A-E

EA/632 2012 Series C

CIVIL/MECHANICAL (COMMON)
Paper II

*Time : **150** Minutes* *Max. Marks : **150***

INSTRUCTIONS

1. Please check the Test Booklet and ensure that it contains all the questions. If you find any defect in the Test Booklet or Answer Sheet, please get it replaced immediately.

2. The Test Booklet contains **150** questions. Each question carries **one** mark.

3. The Test Booklet is printed in four (4) Series, viz. [A] [B] [C] [D]. The Series, [A] or [B] or [C] or [D] is printed on the right-hand corner of the cover page of the Test Booklet. Mark your Test Booklet Series [A] or [B] or [C] or [D] in Part C on side 1 of the Answer Sheet by darkening the appropriate circle with Blue/Black Ball point pen.

Example to fill up the Booklet Series

If your Test Booklet Series is **A**, please fill as shown below :

● (B) (C) (D)

If you have not marked the Test Booklet Series at Part C of side 1 of the Answer Sheet or marked in a way that it leads to discrepancy in determining the exact Test Booklet Series, then, in all such cases, your Answer Sheet will be invalidated without any further notice. No correspondence will be entertained in the matter.

4. Each question is followed by 4 answer choices. Of these, you have to select one correct answer and mark it on the Answer Sheet by darkening the appropriate circle for the question. If more than one circle is darkened, the answer will not be valued at all. Use Blue/Black Ball point pen to make heavy black marks to fill the circle completely. Make **no** other stray marks.

e.g. : If the answer for Question No. **1** is Answer choice (2), it should be marked as follows :

1	(1)	●	(3)	(4)

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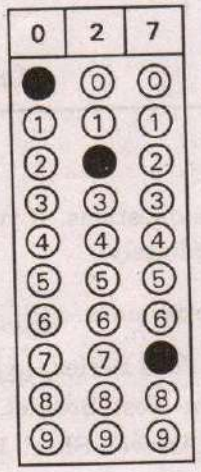
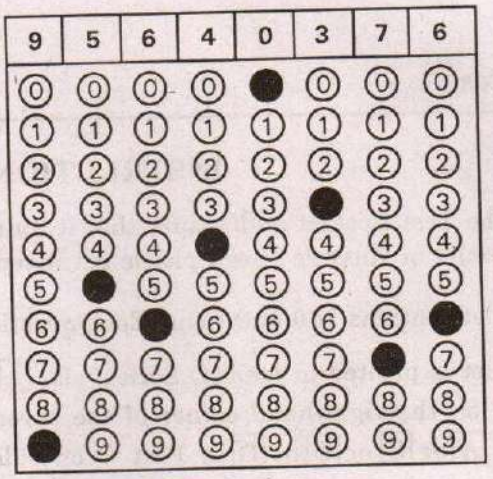
5. Mark Paper Code and Roll No. as given in the Hall Ticket with Blue/Black Ball point pen by darkening appropriate circles in Part A of side 1 of the Answer Sheet. Incorrect/not encoding will lead to ***invalidation*** of your Answer Sheet.

Example : If the Paper Code is **027**, and Roll No. is **95640376** fill as shown below :

Paper Code



Roll No.



6. Please get the signature of the Invigilator affixed in the space provided in the Answer Sheet. An Answer Sheet without the signature of the Invigilator is liable for ***invalidation***.

7. The candidate should **not** do rough work or write any irrelevant matter in the Answer Sheet Doing so will lead to ***invalidation***.

8. Do **not** mark answer choices on the Test Booklet. Violation of this will be viewed seriously.

9. Before leaving the examination hall, the candidate should hand over the original OMR Answe Sheet (top sheet) to the Invigilator and carry the bottom sheet (duplicate) for his/her record, failin which disciplinary action will be taken.

10. Use of whitener is prohibited. If used, the answer sheet is liable for invalidation.

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1. A thin cylinder of radius r and thickness t when subjected to an internal hydrostatic pressure 'p' causes a radial displacement 'u'. Then the tangential strain caused is

(1) $\frac{du}{dr}$

(2) $\frac{1}{r} \cdot \frac{du}{dt}$

(3) $\frac{u}{r}$

(4) $\frac{2u}{r}$

2. A body having weight of 1000 N is dropped from a height of 10 cm over a close coiled helical spring of stiffness 200 N/cm. The resulting deflection of spring is nearly

(1) 5 cm

(2) 16 cm

(3) 35 cm

(4) 100 cm

3. Which of the following stresses are associated with the design of pins in bushed pin type flexible coupling ?

(i) Bearing stress

(ii) Bending stress

(iii) Axial tensile

(iv) Transverse shear

Code :

(1) (i), (iii) and (iv)

(2) (ii), (iii) and (iv)

(3) (i), (ii), and (iii)

(4) (i), (ii) and (iv)

