

### 3 (Sem-5) ECO M 2 (Arts/Sc)

2 0 1 4

## ECONOMICS

( Major )

Paper : 5.2

Full Marks : 60

Time : 3 hours

*The figures in the margin indicate full marks  
for the questions*

( For Arts Stream )

( **Basic Statistics** )

1. (a) Choose the correct answer : 1×3=3

(i) If  $x$  and  $y$  are two random variables, there can be at most — (one / two / three) regression line(s).

(ii) If  $P(A) = P(B)$ , then the two events  $A$  and  $B$  are — (independent / dependent / equally likely).

(iii) The relation among arithmetic mean, geometric mean and harmonic mean is — (AM>GM>HM / AM>HM>GM / AM=HM=GM / HM>GM>AM).

(b) State whether the following statements are *True* or *False* : 1×4=4

(i) The algebraic sum of deviations taken from any central value is always zero.

(ii) If each observation of a set is divided by 2, then the mean of the new set will be same as the original mean.

(iii) A high degree of correlation means that the cause and effect relationship exists between the two correlated variables.

(iv) In normal distribution, mean = median = mode.

2. Answer the following questions : 2×4=8

(a) If the mean is 5 and the median is 6, calculate the mode.

(b) It is given that  $P(A) = 0.40$  and  $P(B) = 0.35$ . If the events are independent, calculate  $P(A \cup B)$ .

(c) What do you understand by mean deviation?

(d) For a distribution, the coefficient of variation is 22.5% and the value of the arithmetic mean is 7.5. Find the value of the standard deviation.

3. Answer the following questions (any three) :

5×3=15

(a) What do you mean by regression? Why are there two regression lines in case of a bivariate series? 2+3=5

(b) A bag contains 3 red, 6 white and 7 blue balls. Two balls are drawn at random. What is the probability that out of 2 balls, one is red and other is blue? 5

(c) Explain why standard deviation is regarded superior to other means of dispersion. 5

(d) Show that Karl Pearson's coefficient of correlation is independent of the change of origin and scale of the concerned variables. 5

- (e) In a test series involving India, Virat Kohli and Rohit Sharma made the following scores :

Players	1st Test		2nd Test		3rd Test	
	1st Innings	2nd Innings	1st Innings	2nd Innings	1st Innings	2nd Innings
Virat Kohli	34	7	26	201	56	12
Rohit Sharma	67	35	42	39	47	51

Identify the better and the more consistent batsman in the series. 5

4. Answer the following questions (any three) :

$$10 \times 3 = 30$$

- (a) What are the requisites for an 'ideal' measure of central tendency? Calculate the mean and standard deviation of the following frequency distribution of marks in a class :  $4+6=10$

Marks	:	0-10	10-20	20-30	30-40	40-50	50-60	60-70
No. of Students	:	4	13	18	30	15	12	8

- (b) (i) When are two variables said to be correlated? Distinguish between linear and non-linear correlations.

(ii) In trying to evaluate the effectiveness in its advertisement expenditure, a firm compiled the following information :

Year	2003	2004	2005	2006	2007	2008	2009	2010
Advertisement Expenditure (₹ in '000)	12	15	15	23	24	38	42	48
Sales (₹ in lakh)	5.0	5.6	5.8	7.0	7.2	8.8	9.2	9.5

Estimate the regression equation of sales on advertising expenditure. Also estimate the likely sales when advertising expenditure is ₹ 60,000.

$$4+6=10$$

(c) (i) Distinguish between absolute and relative measures of dispersion. In what situation relative measures are used?

(ii) A survey of domestic consumption of electricity gave the following distribution of units consumed :

No. of Units	: Below 100	100-200	200-300	300-400
No. of Consumers	: 9	18	27	32
No. of Units	: 400-500	500-600	600-700	700 and above
No. of Consumers	: 45	38	20	11

Compute the quartile deviation and its coefficient.

$$4+6=10$$

- (d) What do you understand by binomial distribution? What are its main features? For a binomial distribution, mean = 7 and variance = 11. Give your comment whether the statement is right or wrong.

$$3+4+3=10$$

- (e) (i) State and prove the multiplicative law of probability.

