JELET-2019

Subject : DIPLOMA IN ENGINEERING & TECH.

(Booklet Number)

Duration : 2 Hours **Full Marks : 100**

INSTRUCTIONS

1. All questions are of objective type having four answer options for each. Only one option is correct. Correct answer will carry full marks **1**. In case of incorrect answer or any combination of more than one answer, ¼ marks will be deducted.
2. Questions must be answered on OMR sheet by darkening the appropriate bubble marked A, B, C or D.
3. Use only **Black/Blue ball point pen** to mark the answer by complete filling up of the respective bubbles.
4. Mark the answers only in the space provided. Do not make any stray mark on the OMR.
5. Write question booklet number and your roll number carefully in the specified locations of the **OMR**. Also fill appropriate bubbles.
6. Write your name (in block letter), name of the examination centre and put your full signature in appropriate boxes in the OMR.
7. The OMR is liable to become invalid if there is any mistake in filling the correct bubbles for question booklet number/roll number or if there is any discrepancy in the name/signature of the candidate, name of the examination centre. The OMR may also become invalid due to folding or putting stray marks on it or any damage to it. The consequence of such invalidation due to incorrect marking or careless handling by the candidate will be sole responsibility of candidate.
8. Candidates are not allowed to carry any written or printed material, calculator, pen, docu-pen, log table, wristwatch, any communication device like mobile phones etc. inside the examination hall. Any candidate found with such items will be **reported against** & his/her candidature will be summarily cancelled.
9. Rough work must be done on the question paper itself. Additional blank pages are given in the question paper for rough work.
10. Hand over the OMR to the invigilator before leaving the Examination Hall.

MATHEMATICS

1. Choose the correct one:

(A) Every non-singular matrix is orthogonal.

(B) Every orthogonal matrix is invertible.

(C) Every orthogonal matrix is symmetric.

(D) Every orthogonal matrix is skew symmetric.

2. If $A = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$, then A^{100} is equal to

(A) $2^{100}.A$

(B) $2^{99}.A$

(C) $100A$

(D) $99A$

3. If $\alpha = \begin{vmatrix} a+b & b+c & c+a \\ b+c & c+a & a+b \\ c+a & a+b & b+c \end{vmatrix}$ and $\beta = \begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$ then

(A) $\alpha = \beta$

(B) $\alpha = 2\beta$

(C) $\beta = 2\alpha$

(D) $\alpha = \beta + abc$

4. The matrix $A = \frac{1}{3}\begin{bmatrix} a & 2 & 2 \\ 2 & 1 & b \\ 2 & c & 1 \end{bmatrix}$ obeys $AA^T = I_3$

Then

(A) $a = b = c = 1$

(B) $a = 1, b = c = -2$

(C) $a = 2, b = 1, c = -1$

(D) $a = 0, b = 1, c = 2$

5. If $\vec{a}.\vec{b} = \vec{b}.\vec{c} = \vec{c}.\vec{a} = 0$, then $\vec{a}.(\vec{b} \times \vec{c}) =$

(A) a non-null vector

(B) 1

(C) -1

(D) $|\vec{a}||\vec{b}||\vec{c}|$

6. The position vector of the points A, B, C, D are $\hat{i}+\hat{j}+\hat{k}$, $2\hat{i}+3\hat{j}$, $3\hat{i}+5\hat{j}-2\hat{k}$ and $\hat{k}-\hat{j}$ respectively.

Then $\overrightarrow{AB}$ and $\overrightarrow{CD}$ are

(A) perpendicular to each other
(B) parallel to each other
(C) inclined at an angle 60°
(D) inclined at an angle 45°

7. If $u=\frac{x^2+y^2}{\sqrt{x+y}}$ then $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=ku$, where k =

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

8. If $H=f(y-z, z-x, x-y)$, then $\frac{\partial H}{\partial x}+\frac{\partial H}{\partial y}+\frac{\partial H}{\partial z}=$

(A) 0
(B) f
(C) 2f
(D) $\frac{1}{2}f$

9. $f(x,y)=\sin^{-1}\frac{y}{x}+\tan^{-1}\frac{x}{y}$, then xf_x+yf_y is

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

10. The order of the differential equation associated with the parametric equation $y=A+B\log_e x$, where A and B are parameters, is