4. In a beam of I section, the maximum shear force is carried by

(1) the upper flange

(2) the web

(3) the lower flange

(4) Any of these

5. Autofrettage is the method of

(1) joining thick cylinders

(2) calculating stresses in thick cylinders

(3) prestressing thick cylinders

(4) increasing the life of thick cylinders

6. During tensile-testing of a specimen using a UTM, the parameters actually measured include

(1) True stress and true strain

(2) Poisson's ratio and Young's modulus

(3) Engineering stress and Engineering strain

(4) Load and elongation

7. In the formulation of Lewis equation for toothed gearing, it is assumed that tangential tooth load 'F_1' acts on the

(1) pitch point

(2) tip of the tooth

(3) root of the tooth

(4) whole face of the tooth

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8. In a thick cylinder pressurized from inside, the hoop stress is maximum at

(1) the centre of the wall thickness

(2) the outer radius

(3) the inner radius

(4) both inner and outer radii

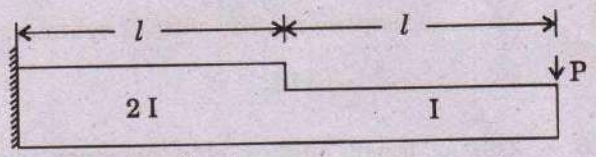
9. Which one of the following features improves the fatigue strength of a metallic material ?

(1) Increasing the temperature

(2) Scratching the surface

(3) Over stressing

(4) Under stressing

10. 

$I = 375 \times 10^{-6}\ m^4$

$l = 0{\cdot}5$ m

E = 200 GPa

Determine the stiffness of the beam shown in the above fig.

(1) 12×10^{10} N/m

(2) 10×10^{10} N/m

(3) 4×10^{10} N/m

(4) 8×10^{10} N/m

11. Cermets are

(1) metals for high temperature use with ceramic like properties

(2) ceramics with metallic strength and lustre

(3) coated tool materials

(4) metal-ceramics composites

12. Circumferential and longitudinal strains in a cylindrical boiler under steam pressure are ε_1 and ε_2 respectively. Change in volume of the boiler cylinder per unit volume will be

(1) $\varepsilon_1 + 2\varepsilon_2$

(2) $\varepsilon_1\, \varepsilon_2^2$

(3) $2\varepsilon_1 + \varepsilon_2$

(4) $\varepsilon_1^2\, \varepsilon_2$

13. If two shafts of the same length, one of which is hollow, transmit equal torque and have equal maximum stress, then they should have equal

(1) polar moment of inertia

(2) diameter

(3) polar modulus of section

(4) angle of twist

14. A plane stressed element is subjected to the state of stress given by $\sigma_x = \tau_{xy} = 100$ kgf/cm^2 and $\sigma = 0$. Maximum shear stress in the element is equal to

(1) $50\sqrt{3}$ kgf/cm^2

(2) 100 kgf/cm^2

(3) $50\sqrt{5}$ kgf/cm^2

(4) 150 kgf/cm^2

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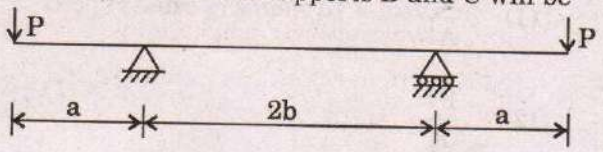
15. For the beam shown in the fig, the elastic curve between the supports B and C will be



(1) circular

(2) parabolic

(3) elliptic

(4) a straight line

16. Dynamic viscosity (μ) has the dimensions as

(1) MLT^{-2}

(2) $ML^{-1}T^{-1}$

(3) $ML^{-1}T^{-2}$

(4) $M^{-1}L^{-1}T^{-1}$

17. Atmospheric pressure held in terms of water column is

(1) 7·5 m

(2) 8·5 m

(3) 9·81 m

(4) 10·30 m

18. The flow rate through a circular pipe is measured by

(i) pitot-tube

(ii) venturimeter

(iii) orificemeter

(iv) None of the above

Code :

(1) (i)

(2) (i), (ii) and (iii)

(3) (ii) and (iii)

(4) All of the above

19. Hydrostatic law of pressure is given by

(1) $\frac{\partial P}{\partial z} = \rho g$

(2) $\frac{\partial P}{\partial z} = 0$

(3) $\frac{\partial P}{\partial z} = z$

(4) $\frac{\partial P}{\partial z} = c$

20. Study of fluid at rest is known as

(1) Kinematics

(2) Dynamics

(3) Statics

(4) None of the above

21. The rate of flow through a V-notch varies as

(1) H

(2) $\sqrt{H}$

(3) $H^{3/2}$

(4) $H^{5/2}$

22. Notch is a device used for measuring

(1) rate of flow through pipes

(2) rate of flow through a small channel

(3) velocity through a pipe

(4) velocity through a small channel

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23. For supersonic flow, if the area of flow increases then

