Name of the student:-

Roll No:-. . .

Tribhuvan University

Institute of Science and Technology

M.A. / M.Sc. Entrance Examination

2078

Time: 2 Hours — Full Marks: 100

Attempt 100 questions (from 1 to 94) and remaining 6 (from 95 to 100 either Mechanics or Linear Programming). 1×100

Tick (✓) the best alternatives.

1. Which of the following property holds in a group $(G, *)$ for all $a, b \in G$?

   (a) $a * b = a * c \Rightarrow a = c$

   (b) $a * b = b * a$

   (c) $a * a = a$

   (d) $a * e = e$

2. The order of the group $(\mathbb{Z}, +)$ is

   (a) 0

   (b) 2

   (c) 4

   (d) infinite

3. In the group $(\mathbb{Q} - \{0\}, *)$ where $a * b = ab$, the identity element is

   (a) 0

   (b) 1

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

   (d) $\frac{1}{a}$

4. Which is a subgroup of the group $(\mathbb{Q}, +)$?

   (a) $(\mathbb{Q}^+, +)$

   (b) $(\mathbb{Q}^+, \times)$

   (c) $(\mathbb{N}, +)$

   (d) $(\mathbb{Z}, +)$

5. If S and T are two subgroups of a group S, then which of the following is a subgroup?

   (a) $S \cup T$

   (b) $S \cap T$

   (c) $S - T$

(d) $G - S$

6. The number of generators of the cyclic group $\{1, -1, i, -i\}$ is

   (a) 1
   (b) 2
   (c) 0
   (d) infinite

7. Let $f : (\mathbb{Z}, +) \to (\mathbb{Z}, +)$ defined by $f(x) = 2x$. Then kernel of f is

   (a) $\{1\}$
   (b) $\{1, -1\}$
   (c) $\{0, 1\}$
   (d) $\{0\}$

8. If R is a ring without zero divisors, then $x.y = 0$ implies

   (a) $x = 0$ or $y = 0$
   (b) $x = 0$ and $y = 0$
   (c) $x = 0,\ y \neq 0$
   (d) $x \neq 0, y = 0$

9. The number of binary operations involved in a ring is

   (a) 0
   (b) 1
   (c) 2
   (d) infinite

10. An integral domain D is a field if

   (a) D is finite
   (b) D is infinite
   (c) The element of D can be arranged in a particular order
   (d) None of these.

11. If $\begin{pmatrix} x & 1 \\ 2 & y \end{pmatrix} \begin{pmatrix} 2 \\ 4 \end{pmatrix} = \begin{pmatrix} 4 \\ 0 \end{pmatrix}$, then the values of x and y are

   (a) $x = 0,\ y = -1$
   (b) $x = -3\ ,\ y = 7$
   (c) $x = 0,\ y = 1$
   (d) $x = 3,\ y = 7$

12. If the value of a determinant is 5 and if its first row is multiplied by 3, then the value of the new determinant is

   (a) 3

(b) 5

(c) 15

(d) $\frac{5}{3}$

13. The rank of the matrix $\begin{pmatrix} 2 & 3 & 4 \\ 4 & 6 & 8 \end{pmatrix}$ is

(a) 1

(b) 2

(c) 3

(d) 0

14. The value of k for which the vectors $(1, 5)$ and $(2, k)$ are linearly dependent is

(a) $k = 1$

(b) $k = 5$

(c) $k = -2$

(d) k= 10

15. The system of equation $x + 2y = 3$, $2x + ay = b$ has unique solution if

(a) $a = 5$

(b) $a = 4$

(c) $a = 4$, $b = 1$

(d) $a \neq 4$.

16. If $||\alpha|| = 2$, then the norm of the vector -5α is

(a) -10

(b) 10

(c) 2

(d) -2.

17. If the vectors $\alpha = (k, 0, 0)$ and $\beta = (0, k, 0)$ are orthogonal, then k is

(a) 0

(b) 1

(c) -1

(d) for all values of k.

18. For a bijective mapping $T : \mathbb{R}^3 \to \mathbb{R}^3$, the rank of T is

(a) 1

(b) 2

(c) 3

(d) 4.

