

- N.B. (1) Attempt any five questions.  
 (2) All questions carry equal marks.  
 (3) Statistical tables and graph papers will be supplied on request.  
 (4) Use of non-programmable calculator is allowed.

Q.1 (a) Find mean, mode and standard deviation for the data given below and hence

Calculate Karl Pearson's correlation coefficient.

Age(yrs)	20-28	28-36	36-44	44-52	52-60
Employees	18	25	10	5	2

(b) Find combined standard deviation and also find which group is more consistent in weight.

	No.	Mean Weight	S.D. of wt.
Boys	55	61	8
Girls	45	51	6

Q.2 (a) The credit earned by 8 students in sports and extra-curricular activities is as follows. Calculate Spearman's Rank correlation coefficient.

Student no.	1	2	3	4	5	6	7	8
Credit in Sports	85	85	70	60	60	73	68	65
Credit in Extra-curricular	85	92	81	63	63	89	85	63

(b) Given the following information

	Production(X)	Rainfall(Y)
Mean	10 units	8 cms
Standard Deviation	8 units	2 cms

[ TURN OVER

The coefficient of correlation between production and rainfall is 0.5. Estimate the most probable yield when rainfall is 9 cms and also estimate the most probable rainfall if yield is 12 units.

Q.3.(a) If a fair coin is tossed 10 times find the probability of getting exactly 6 heads.

(b) If 5% of electric bulbs manufactured by a company are defective, use Poisson distribution to find the probability that in a sample of 100 bulbs, at least one bulb will be defective. (Given  $e^{-5} = 0.007$ )

(c) The weights of 4000 students are found to be normally distributed with mean 50 kg and standard deviation 5 kg. Find the number of students with weights between 45 and 60 kg.

(Area between  $z=0$  and  $z=1$  is 0.3413 and the area between  $z=0$  and  $z=2$  is 0.4772)

Q.4 (a) Test made on breaking strength of 10 pieces of a metal wire gave the following results.

568,578,572,570,572,570,570,572,596,584, in kgs. Test if the breaking strength of the metal wire can be assumed to be 577kg in population?

(b) A wholesaler in apples claims that only 5% of the apples supplied by him are defective. A random sample of 400 apples contained 30 defective apples. Test the claim of the wholesaler.

Q. 5 (a) Following table indicated number of students passed and failed in 3 subjects.

	Subject-1	Subject-2	Subject-3	Total
Passed	50	60	80	190
Failed	10	20	30	60
Total	60	80	110	250

Is this evidence convincing that there is a relationship between the result and the subject?

[Given at 5% l.o.s., d.f.=2, chi square statistic is 5.99]

(b) An attempt was made to check whether there is any effect on marks after listening to music. Students were given similar test papers before and after listening to music. Following numbers indicate the changes in marks of 12 students after listening to music

5, 2, 8, -1, 3, 0, 6, -2, 1, 5, 0, 4.

Can it be concluded that listening to music will be in general accompanied by an increase in marks.

Q.6. From the data given below, set up table of variance analysis and find out if the mean of the various samples differ significantly among themselves.

Sample-1	11	15	14	10	15
Sample-2	16	18	12	17	17
Sample-3	13	19	17	9	7
Sample-4	14	10	11	19	16

Q.7.(a) Explain different types of control charts with their utilization.

(b) The following table gives the number of runs scored by a player during 10 test matches. Find whether the number of runs are uniformly distributed or not?

Test match	1	2	3	4	5	6	7	8	9	10
runs	8	8	10	9	12	8	10	14	10	11

Q.8 Write short notes on any Four:

- 1) Merits and Demerits of measures of dispersion.
  - 2) Skewness and Kurtosis
  - 3) Type-1 and Type-2 errors.
  - 4) Properties of normal distribution
  - 5) Components of time series.
  - 6) Requirements of good measure of central tendency.
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# Basics of Operations Research

## Paper-V,

(3 Hours)

[Total Marks]

May 2013  
22  
(3)  
StudentBounty.com

- N.B. :** (1) Attempt any **five** questions.  
 (2) **All** questions carry **equal** marks.  
 (3) **Figures** to the **right** indicate marks to a question/sub-question.  
 (4) Use of handheld, non-programmable scientific calculator is **allowed**.