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

11. The integral curve of the differential equation $(y - x)\frac{dy}{dx} = 1$, passes through (0, 0) and $(\alpha, 1)$.

Then α =

(A) $2 - e^{-1}$ (B) $1 - e^{-1}$

(C) e^{-1} (D) $1 + e$

12. The solution of the differential equation $\frac{dy}{dx} = \frac{1 + y^2}{1 + x^2}$ is

(A) $y = \tan^{-1} x + c$ (B) $y - x = c(1 + xy)$

(C) $x = \tan^{-1} y + c$ (D) $\tan xy = c$

(where c is arbitrary constant)

13. Integrating factor of the differential equation $\cos x \frac{dy}{dx} + y \sin x = 1$ is

(A) $\cos x$ (B) $\tan x$

(C) $\sec x$ (D) $\sin x$

14. The complementary function of $\frac{d^2y}{dx^2} + 4y = 2e^x$ is

(A) $Ae^{2x} + Be^{-2x}$ (B) $A\cos x + B\sin x$

(C) $Ae^{x} + Be^{-x}$ (D) $A\cos 2x + B\sin 2x$

15. Three integers are chosen at random from the first 20 integers. The probability that their product is even, is

(A) $\frac{2}{19}$ (B) $\frac{17}{19}$

(C) $\frac{3}{19}$ (D) $\frac{4}{19}$

16. Events A, B, C are mutually exclusive such that $P(A)=\frac{3x+1}{3}$, $P(B)=\frac{1-x}{4}$, $P(C)=\frac{1-2x}{2}$.

Then x lies in the interval

(A) [0, 1]

(B) $\left[\frac{1}{3},\frac{2}{3}\right]$

(C) $\left[\frac{1}{3},\frac{1}{2}\right]$

(D) $\left[\frac{1}{3},\frac{13}{3}\right]$

17. Taking n=4, by Simpson's 1/3rd rule, the approximate value of $\int_0^4 2^x\,dx=$

(A) $\frac{64}{3}$

(B) $\frac{62}{3}$

(C) $\frac{61}{3}$

(D) $\frac{65}{3}$

18. The root upto the first approximation of the equation $x^3 + 2x - 1 = 0$ in (0, 1) by Regula Falsi method is given by

(A) 1

(B) $\frac{1}{2}$

(C) $\frac{1}{3}$

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

19. The value of $\sqrt{3}$ correct to two decimal places by bisection method is

(A) 1.63

(B) 1.65

(C) 1.64

(D) 1.62

20. $(1+\Delta)(1-\nabla) \equiv$

(A) 0

(B) 1

(C) $\Delta - \nabla$

(D) $\nabla - \Delta$

[With usual symbols]

ELECTRICAL TECHNOLOGY

21. Kirchhoff's laws are valid for

(A) linear circuits only

(B) non-linear circuits only

(C) neither linear nor non-linear circuits

(D) both linear and non-linear circuits

22. A delta connection of resistances contains three equal impedances of 60 Ω. The impedance of each arm of the equivalent star connection will be

(A) 15 Ω (B) 20 Ω

(C) 30 Ω (D) 40 Ω

23. The reactance offered by a capacitor to an alternating current of frequency 50 Hz is 20 Ω. What will be the reactance if the frequency is increased to 100 Hz ?

(A) 2.5 Ω (B) 5 Ω

(C) 10 Ω (D) 15 Ω

24. Laminated cores are used in power transformers to reduce

(A) eddy loss (B) hysteresis loss

(C) copper loss (D) current loss

25. A capacitor start, capacitor run single phase induction motor is basically a

(A) AC series motor (B) DC series motor

(C) 2 phase induction motor (D) 3 phase induction motor

26. A motor can be easily identified as a DC motor by looking at its

(A) frame (B) shaft

(C) commutator (D) stator

27. Direct-on-line starters are not suggested for starting large DC motors because

(A) the motor may run away

(B) the starting torque becomes very low

(C) the motor may start in reverse direction

(D) the starting current will be enormously high

28. Conductivity is analogous to
(A) retentivity
(B) resistivity
(C) permeability
(D) inductance

29. Which of the following is not a standard voltage for transmission of electrical power ?
(A) 132 KV
(B) 66 KV
(C) 33 KV
(D) 20 KV

30. The braking system of energy meter basically consists of a
(A) mechanical brake
(B) plugging brake
(C) regenerative brake
(D) permanent magnet

