Marking Scheme
Applied Mathematics
Term - I
Code-241

Q.N.	Correct option	Hints/Solutions
		Section – A
1	**c**	$5 \odot_8 11 = (5 \times 11) mod\, 8 = 55\, mod\, 8 = 7$
2	**a**	For distinct $x, y > 0; AM > GM \Rightarrow \frac{x+y}{2} > \sqrt{xy} \Rightarrow x + y > 2\sqrt{xy}$
3	**c**	Let *x be the speed of the stream* $\therefore 8 + x = 3(8 - x) \Longrightarrow 4\text{x} = 16 \Longrightarrow \text{x} = 4\text{km/h}$
4	**d**	Since $3\|(x + 4) is\ true\ for\ x = 35$
5	**d**	$\|adj(A)\| = \|A\|^{n-1} \Longrightarrow \|\text{adj(A)}\| = (-2)^2 = 4$
6	**a**	The summation of product of a_{ij} of 2[nd] column with corresponding c_{ij} of 3 column =0
7	**c**	$\|AB\| = 12 \Longrightarrow \|\text{A}\|\,\|B\| = 12$ $\Longrightarrow -4\|\text{A}\| = 12 \Longrightarrow \|\text{A}\| = -3$
8	**a**	If $\Delta = 0$ and at least $(one\ of\ \Delta_x,\ \Delta_y,\ \Delta_z) \neq 0$ The system of linear equations has no solution
9	**c**	$C(x) = x^2 + 30x + 1500$ $MC = C'(x) = 2x + 30$ MC when 10 units are produced = $C'(10) =$ ₹ 50
10	**c**	$y = \frac{1}{x} \Longrightarrow \frac{dy}{dx} = -\frac{1}{x^2} < 0$ for $(-\infty, 0) and\ (0, \infty)$
11	**b**	$$y = x^3 + x \Longrightarrow \frac{dy}{dx} = 3x^2 + 1 \Longrightarrow \left(\frac{dy}{dx}\right)_{x=1} = 4$$ $\therefore$ Equation to target is $y - 2 = 4(x - 1) \Longrightarrow 4\text{x} - \text{y} = 2$
12	**b**	Expected number of votes=$np = \frac{70}{100} \times 120000 = 84000$
13	**d**	The total area under the normal distribution curve above the base line is 1
14	**c**	$\sum p_i = 1 \Longrightarrow 7\text{k} = 1 \Longrightarrow \text{k} = \frac{1}{7}$ Now, $P(x \geq 3) = 3k = \frac{3}{7}$
15	**b**	For Poisson distribution Mean = variance = $np = 20000 \times \frac{1}{10000} = 2$
16	**d**	$\sum_{k=0}^{\infty} \frac{e^{-\lambda}\lambda^k}{k!}$ = Total probability = 1
17	**b**	$p = 0.05 = \frac{1}{20}, q = \frac{19}{20}$ $$P\ (x \geq 1) = 1 - P(0) = 1 - 6_{c_0}(\frac{1}{20})^0(\frac{19}{20})^6 = 1 - (\frac{19}{20})^6$$
18	**c**	In Laspeyre's price index the weight are taken as base year quantities
19	**a**	$P_{01}^{P} = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100 = \frac{506}{451} \times 100 = 112.19$
20	**c**	Marshall- Edgeworth formula uses the arithmetic mean of the base and current year quantities.

		Section –B
21	c	Since Vijay is faster by 4 secs. ∴ he beats Samuel by = $\frac{100}{16} \times 4 = 25\ meters$
22	b	∵ 876 (mod24) = 12 ∴ 8.40 PM will change to 8.40 AM after 12 hours, further after 30 minutes the time will be 9.10 AM
23	b	Let total capital be = x & let C's contribution = y, B's contribution = $\frac{x}{3}$, A's Contribution = $\frac{x}{3} + y$. Now (A+B+C)'s contribution = $x \Rightarrow x = 6y$ $hence\ their\ contribtions\ are\ 2y + y : 2y : y\ i.e., in\ the\ ratio\ \ 3:2:1$
24	d	The relation R_m defined as a ≡ b (mod m) is reflexive, symmetric and transitive ∴ R_m is an equivalent relation
25	b	Time ratio = 2 : 3 : 4 Profit sharing ratio = 6: 7: 8 Investment ratio = $\frac{6}{2} : \frac{7}{3} : \frac{8}{4}$ $(\frac{Profit}{Time})$ = 9 : 7 : 6
26	c	$2a + b + c - 3d = b + c \quad (\because a = d = 0)$ $= b + (-b)(\because c = -b)$ $= 0$
27	d	$\because 1 - a_{11}, 1 - a_{22} > 0\ and\ \|I - A\| > 0$ and it is true only for $\begin{pmatrix} 0.3 & 0.2 \\ 0.1 & 0.5 \end{pmatrix}$
28	c	$y = \|x\|$ has a sharp point at $x = 0$ $y = \|x\|$ is continuous but not differentiable at $x = 0$
29	a	$\frac{dy}{dx} = \frac{dy/dt}{dx/dt} = \frac{2a}{2at} = \frac{1}{t} \Longrightarrow \frac{d^2y}{dx^2} = -\frac{1}{t^2} \times \frac{dt}{dx} = -\frac{1}{2at^3}$
30	c	$TC = VC + FC = x^2 + 2x + 10000$ AC= $x + 2 + \frac{10000}{x}$ $\frac{d(AC)}{dx} = 1 - \frac{10000}{x^2} = 0 \Longrightarrow \text{x} = 100$
31	a	Prize (x_i) — p_i — x_ip_i 500000 — $\frac{1}{10000}$ — 50 0 — $\frac{9999}{10000}$ — 0 So, $\sum x_ip_i = 50$ Net expected gain = 50 – 100 = -50 So gain is -50
32	c	$P(r < 2) = P(0\ or\ 1) = 10_{C_0}(\frac{1}{2})^{10} + 10_{C_1}(\frac{1}{2})^{10} = \frac{1+10}{1024} = \frac{11}{1024}$
33	d	$n = 100,\ \ p = \frac{1}{10}, q = \frac{9}{10}$ $\sigma = \sqrt{npq} = \sqrt{100 \times \frac{1}{10} \times \frac{9}{10}} = 3$
34	a	$P(x > 518) = 1 - p(x < 518)$ $= 1 - P(z < 1) = 1 - 0.8413$ $= 0.1587$
35	b	$P(x < 54) = P(z < 1.5)$ $= 0.9332$ $= 93.32\ \%$

