DIRECTORATE OF GOVERNEMENT EXAMINATION, CHENNAI-6

HSE EXAMINATIONS (FIRST YEAR) – MARCH - 2025

BUSINESS MATHEMATICS AND STATISTICS - ANSWER KEY

Maximum Marks : 90

GENERAL INSTRUCTIONS

1. Answers written only in **BLACK** or **BLUE** should be evaluated.
2. For objective type questions, award 1 mark for "writing the correct option's code and the corresponding option's answer".
3. Marks should be awarded for suitable alternative method also.
4. Mark(s) should not be reduced for the correct answer / stage, if it is written without formula / properties also, **2* means award one mark for the formula.**
5. Award full mark directly, if the solution is arrived with no mistakes without giving weightage for the stages.
6. The stage mark is essential, only if the part of the solution is incorrect.
7. Award marks, if the answer is in decimal value and also approximately equal to the key answer
8. **Important Note for Part II, Part III and Part IV**

   For a particular stage in which the stage mark is greater than 1 and one who begins with correct step but reaches with incorrect solution, for such suitable credits should be given by breaking the stage marks.

PART - I

i. **Answer all the questions**

ii. **Choose the most appropriate from the given <u>Four</u> alternatives and write the option code and the corresponding answer**

20×1=20

Q.No	Option	Answer	Mark
1	(a)	$tan^{-1}\left(\frac{\sqrt{33}}{5}\right)$	1
2	(a)	1	1
3	(d)	$x^2 - 7$	1
4	(d)	$\frac{1}{5}$	1
5	(c)	Negative	1
6	(d)	15	1
7	(d)	Sir Francis Galton	1
8	(c)	A.M ≥ G.M ≥ H.M	1
9	(d)	₹10,000	1
10	(c)	0.25	1
11	(a)	An endowment fund to give scholarships to students	1
12	(b)	$2xe^{x^2}$	1
13	(d)	$\frac{1}{f(x)}$	1
14	(b)	$\left[\frac{-\pi}{2}, \frac{\pi}{2}\right]$	1
15	(b)	$x^2 - 2ax + y^2 = 0$	1
16	(a)	1	1
17	(d)	78	1
18	(d)	$-\frac{1}{2}$	1
19	(c)	$\frac{7!}{2}$	1
20	(a)	$\frac{30}{7}\begin{pmatrix}\frac{1}{2} & \frac{5}{12}\\ \frac{2}{5} & \frac{4}{5}\end{pmatrix}$	1

PART – II

Answer any SEVEN questions. Question No.30 is compulsory. 7×2=14

Note : 2* means award one mark for the formula.

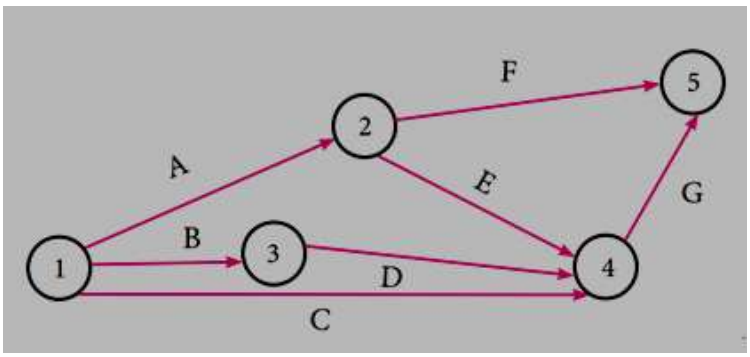
Q.No.	Answer	Marks
21	$f(x) = g(x)$ (or) $2x^2 - 1 = 1 - 3x$	2*
	Domain $\left\{-2, \frac{1}{2}\right\}$	
22	a = ₹1500, i = 0.08, n = 16 (or) $P = \frac{a(1+i)}{i}\left[1 - \frac{1}{(1+i)^n}\right]$	1
	= ₹14339	1
23	$\gamma = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{N\sum X^2 - (\sum X)^2}\sqrt{N\sum Y^2 - (\sum Y)^2}}$	2*
	γ= 0.95	
24	H.M. = $\frac{n}{\frac{1}{a}+\frac{1}{b}+\frac{1}{c}+\frac{1}{d}}$ (or) H.M. = $\frac{n}{\sum\frac{1}{x}}$	2*
	= 192 Km/hr (or) 195 Km/hr	
25	$\eta_d = \frac{-p}{x}\frac{dx}{dp} = \frac{40-x}{x} = 1$	2*
	$x = 20\ units$	
26	$2x^2 - 17x + 26 = 0$	1
	$x = 2, \frac{13}{2}$	1
27	Alphabetical order = A, K, N, R	1
	Rank of the word 'RANK' = 20 **Award full mark for alternate Method**	1
28	$\sin 60^\circ = \frac{2\tan 30°}{1 + tan^2 30°} = \frac{\sqrt{3}}{2}$	1
	$\therefore \sin 2A = \frac{2\tan A}{1 + tan^2 A}$	1
29	Number of 5 digit telephone numbers = 8 X 7 X 6 = 336	2
30	**Compulsory :** $Centre = (1, -3)$	1
	The other extremity = $(4,1)$	1

