FOUNDATION COURSE EXAMINATION

June 2016

P–4(FBMS)
Syllabus 2012

Fundamentals of Business Mathematics and Statistics

Time Allowed: 3 Hours

Full Marks: 100

The figures in the margin on the right side indicate full marks.
Notations and symbols used are as usual.

Section A

1. Answer *any two* questions: 5×2=10

(a) The difference between the compound interest and the simple interest on a sum put out for 2 years at 10% was ₹ 500. Find the sum.

(b) Simplify: $[\{(1-0.1)^{-1}-1\}^{-1}]^{-\frac{1}{2}}$.

(c) The average cost function (AC) for a certain commodity is given by $AC = 2q^2 - 36q + \frac{70}{q}$ in terms of output q. Find the value of q for which the marginal cost is a minimum.

2. Answer *any two* questions: 3×2=6

(a) In an A.P. the sum of first 16 terms is 80 and the 16th term is 20. Find the sum of first 26 terms.

(b) Solve for x : $(\log_{10} x)^2 - 5\log_{10} x = 2(1 - 2\log_{10} x)$.

(c) Find $A + A'$ where the matrix $A = \begin{bmatrix} 5 & 6 & -3 \\ 5 & 7 & 2 \\ -9 & 8 & 11 \end{bmatrix}$, and A' is the transpose of A.

3. Choose the correct answer: 1×5=5

(a) What number is to be added to each term of the ratio 7 : 9 to equal 15 : 16?

(i) 23 (ii) 16 (iii) 31 (iv) 13.

(b) If $x \propto y$ and $x = 2$, then $y = 4$, when $x = 3$, the value of y is

(i) $\frac{1}{6}$ (ii) $\frac{1}{2}$ (iii) 6 (iv) 2.

(c) If ${}^5C_r = {}^5C_{r+1}$, then ${}^rC_2$ is

(i) 1 (ii) 2 (iii) 0 (iv) 3.

(d) If $f(x+1) = 3x - 4$, then $f(x)$ is

(i) $3x + 2$ (ii) $3x - 7$ (iii) $4x - 3$ (iv) $3x - 1$

(e) If $\int_1^2 k dx = 4$, (where k is a constant), then the value of k is

(i) 4 (ii) 2 (iii) 0 (iv) – 3

4. Fill in the blanks: 1×5=5

(a) The range of x for which the function $3x^3 - 9x$ is a decreasing function of x is _____.

(b) If $A = \begin{bmatrix} 1 & 2 \\ 3 & 2 \end{bmatrix}$, then determinant of A is _____.

(c) If $y = e^{2\log x}$, then $\frac{dy}{dx}$ is _____.

(d) If the sum of the roots of the quadratic equation $(m+1)x^2 + 2mx + 1 = 0$ be 1, then the value of m is _____.

(e) The ninth term of the sequence 1, 3, 9, 27, 81, ... is _____.

5. State whether the following statements are true (T) or false (F): 1×5=5

(a) $(1 + 2 + 3 + \cdots + n)^2 = 1^3 + 2^3 + 3^3 + \cdots + n^3$.

(b) The null set is a subset of every set.

(c) If a function is continuous at $x = 1$, then $\lim_{x\to 1} f(x) \neq f(1)$.

(d) $\frac{d}{dx}$ of a constant function is zero.

(e) The value of 2° is 2.

6. Match the following: 1×5=5

(a) If the matrix $\begin{bmatrix} 2 & 3 \\ -4 & -k \end{bmatrix}$ be singular the value of k is	(i) $\frac{3}{2}$
(b) if ${}^nP_2 = 20$, the value of n is	(ii) 4
(c) The third term of the expansion $\left(\frac{2x}{3} - \frac{3}{4x}\right)^4$ is	(iii) 6
(d) If $n(A) = 15, n(B) = 20$ and $n(A \cup B) = 22$, then $n(A \cap B)$ is	(iv) 5
(e) $\int_0^2 x^3 dx =$	(v) 13

7. Answer the following in one or two steps: 1×4=4

(a) Using truth table show that $(p \vee q) \vee \sim p$ is a tautology.

(b) Draw a Venn diagram for three non-empty sets A, B and C, satisfying the properties:

$A \subset (B \cap C), B \subset C, C \neq B, C \neq A.$

(c) Solve for $x : 3x - 4 < 8x + 6.$

(d) If $u = x^2 - 2xy + y^2$, then $\frac{\partial^2 u}{\partial y \partial x} = ?$