(1) velocity decreases

(2) velocity increases

(3) velocity is constant

(4) None of the above

24. Chezy's formula is given by

(1) $v = i\sqrt{mC}$

(2) $v = C\sqrt{mi}$

(3) $v = m\sqrt{Ci}$

(4) None of the above

25. The square root of the ratio of inertia force to gravity force is called

(1) Reynolds number

(2) Froude number

(3) Mach number

(4) Euler number

26. Muschel curve means

(1) curve at constant head

(2) curve at constant speed

(3) curve at constant efficiency

(4) None of the above

27. The hydraulic mean depth is given by

(1) $\frac{P}{A}$

(2) $\frac{P^2}{A}$

(3) $\frac{A}{P}$

(4) $\sqrt{\frac{A}{P}}$

Where A – Area, P – wetted perimeter

28. Cavitation will take place if the pressure of the flowing fluid at any point is

(1) more than vapour pressure of the fluid

(2) equal to vapour pressure of the fluid

(3) less than vapour pressure of the fluid

(4) None of the above

29. The speed ratio for Pelton wheel varies from

(1) 0·45 to 0·50

(2) 0·6 to 0·7

(3) 0·3 to 0·4

(4) 0·8 to 0·9

30. Maximum efficiency of power transmission through pipe is

(1) 50%

(2) 66·67%

(3) 75%

(4) 100%

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31. For the same discharge in a pipe with laminar flow, reduction of radius to half will increase the pressure gradient by a factor of

(1) 2

(2) 4

(3) 8

(4) 16

32. A pipe is said to be a siphon if

(1) it can operate without external power

(2) it can discharge a liquid at a fast rate

(3) it has sub-atmospheric pressure in it

(4) the exit is at a lower level than the inlet

33. In supersonic flow, a diverging passage results in

(1) increase in velocity and pressure

(2) decrease in pressure and density

(3) increase in velocity and density

(4) decrease in velocity and pressure

34. Which one of the following is dimensionless ?

(1) $\frac{\partial p}{\partial x} \cdot \frac{D^4}{\mu Q^2}$

(2) $\frac{\partial p}{\partial x} \cdot \frac{D^3}{\mu Q}$

(3) $\frac{\partial p}{\partial x} \cdot \frac{D^4}{\mu Q}$

(4) $\frac{\partial p}{\partial x} \cdot \frac{\mu Q}{D^4}$

35. *Assertion (A) :* In a supersonic flow, the velocity increases as the area increases.

Reason (R) : Conservation of masses, momentum and energy require that dA/A should increase with dM/M for M greater than unity.

(1) A is true; R is true, and it explains A

(2) A is true; R is true, but it does not explain A

(3) A is true; R is false

(4) A is false; R is true

36. How does the sonic velocity in air at STP condition change with the altitude in the standard atmosphere ?

(1) 340·3 m/s

(2) 170·15 m/s

(3) 0

(4) 680·6 m/s

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37. Match List I with List II and select the correct answer using the codes given below the Lists :

List I		*List II*	
A.	Oscillating jump	i.	less than 2
B.	Strong jump	ii	between 2 and 3
C.	Weak jump	iii	around 4
D.	Undular jump	iv.	around 10

Code :

	A	B	C	D
(1)	iii	iv	ii	i
(2)	i	ii	iii	iv
(3)	iv	iii	i	ii
(4)	ii	i	iii	iv

38. A rectangular channel of 4 m width conveys water at 8 m^3/s under critical condition. Specific energy for this flow is

(1) 1·1123 m

(2) 1·4830 m

(3) 0·3703 m

(4) 0·7416 m

39. Match List I with List II and select the correct answer using the codes given below the Lists :

List I		*List II*	
A.	a sphere	i.	0·2
B.	an aerofoil	ii	0·3
C.	a bluff body	iii	1·6
D.	a racing car	iv.	0·1

Code :

	A	B	C	D
(1)	i	iv	iii	ii
(2)	i	iv	ii	iii
(3)	iv	i	iii	ii
(4)	iv	i	ii	iii

40. A trip wire is mounted near the leading edge of a body

(1) to increase the lift

(2) to decrease the lift

(3) to advance the point of separation

(4) to delay the point of separation

41. The flow in a capillary tube is laminar because

(1) the capillary tube is made of glass

(2) the surface tension and capillarity promote laminarisation

(3) only inviscid liquids can flow through a capillarity tube

(4) the diameter of the capillarity tube is very small

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42. Impingement of a jet on a flat plate may be idealised by

(1) $\psi = xy$

(2) $\psi = x^2 - y^2$

(3) $\psi = x^2 + y^2$

(4) $\psi = x/y$

43. Coefficients of velocity, contraction and discharge arranged in increasing order of value are

(1) c_v, c_c, c_d

(2) c_d, c_c, c_v

(3) c_v, c_d, c_c

(4) c_c, c_d, c_v

44. In a converging steady flow, there is

(1) no acceleration

(2) no temporal acceleration

(3) only convective acceleration

(4) convective and temporal acceleration

45. A solid body sinks in a fluid when

(1) the specific gravity of its material is greater than unity

(2) the buoyancy force does not pass through the metacentre

(3) the weight of the fluid displaced is less than the weight of the body

(4) the metacentre lies below the C.G.