19. The eigenvalues of the matrix $\begin{pmatrix} 1 & 2 & 4 \\ 0 & 3 & 1 \\ 0 & 0 & 2 \end{pmatrix}$ are

(a) { 1, 2, 3 }
(b) $\{1, 0, 2\}$
(c) $\{1, 2, 4\}$
(d) $\{1, 0, 0\}$.

20. The characteristic polynomial of the matrix $\begin{pmatrix} 1 & 2 \\ -1 & 3 \end{pmatrix}$ is

(a) $\lambda^2 - 2\lambda + 2$
(b) $\lambda^2 - 4\lambda + 5 = 0$
(c) $\lambda^2 - 4\lambda + 5$
(d) $\lambda^2 - 4\lambda + 6$.

21. "If I love math, then I will pass this course; but I know I love math". Therefore, I will pass the course. What is the correct symbolic form ?

(a) $[(p \Rightarrow q) \wedge p] \Rightarrow q$
(b) $[(p \Rightarrow q) \wedge \sim p] \Rightarrow q$
(c) $[(p \Rightarrow q) \vee p] \Rightarrow q)$
(d) $[(p \Rightarrow q) \vee p] \Rightarrow \sim q)$

22. What is the least upper bound of the set $S = \{x : x^2 < 9\}$?

(a) 9
(b) 3
(c) 4
(d) 5

23. If $A_n = (\frac{-1}{n}, \frac{1}{n})$ for each $n \in \mathbb{N}$, What is the value of $\cap_{n=1}^{\infty} A_n$?

(a) $\frac{1}{n}$
(b) $\frac{-1}{n}$
(c) $\{1\}$
(d) $\{0\}$

24. The sequence $\{1, 0, 1, 0, \cdots\}$ is

(a) increasing and not bounded above
(b) convergent and not bounded
(c) convergent and bounded
(d) not convergent and bounded

25. The convergence test of the series $\sum_{n=1}^{\infty} (-1)^{n-1}$ by Cauchy criterion is

(a) convergent
(b) conditionally convergent
(c) not convergent
(d) none of them

26. If f is a continuous function defined in a closed and bounded subset A of $\mathbb{R}$ then f is uniformly continuous in A, is the statement of

(a) Heine theorem
(b) Bolzano theorem
(c) intermediate Value theorem
(d) Lipschitz theorem

27. The value of $\lim_{x \to 0} \frac{(e^x - 1)\tan^2 x}{x^3}$ is

(a) 0
(b) -1
(c) 1
(d) 2

28. $[x]$ denotes the greatest integer not greater than x and is integrable on [0,3] then what is the value of the integral $\int_0^3 [x]dx$?

(a) 0
(b) 3
(c) 1
(d) 4

29. If f is continuous on a closed interval $[a, b]$ and g is continuous on $[a, b]$, then there exists a point $r \in [a, b]$ such that

$$\int_a^b f(x)g(x) = f(a)\int_a^c g(x)dx + f(b)\int_c^b g(x)dx$$

is the statement of

(a) second mean value theorem for Riemann integral
(b) first mean value theorem for Riemann integral
(c) generalized second mean value theorem for Riemann integral
(d) generalized first mean value theorem for Riemann integral

30. The arbitrary intersection of open set is

(a) always open
(b) closed
(c) open
(d) not necessarily open

31. The set $[0, \infty)$ in $\mathbb{R}$ is

(a) not closed not bounded
(b) closed but bounded
(c) closed but not bounded
(d) open and bounded

32. A real sequence $\{x_n\}$ is monotonically non-increasing for $n \in \mathbb{N}$, if

(a) $x_{n+1} > x_n$
(b) $x_{n+1} < x_n$
(c) $x_{n+1} \geq x_n$
(d) $x_{n+1} \leq x_n$

33. A function $f : S \to \mathbb{R}^k$ is said to be bounded on S if there exist a positive constant M such that

(a) $|f(x)| \leq M \ \forall x \in S$
(b) $\|f(x)\| \leq M \ \forall x \in S$
(c) $< f(x) > \leq M \ \forall x \in S$
(d) none of them

