### Department of Mathematics and Scientific Computing
### NIT Hamirpur
### End Term Exam(2023)

**Course name: Applied Time Series Analysis**     **Course Code: MA-371**

**Timing: 3-hour**     **Maximum marks: 50**

**Attempt all (1-8) questions.**

1. The production of cement by a firm in years 1 to 9 is given below

| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|------|---|---|---|---|---|---|---|---|----|
| Production (in tons) | 4 | 5 | 5 | 6 | 7 | 8 | 9 | 8 | 10 |

Calculate the trend values for the above series by the following two methods

(i)     3-yearly moving average,

(ii)     Linear trend.     **Marks (5)**

2. The price of a commodity during 2002-2007 are given below. Fit a parabola
   $Y = a + b\,X + c\,X^2$ to these data. Estimate the price of the commodity for the year 2008.

| Year | Prices | Year | Prices |
|------|--------|------|--------|
| 2002 | 100 | 2005 | 140 |
| 2003 | 107 | 2006 | 181 |
| 2004 | 128 | 2007 | 192 |

**Marks (5)**

3. Calculate seasonal indices (using multiplicative model) by the ratio to moving average method from the following data:

| Year / Quarters | 1980 | 1981 | 1982 | 1983 |
|------|------|------|------|------|
| Q1 | 75 | 86 | 90 | 100 |
| Q2 | 60 | 65 | 72 | 78 |
| Q3 | 54 | 63 | 66 | 72 |
| Q4 | 59 | 80 | 85 | 93 |

**Marks (5)**

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4. Explain clearly what is meant by a time series? What are components of times series? Describe uses of time series?  **Marks (5)**

5. Derive the first order Auto-regression series.  **Marks (5)**

6. For an infinite series generated by the moving average of a random component with equal weights, the correlogram is given by $r_k = \begin{cases} 1 - \dfrac{k}{m}, & k \le m \\ 0, & k > m \end{cases}$, where k is the order of the serial correlation and m is the length of the moving average.  **Marks (5)**

7. In a partially destroyed laboratory, record of an analysis of correlation data, the following results only are legible:
   Variance of X = 9. Regression equations: 8X-10Y+66=0 ; 40X- 18Y =214.
   What are :
   (a) the mean values of X and Y,
   (b) the correlation coefficient between X and Y, and
   (c) the standard deviation of Y?  **Marks (5)**

8. From the following data obtain the two regression equations and calculate the correlation coefficient:

| X | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|----|----|----|----|----|----|----|
| Y | 9 | 8 | 10 | 12 | 11 | 13 | 14 | 16 | 15 |

Estimate the value of Y which should correspond on an average to X = 6.2.  **Marks (15)**

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