1. (a) A section of a truck pipe line is due for repairs. The section can be repaired at a cost of ₹ 10,000 which will last for 3 years. Alternatively the section can be replaced by a new one at a cost of ₹ 30,000 which will last for ten years. Assuming the cost of capital to be 10% and ignoring the salvage value, what course should be adopted in the above situation ? 10
- (b) For an item having annual demand of 1200 units costing ₹ 3 each, suppose a discount of 2% is offered if the requirement for the entire year is bought in one go. If the actual cost of ordering is ₹ 5 and inventory carrying cost incurred by the company is 10%, find whether the offer is worth going for ? 10
2. (a) An equipment costs ₹ 46,000 and its effective life is estimated to be 10 years. A sinking fund is created for replacing the equipment at the end of its effective life when its scrap realises a sum of ₹ 6,000 only. Calculate the amount which should be provided every year. For the sinking fund, if it accumulates at compound interest 7% per annum. 10
- (b) Determine the optimal sequence of jobs that minimises the total elapsed time based on the following information. Processing Time on machines is given in hours and passing is not allowed : 10

Job	Machine $M_1$	Machine $M_2$	Machine $M_3$
A	3	4	6
B	8	3	7
C	7	2	5
D	4	5	11
E	9	1	5
F	8	4	6
G	7	3	12

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3. (a) There are five jobs, each of which must go through the two machines A and B in the order AB. Processing times are given below :

Job	Time For A	Time For B
1	5	2
2	1	6
3	9	7
4	3	8
5	10	4

Determine a sequence for five jobs that will minimise the elapsed time T. Calculate the total idle time for the machines in this period.

- (b) The data collected in running a machine, the cost of which is ₹ 60,000 is given below : 10

Year	Resale Value ₹	Cost of Spares ₹	Cost of Labour ₹
1	42,000	4,000	14,000
2	30,000	4,270	16,000
3	20,400	4,880	18,000
4	14,400	5,700	21,000
5	9,650	6,800	25,000

Determine the optimum period of replacement of the machine.

4. (a) Suppose the required values for ordering cost and holding rate in some firm are ₹ 30 and 16% respectively, but the firm actually uses ₹ 15 and 16% for them. Assess its impact on TVC. 10
- (b) A panel of judges A and B graded seven debators and independently awarded the following marks. 10

Debator	1	2	3	4	5	6	7
Marks by A	40	34	28	30	44	38	31
Marks by B	32	39	26	30	38	34	28

An eighth debator was awarded 36 marks by the judge A while the judge B was not present. If the judge B were also present, how many marks would you expect him to award to the eighth debator assuming that the same degree of relationship exists in their judgement ?



5. Monthwise Demand during August 2012 to June, 2013 of a particular item is as given below

Month	Actual Demand No. of Units
August '12	2100
September '12	1450
October '12	2050
November '12	2075
December '12	3200
January '13	1850
February '13	1650
March '13	1400
April '13	2300
May '13	2870
June '13	2450

- (a) Forecast Demand for July '13 by taking  $\alpha = 0.1, 0.5$  and  $0.9$   
 (b) Compute M.A.D. and M.S.E. in each case and comment on the selection of  $\alpha$ .
6. A wholesaler stocks an item for which demand is uncertain. He wishes to assess two re-ordering policies i.e. order 10 units at a re-order level of 10 units or order 15 units at a re-order level of 15 units, to see which is the most economical over a 10 day period. The following information is given :

Demand per day (units)	4	5	6	7	8
Probability	0.1,	0.15,	0.25,	0.30,	0.20

Carrying Cost is ₹ 15 per unit per day, ordering cost is ₹ 50 per order. Loss of goodwill cost for each unit out of stock is ₹ 30, lead time is 3 days and opening stock is of 17 units.

The probability distribution is to be based on the following random numbers :

41, 92, 05, 44, 66, 07, 00, 00, 14, 62, 20, 07, 95, 15, 79, 95, 64, 26, 06, 48.

The re-order level is physical stock plus any replenishment orders outstanding.

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7. The following failure rates have been observed for a certain type of transistors in a digital computer :

End of the week	1	2	3	4	5	6	7	8
Probability of failure to date	0.05,	0.13,	0.025,	0.43,	0.68,	0.88,	0.96,	1.00

The cost of replacing an individual failed transistor is ₹ 1.25. The decision is made to replace all these transistors simultaneously at fixed intervals and to replace the individual transistors as they fail in service. If the cost of group replacement is 30 paise per transistor, what is the best interval between group replacement ? At what group replacement price per transistor would a policy of strictly individual replacement become preferable to the adopted policy ?