34. For a function $T : S \to S$ defined by $T(x) = x^2$, $0 \leq x \leq \frac{1}{3}$ has a contraction constant value as

(a) 2
(b) $\frac{2}{3}$
(c) $\frac{1}{3}$
(d) 0

35. Let f be defined on a closed interval $[a, b]$ and $f(c^+)$ and $f(c^-)$ both exists at some interior point $c \in (a, b)$ then $f(c^+) - f(c^-)$ is called the

(a) left hand jump of f at c
(b) right hand jump of f at c
(c) jump of f at c
(d) no jump of f at c

36. The integral value $\int_0^\pi x d(sinx)$ is

(a) 1
(b) -1
(c) -2
(d) 8

37. If f is continuous on $[a, b]$ and if α is of bounded variation on $[a, b]$ then the condition for $f \in R(\alpha)$ on $[a, b]$ is

(a) $U(P, f.\alpha) - L(P, f, \alpha) < \epsilon, \quad \forall \ P_\epsilon \subseteq P$

(b) $U(P, f.\alpha) - L(P, f, \alpha) > \epsilon, \ \forall \ P_\epsilon \subseteq P$

(c) $U(P, f.\alpha) - L(P, f, \alpha) \leq \epsilon, \ \ \forall \ P_\epsilon \subseteq P$

(d) $U(P, f.\alpha) - L(P, f, \alpha) \geq \epsilon, \ \forall \ P_\epsilon \subseteq P$

38. Let $f_n(x) = \dfrac{x^{2n}}{1+x^{2n}}, x \in \mathbb{R}, n = 1, 2. \cdots$.What will be the limit of $f_n(x)$ for $|x| > 1$?

(a) 0

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

(c) 1

(d) 3

39. The power series $\sum_{n=0}^{\infty} a_n(z - z_0)^n$ converges absolutely if

(a) $|z - z_0| < r$

(b) $|z - z_0| > r$

(c) $|z - z_0| \leq r$

(d) $|z - z_0| \geq r$

40. What is the value of the integral $\int_1^5 \dfrac{dx}{\sqrt{x^4 - 1}}$ converges for $x > 1$?

(a) 4

(b) 0

(c) 3

(d) 5

41. The function $f(x) = x \sin(1/x)$ at $x = 0$

(a) has no limit

(b) is discontinuous at $x = 0$

(c) has limiting value 0

(d) has limiting value 1

42. The function $f(x) = |x|$ is

(a) not continuous at $x = 0$

(b) not differentiable at $x = 0$

(c) not defined at $x = 0$

(d) all of the above

43. The limiting value of $\dfrac{(\sin^2 x - x^2)}{x^4}$ as $x \to 0$ is

(a) $\dfrac{-1}{3}$

(b) $\frac{1}{3}$
(c) $\frac{0}{0}$
(d) $\frac{\infty}{\infty}$

44. The function $f(x) = x^3$ has

(a) minimum value 0
(b) maximum value 0
(c) no extreme values
(d) none of the above

45. If $y = e^{-kx}$ then $y_n =$

(a) $(-1)^n k^n e^{-kx}$
(b) $k^n e^{-kx}$
(c) $(-1)^n e^{-kx}$
(d) $(-1)^n k^n e^{kx}$

46. The equation of tangent $y^2 = 4x$ which makes an angle 45^o with x axis is

(a) $x + y - 2 = 0$
(b) $x - y - 1 = 0$
(c) $x + y = 0$
(d) none of the above

47. A function $y = f(x)$ is said to have horizontal asymptote if

(a) $\lim_{x \to a} f(x) = \infty$
(b) $\lim_{x \to a} f(x) = 0$
(c) $\lim_{x \to \infty} f(x) = a$
(d) all of the above

48. A curve $y = f(x)$ is said to be symmetrical about y axis if

(a) replacing y by $-y$ does not make change in the equation
(b) replacing x by $-x$ makes the change in the equation

(c) replacing y by $-y$ makes the change in the equation
(d) replacing x by y makes the change in the equation