46. Select the correct statement.

(1) Viscosity of gas increases with temperature.

(2) Density of gas increases with temperature.

(3) Surface tension of liquid increases with temperature.

(4) Bulk modulus is independent of temperature.

47. Measurement of velocity without any obstruction to the flow in a pipe may be made by

(1) pitot-static probe

(2) hot-wire anemometer

(3) hot-film anemometer

(4) laser-doppler anemometer

48. Schlieren flow visualisation technique operates by employing

(1) density variation in flow

(2) density gradients in flow

(3) second derivatives of density

(4) higher derivatives of density

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49. The integral momentum equation requires the assumption that

(1) the flow is uniform

(2) the flow is unidirectional

(3) the fluid is incompressible

(4) the flow is steady

50. The critical angle of attack of an aerofoil is that where

(1) the lift becomes zero

(2) the drag becomes zero

(3) the drag begins to rise

(4) the lift begins to drop

51. The height through which water rises by capillary action in a glass tube of 2 mm bore if the surface tension at the prevailing temperature is 0·075 g/cm, is

(1) 1·5 cm

(2) 3 cm

(3) 0·75 cm

(4) 10·3 cm

52. Calculate the maximum allowable discharge of water through a venturimeter throat 5 cm, fitted in a 10 cm diameter line with its inlet at an open channel. Assume $c_d = 0·95$.

(1) 0·0224 m^3/s

(2) 0·0448 m^3/s

(3) 0·8 m^3/s

(4) 0·04 m^3/s

53. There is a pin hole of diameter 0·1 mm at the bottom of a glass vessel containing mercury. What depth of mercury can be put in the vessel without any leakage occurring ? Take $\sigma = 0·55$ N/m.

(1) $h = 0·165 \cos \theta$ m

(2) $h = 0·23 \cos \theta$ m

(3) $h = 0$ m

(4) $h = 10·3$ m

54. Match List I with List II and select the correct answer using the codes given below the Lists :

List I		*List II*	
A.	Kaplan turbine	i.	works at atmospheric pressure
B.	Pelton wheel	ii	high-part load efficiency
C.	Axial flow pumps	iii	pressure head recovery
D.	Draft tube	iv.	high value of N_S

Code :

	A	B	C	D
(1)	ii	i	iv	iii
(2)	i	ii	iv	iii
(3)	ii	i	iii	iv
(4)	i	ii	iii	iv

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55. A dimensionless group formed with the variables ρ, w, μ and D is

(1) $\rho w\mu/D^2$

(2) $\rho wD^2/\mu$

(3) $\mu D^2\rho w$

(4) $\rho w\mu D$

56. An air stream with a velocity of 300 m/s at 10 kN/m^2 vacuum and temperature of 320 K passes through a section where its gauge is 20 kN/m^2. Compute its stagnation properties (M, T, P).

(1) 0·84, 365 K, 142 kN/m^2

(2) 0·96, 385 K, 284 kN/m^2

(3) 0·42, 225 K, 71 kN/m^2

(4) None of the above

57. A 3 metre wide rectangular channel flowing at its normal depth of 0·8 m carries a discharge of 5·5 m^3/s. The bed slope of the channel is

(1) Steep

(2) Critical

(3) Mild

(4) Adverse

58. The head loss in a sudden pipe expansion from area A_1, to area A_2 and from velocity u_1 to velocity u_2 is given by

(1) $(1 - A_1/A_2)^2 \cdot \frac{u_1^2}{2g}$

(2) $(1 - A_1/A_2)^2 \cdot \frac{u_2^2}{2g}$

(3) $(1 - A_2/A_1)^2 \cdot \frac{u_2^2}{2g}$

(4) $(1 - A_2/A_1) \cdot \frac{u_1^2}{2g}$

59. Compare the cost of pumping the same fluid at the same flow rate through a 150 mm pipe and through 200 mm pipe both having the same roughness factor = 0·03. (negligible minor loss).

(1) 4·2 times

(2) 2·1 times

(3) 8·4 times

(4) 10 times

60. A 2 m diameter cylinder rotates at 1800 r.p.m. in a stream (P = 1·225 kg/m^3) of 25 m/s. Estimate the lift per unit length of the cylinder.

