of diameter

7. Velocity at a point in pipe flow may be measured by installing
 - (a) a wall tap
 - (b) a venturimeter
 - (c) Pitot static probe
 - (d) Rotameter

8. Which one of the following velocity fields does not represent a possible motion of an incompressible fluid
 - (a) $\bar{U} = 5x^3 \hat{i} - 15x^2y \hat{j} + t \hat{k}$
 - (b) $\bar{U} = 5x^3 \hat{i} - 15x^2y \hat{j}$
 - (c) $\bar{U} = 2x \hat{i} - 2y \hat{j}$
 - (d) $\bar{U} = 2x \hat{i} + 2y \hat{j}$

where \hat{i} , \hat{j} and \hat{k} are unit vectors in x, y and z directions and 't' is the time variable.

9. A solid body sinks in a fluid when
- The specific gravity of its material greater than unity
 - The buoyancy force does not pass through the metacentre
 - The weight of the fluid displaced is less than the weight of the body
 - The metacentre lies below the centre of gravity
10. The vertical component of the hydrostatic force on a submerged curved surface is
- The force on a vertical projection of the surface
 - The product of pressure at centroid and the surface area
 - The mass of the liquid vertically above it
 - The weight of the liquid vertically above it
11. Choose the correct statement with respect to the psychrometric chart
- The specific humidity and enthalpy scales are linear
 - The dry bulb temperature scale is linear
 - The specific humidity and dry bulb temperature scales are linear
 - The enthalpy and dry bulb temperature scales are linear
12. The minimum temperature to which air can be cooled under ideal conditions in evaporative cooling is
- Dew point temperature of the inlet air
 - Wet bulb temperature of the inlet air
 - Dry bulb temperature of the inlet air
 - All the above
13. For summer air conditioning in coastal regions, the psychrometric process employed is
- cooling with humidification
 - cooling with dehumidification
 - sensible cooling
 - sensible heating
14. In psychrometry, during a sensible cooling process, the dew point temperature
- Decreases
 - Increases
 - May increase or decrease
 - Remains constant
15. In refrigeration, reciprocating compressors are very suitable for
- Small displacement and low condensing pressure
 - Small displacement and high condensing pressure
 - Large displacement and low condensing pressure
 - Large displacement and high condensing pressure

16. It is desirable for a good refrigerant to have
- High critical temperature
 - Low critical temperature
 - High freezing point
 - High melting point
17. Which of the following is NOT an ozone friendly refrigerant ?
- Freon-12
 - Ammonia
 - Air
 - Carbon dioxide
18. In aqua-ammonia absorption refrigeration system, the refrigerant is
- Water
 - aqua-ammonia
 - Ammonia
 - air
19. In vapour compression refrigeration system, oil-separator is placed between
- Compressor and condenser
 - Condenser and throttling valve
 - Throttling valve and evaporator
 - Evaporator and compressor
20. In vapour compression refrigeration system, heat is rejected by the refrigerant in
- Compressor
 - Condenser
 - Throttle valve
 - Evaporator
21. In vapour compression refrigeration system, the refrigerant is superheated mainly to
- Increase the volumetric efficiency of the compressor
 - Avoid wet compression
 - Decrease compressor work input
 - Decrease load on the condenser
22. Air-refrigerator works on
- Carnot cycle
 - Rankine cycle
 - Brayton cycle
 - Bell-Coleman cycle
23. A simple refrigeration system operates between a condenser temperature of 40°C and evaporator temperature of 0°C respectively. The maximum C.O.P. is
- 7.8
 - ∞ (Infinity)
 - 0 (Zero)
 - 6.8
24. 'TR', Ton of Refrigeration, is the unit of refrigeration. (1 TR = 3.5 kW). Ten (10) kg of water is cooled from 20°C to ice at 0°C (Twenty $^{\circ}\text{C}$ to Zero $^{\circ}\text{C}$) in one hour by an ice-making plant. The capacity of refrigeration of the ice-making plant in 'TR' is
- 0.33 TR
 - 1.15 TR
 - 10 TR
 - 0.1 TR