49. If $z = x^3 + 3x^2y + y^3$ then z_y at $(1, 2)$ is

(a) 12
(b) 3
(c) 3
(d) 15

50. If $z = e^{xy}, x = t, y = \sin t$ then $\frac{dz}{dt} =$

(a) $e^{\sin t}[\sin t + t \cos t]$
(b) $e^{t \sin t}[\sin t + \cos t]$
(c) $e^{t \sin t}[\sin t + t \cos t]$
(d) $e^{t \sin t} t \cos t$

51. $y = ax + b$ is the solution of

(a) $y'' = 0$
(b) $y' = 0$
(c) $y'' + y' = 0$
(d) $y'' - y' = 0$

52. The differential equation $y' + y^2 = 0$ is

(a) linear
(b) nonlinear
(c) non homogeneous
(d) none of the above

53. The general solution of $y'' + 4y = 0$ is

(a) $y = C \sin 2x + D \cos 2x$
(b) $y = A \sin 2x$
(c) $y = Ae^{2x} + Be^{-2x}$
(d) $y = A \cos 2x$

54. $y' - y = 0, \quad y(0) = 1$ is

(a) a boundary value problem

(b) an initial boundary value problem

(c) single valued problem

(d) initial value problem

55. $y = e^{kx}$ is the solution of $y'' + y' + y = 0$. If the roots k_1, k_2 of the auxiliary equation are repeated then the solution of the given equation is

(a) $y = Ce^{k_1 x} + De^{-k_2 x}$

(b) $y = e^{k_1 x} + Dk_1 e^{k_2 x}$

(c) $y = e^{k_1 x} + Dxe^{k_2 x}$

(d) all of the above

56. The general solution of $u_{tt} - u_{xx} = 0$ is

(a) $u = f(x - ct) + g(x + ct)$

(b) $u = f(x - t) + g(x + t)$

(c) $u = f(x - t)$

(d) None of the above

57. $u_t + uu_x = 0$ is

(a) linear

(b) non homogeneous

(c) second order

(d) non linear

58. If $\int F(x)dx = f(x)$ then $F(x)$ is

(a) primitive

(b) integration

(c) integrand

(d) none of the above

59. The value of $\frac{d}{dx} \int_1^x t^4 dt =$

(a) x^4
(b) x^3
(c) 0
(d) non of the above

60. $\int_0^c f(x)dx =$

(a) $\int_0^c (x-c)dx$
(b) $\int_0^c (x+c)dx$
(c) $\int_0^c (c-x)dx$
(d) $\int_0^c (c+x)dx$

61. $\displaystyle\int_0^\infty \frac{1}{1+x^2}\,dx =$

(a) π
(b) 2π
(c) 0
(d) $\pi/2$

62. $\displaystyle\int_{-\infty}^{\infty} e^{-x^2}\,dx =$

(a) $\frac{\sqrt{\pi}}{2}$
(b) $2\sqrt{\pi}$
(c) $\sqrt{\pi}$
(d) none of the above

63. The area of the loop of the curve $a^2y^2 = a^2x^2 - x^4$ is

(a) $\frac{4a^2}{3}$
(b) $\frac{2a^2}{3}$
(c) $4a^2$
(d) $\frac{a^2}{3}$

64. The volume of the ellipsoid formed by the revolution of an ellipse about x axis is

(a) $4\,\pi\,ab^2$

(b) $\dfrac{4\pi ab^2}{3}$

(c) $\dfrac{\pi\, ab^2}{3}$

(d) none of the above

65. $\displaystyle\int_0^{\pi}\int_0^{x} \sin y \; dy \; dx =$

(a) $\pi/2$

(b) 2π

(c) π

(d) $\pi/3$

66. Consider the function $f(x,y) = y^2 - 2x^2y + 2x^4$. Then the function has

(a) maximum at $(0,0)$

(b) minimum at $(0,0)$

(c) both (a) and (b) correct

(d) neither maximum at (0,0) nor minimum at (0,0)

67. If $f(x)$ be a maximum or a minimum at $x = p$, and if $f'(p)$ exists, then

(a) $f'(p) > 0$

(b) $f'(p) < 0$

(c) $f'(p) = 0$

(d) $f'(p)$ can be anything.

68. which integral is the form of Gamma function?