(1) L = 11·55 kN

(2) L = 9·22 kN

(3) L = 24 kN

(4) L = 5·99 kN

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61. An oil of specific gravity 0·7 and pressure 0·14 kgf/cm^2 will have the weight of oil as

(1) 70 cm of oil

(2) 2 m of oil

(3) 20 cm of oil

(4) 80 cm of oil

62. The term $v^2/2g$ is known as

(1) kinetic energy

(2) pressure energy

(3) kinetic energy/unit weight

(4) None of the above

63. Bernoulli's theorem deals with the law of conservation of

(1) mass

(2) momentum

(3) energy

(4) None of the above

64. For a submerged body, if the centre of buoyancy coincides with the centre of gravity, the equilibrium is called

(1) stable

(2) unstable

(3) neutral

(4) None of the above

65. If the fluid particles move in a zig-zag way, the flow is called

(1) unsteady

(2) non-uniform

(3) turbulent

(4) incompressible

66. Compressibility is equal to

(1) $\frac{dV/V}{dp}$

(2) $\frac{dp}{-(dV/V)}$

(3) $\frac{dp}{d\rho}$

(4) $\sqrt{\frac{dp}{d\rho}}$

67. A current meter is a device used for measuring

(1) velocity

(2) viscosity

(3) current

(4) pressure

68. The discharge through a single-acting reciprocating pump is

(1) $Q = \frac{ALN}{60}$

(2) $Q = \frac{2ALN}{60}$

(3) $Q = ALN$

(4) $Q = 2ALN$

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69. The boundary layer takes place

(1) for ideal fluid

(2) for pipe flow only

(3) for real fluid

(4) for flow over flat plates only

70. The discharge through a rectangular channel is maximum when

(1) $m = d/3$

(2) $m = d/2$

(3) $m = 2d$

(4) $m = 3d/2$

71. For a circular channel, the wetted perimeter is given by

(1) $\frac{R\theta}{2}$

(2) $3R\theta$

(3) $2R\theta$

(4) $R\theta$

72. The discharge through a trapezoidal channel is maximum when

(1) half of top width = sloping side

(2) top width = half of sloping side

(3) top width = 1·5 × sloping side

(4) None of the above

73. The difference in pressure head, measured by a mercury water differential manometer for a 20 cm difference of mercury will be

(1) 2·72 m

(2) 2·52 m

(3) 2·0 m

(4) 0·2 m

74. Shear strain rate is given by

(1) $\frac{1}{2}\left(\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}\right)$

(2) $\frac{1}{2}\left(\frac{\partial v}{\partial x}+\frac{\partial u}{\partial y}\right)$

(3) $\frac{1}{2}\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}$

(4) $\frac{1}{2}\frac{\partial v}{\partial x}+\frac{\partial u}{\partial y}$

75. The value of momentum correction factor for the viscous flow through a circular pipe is

(1) 1·33

(2) 1·50

(3) 2·0

(4) 1·25

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76. A boundary is known as hydrodynamically smooth if

(1) $\frac{k}{\delta'} = 0{\cdot}3$

(2) $\frac{k}{\delta'} > 0{\cdot}3$

(3) $\frac{k}{\delta'} < 0{\cdot}25$

(4) $\frac{k}{\delta'} = 6{\cdot}0$

77. The resultant hydrostatic force acts through a point known as

(1) centre of gravity

(2) centre of buoyancy

(3) centre of pressure

(4) None of the above

78. The loss of pressure head for the laminar flow through pipe varies

(1) as the square of velocity

(2) directly as the velocity

(3) as the inverse of the velocity

(4) None of the above

79. Geometric similarity between model and prototype means

(1) the similarity discharge

(2) the similarity of linear dimensions

(3) the similarity of motion

(4) the similarity of forces

80. The work saved by fitting an air vessel to single acting reciprocating pump is

(1) 39·2%

(2) 89·4%

(3) 48·8%

(4) 92·3%

81. The thickness of laminar boundary layer a distance x from the leading edge over a f plates varies as

(1) $x^{4/5}$

(2) $x^{1/2}$

(3) $x^{1/5}$

(4) $x^{3/5}$

82. If the surface tension at the air – wa interface is 0·073 N/m, estimate the press difference between inside and outside an bubble of 0·01 mm .