PART – III

Answer Any SEVEN Questions.

Question No- 40 is Compulsory. **7×3=21**

Note : 2* means award one mark for the formula.

Q.No.	Answer	Marks
31	$\frac{A}{x-3}+\frac{B}{x-2}$	1
	$A=5,\ B=-3$	1
	$\frac{2x-1}{x^2-5x+6}=\frac{5}{x-3}-\frac{3}{x-2}$	1
32	$\sum d^2 = 226$ (or) Table	1
	$\rho=1-\frac{6\sum d^2}{n(n^2-1)}$ ρ = 1-1.369 = -0.369 $\cong -0.37$	2*
33	$\frac{\partial u}{\partial x} = -3x^2+2xy+y^2$	1
	$\frac{\partial u}{\partial y} = x^2-3y^2+2xy$	1
	$\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y} = -2(x-y)^2$	1
34	$X=A^{-1}B$ $= \frac{1}{-7}\begin{pmatrix}-2 & -3\\ -1 & 2\end{pmatrix}\begin{pmatrix}5\\ -1\end{pmatrix}$	2*
	X=1 y=1	1
35	Focus (0,a) =(0,2)	1
	Vertex = (0,0)	1
	directrix y=-a y=-2	1
36	 Any Rough Diagram (1 Mark)	3

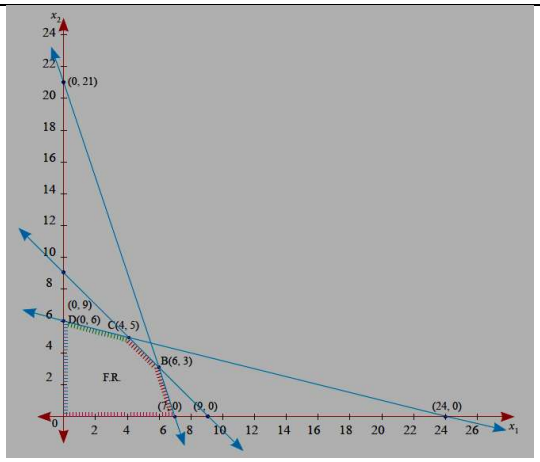
37	$y_1 = 7(500e^{7x}) - 7(600e^{-7x})$	1
	$y_2 = 49(500e^{7x}) + 49(500e^{-7x})$	1
	y_2-49y=0	1
38	$\frac{\sin(B-C)}{cosBcosC} = tanB - tanC$ $LHS = \frac{sinB}{cosB} - \frac{sinC}{cosC} + \frac{sinC}{cosC} - \frac{sinA}{cosA} + \frac{sinA}{cosA} - \frac{sinB}{cosB}$ (or) $= tanB - tanC + tanC - tanA + tanA - tanB$	2*
	$\frac{\sin(B-C)}{cosBcosC} + \frac{\sin(C-A)}{cosCcasA} + \frac{\sin(A-B)}{cosAcosB} = 0$	1
39	m = $-\frac{3}{4}$, c = $\frac{k}{4}$, a^2 = 64	1
	$c^2 = a^2(1+m^2)$	1
	K = ±(8x5) = ± 40	1
40	**Compulsory:** $\lim_{x \to 0} \frac{log(1+x^4)}{x^4} \times \frac{x^4}{tan^4 x}$	1
	$= \lim_{x \to 0} \frac{log(1+x^4)}{x^4} \times \frac{1}{\lim_{x \to 0} \frac{tan^4 x}{x^4}}$	1
	= 1 x$\frac{1}{1}$ =1 **Award full mark for alternate Method**	1

PART - IV

Answer all the questions. **7×5=35**

Note : 2* means award one mark for the formula.