(a) $\displaystyle\int_0^1 x^m y^m \; dx \; (m > -1)$

(b) $\displaystyle\int_0^1 x^{m-1}(1-x)^{n-1} \; dx \; (m,\; n > -1)$

(c) $\displaystyle\int_0^\infty e^{-x} x^{n-1} \; dx \; (n > -1)$

(d) $\displaystyle\int_0^\infty e^{x} x^{-n+1} \; dx \; (n > -1)$

69. What the value of $\displaystyle\lim_{x\to 0} \frac{\sin x - x}{x^3}$

(a) $\dfrac{1}{6}$

(b) 0

(c) 6

(d) 1

70. What the value of $\lim_{x\to\infty} \frac{x^4}{e^x}$

(a) 4
(b) 0
(c) -1
(d) 1

71. Identify the wrong statement

(a) the sum or the difference of two continuous real valued functions is a continuous function
(b) the product of two continuous functions is a continuous function
(c) if a function is continuous at a point in an interval, it must also be differentiable there
(d) if a function is differentiable at a point, then it is continuous at this point

72. Which is the correct expression of a total differential a function u= f(x,y)?

(a) $du = \frac{\partial u}{\partial x}dx + \frac{\partial u}{\partial y}dy$
(b) $\partial u = \frac{du}{dx}\partial x + \frac{du}{dy}\partial y$
(c) $du = \frac{\partial u}{\partial x}\partial x + \frac{\partial u}{\partial y}\partial y$
(d) none of these

73. If $u = \cos^{-1}\frac{x+y}{\sqrt{x}+\sqrt{y}}$, then Euler's theorem results that

(a) $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \sin u$
(b) $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = -\cot u$
(c) $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = -\frac{1}{2}\cot u$
(d) $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \cos u$

74. The polar form of an ellipse is

(a) $\frac{1}{r} = \frac{cos^2\theta}{a^2} + \frac{sin^2\theta}{b^2}$
(b) $\frac{1}{r^2} = \frac{cos^2\theta}{a^2} - \frac{sin^2\theta}{b^2}$
(c) $\frac{1}{r^2} = \frac{cos\theta}{a^2} + \frac{sin\theta}{b^2}$
(d) $\frac{1}{r^2} = \frac{cos^2\theta}{a^2} + \frac{sin^2\theta}{b^2}$

75. The condition that the line $y = mx + c$ meets the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ exactly at a point if

(a) $c = \pm\sqrt{a^2m^2 + b^2}$
(b) $c^2 = \sqrt{a^2m^2 + b^2}$
(c) $c = \pm\sqrt{a^2m^2 - b^2}$
(d) $c = -\sqrt{a^2m^2 - b^2}$

76. Let $\dfrac{x^2}{a^2} - \dfrac{y^2}{b^2} = 1$ be the equation of a hyperbols. The length of latus rectum is

(a) $\frac{2b^2}{a}$

(b) $\frac{2a^2}{b}$

(c) $\frac{b^2}{a}$

(d) $\frac{b^2}{2a}$

77. Let e and e' be the eccentricity of a hyperbola and its conjugate, respectively. Then $\frac{1}{e^2} + \frac{1}{e'^2} =$

(a) $\sqrt{2}$

(b) ± 1

(c) 1

(d) -1

78. The co-ordinate $(\dfrac{hf - bg}{ab - h^2}, \dfrac{gh - af}{ab - h^2})$ is called the

(a) point where a chord meets the conic

(b) centre of a conic

(c) focus of a conic

(d) point of intersection of two axes of a conic

79. The distance between the points $(-1, 6, 6)$ and $(-4, 9, 6)$ is

(a) $2\sqrt{2}$

(b) $3\sqrt{2}$

(c) $3\sqrt{3}$

(d) $3\sqrt{5}$

80. The equation $lx + my + nz = p$ stands for the equation of

(a) a line in a general form

(b) a line in a normal form

(c) a plane in a general form

(d) a plane in normal form

81. The value of k when a line $\dfrac{x-2}{2} = \dfrac{y+3}{5} = \dfrac{z-5}{k}$ is parallel to a plane $2x - 3y + z = 3$ is