(1) 159·7 kN/m^2

(2) 159·7 MN/m^2

(3) 319·4 kN/m^2

(4) 0

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83. Piezometric head of a fluid is defined as
(1) the sum of absolute pressure head and datum
(2) the stagnation pressure head
(3) the sum of stagnation head and datum head
(4) the sum of gauge pressure head and datum head

84. The pressure at a point in a fluid is not equal in all directions if
(1) the fluid is at rest
(2) there are shear stresses
(3) the fluid is accelerated
(4) the fluid is rotated at a constant speed

85. *Assertion (A) :* Pressure is equal in all directions at a point in an ideal fluid flow.
Reason (R) : Pascal's law is valid for all cases where shear stresses are zero.
(1) A is true; R is true, and it explains A
(2) A is true; R is true, but it does not explain A
(3) A is true; R is false
(4) A is false; R is true

86. Observation of a flow net enables us to
(1) determine the velocity at all points
(2) estimate the pressure at all points
(3) estimate the velocity variations
(4) determine the energy loss in flow

87. The assumption not made in the derivation of Bernoulli's equation is
(1) inviscid flow
(2) steady flow
(3) two-dimensional flow
(4) uniform flow

88. Venturimeter (V), flow nozzle (N) and orificemeter (O) arranged in increasing order of co-efficient of discharge are
(1) V, N, O
(2) N, O, V
(3) O, N, V
(4) O, V, N

89. According to the King's Law for a constant temperature hot wire anemometer
(1) $E \propto U$
(2) $E^2 \propto U$
(3) $E^2 \propto \sqrt{U}$
(4) $E \propto U^2$

90. The dividing streamline for a uniform flow superimposed over a two-dimensional droplet is
(1) a straight line
(2) a circle
(3) a sphere
(4) an ellipse

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91. The number of elastic constants for a completely anisotropic elastic material which follows Hooke's law is

(1) 3

(2) 4

(3) 21

(4) 25

92. A close-coiled helical spring absorbs 80 N mm of energy while extending by 4 mm. The stiffness of the spring is

(1) 5 N/mm

(2) 10 N/mm

(3) 16 N/mm

(4) 20 N/mm

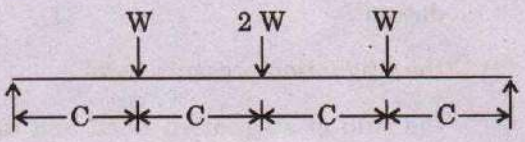
93. Match List I with List II and select the correct answer using the codes given below the lists :

List I		*List II*	
A.	Both ends hinged	i.	L
B.	One end fixed and other end free	ii.	$\sqrt{2}$ L
C.	One end fixed and the other pin-joined	iii.	L/2
D.	Both ends fixed	iv.	2 L

Code :

	A	B	C	D
(1)	i	iii	iv	ii
(2)	i	iii	ii	iv
(3)	iii	i	ii	iv
(4)	iii	i	iv	ii

94. A simply supported beam is loaded as shown in fig. The maximum shear force in the beam will be



(1) Zero

(2) W

(3) 2 W

(4) 4 W

95. The equivalent bending moment under combined action of bending moment M and torque T is

(1) $\sqrt{M^2 + T^2}$

(2) $\frac{1}{2}\sqrt{M^2 + T^2}$

(3) $M + \sqrt{M^2 + T^2}$

(4) $\frac{1}{2}\left[M + \sqrt{M^2 + T^2}\right]$

96. Young's modulus of elasticity and Poisson's ratio of a material are $1{\cdot}25 \times 10^5$ MPa and 0·34 respectively. The modulus of rigidity of the material is

(1) $0{\cdot}4025 \times 10^5$ MPa

(2) $0{\cdot}4664 \times 10^5$ MPa

(3) $0{\cdot}8375 \times 10^5$ MPa

(4) $0{\cdot}9469 \times 10^5$ MPa

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97. A solid circular shaft is subjected to a maximum shearing stress of 140 MPa. The magnitude of the maximum normal stress developed in the shaft is

(1) 140 MPa

(2) 80 MPa

(3) 70 MPa

(4) 60 MPa

98. The ratio of circumferential stress to longitudinal stress in a thin cylinder subjected to internal hydrostatic pressure is

(1) 1/2

(2) 1

(3) 2

(4) 4

99. The independent elastic constants for a homogeneous and isotropic material are

(1) E, G, K, ν

(2) E, G, K

(3) E, G, ν

(4) E, G

100. The ratio of the deformation of a bar due to its own weight, to the deformation due to axial load equal to its weight, is

(1) 1

(2) 1/2

(3) 2

(4) 4

101. A material having identical properties in all directions, is called

(1) elastic

(2) homogeneous

(3) isotropic

(4) Any of these

102. The stresses in a thick cylinder subjected to uniform pressure vary proportional to

(1) r

(2) 1/r

(3) r^2

(4) $1/r^2$

103. Maximum deflection for a cantilever of span L loaded at the free end by P is given by

(1) $\frac{PL^2}{3\,EI}$

(2) $\frac{PL^2}{6\,EI}$

(3) $\frac{PL^3}{8\,EI}$

(4) $\frac{PL^3}{3\,EI}$

104. The ratio of lateral strain to linear strain is known as

(1) Elastic limit

(2) Poisson's ratio

(3) Elasticity

(4) Rigidity

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105. Polar moment of inertia of a circular area is