25. The tolerance radiation level in particles / cm^2/s is
- 10
 - 10^2
 - 10^3
 - 10^4
26. A reactor that produces more fissionable material than it consumes is called
- breeder reactor
 - fast breeder reactor
 - water cooled reactor
 - nuclear reactor
27. Inertia to gravity force ratio gives a non-dimensional number called
- Reynolds number
 - Froude number
 - Cauchy number
 - Mach number
28. The pipe carrying water from reservoir to the turbine house in a hydraulic power plant is called
- supply pipe
 - inlet pipe
 - pen stock
 - draft tube
29. Unit speed of a turbine can be determined by dividing the normal speed by
- \sqrt{P}
 - \sqrt{H}
 - $P^{3/2}$
 - $H^{3/2}$
30. Hydel plants having capacity of the order of 100 kW are called
- pico hydel plants
 - micro hydel plants
 - mini hydel plants
 - none of the above
31. Efficiency of a draft tube is the ratio actual regain of pressure head and
- velocity head at the entrance
 - pressure head at the entrance
 - theoretical regain of pressure head
 - none of the above
32. The best suited pump for lifting water having solids in suspension is
- air lift pump
 - jet pump
 - centrifugal pump
 - reciprocating pump
33. Specific speed of a hydraulic turbine is inversely proportional to
- $P^{5/4}$
 - $H^{5/4}$
 - $P^{3/4}$
 - $H^{3/4}$

34. In condensing turbines expanding to high vacuum, the ratio of volume of steam at exhaust to that at the inlet is around
- 1
 - 10
 - 100
 - 1000
35. In steam turbines the ratio of blade length divided by the steam passage width is
- aspect ratio
 - diagram factor
 - unity
 - none of these
36. The dissolved oxygen is removed from feed water for boiler is
- deaerator
 - feed water heater
 - economizer
 - superheater
37. The burner tips in corner fired boiler are tilted to control
- steam temperature
 - steam quantity
 - air fuel ratio
 - atmospheric pollution
38. Electrostatic precipitators are devices used
- to reduce atmospheric pollution
 - with pulverised coal fired boilers
 - for dust collection from exhaust gas
 - all the above
39. At a pressure of 221.2 bar and temperature of 374.15°C, the change of volume accompanying evaporation of water is
- very high
 - very low
 - negligible
 - zero
40. If n is the index of compression, then the work done in compressing air is proportional to
- n
 - n^2
 - $\left(\frac{n}{n-1}\right)$
 - $\left(\frac{n-1}{n}\right)$
41. For the same compression ratio
- Otto cycle is more efficient than Diesel cycle
 - Diesel cycle is more efficient than Otto cycle
 - the efficiency of Otto and Diesel cycle are same
 - none of the above
42. Reheating in gas turbines is done
- between compressor stages
 - between turbine stages
 - between compressor and turbine
 - within the combustion chamber

43. Intercooling in compressors is meant for
- reducing the work of compression
 - increasing the compressor efficiency
 - reducing the power input
 - all the above
44. Compression ratio is the ratio between
- total volume and clearance volume
 - total volume and swept volume
 - maximum pressure and minimum pressure
 - delivery pressure and suction pressure
45. Choose the cycle which provides the concept of maximizing work output between two temperature limits
- Otto cycle
 - Diesel cycle
 - Brayton cycle
 - Carnot cycle
46. A process in which all thermodynamic properties are same at the start and at the end of the process is known as
- reversible process
 - quasi-static process
 - cyclic process
 - irreversible process
47. The first law of thermodynamics deals with
- conservation of mass
 - conservation of enthalpy
 - conservation of energy
 - conservation of momentum
48. The quantity $H-TS$ is termed as
- flow work
 - Gibbs function
 - Helmholtz function
 - exergy
49. The work done in a constant volume process is
- very high
 - very low
 - moderate
 - zero
50. In a process following $PV^n = C$, if $n = 1$ then the process is
- constant temperature
 - constant pressure
 - constant volume
 - constant entropy
51. A thermodynamic system which permits only energy transfer through its boundaries is a
- open system
 - closed system
 - isolated system
 - rigid system
52. The Carnot cycle consists of
- two constant volume process
 - two constant pressure process
 - two isenthalpic process
 - two isothermal process

