

No. **24002****GENERAL ENGLISH****( Essay/Précis Writing and Draft )**

Marks : 100

Time : 2 hours

1. Write an essay within 1500 words on any one of the following topics : 40

- (a) Too many politicians : too few statesmen!
- (b) Tolerance is the key to national unity
- (c) The pleasures of gardening
- (d) Books in an age of audio-visual entertainment

2. Write a précis of the following passage and give a suitable title : 25+5=30

There is an enemy beneath our feet—an enemy more deadly for his complete impartiality. He recognizes no national boundaries, and no political parties. Everyone in the world is threatened by him. The enemy is the Earth itself. When an earthquake strikes, the world trembles. The power of a quake is greater than anything man himself can produce.

But today scientists are directing a great deal of their effort into finding some way of combating earthquakes and, perhaps at some time shortly, mankind will have discovered a means of protecting itself from earthquakes. An earthquake strikes without warning. When it does, its power is immense. If it strikes a modern city, the damage it causes is as great as if it has struck a primitive village. Gas mains burst, explosions are caused and fires are started. Underground railways are wrecked. Buildings collapse, bridges fall, dams burst and gaping crevices appear in busy streets.

If the quake strikes at sea, huge tidal waves sweep inland. If it strikes mountain regions, avalanches roar down into the valley. Consider the terrifying statistics from the past, 1755 : Lisbon, capital of Portugal—the city was destroyed entirely and 450 killed. 1970 : Peru—50,000 killed. In 1968, an earthquake struck Alaska. As this is a relatively unpopulated part, only a few people were killed. But this likely was one of the most powerful quakes ever to have hit the world.

Geologists estimate that during the tremors, the whole of the state moved over 80 feet farther west into the Pacific Ocean. Imagine the power of something that can move an entire subcontinent! This is the problem that scientists face. They are dealing with forces so immense that man cannot hope to resist them. All that can be done is to try to pinpoint just where the earthquake will strike and work from there. At least some precautionary measures can then be taken to save lives and some property.

( 322 words )

3. As a concerned resident of your city, draft a letter to the CEO of the Municipal Board to complain about the menace of stray dogs in your neighbourhood.

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**STATISTICS**

Marks : 100

Time : 2 hours

Answer any **ten** questions

1. (a) Define an unbiased estimator of the population parameter  $\theta$ . Give an example to show that unbiased estimator is not unique. 5
- (b) Let  $X_1, X_2, \dots, X_n$  be a random sample from  $U(\theta_1, \theta_2)$ . Find the maximum likelihood estimators of  $\theta_1$  and  $\theta_2$ . 5
2. (a) Explain what is Transportation Problem. Differentiate between balanced and unbalanced Transportation Problem. 6
- (b) In a factory, there are six machines (of same type) and five workers. The handling costs for the  $i$ th worker ( $i=1, 2, \dots, 5$ ) to handle the  $j$ th machine ( $j=1, 2, \dots, 6$ ) are given below in the form of a matrix. Find the optimal assignment and the minimum cost of handling the machines and find which machine will remain unused. 4

	$M_1$	$M_2$	$M_3$	$M_4$	$M_5$	$M_6$
$W_1$	12	8	10	14	11	18
$W_2$	14	14	8	15	17	12
$W_3$	9	11	13	15	6	12
$W_4$	11	9	9	11	8	14
$W_5$	10	12	15	13	10	12

3. (a) State and prove Bayes' theorem. 6
- (b) Three urns are there containing white and black balls. First urn has 3 white and 2 black balls, second urn has 2 white and 3 black balls and third urn has 4 white and 1 black ball. Without any biasing one urn is chosen and from that one ball is chosen randomly which was white. What is the probability that it came from the third urn? 4

4. (a) Complete the following analysis of variance table of a design and examine whether there is a significant difference between treatments at 5% level of significance :