Section B

8. Choose the correct answer (*any nine*): 2×9=18

(a) OGIVE is the

(i) Frequency curve

(ii) Frequency polygon

(iii) Cumulative frequency polygon

(iv) Histogram

(b) Pie chart is also called

(i) Multiple bar diagram

(ii) Circular diagram

(iii) Line chart

(iv) Simple bar diagram

(c) The Arithmetic Mean of three numbers 1, 2 and 4 is

(i) $(1 \times 2 \times 4)^{1/3} = 2$

(ii) $1 \times 2 \times 4 = 8$

(iii) $\frac{3}{1+\frac{1}{2}+\frac{1}{4}} = \frac{12}{7}$

(iv) $\frac{1+2+4}{3} = 2\frac{1}{3}$

(d) The variance of the observations $x_1, x_2, \cdots, x_n$ is

(i) $\sum_{i=1}^{n}(x_i - \bar{x})^2$

(ii) $\sum_{i=1}^{n} \frac{x_i^2 - \bar{x}^2}{n}$

(iii) $\frac{1}{n}\sum_{i=1}^{n} x_i^2 - \bar{x}^2$

(iv) $\left[n \sum_{i=1}^{n} x_i^2 - \bar{x}^2\right]/n$

(e) The Arithmetic Mean of $1, 2, 2^2, \cdots, 2^9$ is

(i) 102·4

(ii) 102·3

(iii) 1024

(iv) 51·1

(f) The Geometric Mean of 4, 6, 9 with weights 1, 2, 1 respectively is

(i) 4

(ii) 8

(iii) 6

(iv) 3

(g) If $Q_1 = 26$, $Q_2 = 46$ and $Q_3 = 76$, the value of the Quartile Deviation is

(i) 50

(ii) 20

(iii) 30

(iv) 25

(h) For two mutually exclusive events A and B if $\mathrm{P}(A) = \frac{1}{2}$ and $\mathrm{P}(A \cup B) = \frac{2}{3}$, then $\mathrm{P}(B)$ is

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

(ii) $\frac{1}{6}$

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

(iv) $\frac{1}{5}$

(i) For a binomial distribution $b\ (n, p)$ if mean and variance are 9 and 6 respectively, then the value of n is

(i) 24

(ii) 21

(iii) 27

(iv) 18

(j) If the regression coefficients are $b_{xy} = -0.2$ and $b_{yx} = -0.8$, then the correlation coefficient is

(i) 0·2

(ii) ±0·4

(iii) −0·4

(iv) +0·4

(k)

Commodity	Base price (in ₹)	Base quantity (in kg.)	Current price (in ₹)	Current quantity (in kg.)
A	2	1	7	2
B	4	2	6	3
C	3	3	5	4
D	1	4	3	5

Laspeyre's Price Index is

(i) 200

(ii) 2

(iii) 50

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

9. Answer *any nine* questions: 2×9=18

(a) The Geometric Mean of 4, 6 and p is 6. Find the value of p.

(b) Using empirical relation between mean, median and mode find the mode when mean = 12 and median = 11.

(c) For two observations AM =25 and GM=15. Find HM.

(d) If s.d. of x is 5, find s.d. of y=3x–10.

(e) If $2x - y + 1 = 0$ and $x - 2y + 1 = 0$ be two regression equations, find the value of y when x=5.

(f) For two independent events A and B, if $P(A \cup B) = \frac{7}{12}$ and $P(A) = \frac{1}{3}$ find $P(B)$.

(g) For a Poisson variable X, $P(X = 0) = P(X = 1)$. Find the mean of X.

(h) For a binomial distribution with n=6 and p, the mean is 2. Find $P(X = 0)$.

(i) Find the 3-year moving averages of the following data:

Year	2008	2009	2010	2011	2012
Value	3	5	7	9	11

(j) The algebraic sum of deviations from 45 of 25 observations is –55. Find the arithmetic mean of the observations.

(k) If $P(A) = \frac{2}{3}$, $P(B) = \frac{3}{4}$ and $P(A \cup B) = \frac{5}{7}$, then find the conditional probability $P(A/B)$.

10. Answer *any four* questions: 6×4=24

(a) Consider the frequency distribution of daily sales (in'00 ₹) of a shop for 685 days with some missing frequencies.

Class	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80
Frequency	185	*	34	180	136	*	50

If the median of the distribution is 42·6, find out the missing frequencies.

(b) The following frequency distribution shows the height (in cm) of 90 students of a college selected at random:

Class	140·5 –145·5	145·5 – 150·5	150·5 – 155·5	155·5 – 160·5	160·5 – 165·5	165·5 – 170·5	170·5 – 175·5
Cumulative Frequency	7	16	31	54	75	85	90

Calculate first and third quartiles and hence calculate the quartile deviation.

(c) Three identical urns contain respectively 5 white and 3 black, 6 white and 2 black, and 3 white and 5 black balls. One urn is chosen at random and a ball is drawn from it.

(i) What is the probability that the ball is white?

(ii) Given that the ball is white, find the probability that it came from the third urn.

(d) You are given the following data:

Variable	Arithmetic mean	Standard deviation	Correlation coefficient
x	20	5	0·6
y	25	4	

Find the regression equations y on x and x on y. Estimate y when $x = 25$.

(e) Fit a linear trend to the following data by least squares method and estimate exports for the year 2016:

Year	2007	2008	2009	2010	2011	2012	2013
Exports (in tons)	50	53	56	68	65	67	75