Q.P. Code :09653

[Time: Three Hours] **[Marks:100]**

Please check whether you have got the right question paper.

N.B:
1) All question are compulsory.
2) Attempt any four sub- questions from Q. No. 1 any two sub-questions from each of the remaining questions.
3) Figures to the right indicate full marks for the sub-questions.
4) Use of calculators is allowed.

1. **(a)** By making suitable assumption, prove, in usual notations, that – **5**

$$\mu_x = \frac{1}{12\, l_x}\left[8(l_{x-1} - l_{x+1}) - (l_{x-2} - l_{x+2})\right]$$

(b) Explain the concept of present value and accumulated value. **5**

(c) Obtain the expression for present value of immediate life annuity of 1 p.a. on a life aged x years now, in term of commutation functions. **5**

(d) What is Time series? Explain the models used in time series analysis. **5**

(e) Define reliability of component. Discuss series system and parallel system. **5**

(f) Consider the following time series data:- **5**

Week:	1	2	3	4	5	6
Value:	8	13	15	17	16	9

Use $\propto = 0.2$ to compute the exponential smoothing values for the time series. What is the forecast for week 7?

2. **(a)** For a stationary population, define the terms, curtate expectation of life and complete expectation of life. Further, in usual notations, show that – **10**

(i) $e_x = \frac{\sum_{t=1}^{\infty} l_{x+t}}{l_x}$

(ii) $e_x^o = \frac{T_x}{l_x}$

(b) For increasing immediate annuity certain, in usual notations, Find the present value of the annuity in terms of commutation functions. Also state the accumulated value. **10**

(c) Explain the term " variable annuity". Obtain the expression for present value of increasing annuity certain when the successive payments form Arithmetic progression for n years and the payments are made at the end of each successive year. **10**

3. **(a)** Obtain the expression for present value of assurance, in terms of commutation functions, for temporary assurance after giving the plan details. **10**

(b) Obtain the expression for level annual premium, for endowment assurance of n years after obtaining the present value of assurance of the plan under consideration. **10**

(c) (i) What are natural premiums? What are its drawbacks? How are these drawbacks overcome by level annual premiums? **6**

(ii) Explain the term 'Mortality Loading 'in office premiums. **4**

4. **(a)** What are the components of “Time Series”? Explain the components briefly giving illustrations. **10**

(b) Explain the following method with their merits and demerits **10**
(i) Freehand Curve Method
(ii) Method of moving averages

(c) Using the following probability distributions explain how you will generate random observations:- **10**
i. Uniform Distribution
ii. Normal distribution

5. **(a)** Define hazard rate. Obtain the expression for reliability of the component in terms of hazard rate. If hazard rate is constants, then obtain failure time distribution. **10**

(b) (i) What is multiple regression model? State the various assumption made in multiple regression model. **6**
(ii) For a simple linear regression model $Y = \beta_0 + \beta_1 X + u$, obtain least square estimators of β_0 and β_1. **4**

(c) What is autocorrelation? Explain Durbin-Watson d test, for detecting autocorrelation. What are the consequences of using OLS (Ordinary Least Squares) estimators in the presence of autocorrelation? **10**