31. Which of the following is an integrating instrument ?
(A) Ammeter
(B) Voltmeter
(C) Galvanometer
(D) Energy meter

32. The power factor of an R-C circuit is
(A) often zero
(B) between 0 and 1
(C) always 1
(D) between 0 and -1

33. SMPS is used for
(A) obtaining controlled AC power supply
(B) obtaining controlled DC power supply
(C) storing DC power
(D) controlled switching between various power supplies

34. Colour code for the phase and the neutral in 230 V AC supply is
(A) Black and green
(B) Red and green
(C) Red and black
(D) Red and blue

35. Illumination level required for precision work is of the order of
(A) 20 to 50 lm/m^2
(B) 50 to 100 lm/m^2
(C) 150 to 200 lm/m^2
(D) 500 to 1000 lm/m^2

COMPUTER APPLICATION

36. Information about the first partition of the logical-address space of a process is kept in the

(A) global descriptor table
(B) local descriptor table
(C) page table
(D) process control block

37. The performance of cache memory is frequently measured in terms of a quantity called

(A) page fault
(B) page replacement
(C) hit ratio
(D) number of bits per track

38. A typical file control block does not contain

(A) file permissions
(B) file size
(C) file data blocks
(D) file name

39. What is the 9's complement form of $(12389)_{10}$?

(A) 87610
(B) 87611
(C) 110011
(D) None of these

40. The equivalent octal number of the hexadecimal number F3A7C2 is

(A) $(74723702)_8$
(B) $(74723802)_8$
(C) $(74723700)_8$
(D) $(74728702)_8$

41. The equivalent binary number of $(0.6975)_{10}$ is

(A) $(0.1101)_2$
(B) $(0.1100)_2$
(C) $(0.1011)_2$
(D) $(0.1001)_2$

42. After compilation of C program, we get the

(A) object file
(B) executable file
(C) binary file
(D) pdf file

43. In first pass, the assembler reads the program to collect symbols defined with offsets in a

(A) Program control table
(B) page table
(C) hash table
(D) symbol table

44. Identify the true statement from the following sentences:

(A) Multi-user operating systems depend upon computer systems with special hardware that permits different processors to be assigned to different users.

(B) Text-based user interfaces are easier to use, though less powerful than graphic user interfaces.

(C) "Context switching" means that the OS causes the processor to divide its attention between a series of different user processes.

(D) Virtual memory expands the amount of space allowed for storing data and instructions by dedicating special cache memory units to hold this information temporarily.

45. Which is **not** the multitasking operating system ?

(A) Windows 2000 (B) MS-DOS

(C) Windows XP (D) Windows NT

46. A program that accepts a symbolic language program and produces its binary machine language equivalent is called

(A) an assembler (B) an interpreter

(C) an application software (D) a compiler

47. What is the output of the following program ?

```
#include <stdio.h>
main()
{int a,b;
a= -3 - -3;
b= -3 - - (-3);
printf("a=%d b=%d",a,b);}
```

(A) error (B) a = 0, b = - 6

(C) a = 1, b = - 5 (D) a = 0, b = 6

48. A do-while loop is used when we want that the statements within the loop must be executed:

(A) at least once (B) more than once

(C) only once (D) infinite times

49. Add the missing statement for the following program to print 45 :

```
#include <stdio.h>
main()
{ int j, *ptr;
*ptr = 45;
printf(\n%d", j);}
```

(A) *ptr = *j
(B) ptr = &j
(C) ptr = *j
(D) &ptr = &*j

50. What is the output of this C code ?

```
#include <stdio.h>
main()
{
    printf( "%c", "abcdefgh"[4]);
}
```

(A) d
(B) No output will be printed
(C) e
(D) Run Time Error

51. A cable interconnects twenty computers and two printers in a single office so that users can share the printers. This configuration is an example of a