(a) 9

(b) 11

(c) 10

(d) 12

82. The equation $(x - x_1)(x - x_2) + (y - y_1)(y - y_2) + (z - z_1)(z - z_2) = 0$ is the equation

(a) of a sphere on the line joining two given points as a diameter

(b) of a sphere on the line joining two given points as a chord

(c) of a cylinder on the line joining two given points as a diameter

(d) of a cylinder on the line joining two given points as a chord

83. The plane $lx + my + nz = p$ is tangent to the central conicoid $ax^2 + by^2 + cz^2 = 1$ if

(a) $\frac{l^2}{a} + \frac{m^2}{b} + \frac{n^2}{c} + p^2 = 0$

(b) $\frac{l}{a} + \frac{m}{b} + \frac{n}{c} = p^2$

(c) $\frac{l^2}{a^2} + \frac{m^2}{b^2} + \frac{n^2}{c^2} = p^2$

(d) $\frac{l^2}{a} + \frac{m^2}{b} + \frac{n^2}{c} = p^2$

84. The geometrical interpretation of the scalar product $\vec{a}.\vec{b}$ of two vectors $\vec{a}$ and $\vec{b}$ is

(a) (magnitude of $\vec{a}$) (projection of $\vec{b}$ on $\vec{a}$)

(b) (magnitude of $\vec{a}$) (projection of $\vec{a}$ on $\vec{b}$)

(c) (magnitude of $\vec{b}$) (projection of $\vec{b}$ on $\vec{a}$)

(d) (magnitude of $\vec{b}$) (projection of $\vec{a}$ on $\vec{b}$)

85. If the vectors $\vec{a}, \vec{b}, \vec{c}$ and $\vec{d}$ are coplanar, then $(\vec{a} \times \vec{b}) \times (\vec{c} \times \vec{d})$ is

(a) $(\vec{a} \times \vec{b}) - (\vec{c} \times \vec{d})$

(b) 0

(c) $(\vec{a} \times \vec{b}) + (\vec{c} \times \vec{d})$

(d) -1

86. The rate of flow of fluid throughout the rectangular parallelepiped per unit volume is

(a) gradient of the velocity

(b) curl of the velocity

(c) divergent of the curl of the velocity

(d) divergent of the velocity

87. Total work done by a force $\vec{F}$ in moving the particle through the curve C is

(a) $-\int_C \vec{F} \times d\vec{r}$

(b) $\int_C \vec{F} \times d\vec{r}$

(c) $-\int_C \vec{F}.d\vec{r}$

(d) $\int_C \vec{F}.d\vec{r}$

88. Let a particle moves along the curve $x = 2sin3t$, $y = 2cos3t$, $z = 8t$ at any time $t = \frac{\pi}{3}$. The velocity of the particle is

(a) 10

(b) 12

(c) 5

(d) 15

89. Consider the function $f(x) = 2x^3 - 21x^2 + 36x + 20$. Then the function has

(a) minimum for $x = 1$

(b) maximum value for $x = 6$

(c) maximum at $x = 1$ and minimum at $x = 6$

(d) both (a) and (b) correct

90. A point on a certain curve is said to be "a point of inflexion" if

(a) at this point, the curve on one side is convex

(b) at this point, the curve on one side is concave

(c) both answers (a) and (b) are wrong

(d) both answers (a) and (b) are correct

91. Suppose that q be a point in the interval in which the function $g(x)$ is defined and $g'(q) = 0$ but $g''(q) \neq 0$.

(a) g has a maximum at q if $g''(q)$ is negative

(b) g has a minimum at q if $g''(q)$ is positive

(c) both (a) and (b) are wrong answers

(d) both (a) and (b) are correct answers

92. Which is an indeterminate form

(a) $\frac{0}{0}$

(b) $\infty - \infty$

(c) $\frac{\infty}{\infty}$

(d) all of the above

93. What the value of $\lim_{x \to 0} \dfrac{e^x - e^{-x} - 2x}{x - \sin x}$

(a) 2

(b) 0

(c) -2

(d) 1

94. If $f(x, y)$ be a homogeneous function of x and y of degree n, then Euler's theorem states that

(a) $x\frac{\partial f}{\partial x} + y\frac{\partial f}{\partial y} = f(x, y)$

(b) $x\frac{\partial f}{\partial x} + y\frac{\partial f}{\partial y} = nf(x, y)$

(c) $y\frac{\partial f}{\partial x} + x\frac{\partial f}{\partial y} = f(x, y)$

(d) $x\frac{\partial f}{\partial x} + y\frac{\partial f}{\partial y} = -nf(x, y)$

Attempt either from Mechanics or Linear Programming.