53. The property of a system whose value does not depend upon the mass of the system is known as
- intensive property
 - extensive property
 - constant property
 - variable property
54. An enclosure which prevents thermal interaction is called
- Isothermal
 - Adiabatic
 - Isochoric
 - Isometric
55. In Krandle's notation for representing queuing models : (a | b | c) : (d | e), d stands for
- probability law for inter-arrival time
 - probability law for customers being served
 - number of channels
 - capacity of the system
56. Ideal 'Operating Characteristic Curve' looks like
- Triangle
 - Circle
 - Rectangle
 - Square
57. Taguchi's quality philosophy
- is connected with reduction in performance variation
 - is connected with increase in performance variation
 - independent of performance variation
 - Helps in cost control of product
58. In the Deming's quality cycle-'P' stands for
- product
 - productivity
 - process
 - plan
59. Quality circle leader should be trained in
- democratic skills
 - authoritarian skills
 - interpersonal skills
 - none of the above
60. Poka-Yoke is a concept of
- mistake-proofing systems
 - rework of jobs
 - inventory control system
 - tool for production planning control
61. Simplex method is used for
- linear programming
 - queuing theory
 - network analysis
 - value engineering

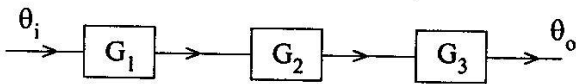
62. Break-even analysis consists of
- fixed cost
 - variable cost
 - fixed and variable cost
 - operation costs
63. Statistical quality control techniques are based on the theory of
- quality
 - statistics
 - probability
 - all of the above
64. In micro-motion study, therblig is described by
- a symbol
 - an activity
 - micro motion
 - standard symbol and color
65. Work study is concerned with
- improving present method and finding standard time
 - motivation of workers
 - improving production capability
 - improving production planning and control
66. Hungarian Method of solving the Assignment Problems involves
- Covering maximum number of zeroes with maximum number of lines
 - Covering minimum number of zeroes with maximum number of lines
 - Covering all zeroes with minimum number of lines
 - Covering maximum number of zeroes with minimum number of lines
67. If one solid phase splits into two solid phases on heating, the reaction is
- eutectic
 - peritectic
 - eutectoid
 - peritectoid
68. Chemical embossing process is basically
- an etching process
 - electroplating process
 - galvanizing process
 - engraving process
69. In Taylor's tool life equation, $VT^n = C$, index 'n' depends upon
- material of work-piece
 - condition of machine
 - material of tool
 - coolant used
70. Time taken to drill a hole through a 25 mm thick plate at 300 rpm at a feed rate of 0.25 mm/revolution will be
- 20 sec
 - 0.2 sec
 - 18.75 sec
 - 180 sec

71. The numerical control system which is applicable to a milling machine is called the
- point to point system
 - continuous path system
 - straight cut system
 - contouring system
72. Which of the following tools are harder and more wear resistant than tungsten carbide but are weaker in tension ?
- low carbon steel tools
 - high carbon steel tools
 - HSS tools
 - Ceramic tools
73. For machining tungsten carbide by ultrasonic machining which abrasive is used for maximum machining rate ?
- silicon carbide
 - aluminum oxide
 - boron carbide
 - carbon particles
74. The following non-conventional method of machining essentially requires electrolyte
- EDM
 - ECM
 - LBM
 - EBM
75. In resistance welding, voltage used for heating is
- 1 V
 - 10 V
 - 100 V
 - 1000 V
76. Merchant's theory of metal cutting is based on the assumption that
- The shear stress is maximum at the shear plane and shear will take place in a direction in which the energy required for shearing is maximum
 - The cutting energy depends on microstructures and coefficient of friction
 - During cutting operation electrons are disintegrated causing generation of heat and new surfaces which are softer than original
 - Shear occurs in a single plane and there exists a shear plane which separates the chip and work-piece
77. Which colour of flame represent highest temperature ?
- blue
 - bright red
 - dark yellow
 - white
78. Kerosene is required while machining
- aluminum
 - magnesium alloy
 - brass
 - low carbon steel
79. Large castings are gradually subjected to
- tempering
 - annealing
 - normalizing
 - tumbling
80. 18-4-1 high speed steel has
- 1% chromium
 - 4% tungsten
 - 18% vanadium
 - 0.7% carbon