(A) MAN
(B) WAN
(C) LAN
(D) VPN

52. Which layer handles the creation of data frames ?

(A) physical
(B) data link
(C) session
(D) transport

53. A device operating at the network layer is called a

(A) Bridge
(B) Router
(C) Hub
(D) Repeater

54. For electronic mail transmission we need

(A) FTP
(B) HTTP
(C) SMTP
(D) TCP/IP

55. HTTP server uses the port number

(A) 20
(B) 40
(C) 23
(D) 80

ENVIRONMENTAL ENGINEERING

56. Which of the following is not included in Environmental Auditing ?

(A) Pollution monitoring schemes

(B) Storage of toxic chemicals

(C) Scrutiny by the government agencies

(D) Safety provisions for industrial works

57. CFC-11 is

(A) CF_3Cl

(B) $CFCl_3$

(C) CF_2Cl_2

(D) $CHCl_3$

58. For air stability, we must have

(A) Dry adiabatic lapse rate = Ambient lapse rate

(B) Dry adiabatic lapse rate > Ambient lapse rate

(C) Dry adiabatic lapse rate < Ambient lapse rate

(D) Both (A) & (C)

59. The pollutant primarily responsible for photochemical smog is

(A) Water vapour

(B) Sulphur dioxide

(C) Oxides of nitrogen

(D) Ozone

60. Chernobyl nuclear disaster occurred on

(A) 26th April, 1986

(B) 28th November, 1987

(C) 17th June, 1977

(D) 5th January, 1999

61. There are two samples of water. Sample 1 has BOD 50 mg/lit and Sample 2 has BOD 30 mg/lit. Then

(A) The degree of pollution is same in both the samples

(B) Sample 1 is more polluted than sample 2

(C) Sample 2 is more polluted than sample 1

(D) No inference can be drawn on the degree of pollution

62. Organomercury is an example of

(A) Fungicide

(B) Fumigant

(C) Antibiotic

(D) Rodenticide

63. COD test is more scientific than BOD test because
(A) It is related to the microorganisms
(B) It is not related to the microorganisms
(C) It is related to oxidizing chemicals
(D) It is related to both microorganisms and oxidizing chemicals

64. The main chemical responsible for hematotoxicity is
(A) NO_2 (B) CO_2
(C) SO_2 (D) CO

65. Which one of the following methods would be the best suited for disposal of plastic and rubber waste ?
(A) Composting (B) Pyrolysis
(C) Incineration (D) Sanitary landfill

66. Composting is suitable
(A) for stable organic matters (B) at low temperatures
(C) in absence of moisture content (D) in all the above conditions

67. Full form of ESP is
(A) Electrostatic Precipitator (B) Electrostatic Producer
(C) Electrostatic source Precipitator (D) Electrostatic Production

68. In residential area permissible noise level standard during Night time (9 p.m. to 6 a.m.) is
(A) 45 dBA (B) 55 dBA
(C) 65 dBA (D) 75 dBA

69. Montreal protocol is related with
(A) Water pollution (B) Use of CFCs
(C) Phosphate (D) Carbonate

70. Aircraft noise is measured by
(A) L_{epn} (B) L_{eq}
(C) L_{10} (18hrs) index (D) Decibel

ENGINEERING MECHANICS

71. The arms of a common balance are of unequal length, but the beam of the balance remains in a horizontal position when the scale pans are not loaded. If W_1 and W_2 are the measured weight of a body when it is placed in the left and the right pans respectively, the correct weight of the body is

(A) $\frac{W_1 + W_2}{2}$

(B) $\sqrt{W_1 W_2}$

(C) $\sqrt{W_1^2 + W_2^2}$

(D) $\frac{W_1 W_2}{W_1 + W_2}$

72. In a first system of pulleys, there are 3 movable pulleys, each of which weighs 5 N. If the effort is 50 N, what weight can it support ?

(A) 355 N

(B) 360 N

(C) 365 N

(D) 370 N

73. A force P_1, acting on a body along the inclined plane in upward direction is just enough to drag the body upward along the plane. The inclined plane is rough and is inclined at an angle θ with the horizontal. If the force P_1 is now reduced to P_2 in the same direction, the body is about to slip down the inclined plane. The weight of the body is,

(A) $\frac{P_1 + P_2}{2} \sin\theta$

(B) $\frac{P_1 + P_2}{2} \operatorname{cosec}\theta$

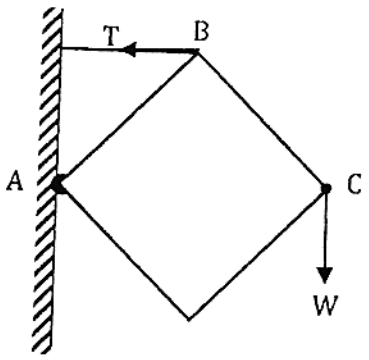
(C) $\frac{P_1 + P_2}{2 \tan\theta}$

(D) $\frac{P_1 + P_2}{2 \operatorname{cosec}\theta}$

74. P = 80 N and Q = 80 N are components (not rectangular) of the resultant force R = 80 N. The angle between the component P and the resultant R is,