Mechanics

95. Let a force P acts horizontal and a force Q acts vertical on a particle. Then the magnitude of the resultant force R of the two forces is

(a) $\sqrt{P^2 - Q^2}$
(b) $\sqrt{P + Q}$
(c) $\sqrt{P^2 + Q^2}$
(d) $P^2 + Q^2$

96. The necessary and sufficient conditions for the equilibrium of coplanar and concurrent forces are

(a) the resultant or their resolved parts along two perpendicular directions are zero
(b) the resultant and their resolved parts along two non-perpendicular directions are zero
(c) the resultant but not their resolved parts along two perpendicular directions are zero
(d) the resultant and their resolved parts along two perpendicular directions are zero

97. If three coplanar forces, acting in one plane upon a rigid body, keep it in equilibrium, they must

(a) either meet in a point or be parallel
(b) neither meet in a point nor be parallel
(c) either meet in a point or be perpendicular
(d) neither meet in a point nor be perpendicular

98. Let $P(r, \theta)$ be the position of a particle at time t. The radial and transverse components of velocity are

(a) $\dot{r}$ and $\dot{r}\theta$
(b) $\dot{r}$ and $r\theta$
(c) $\dot{r}$ and $r\dot{\theta}$
(d) $\dot{r}$ and $\dot{r}\dot{\theta}$

99. Let v be the velocity of a particle $P(r, \theta)$ and p be the perpendicular distance from the origin to the tangent at P. The relation between angular and linear velocities is

(a) $(r\dot{\theta}) = \frac{vp}{r^2}$
(b) $\theta = \frac{vp}{r^2}$
(c) $\dot{\theta} = \frac{vp}{r^2}$
(d) $\dot{\theta} = \frac{\dot{v}p}{r^2}$

100. Let T be the periodic time, the number n of complete oscillations in one second is given by

(a) $\frac{1}{T-1}$

(b) $\frac{1}{T+1}$

(c) $\frac{1}{\sqrt{T}}$

(d) $\frac{1}{T}$

Linear Programming

95 A linear programming problem is characterized by

(a) A linear objective function but any type of constraints
(b) all linear constraints but any type of objective function
(c) the objective function and all constraints must be linear.
(d) either linear objective function or linear constraints

96 For a linear programming problem, the statement is correct

(a) it may be infeasible yielding infeasible region
(b) it may have feasible solution with feasibility region
(c) the region may be unbounded
(d) any of the above statement may hold

97 Following statement is false for a linear programming

(a) a general LP can be converted to its Dual that is not LP
(b) the dual of a dual in an LP is the primal problem
(c) a general LP can be converted to its Dual that is also LP
(d) if a primal problem has a finite optimal solution, then its dual also have a finite optimal solution

98 Consider an LP $\min\{cx \mid Ax = b, x \geq 0\}$ with set of feasible solutions F. Then

(a) a basic solution x_0 must be in F
(b) a basic solution is always an optimal solution
(c) a basic solution may not be feasible
(d) all of the above statements are false

99 Suppose that one formulates a diet problem as an LP, where one has to select a set of foods that will satisfy a set of daily nutritional requirement at least cost. Then

(a) the problem is to minimize the cost
(b) the constraints are to satisfy the specified nutritional requirements
(c) both (a) and (b) must hold
(d) the problem is to maximize the cost

100 Consider the LP in standard form $\min\{y \mid x + y \leq 2, x \geq 0, y \geq 0\}$. Then

(a) the optimal solution is at (2, 2)
(b) the optimal solution is at (0, 2)
(c) the optimal solution is at (1, 1)
(d) the optimal solution is at (0, 0)