81. A strut of length 'L' and flexural rigidity 'EI' is fixed at both the ends. The buckling load under compression is
- $\frac{\pi^2 EI}{4L^2}$
 - $\frac{\pi^2 EI}{L^2}$
 - $\frac{2\pi^2 EI}{L^2}$
 - $\frac{4\pi^2 EI}{L^2}$
82. A thin cylindrical shell has closed hemispherical ends. The material properties are Young's modulus (E) and Poisson's Ratio (ν). For no distortion to take place at the junction of cylindrical and hemispherical portions, the ratio of shell thickness of spherical portion to that of cylindrical portion is
- $\frac{1-\nu}{2+\nu}$
 - $\frac{1+\nu}{2-\nu}$
 - $\frac{1-\nu}{2-\nu}$
 - $\frac{1+\nu}{2+\nu}$
83. A closed coil helical spring of stiffness 'K' is cut to $\frac{2}{3}$ of its original length. The stiffness of this spring of reduced length is
- $\frac{3}{2} K$
 - K
 - $\frac{2}{3} K$
 - $\frac{1}{3} K$
84. The ratio of weights of equal lengths of hollow and solid shafts made of same material to transmit a given torque for the same maximum shear stress, if the inside diameter is $\frac{2}{3}$ of the outside is
- 0.66
 - 0.642
 - 0.5
 - 0.25
85. The width and depth of the strongest beam of rectangular section that can be cut out of a cylindrical log of wood whose diameter is 30 cm are
- $10\sqrt{3}$ cm and 10 cm
 - 10 cm and $10\sqrt{2}$ cm
 - $10\sqrt{3}$ cm and $10\sqrt{6}$ cm
 - 10 cm and $10\sqrt{3}$ cm
86. Vicker's Hardness Test has an indenter of shape
- flat cuboidal
 - spherical
 - conical
 - pyramidal

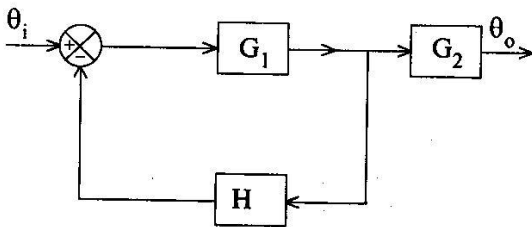
87. For fatigue design of machine members, the relevant material property to be considered is
- yield strength
 - endurance strength
 - hardness
 - impact strength
88. The state of stress at a point in a loaded member is of pure shear stresses of ± 800 MPa on two given planes at right angles to each other. The principal stresses are
- 800 MPa and -800 MPa
 - 800 MPa and 800 MPa
 - -800 MPa and -800 MPa
 - 1600 MPa and -1600 MPa
89. A column is to be designed so that no tensile stresses will be set-up. If 'd' be the diameter of the column, the compressive load should be applied through the ends over a concentric area of diameter
- d
 - $\frac{d}{2}$
 - $\frac{d}{4}$
 - $\frac{d}{8}$
90. A simply supported beam of length 'L' acted upon by a couple of magnitude 'M' at a length of $\frac{2}{3}L$ from one of the ends. The magnitude of maximum Bending moment in the beam is
- $\frac{1}{3}M$
 - $\frac{2}{3}M$
 - M
 - $\frac{3}{2}M$
91. The relation between Young's modulus (E), shearing modulus (G) and Poisson's ratio (ν) for an isotropic material is given by
- $E = 2G(1 + \nu)$
 - $E = 2G(1 - \nu)$
 - $E = 3G(1 + 2\nu)$
 - $E = 3G(1 - 2\nu)$
92. For a punch the maximum crushing stress is 4 times the maximum shearing stress of the plate in which a hole is to be made by punching. The biggest, hole that can be punched in the plate of thickness 't' is of diameter equal to
- 4 t
 - 2 t
 - t
 - $\frac{t}{2}$