(A) 75°
(B) 60°
(C) 15°
(D) 55°

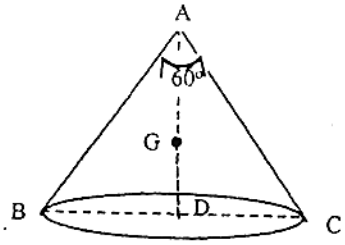
75.



As shown in the figure, a square uniform lamina of weight W is hinged to a vertical wall at A with its plane vertical. Another body of weight W is suspended from the opposite corner C. The lamina is supported with its diagonal AC horizontal by means of a horizontal string joining B to the wall. The tension T in the string is

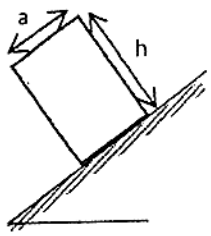
(A) $\frac{\sqrt{3}}{2}$ W
(B) 2W
(C) 3W
(D) 4W

76.



As shown in the figure, D is the centre of the circular base of a right circular solid cone ABC, whose vertical angle is 60°. If the largest possible sphere is scooped out from the cone, the centre of gravity of the remaining solid body lies at G. Find the ratio of AG : GD.

(A) $\frac{47}{11}$
(B) $\frac{48}{11}$
(C) $\frac{49}{11}$
(D) $\frac{50}{11}$

77. 

As shown in the figure, a uniform rectangular block of height 'h' and width 'a' rests on an inclined surface whose coefficient of static friction is μ. If the angle of inclination of the plane is gradually increased, what should be the relationship between a, h and μ so that the block topples over before slipping down ?

(A) $\mu = \frac{a^2}{h^2}$

(B) $\mu < \frac{a}{h}$

(C) $a\mu < h$

(D) $\mu > \frac{a}{h}$

78. A particle projected vertically upward reaches a height 'h' from the ground in time 't_1' and returns to ground after time 't_2' from that point. Which of the relations given below is correct (g = acceleration due to gravity) ?

(A) $h = \frac{1}{2} g (t_1^2 + t_2^2)$

(B) $h = \frac{1}{2} g t_1 t_2$

(C) $h = \frac{1}{2} g \sqrt{t_1^4 + t_2^4}$

(D) $h = g t_1 t_2$

79. A particle is projected at an angle θ to the horizontal and it attains a maximum height 'H'. The time taken by the particle to reach the maximum height is (g = acceleration due to gravity)

(A) $\sqrt{\frac{H}{g}}$

(B) $\sqrt{\frac{2H}{g}}$

(C) $\sqrt{\frac{2H \sin\theta}{g}}$

(D) $\frac{1}{\sin\theta}\sqrt{\frac{2H}{g}}$

80. The kinetic energy of a projectile of range 'R' becomes minimum after it covers a horizontal distance equal to

(A) 0.33 R.

(B) 0.5 R

(C) 0.67 R

(D) 1.0 R

81. Two particles of masses 5 kg and 10 kg are moving with speed 2 m/s in $+x$ direction and in +y direction respectively. After collision, they stick together and move as a single mass. The velocity of the combined mass is

(A) $\frac{2\sqrt{2}}{3}$ m/s

(B) $\frac{2\sqrt{3}}{3}$ m/s

(C) $2\sqrt{3}$ m/s

(D) $3\sqrt{2}$ m/s

82. The ratio of polar moments of inertia of a circular lamina and that of a square lamina, having same area is

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

(B) $\frac{3}{2\pi}$

(C) $\frac{4}{\pi}$

(D) $\frac{5}{4\pi}$

83. Two equal balls P and Q lie in contact in a smooth horizontal circular groove. They are projected along the groove and come into collision after a time 't'. The second impact of the balls will take place after a further interval of: (e being the coefficient of restitution)