8. Attempt any **two** of the following :—

20

- What are the Advantages and Disadvantages of holding inventory ?
- Explain any two areas of application of Simulation.
- What is Heuristic Programming ? Explain with an example.
- What are the assumptions of Job sequencing ?

# Business Mathematics,

D : PH (April Exam) 133

Con. 7352-13.

(3 Hours)

[ Total Marks ]

- N.B.** (1) Attempt any **five** questions.  
 (2) **Figures to the right** indicate marks.  
 (3) Graph paper will be supplied on **request**.  
 (4) Use of scientific, non-programmable calculator is **allowed**.

1. (a) Solve the equation – 10  
 $4x^3 - 24x^2 + 23x + 18 = 0$   
 given that the roots are in Arithmetic progression.

- (b) Solve – 10  
 $\sqrt{2x+1} + \sqrt{3x+4} = 7$

2. (a) If the value of a car depreciated by 25 per cent annually, what will be its estimated value at the end of 8 years if its present value is ₹ 2,048 ? 10

- (b) Find the sum of the following series : 10  
 $\frac{1}{2} + \frac{1}{3^2} + \frac{1}{2^3} + \frac{1}{3^4} + \frac{1}{2^5} + \frac{1}{3^6} + \dots \infty$

3. (a) Express – 10

$$\begin{vmatrix} (a-x)^2 & (b-x)^2 & (c-x)^2 \\ (a-y)^2 & (b-y)^2 & (c-y)^2 \\ (a-z)^2 & (b-z)^2 & (c-z)^2 \end{vmatrix}$$

as a product of **two** determinants and prove that the value of the determinant is –  
 $2(b-c)(c-a)(a-b)(y-z)(z-x)(x-y)$

- (b) Obtain the characteristic equation of the matrix – 10

$$A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$$

Hence or otherwise calculate its inverse.

4. (a) Evaluate  $\int \frac{x+2}{(x^2+3x+2)\sqrt{x+1}} dx$ . 10

- (b) If  $u = \frac{1}{\sqrt{x^2+y^2+z^2}}$  show that : 10

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} = 0$$



5. (a) Five men in a company of 20 are graduate. If 3 men are picked out of the 20 at random, what is the probability that they are all graduates ?
- (b) In a bolt factory, machine A, B and C manufacture respectively 25%, 35% and 40% of the total of their output 5, 4, 2 percent are defective bolts. A bolt is drawn at random from the product and is found to be defective. What are probabilities that it was manufactured by machines A, B and C ?

6. (a) A box with a square base is to be made from a square piece of cardboard 24 cms on a side by cutting out a square from each corner and turning up the sides. Find the dimensions of the box that yield maximum volume. 10
- (b) Show that the rate of change of marginal utility of commodity with respect to  $y$  is equal to the rate of change of marginal utility of  $y$  with respect to  $x$ , where utility function is given by :— 10

$$U = 3x^2 y^2 + y^2$$

7. (a) A Radio manufacture produces  $x$  sets per week at a total cost ₹  $(x^2 + 78x + 2500)$ . 10

He is a monopolist and the demand function for his product is  $x = \frac{600 - p}{8}$  when the price is ₹  $p$  per set. Show that maximum revenue is obtained when 29 sets are produced per week.

- (b) The Average Cost function (AC) for a commodity is given by  $AC = x + 5 + \frac{36}{x}$  10
- in terms of the output  $x$ . Find the output for which AC is increasing and the outputs for which AC is decreasing, with increasing output. Also find the Total Cost  $C$  and the Marginal Cost (MC) as function of  $x$ .

8. (a) Find the Equilibrium price given  $D = \frac{8p}{p - 2}$  and  $S = p^2$  10

- (b) If  $y = x^{x^{x^{\dots \infty}}}$  prove that : 10

$$x \frac{dy}{dx} = \frac{y^2}{1 - y \log x}$$

- N.B.** (1) In **Section I**, Question No. 1 is **compulsory**. Attempt any **two** questions from remaining **four** questions in **Section I**.  
 (2) In **Section II**, Question No. 6 is **compulsory**. Attempt any **two** questions from remaining **four** questions in **Section II**.  
 (3) **Figures** to the **right** indicate marks.  
 (4) Answers to **both** the **sections** to be written in the **same** answer book.  
 (5) Use a **fresh page** for answering **fresh question**.  
 (6) Use of calculators is **permitted**.