- (ii) For events  $A$  and  $B$ , if  $P(A) = \frac{1}{4}$ ,  $P(B) = \frac{2}{5}$ ,  $P(A \cup B) = \frac{1}{2}$ , then find  $P(A \cap B)$  and  $P(B/A)$ .

$$4+6=10$$

- (f) What do you mean by normal distribution? Write different properties and importance of normal distribution.

$$2+5+3=10$$

( For Science Stream )

**( Elementary Econometrics )**

5. Answer the following questions : 1×7=7

- (a) Define degrees of freedom.
- (b) State the general relationship between consumption  $C$  and disposable income  $Y$  in stochastic form.
- (c) Name the error of accepting a false hypothesis.
- (d) Mention one test that is used for testing small samples.
- (e) How is 'bias' defined in econometrics?
- (f) Which variables are known as 'controlled variables'?
- (g) Name the problem that arises in the estimation of a linear regression model when the assumption of  $E(u_i^2) = \sigma^2$  is violated.

6. Answer the following questions (any four) :

2×4=8

(a) Distinguish between 'estimate' and 'estimator'.

(b) Comment on the following :

For a binomial distribution, mean = 7  
and variance = 11.

(c) Write two measures of 'goodness of fit'.

(d) If a random variable  $X$  follows the Poisson distribution pattern such that  $P(X = 1) = P(X = 2)$ , find the mean of the distribution.

(e) What are the critical values of  $Z$  at 1% and 5% levels of significance for a two-tailed normal test?

(f) How do you interpret the 'intercept term' in a two-variable linear regression model?

7. Answer the following questions (any three) :

5×3=15

(a) In a two-variable linear regression model, show how the sum of the squares is decomposed to obtain the coefficient of determination. 5

(b) Given  $r_{12} = 0.65$ ,  $r_{13} = 0.60$  and  $r_{23} = 0.90$ , calculate the value of the partial correlation coefficient  $r_{12.3}$ . 5

(c) Outline the principle of maximum likelihood method of estimation. 5

(d) What are the criteria for a good estimator? Show that the sample mean based on a simple random sample with replacement is an unbiased estimator of the population mean. 2+3=5

(e) State the assumptions of the three-variable linear regression model

$$Y_i = b_0 + b_1 X_{1i} + b_2 X_{2i} + u_i$$

Interpret the meaning of  $b_0$ ,  $b_1$  and  $b_2$ .

2+3=5

8. Answer the following questions (any three) :

10×3=30

(a) The intelligent quotients (IQs) of 16 students from one area of a city showed a mean of 107 and a standard deviation of 10, while the IQs of 14 students from another area of the city showed a mean of 112 and a standard deviation of 8. Is there a significant difference between the IQs of the two groups at significant level of (i) 0.01 and (ii) 0.05?

[ $t_{0.01} = 2.76$  for 28 degrees of freedom (d.f.) and  $t_{0.05} = 2.05$  for 28 d.f.] 10

(b) Prove that ordinary least squares estimators are Best Linear Unbiased Estimators (BLUE). 10

(c) Discuss the problems associated with violation of classical least squares assumptions. 10

(d) A die is thrown 60 times with the following results :

Face	:	1	2	3	4	5	6	Total
Frequency	:	6	10	8	13	11	12	60

Are the data consistent with the hypothesis that the die is unbiased?

[ $\chi_{0.01}^2 = 15.09$  for 5 d.f.] 10

- (e) What is probability density function? Define normal distribution and the standard normal distribution. The average marks in a particular class is 79. The standard deviation is 5. If the marks are distributed normally, how many students in a class of 200 did not receive marks between 75 and 82?

$$[ P \leq Z \leq 0.8 = 0.2881$$

$$P \leq Z \leq 0.6 = 0.2257$$

where  $Z$  is a standard normal variate ]

$$2+3+5=10$$

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