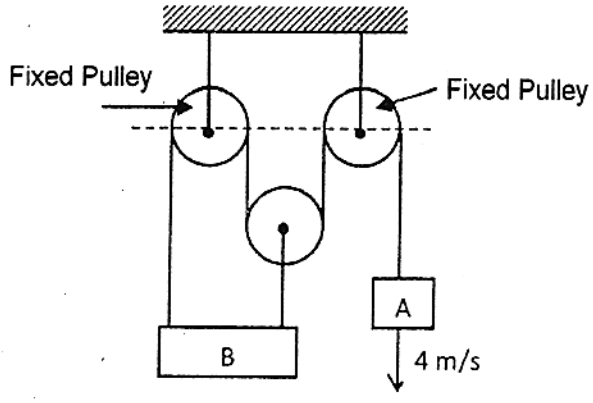
(A) $\frac{2t}{e}$

(B) $\frac{t}{e}$

(C) $\frac{t}{2e}$

(D) $\frac{t}{3e}$

84.



Two blocks A and B are connected by a string via pulleys as shown in the figure. If the block A moves downward with a velocity of 4 m/s, what will be the velocity of block B ?

(A) $\frac{2}{3}$ m / s upward

(B) $\frac{4}{3}$ m / s upward

(C) $\frac{5}{3}$ m / s upward

(D) $\frac{7}{3}$ m / s upward

85. Kinetic energy of a body moving in a straight line increases linearly with time. Then the net force acting on the body is

(A) directly proportional to its velocity

(B) inversely proportional to its velocity

(C) zero

(D) constant

STRENGTH OF MATERIALS

86. A uniform rectangular bar of length '*l*', width 'b' and thickness 't' is subjected to a tensile stress in longitudinal direction. If ε be the longitudinal strain developed and μ be the Poisson's ratio, the resulting volume strain will be

(A) $\varepsilon(1-2\mu)$

(B) $2\varepsilon(1-\mu)$

(C) $\varepsilon(1+2\mu)$

(D) 3ε

87. A uniform steel bar (Young's modulus = 200 GPa, density = 7.8 gm/cc) of total length 40 m hangs vertically. The ratio of elongation of top 10 m to that of top 20 m of the bar would be

(A) 1 : 2

(B) 2 : 3

(C) 5 : 8

(D) 7 : 12

88. A thin hollow cylinder with both ends closed is subjected to internal pressure. If the longitudinal stress at the outer surface of the cylinder is σ, the maximum shear stress at that surface is

(A) 2σ

(B) 1.5σ

(C) σ

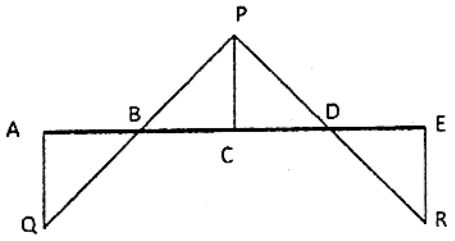
(D) 0.5σ

89. A thin hollow cylinder with both ends closed is subjected to internal pressure. The longitudinal stress at the outer surface of the cylinder is σ. If Poisson's ratio of the material of the cylinder is 0.3, the ratio of circumferential strain to longitudinal strain is

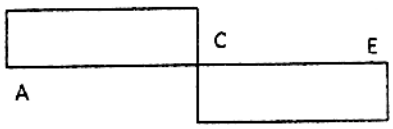
(A) 3.5 (B) 4.0

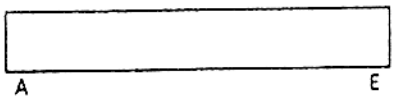
(C) 4.25 (D) 5.5

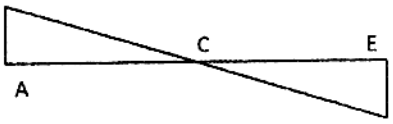
90.

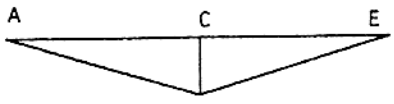


The bending moment diagram of a simply supported beam, supported at both ends is shown in the figure. In that case, which of the following figures shows the nature of shear force distribution in the beam ? It is given that AB = BC = CD = DE and |AQ| = |PC| = |ER|.