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Sources of variation	Degrees of freedom	Sum of squares	Mean sum of squares	Variance ratio
Blocks	—	21	4.2	—
Treatments	—	—	5.0	—
Error	15	12	—	—
Total	—	—	—	—

Given that

$$F_{0.05}(3, 15) = 8.70$$

$$F_{0.05}(5, 15) = 4.62$$

- (b) Suppose  $Y_1, Y_2, Y_3, Y_4$  are independent with

$$E(Y_1) = E(Y_2) = \theta_1 + \theta_2$$

$$E(Y_3) = E(Y_4) = \theta_1 + \theta_3$$

$$\text{Var}(Y_i) = \sigma^2, i = 1, 2, 3, 4$$

Determine the condition of estimability of the parametric function  $l'\theta = l_1\theta + l_2\theta + l_3\theta$ . Obtain a solution of the normal equation.

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5. (a) Define Index number. Why are index numbers called as economic barometer? Mention the steps in the construction of index number. 2+2+2=6

- (b) From the following data given below construct index number of the group of four commodities by using Fisher's Ideal Formula. Also show that Fisher's Index number satisfies the factor reversal test for the given data :

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Commodities	Base Year		Current Year	
	Price per unit (₹)	Expenditure (₹)	Price per unit (₹)	Expenditure (₹)
A	2	40	5	75
B	4	16	8	40
C	1	10	2	24
D	5	25	10	60

6. Write brief notes on the following :

$2\frac{1}{2} \times 4 = 10$

- (a) National Statistical Commission (NSC)
- (b) Central Statistics Office (CSO)
- (c) National Sample Survey Office (NSSO)
- (d) Annual Survey of Industries (ASI)

7. What is meant by standardised death rate? Calculate the standardised death rate (with respect to age) using the following data :

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Age	0-2	2-5	5-15	15-40	40-60	above 60
Specific death rates	375	210	85	41	93	195
Standard population ('000)	15	10	12	38	15	10

8. Explain the following terms :

$2 \times 5 = 10$

- (a) AQL (Acceptable Quality Level)
- (b) LTPD (Lot Tolerance Percent Defective)
- (c) Consumer's risk
- (d) Producer's risk
- (e) OC (Operating Characteristic) curve

9. Let  $(X_1, X_2)$  be a random sample from  $N(0, 1)$ . Answer the following, giving reasons :

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- (a) What is the distribution of  $\frac{(X_1 - X_2)^2}{2}$ ?
- (b) What is the distribution of  $\frac{(X_1 + X_2)^2}{(X_1 - X_2)^2}$ ?
- (c) What is the distribution of  $\frac{1}{Z}$ , if  $Z = \frac{X_1^2}{X_2^2}$ ?

10. (a) For the following data, test the hypothesis that the median measure in the population  $X$  is less than the median measure in the population  $Y$ , using Mann-Whitney  $U$ -test. (use  $\alpha=0.05$  and given the critical region is :  $U \leq 4$ ) 5

$X$	:	60	45	23	32				
$Y$	:	10	25	20	54	32	65	8	

- (b) State and prove the General Quadrature Formula for equidistant ordinates. Explain briefly what happens when  $n$  takes the values 1, 2 and 3 respectively in the general quadrature formula. 5

11. Prove that in SRSWOR, for large sample  $n$ , an approximation to the variance of  $\hat{R}$  is given by

$$\text{Var}(\hat{R}) = \frac{1-f}{n\bar{X}^2} \sum_{i=1}^N \frac{(y_i - R_{x_i})^2}{(N-1)}$$

where  $f\left(= \frac{n}{N}\right)$  is the sampling fraction. 10

12. (a) What is meant by association of attributes? When are the two attributes said to be (i) independent, (ii) positively associated and (iii) negatively associated? 4

- (b) What is meant by consistency of data? How will you examine the consistency of data classified according to different attributes? Explain the term 'order of class frequency' and 'ultimate class frequency' in a contingency table. 6

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