36	**b**	$\frac{\sum P_1}{\sum P_0} \times 100 = \frac{340}{300} = 113.34$
37	**b**	$P_{01}^{F} = \sqrt{(P_{01}^{L} \times P_{01}^{P})} = \sqrt{118.4 \times 117.5} = 117.95$
38	**c**	Since, $L: P = 28: 27,\ \therefore\ \frac{\sum \boldsymbol{p_1 q_0}}{\sum \boldsymbol{p_0 q_0}} \times \frac{\sum \boldsymbol{p_0 q_1}}{\sum \boldsymbol{p_1 q_1}} = \frac{\mathbf{28}}{\mathbf{27}}$ $\Longrightarrow 9\mathrm{x} + 36 = 40 + 8\mathrm{x} \Longrightarrow \mathrm{x} = 4$
39	**a**	$\frac{\sum\left(\frac{p_1}{p_0}\right)(p_o q_0)}{\sum(p_o q_0)} \times 100$
40	**d**	Time reversal Test is satisfied by Fishers ideal index
41	**a**	$C = -5\%$ $\quad d = 10\%$ $\quad m = 7\%$ $(d - m) : (m - c)$= 1 : 4 Quantity sold at 10 % profit = $\frac{4}{5} \times 250$ = 200 Kg
42	**d**	Portion of cistern filled by both pipes in 1 hour = $\frac{1}{8} + \frac{1}{12} = \frac{5}{24}$. Time taken by both pipes to fill the cistern = 4 h 48 mints Time taken to fill tank due to leakage = 5 h Work done by leakage in 1 h=$\frac{5}{24} - \frac{1}{5} = \frac{1}{120}$ Time taken by leakage to empty the tank=120 h
43	**a**	$TR = px = \frac{75x - x^2}{3}$ $P = TR - TC = \frac{75x - x^2}{3} - (3x + 100)$ $\frac{dP}{dx} = 22 - \frac{2}{3}x = 0 \Longrightarrow \mathrm{x} = 33$
44	**d**	$P(X \geq 1) = 1 - P(0) = 1 - \frac{e^{-2}(2)^0}{0!}$ $= 1 - e^{-2} = 0.8647$
45	**c**	$P\ (10 < \times < 30)$ $= P(-2.5 < Z < 2.5)$ $= P(z < 2.5) - P(z < -2.5)$ = 0.9876
46	**b**	Since elements of technology matrix a_{ij}, represents units of sector i to produce 1 unit of sector j $\therefore \begin{pmatrix} 0.50 & 0.25 \\ 0.10 & 0.25 \end{pmatrix}$ is the technology matrix
47	**c**	$I - A = \begin{pmatrix} 0.50 & -0.25 \\ -0.10 & 0.75 \end{pmatrix} \Longrightarrow (\mathrm{I} - A)^{-1} = \frac{20}{7}\begin{pmatrix} 0.75 & 0.25 \\ 0.1 & 0.5 \end{pmatrix}$ $= \frac{1}{7}\begin{pmatrix} 15 & 5 \\ 2 & 10 \end{pmatrix}$
48	**b**	System is viable if $\|I - A\| > 0$ and $1 - a_{11} > 0,\ \ 1 - a_{22} > 0$
49	**a**	$X = (I - A)^{-1}D = \frac{1}{7}\begin{pmatrix} 15 & 5 \\ 2 & 10 \end{pmatrix}\begin{pmatrix} 7000 \\ 14000 \end{pmatrix} = \begin{pmatrix} 25000 \\ 22000 \end{pmatrix}$
50	**d**	Internal consumption=total production-external demand =$\begin{pmatrix} 25000 \\ 22000 \end{pmatrix} - \begin{pmatrix} 7000 \\ 14000 \end{pmatrix}$ =$\begin{pmatrix} 18000 \\ 8000 \end{pmatrix}$