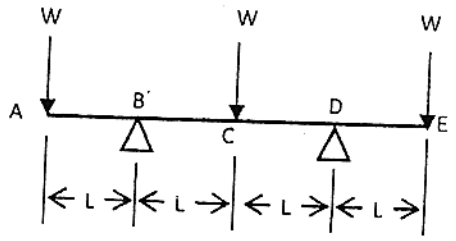
(A) 

(B) 

(C) 

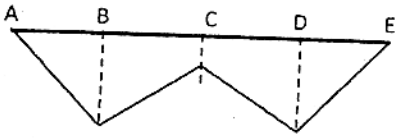
(D) 

91.

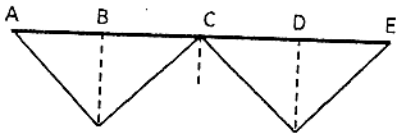


A uniform simply supported beam is loaded as shown in the figure. Which of the diagrams below best represents its bending moment distribution ?

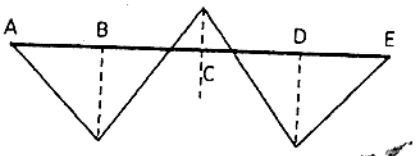
(A)



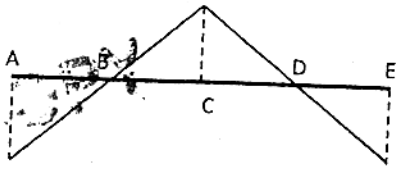
(B)



(C)



(D)



92. A long slender bar having uniform cross-section B×H is acted upon by an axial compressive force. The sides B and H are parallel to x and y axes respectively. Ends of the bar are connected with supports in such a way that, they behave as pin-jointed when the bar tends to buckle in a plane normal to x-axis, and they behave as built-in when the bar buckles in a plane normal to y-axis. If axial load capacity (in terms of buckling) in either mode is same, the B/H ratio will be

(A) $\frac{1}{2}$

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

(C) $\frac{1}{8}$

(D) $\frac{1}{16}$

93. A uniform cantilever beam AB of length *l* and flexural rigidity EI is carrying a distributed load whose intensity varies from zero at the fixed end to W per unit length at the free end. The deflection at the free end will be

(A) $\frac{1}{48}\frac{W\ell^4}{EI}$ (B) $\frac{1}{30}\frac{W\ell^4}{EI}$

(C) $\frac{1}{20}\frac{W\ell^4}{EI}$ (D) $\frac{11}{120}\frac{W\ell^4}{EI}$

94. A rectangular beam of uniform strength is subjected to bending moment M at a section. If the width of the beam is constant, the variation of depth will be proportional to

(A) M (B) $\sqrt{M}$

(C) $M^{3/2}$ (D) $M^{5/2}$

95. A beam is said to be continuous when

(A) it extends beyond its support (B) it has only one support

(C) it has more than two supports (D) it is infinitely long

96. A beam has a square cross-section with sides x. At a section of the beam, the transverse shear force is S. The magnitude of shear stress at the top surface of the beam at that section is

(A) $1.5\frac{S}{x^2}$ (B) $\frac{S}{x^2}$

(C) $0.5\frac{S}{x^2}$ (D) zero

97. The ratio of equivalent length of a column having one end fixed and other end free, to its actual length is

(A) 2 (B) $\sqrt{2}$

(C) $\frac{1}{2}$ (D) $\frac{1}{\sqrt{2}}$

98. Total strain energy stored in a simply supported beam of span L and flexural rigidity EI, subjected to a concentrated load W at the mid-span is equal to

(A) $\frac{1}{40}\frac{W^2L^3}{EI}$ (B) $\frac{1}{60}\frac{W^2L^3}{EI}$

(C) $\frac{1}{96}\frac{W^2L^3}{EI}$ (D) $\frac{1}{120}\frac{W^2L^3}{EI}$

99. The state of stress at a point is given by $\sigma_x = \sigma_y = \sigma_0$ and $\tau_{xy} = 0$. The normal stress at the same point in a direction 22½° to the x-axis will be

(A) $\frac{\sigma_0}{\sqrt{2}}$ (B) σ_0

(C) $\sqrt{2}\sigma_0$ (D) Cannot be predicted

100. Two circular shafts of same material, same length L and same outside diameter D are subjected to torques so that they develop same maximum shear stress. The first shaft is solid while the second one is hollow with inner diameter D/2. The ratio of total strain energy absorbed by the first shaft to that by the second shaft is

(A) $\frac{4}{3}$ (B) $\frac{8}{7}$

(C) $\frac{15}{16}$ (D) $\frac{16}{15}$