93. For elements in series or cascade as shown in Figure, the overall transfer function is



- (a) $G_1 + G_2 + G_3$
 (b) $G_1 \times G_2 \times G_3$
 (c) G_1
 (d) G_3

94. The transfer function for the system shown is



- (a) $\frac{G_1 G_2}{(1 + G_1 H)}$
 (b) $\frac{G_1 G_2}{(1 - G_1 H)}$
 (c) $\frac{G_1}{(1 + G_2 H)}$
 (d) $\frac{G_2}{(1 + G_1 H)}$

95. A vertical rod of mass m_c and stiffness s is fixed at the top end and a body of mass m is attached at the lower end. Considering the effect of inertia of the rod, the natural frequency of longitudinal vibration is

(a) $f_n = \frac{1}{2\pi} \sqrt{\frac{s}{m + m_c}}$

(b) $f_n = \frac{1}{2\pi} \sqrt{\frac{s}{m - m_c}}$

(c) $f_n = \frac{1}{2\pi} \sqrt{\frac{s}{m + \frac{m_c}{3}}}$

(d) $f_n = \frac{1}{2\pi} \sqrt{\frac{s}{m - \frac{m_c}{3}}}$

96. Natural frequency of transverse vibration of a shaft carrying load at the centre of the span with central deflection δ is

(a) $f_n = \frac{5.632}{\sqrt{\delta}}$

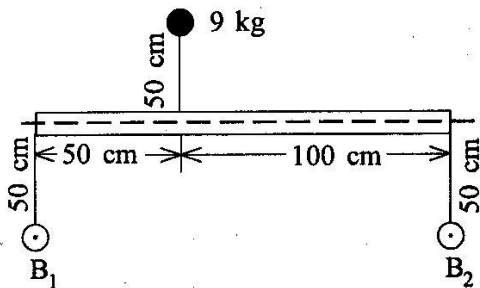
(b) $f_n = \sqrt{\frac{4.987}{\delta}}$

(c) $f_n = \sqrt{\frac{5.632}{\delta}}$

(d) $f_n = \frac{4.987}{\sqrt{\delta}}$

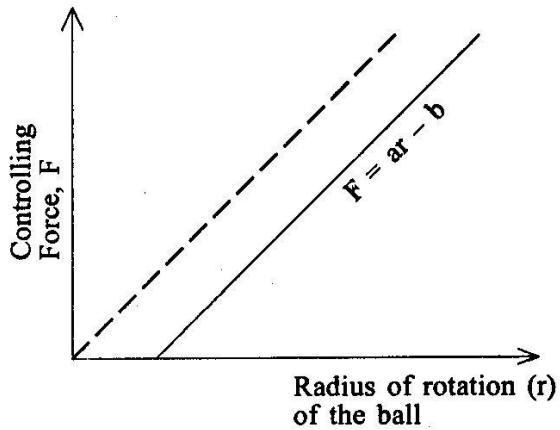
97. In order to have a complete balance of the several revolving masses in different planes
- the resultant couple must be zero
 - the resultant force must be zero
 - both the resultant force and resultant couple must be zero
 - none of the above

98. The Figure shows a rotating shaft in which a mass of 9 kg is attached at a radius of 50 cm. The balancing masses B_1 and B_2 are attached at a radius of 50 cm. The planes of rotation of the three masses are parallel and their relative locations are shown. If the shaft is rotating at 100 rpm, the balancing masses B_1 and B_2 are



- $B_1 = 6$ kg, $B_2 = 3$ kg
 - $B_1 = 6$ kg, $B_2 = 6$ kg
 - $B_1 = 3$ kg, $B_2 = 6$ kg
 - $B_1 = 3$ kg, $B_2 = 3$ kg
99. A flywheel is a device which controls
- the mean speed of rotation of the engine shaft over a long period of time
 - the speed variation caused by cyclic fluctuation of energy
 - the fluctuation of energy over a long period
 - the fuel supply to control the mean speed of the engine shaft

100. The controlling force curve for a spring controlled Governor is given in the figure. Which of the following conditions it represents ?