**Section I — (Marks : 50)**

1. (a) Define the following terms :— 6
  - (i) Consumption
  - (ii) Distribution
  - (iii) Optimization.
- (b) Distinguish between following pairs of terms :— 6
  - (i) Duopoly Vs. Oligopoly
  - (ii) Contribution Ratio Vs. Variable Cost Ratio
  - (iii) Break Even Ratio Analysis Vs. CVP Analysis.
- (c) As per the data supplied by the Accounts Department, the fixed costs of firm Harshad Ltd. are ₹ 28,000 per year and the unit variable cost is ₹ 3.00. The unit selling price of a product is ₹ 10. At what level of output does the firm break even ? What are the break-even-sales ? If the firm produces 3,000 units of product, what will be the firm's annual profit ? What is the profit at Break-Even-Point ? Tabulate the results. 6
2. (a) What is difference between Economics and Managerial Economics ? Explain chief characteristics of Managerial Economics. 8
- (b) What are various methods of Managerial Economics ? 4
- (c) Managerial Economics and Accountancy inter-relationship. 4
3. (a) Define the term Market Demand. What is the Law of Demand ? Discuss the chief characteristics of the Law of Demand. Explain various types of Demand. 8
- (b) What is Price Elasticity of Demand ? Differentiate between Unit Elasticity of Demand and Inelastic Demand. Give examples of these in business showing them graphically. 8
4. (a) Define Production function. What is meant by factors of Production ? How are they of significance in Managerial Economics and Accounting ? Give illustrations. 8
- (b) What is the concept of 'Economies of Scale' ? What is the impact of such scale on business performance ? Explain with the help of practical illustration. 8
5. (a) Explain the meaning, concept and relevance of cost in any business function. Differentiate between — 8
  - (i) Controllable and Un-controllable cost
  - (ii) Escapable and Inescapable cost
  - (iii) Incremental and Sunk cost
  - (iv) Money cost and Opportunity cost.

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(b) Explain following types of cost with the help of Diagrammatic Representation as applied to any business situation :—

- (i) Variable cost
- (ii) Fixed cost
- (iii) Stepped variable cost
- (iv) Total cost.

### Section II — (Marks : 50)

6. (a) Define the following terms :—

6

- (i) Monopsony
- (ii) Weighted cost of capital
- (iii) Margin of safety.

Give appropriate example for each.

(b) What is the concept of Depreciation of machine ? What are the various methods employed in computing Depreciation of a machine ?

6

Calculate the annual depreciation charge of a machine on the basis of following details :—

Cost of machine	: ₹ 2000
Scrap value	: ₹ 300
Life of machine	: 30,000 hours
Annual usage of machine	: 3000 hours

(c) Calculate the Net Present Value of the project with following relevant data :

6

Life of a project	: 3 years
Initial investment	: ₹ 1,00,000
Capitalisation rate	: 10%
Annual cash-in-flows at the end of 1st, 2nd and 3rd year are respectively	: ₹ 30,000, ₹ 40,000, ₹ 45,000

7. (a) Discuss following aspects of Profit Management :—

8

- (i) Profit Policies
- (ii) Profit Planning and
- (iii) Profit Control.

(b) Explain following Theories of Profits :—

8

- (i) The Rent Theory
- (ii) Innovative Theory of Profit
- (iii) Risk Theory (Hawley's theory) of Profit.

8. (a) "Pricing the product or service is the key decision in marketing it," explain determinants of price with a suitable illustrative example.

8

(b) Define the terms : (i) Market (ii) Marketing (iii) Selling.  
How markets are classified on various bases ?

8

9. (a) Define 'Price Leadership'. What are its characteristic features and advantages ?

8

(b) What is meant by Homogeneous and Heterogeneous Oligopsony ? What are its main features ? Give suitable examples.

8

10. (a) Define Capital Budgeting. What are its need and nature in business ? Discuss various types of Capital Budgets.

8

(b) Determine cost of equity capital of Meghna Co. based on following details :—

8

Market Price per Share ₹ 200, Cost of issue 7.5%, Earning per Share ₹ 23.16.  
What will be the 'Before Tax Cost' ? Tax rate is 35%.