9. (a) What is meant by expectation of life? Distinguish between 'curate expectation' and 'complete expectation' of life and prove that:

$$e_x = \frac{\sum_{n=1}^{\infty} l_{x+n}}{l_x}$$

(b) Define the following measures of fertility:
(i) Crude Birth Rate
(ii) General Fertility Rate
(iii) Age specific Fertility Rate
(iv) Total Fertility Rate

(6,6)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1965 **A**

Unique Paper Code : 32375902

Name of the Paper : Applied Statistics

Name of the Course : **Generic Elective : Statistics**

Semester : IV

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **Sx** Questions in all.
3. Question No. **1** is compulsory.
4. Select **two** questions from **Section A** and **three** from **Section B**.
5. Use of simple calculator is allowed.

1. (a) Explain additive and multiplicative models of a time series, stating clearly the assumptions underlying and discuss their relative merits.
   (b) Explain Time reversal test and Factor reversal test and name the index numbers which satisfy the above tests.
   (c) Define the terms:
      (i) Producer's Risk
      (ii) Consumer's Risk
      (iii) Specific Birth Rate

3x5=15

Section A

2. (a) Explain the fitting of a quadratic line trend: $y_t = a + bt + ct^2$ by principle of least squares and discuss the relative merits and demerits.
   (b) Estimate trend values to the following data by the method of semi-averages and mention merits and demerits of the mentioned method.

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Bank Clearance (Rs. Crores)	53	79	76	66	69	94	105	87	79	104	97	92	101

(6,6)

3. (a) What do you understand by seasonal variations in a time series? Describe 'Method of simple averages' with its merits and demerits.
   (b) Use ration to trend method for obtaining indices of seasonal variations for the following data:

Year	Spring	Summer	Autumn	Winter
2001	86	95	96	99
2002	96	102	104	110
2003	103	108	106	107

(6,6)

4. (a) Describe the various methods of constructing the index numbers.
   (b) Show that Marshall-Edgeworth index number lies between Laspeyre's and Paasche's index number if (i) $P_{0i}^{La} > P_{0i}^{Pa}$; (ii) $P_{0i}^{La} < P_{0i}^{Pa}$.

(6,6)

5. (a) Explain the meaning and uses of cost of living index number. Discuss the various methods used for construction of cost of living index number.

   (b) Compute price index and quantity index numbers for the year 2010 with 2005 as base year, using (i) Laspeyre's method ; (ii) Paasche's method ; (iii) Fisher's method for the following data:

Commodity	Quantity(units)		Expenditure(Rupees)	
	2005	2010	2005	2010
A	100	150	500	900
B	80	100	320	500
C	60	72	150	360
D	30	33	360	297

(6,6)

Section B

6. (a) Distinguis between the terms defect and defective. Obtain the control limits for a C-chart when:
      (i) Standards are given.
      (ii) Standards are not given.

   (b) The number of defects on 20 items are given below:

S.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Defects	2	0	4	1	0	8	0	1	2	0	6	0	2	1	0	3	2	1	0	2

(6,6) Compute appropriate control limits and state whether the process is in control.

(6,6)

7. (a) What do you understand by control chart? Give justification for using the 3σ limits in the control charts.
   (b) Describe the various techniques used in 'Statistical quality control'. Mention the various steps in the construction of $\bar{x}$ chart, when standards are given.

(6,6)

8. (a) Describe the various measures of mortality.
   (b) Discuss the assumptions and the steps involved in the construction of a life table. Explain the relationship between its different columns.

(6,6)