- Isochronous
 - unstable
 - stable
 - hunting
101. Identify the antifriction bearing
- Ball and roller bearing
 - Thrust bearing
 - Journal bearing
 - Gas bearing
102. Type of gears used to connect two non-parallel non-intersecting shafts are
- spur gears
 - bevel gears
 - helical gears
 - spiral gears

103. In a gear train, when the axes of the shafts, over which the gears are mounted, move relative to a fixed axis, is called
- simple gear train
 - compound gear train
 - reverted gear train
 - epicyclic gear train
104. In a spur gear the product of diametral pitch and circular pitch is equal to
- $\frac{1}{\pi}$
 - 1
 - 2π
 - π
105. Identify, which of the following is an inversion of single slider crank chain ?
- Watt's indicator mechanism
 - Beam engine mechanism
 - Whitworth quick-return motion mechanism
 - Ellipse frammels
106. A kinematic chain has 'n' links. The number of possible inversions is
- n
 - (n - 1)
 - (n + 1)
 - (n - 2)
107. If the elements in a kinematic pair have line contact or point contact when in motion, the pair is called
- Lower pair
 - Higher pair
 - Closed pair
 - Open pair
108. A ball falls vertically for 2 seconds and hits a plane inclined at 30° to the horizontal. If the co-efficient of restitution = 0.75, the time that elapses before it again hits the inclined plane is
- 3 seconds
 - 2 seconds
 - $\frac{3}{2}$ seconds
 - 1 second
109. If a sphere, a solid cylinder and a hollow cylinder (all of identical masses) roll down the same inclined plane without sliding, which one will reach the bottom first ?
- solid cylinder
 - sphere
 - hollow cylinder
 - all of them simultaneously
110. A flexible but inextensible chain of length 'L' and weight 'wL' is held on a frictionless table with an initial overhang of length 'a'. The velocity 'v' with which the chain will leave the table if released is
- $\frac{g}{L} \sqrt{L^2 - a^2}$
 - $\frac{g}{L} \sqrt{L^2 + a^2}$
 - $\sqrt{\frac{g}{L} (L^2 - a^2)}$
 - $\sqrt{\frac{g}{L} (L^2 + a^2)}$

111. A particle moves along a straight line with a starting velocity of V_0 . If the retarding force on the particle is K times the distance travelled, the distance travelled by the particle before coming to rest is

- (a) $\frac{2V_0}{K}$
 (b) $\frac{2V_0}{\sqrt{K}}$
 (c) $\frac{V_0}{K}$
 (d) $\frac{V_0}{\sqrt{K}}$

112. A sphere impinges directly on a second identical sphere at rest. If the coefficient of restitution is 'e', the ratio of the velocity of the first sphere to that of the second sphere after the impact is

- (a) $\frac{1-e}{1+e}$
 (b) $\frac{1+e}{1-e}$
 (c) $\frac{e}{1+e}$
 (d) $\frac{e}{1-e}$

113. The super elevation 'e' of the order rail on a rail road curve of radius 'r' so that a car travelling at a speed 'V' around the curve will exert equal pressures on the two rails (distance between the rails being 'b') is

- (a) $\frac{bV^2}{g}$
 (b) $\frac{bV^2}{gr}$
 (c) $\frac{gr}{bV^2}$
 (d) $\frac{v^2}{gr}$