(1) $\frac{\pi}{32} d^4$

(2) $\frac{\pi}{64} d^4$

(3) $\frac{\pi}{4} d^4$

(4) $\frac{\pi}{4} d^3$

106. The diameter of kernel of a circular section of diameter 'd' is

(1) d/2

(2) d/3

(3) $d/\sqrt{2}$

(4) d/4

107. The flexural rigidity of a beam is

(1) EI

(2) E/I

(3) I/E

(4) E/I^2

108. One kgf/cm^2 when converted into SI units is

(1) 0·0981 MPa

(2) 0·981 Pa

(3) 10^4 Pa

(4) 1 Pa

109. Point of contraflexure is where

(1) B.M. is maximum

(2) S.F. is maximum

(3) S.F. is zero

(4) B.M. is zero

110. The equivalent length of a column fixed at both ends is

(1) $0{\cdot}7\,l$

(2) $0{\cdot}5\,l$

(3) l

(4) $2\,l$

111. If two springs with stiffness K_1 and K_2 are connected in series, then stiffness of the composite spring is given by

(1) $K_1 + K_2$

(2) $\frac{1}{K_1} + \frac{1}{K_2}$

(3) $\frac{1}{K_1} - \frac{1}{K_2}$

(4) $K_1 - K_2$

112. If σ_1 and σ_2 are principal stresses, the shear stress on the principal planes is given by

(1) $\frac{\sigma_1 - \sigma_2}{2}$

(2) 0

(3) $\frac{\sigma_1 + \sigma_2}{2}$

(4) $\sigma_1 - \sigma_2$

113. The reaction at the prop in a propped cantilever beam subjected to u.d.l. is

(1) $\frac{Wl}{4}$

(2) $\frac{3\,Wl}{8}$

(3) $\frac{5\,Wl}{8}$

(4) $\frac{6\,Wl}{7}$

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114. The ratio of maximum shear stress to average shear stress is 1·5 in a beam of

(1) Circle

(2) Rectangle

(3) Triangle

(4) Any cross-section

115. A solid circular shaft is subjected to pure torsion. The ratio of maximum shear to maximum normal stress at any point would be

(1) 1 : 1

(2) 1 : 2

(3) 2 : 1

(4) 2 : 3

116. The unit of elastic modulus is the same as those of

(1) stress, strain and pressure

(2) strain, shear modulus and pressure

(3) shear modulus, stress and force per area

(4) strain, shear modulus and force

117. The work done per unit volume in elongating a body by a uniaxial force is

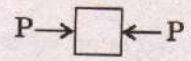
(1) stress/strain

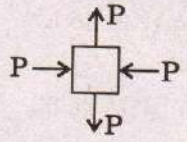
(2) stress × strain

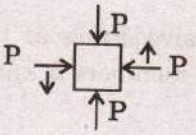
(3) $\frac{1}{2}$ stress × strain

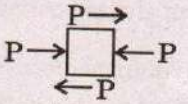
(4) None of the above

118. A solid thick cylinder is subjected to an external hydrostatic pressure 'P'. The state of stress in the material of the cylinder is represented as

(1) 

(2) 

(3) 

(4) 

119. Consider the following statements :
A splined shaft is used for

(i) transmitting power.

(ii) holding a flywheel rigidly in position.

(iii) moving axially the gear wheels mounted on it.

(iv) mounting V-belts pulley on it.

Code :

(1) (ii) and (iii) are correct
(2) (i) and (iv) are correct
(3) (ii) and (iv) are correct
(4) (i) and (iii) are correct

120. Two close-coiled springs are made from a small diameter wire, one wound on 2·5 cm diameter core and the other on 1·25 cm diameter core. If each spring had 'n' coils, then the ratio of their spring constant would be

(1) 1/16

(2) 1/8

(3) 1/4

(4) 1/2

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121. To measure _____ strain, strain rosettes are used.

(1) Linear

(2) Shear

(3) Volumetric

(4) Any of the above

122. A localised compressive stress at the area of contact between two members is known as

(1) Shear

(2) Crushing

(3) Bending

(4) Tensile

123. Moment of inertia of a semicircle about its XX-axis is given by

(1) $0{\cdot}22\ r^3$

(2) $0{\cdot}11\ r^4$

(3) $0{\cdot}14\ r^4$

(4) $0{\cdot}2\ r^4$

124. The point of contraflexure is also called as

(1) the point of inflexion

(2) a virtual hinge

(3) Either of the above

(4) None of the above

125. Which of the following are the statically determinate beams ?

(1) Cantilevers

(2) SSB

(3) Overhanging beams

(4) All of the above

126. The strength of the beam mainly depends on

(1) Bending moment

(2) C.G. of the section

(3) Section modulus

(4) Its weight

127. In case of rectangular section

(1) $\tau_{max} = \frac{1}{2}\ \tau_{mean}$

(2) $\tau_{max} = \tau_{mean}$

(3) $\tau_{max} = \frac{3}{2}\ \tau_{mean}$

(4) $\tau_{max} = \frac{5}{2}\ \tau_{mean}$

128. A square section with side 'X' of a beam is subjected to a shear force 'S'. The magnitude of shear stress at the top edge of the square is

(1) $\frac{1{\cdot}5\ S}{X^2}$

(2) $\frac{S}{X^2}$

(3) $\frac{0{\cdot}5\ S}{X^2}$

(4) Zero

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129. A simply supported beam of span 'l' is carrying point load 'W' at the midspan. What is the deflection at the centre of the beam ?