Q. No.	Answer	Marks
41 (a)	(i) Technology matrix, $B = \begin{pmatrix} \frac{1}{5} & \frac{1}{4} \\ \frac{1}{4} & \frac{1}{3} \end{pmatrix}$ (or) $\begin{pmatrix} 0.2 & 0.25 \\ 0.25 & 0.33 \end{pmatrix}$	2
	(ii) $X = (I - B)^{-1}D$ $X = \frac{1}{\left(\frac{113}{240}\right)} \begin{pmatrix} \frac{2}{3} & \frac{1}{4} \\ \frac{1}{4} & \frac{4}{5} \end{pmatrix} \begin{pmatrix} 23 \\ 3 \end{pmatrix} (or)\ X = \frac{1}{0.4708} \begin{pmatrix} 0.667 & 0.25 \\ 0.25 & 0.8 \end{pmatrix} \begin{pmatrix} 23 \\ 3 \end{pmatrix}$	2*
	$X = \begin{bmatrix} 34.16 \\ 17.31 \end{bmatrix}$ **(OR)**	1
41 (b)	$\frac{\partial q}{\partial p_1} = -2, \quad \frac{\partial q}{\partial p_2} = -6p_2,$	1
	$\frac{Eq}{Ep_1} = -\frac{p_1}{q}\left(\frac{\partial q}{\partial p_1}\right) = \frac{2p_1}{13 - 2p_1 - 3{p_2}^2}$ $\frac{Eq}{Ep_1} = \frac{-4}{3} = -1.33$	2*
	$\frac{Eq}{Ep_2} = -\frac{p_2}{q}\left(\frac{\partial q}{\partial p_2}\right) = \frac{6p_2^2}{13 - 2p_1 - 3p_2^2}$ $\frac{Eq}{Ep_2} = -8$	2*
42 (a)	$\mathrm{p}(\mathrm{B}_1) = \mathrm{p}(\mathrm{B}_2) = \mathrm{p}(\mathrm{B}_3) = \frac{1}{3} = 0.33$	1
	$\mathrm{p}\left(\mathrm{D}/\mathrm{B}_1\right) = \frac{1}{2}, \mathrm{p}\left(\mathrm{D}/\mathrm{B}_2\right) = \frac{1}{8}, \mathrm{p}\left(\mathrm{D}/\mathrm{B}_3\right) = \frac{3}{4}$	2
	$p\left(\frac{B_1}{D}\right) = \frac{4}{11} = 0.3636$ **(OR)**	2*

42 (b)	P(n) = 1 + 2+ 3 + . . . + n = $\frac{n(n+1)}{2}$	1
	$\therefore p(1)$ is true	1
	Let p(k) = 1 + 2 + 3 + . . . + k = $\frac{k(k+1)}{2}$ be true.	1
	P(k+1) = 1 + 2 + 3 + . . . + k + (k+1) = $\frac{(k+1)(k+2)}{2}$	1
	P(n) is true for all n ϵ N	1
43 (a)	a=4, h=6, b=9, g=-3, f= $-\frac{9}{2}$, c =2	1
	h^2- ab = 36 -36 =0	1
	$\therefore$ given lines are parallel straight lines	1
	The separate equationsare 2x + 3y -1 =0 , 2x + 3y -2 =0 **(OR)**	2
43 (b)	$Mean\ of\ X = \bar{X}$ =13, $Mean\ of\ Y = \bar{Y}$ =17	2
	$b_{yx} = 0.8, \quad b_{xy} = 0.45$	1
	$\gamma = \pm\sqrt{b_{xy} \times b_{yx}}$ $\gamma = 0.6$	2*
44 (a)	 **Any Two Lines(1 Mark)**	2