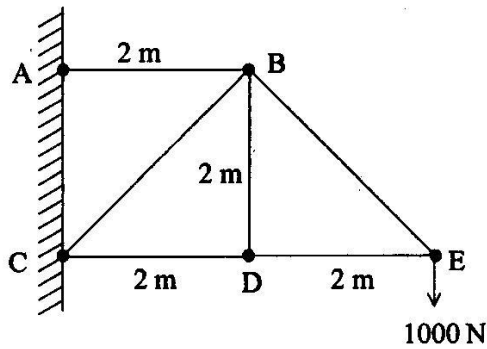
114. A projectile is fired from the level ground at an angle α_0 to the horizontal and with an initial velocity V_0 . The time elapsed by the projectile to hit the ground is

- (a) $\frac{2V_0 \cos \alpha_0}{g}$
 (b) $\frac{V_0^2 \sin 2\alpha_0}{g}$
 (c) $\frac{2V_0 \sin \alpha_0}{g}$
 (d) $\frac{V_0^2 \sin^2 \alpha_0}{2g}$

115. A stone is dropped from the top of a tower of height h . At the instant it has fallen a distance c meter, a second stone is released from rest from a point b meter below the top of the tower ($b > c$). The two stones strike the ground at the same time. The height of the tower is

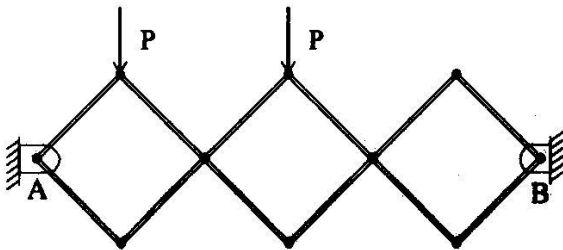
- (a) $\frac{(b+c)^2}{4c}$
 (b) $\frac{(b-c)^2}{4c}$
 (c) $\frac{b^2}{4c}$
 (d) $\frac{4c}{(b+c)^2}$

116. The force in the bar BD of the truss shown in figure is



- (a) 1000 N
- (b) -1000 N
- (c) 500 N
- (d) 0 N

117. The horizontal component of the reaction at A of the plane frame loaded as shown in Figure is

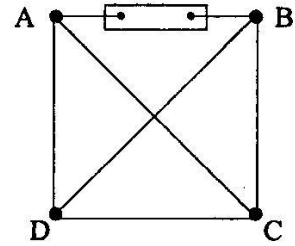


- (a) $2P$
- (b) P
- (c) $\frac{P}{2}$
- (d) $\frac{P}{3}$

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118. Referring to the square frame as shown in figure, a tensile force P is produced in the bar AB by tightening a turn-buckle. The force produced in each of the members AC or BD is

- (a) $\frac{P}{\sqrt{2}}$
- (b) P
- (c) $\sqrt{2}P$
- (d) $2P$



119. A heavy spherical ball of weight W rests on a V-shaped trough, whose sides are inclined at angles α and β to the horizontal. The contact pressure on the two sides of the trough are

- (a) $\frac{W \cos \beta}{\cos(\alpha + \beta)}$ and $\frac{W \sin \alpha}{\cos(\alpha + \beta)}$
- (b) $\frac{W \sin \beta}{\sin(\alpha + \beta)}$ and $\frac{W \sin \alpha}{\sin(\alpha + \beta)}$
- (c) $\frac{W \cos \beta}{\cos(\alpha + \beta)}$ and $\frac{W \cos \alpha}{\cos(\alpha + \beta)}$
- (d) $\frac{W \cos \beta}{\sin(\alpha + \beta)}$ and $\frac{W \cos \alpha}{\sin(\alpha + \beta)}$

120. A pulley is mounted on a vertical pillar above the head of a man of weight 800 N. The man holds one end of a rope that passes over this pulley and to the other end of which is attached a block of weight 600 N. The force with which the man's feet press against the floor is

- (a) 200 N
- (b) 400 N
- (c) 600 N
- (d) 800 N

17-B

SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK

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19-B

SPACE FOR ROUGH WORK