(1) $\frac{Wl^2}{48\ EI}$

(2) $\frac{Wl^3}{48\ EI}$

(3) $\frac{5\ Wl^3}{348\ EI}$

(4) $\frac{11\ Wl^3}{120\ EI}$

130. A beam length 4 m, fixed at both ends carries a point load of 120 kN at the centre. If EI for the beam is 2000 kN m^2, deflection at the centre of beam is

(1) 1·0 mm

(2) 2·0 mm

(3) 5·0 mm

(4) 10·0 mm

131. Thin cylinders are frequently required to operate under pressures upto

(1) 5 MN/m^2

(2) 15 MN/m^2

(3) 30 MN/m^2

(4) 250 MN/m^2

132. The bursting pressure for a cold drawn seamless steel tubing of 60 mm inside diameter with 2 mm wall thickness is (The ultimate strength of steel is 380 MN/m^2)

(1) 25·33 MN/m^2

(2) 24·33 MN/m^2

(3) 26·33 MN/m^2

(4) 50·66 MN/m^2

133. Pressure vessels are made of

(1) non-ferrous materials

(2) sheet metal (steel)

(3) cast iron

(4) Any of the above

134. _____ riveting is used in structural units.

(1) Chain

(2) Zig-zag

(3) Diamond

(4) None of the above

135. In shafts with keyways, the allowable stresses are usually _____ of the value given.

(1) 25%

(2) 50%

(3) 75%

(4) 95%

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136. For the same material, length and given torque, a hollow shaft weighs _____ a solid shaft.

(1) less than

(2) more than

(3) equal to

(4) None of the above

137. Wahl's correction factor (K) is given by the relation

(1) $K = \frac{3S-1}{3S-4} + \frac{0{\cdot}615}{S}$

(2) $K = \frac{4S-1}{4S-4} + \frac{0{\cdot}615}{S}$

(3) $K = \frac{5S-1}{5S-4} + \frac{0{\cdot}615}{S}$

(4) $K = \frac{6S-1}{6S-4} + \frac{0{\cdot}615}{S}$

where S = Spring Index.

138. In case of laminated springs, the load at which the plates become straight is called

(1) Working load

(2) Safe load

(3) Proof load

(4) None of the above

139. The stress due to suddenly applied load is _____ times that of gradually applied load.

(1) 2

(2) 3

(3) 4

(4) 5

140. Strain energy (U) caused by bending is given by the relation

(1) $U = \int \frac{M}{2EI} dx$

(2) $U = \int \frac{M^2}{2EI} dx$

(3) $U = \int \frac{M^2}{EI} dx$

(4) $U = \int \frac{M^2}{3EI} dx$

141. The safe compressive load on a hollow cast iron column (one end fixed other hinged) of 150 mm external diameter, 100 mm internal diameter and 10 m length is (Use Euler's formula with a factor of safety of 5, and $E = 95\ GN/m^2$)

(1) 74·8 kN

(2) 149·6 kN

(3) 37·4 kN

(4) 299·2 kN

142. The radius of gyration of a circular column of diameter 'd' is

(1) d/4

(2) d/2

(3) $d^2/4$

(4) $d^2/16$

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143. Euler's formula is applicable for

(1) short column

(2) long column

(3) medium column

(4) All of the above

144. The ratio of equivalent length of the column to the maximum radius of gyration is called

(1) Poisson's ratio

(2) Buckling factor

(3) Factor of safety

(4) None of the above

145. A member under tension is called

(1) strut

(2) tie

(3) strut-tie

(4) column

146. A perfect frame should satisfy the relation

(1) $m = 2j - 3$

(2) $m = 2j - 4$

(3) $m = 3j - 2$

(4) $m = 3j - 3$

147. Which one of the following properties is more sensitive to increase in strain rate ?

(1) Yield strength

(2) Proportional limit

(3) Elastic limit

(4) Tensile strength

148. Which one of the following materials is highly elastic ?

(1) Rubber

(2) Brass

(3) Steel

(4) Glass

149. Castigliano's theorems are valid for

(1) elastic structure

(2) truss

(3) beam

(4) linear structure

150. If diameter of a long column is reduced by 20%, the percentage of reduction in Euler buckling load is

(1) 4

(2) 36

(3) 49

(4) 59

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