	<table><tr><th>Corner Points</th><th>$Z = 2x_1 + 5x_2$</th></tr><tr><td>O(0,0)</td><td>0</td></tr><tr><td>$A(7,0)$</td><td>14</td></tr><tr><td>$B(6,3)$</td><td>27</td></tr><tr><td>$C(4,5)$</td><td>33</td></tr><tr><td>$D(0,6)$</td><td>30</td></tr></table>	2
	$Z_{max} = 33\ at\ (4,5)$ **(OR)**	1
44 (b)	Constant term = T_{n+1} (or) r=n	1
	$T_{n+1} = (2n)C_n(x)^{2n-n}\left(\frac{1}{x}\right)^n$	2*
	$T_{n+1} = \frac{(2n)!}{n!\,n!}$	1
	$= \frac{1.3.5 \ldots (2n-1)2^n}{n!}$	1
45 (a)	$(cos\alpha + cos\beta)^2 = 4cos^2\left(\frac{\alpha+\beta}{2}\right)cos^2\left(\frac{\alpha-\beta}{2}\right)$	2*
	$(sin\alpha + sin\beta)^2 = 4sin^2\left(\frac{\alpha+\beta}{2}\right)cos^2\left(\frac{\alpha-\beta}{2}\right)$	2*
	$\therefore (cos\alpha + cos\beta)^2 + (sin\alpha + sin\beta)^2 = 4cos^2\left(\frac{\alpha-\beta}{2}\right)$ **(OR)**	1

45 (b)	(i) EOQ in units:- EOQ = $\sqrt{\frac{2RC_3}{C_1}} = \sqrt{\frac{2X800X5}{0.002}}$ =2000 units	1
	(ii) Minimum inventory cost :- $C_o = \sqrt{2RC_1C_3} = \sqrt{2X800X0.002X5}$ = ₹4	1
	(iii) EOQ in rupees:- 2000 X 0.002 = ₹ 40/-	1
	(iv) EOQ in year of supply:- $t_0 = \frac{q_0}{R} = \frac{2000}{800} = 2.5$	1
	(v) Number of orders per year:- $n_0 = \frac{R}{q_0} = \frac{800}{2000} = 0.4$	1
46 (a)	$m\log x + nlogy = (m+n)\log(x+y)$	1
	$m\left(\frac{1}{x}\right) + n\left(\frac{1}{y}\right)\left(\frac{dy}{dx}\right) = (m+n)\left(\frac{1}{x+y}\right)\left(1+\frac{dy}{dx}\right)$	2
	$\frac{dy}{dx}\left(\frac{nx-my}{y(x+y)}\right) = \left(\frac{nx-my}{x(x+y)}\right)$	1
	$\therefore \frac{dy}{dx} = \frac{y}{x}$ **Award full mark for alternate Method (OR)**	1
46 (b)	(i) Income from 12% stock = 4500 × $\frac{12}{100}$ = ₹ 540	1
	(ii) Selling price of 450 shares = 450 × 23 = ₹ 10350/-	1
	(iii) No. of Shares bought in 10% stock = $\frac{10350}{18}$ = 575	1
	(iv) Income from 10% stock = $\frac{575\ X25\ X10}{100}$ = ₹ 1437.50	1
	(v) ∴ Change in his income = ₹(1437.50 - 540) = ₹ 897.50	1

<table>
<tr><td>47 (a)</td><td>AB = $\begin{pmatrix}-1 & 7\\ -2 & -1\end{pmatrix}$</td><td>1</td></tr>
<tr><td></td><td>$(AB)^{-1} = \frac{1}{15}\begin{pmatrix}-1 & -7\\ 2 & -1\end{pmatrix}$</td><td>2*</td></tr>
<tr><td></td><td>$B^{-1}A^{-1} = \frac{1}{15}\begin{pmatrix}-1 & -7\\ 2 & -1\end{pmatrix}$</td><td>1</td></tr>
<tr><td></td><td>$\therefore (AB)^{-1} = B^{-1}A^{-1}$
(OR)</td><td>1</td></tr>
<tr><td>47 (b)</td><td><table><tr><th>Marks</th><th>No.of Students</th><th>Cum.freq</th></tr><tr><td>10</td><td>5</td><td>5</td></tr><tr><td>20</td><td>8</td><td>13</td></tr><tr><td>30</td><td>10</td><td>23</td></tr><tr><td>40</td><td>8</td><td>31</td></tr><tr><td>50</td><td>7</td><td>38</td></tr><tr><td>60</td><td>2</td><td>40</td></tr><tr><td colspan="3">N=$\sum f$ $= 40$</td></tr></table></td><td>1</td></tr>
<tr><td></td><td>Q_1= 20</td><td>1</td></tr>
<tr><td></td><td>Q_3= 40</td><td>1</td></tr>
<tr><td></td><td>Co-efficient of Q.D = $\frac{Q_3-Q_1}{Q_3+Q_1}$
= $\frac{20}{60}$
= 0.333</td><td>2*</td></tr>
</table>