QUESTIONS

A. TIME SERIES

1. Below are the production of a fertiliser factory :

Year	1995	1997	1998	1999	2000	2001	2004
Production (1000 tonnes)	77	88	94	85	91	98	90

   (i) Fit a linear trend line and obtain the trend values.

   (ii) What is the monthly increase in the production ?

2. Below are the production of a certain factory manufacturing air-conditioners :

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Production (1000 units)	17	20	19	26	24	40	35	55	51	74	79

Fit a second degree equation and obtain the trend values.

3. Below are the population of India :

Year	1911	1921	1931	1941	1951	1961	1971
Population (in Crores)	25	25.1	27.9	31.9	36.1	43.9	54.7

   (i) Fit an exponential trend equation and obtain the trend values.

   (ii) Estimate the population in 1981, 2001, 2011.

4. Using Ratio to Trend method, determine the quarterly seasonal indices for the following data :

Year	Q1	Q2	Q3	Q4
1995	30	40	36	34
1996	34	52	50	44
1997	40	58	54	48
1998	54	76	68	62
1999	80	92	86	82

5. The following data show the annual rainfall (in millimeters) in the District of Midnapore, West Bengal :

Year	Rainfall	Year	Rainfall
1980	1391	1986	1822
1981	1913	1987	1236
1982	1254	1988	1390
1983	1292	1989	1558
1984	1665	1990	2152
1985	1351	1991	1584

Determine trend by the method of moving averages and also by fitting a polynomial of appropriate degree.

6. The following table gives the production of steel in India during 1972 to 1975 (in 000 tons) over different quarters :

Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
1972	1336	1065	1215	1335
1973	1463	1039	1183	1161
1974	1306	1041	1290	1321
1975	1525	1251	1456	1408

Obtain sesonal indices by the method of trend ratios, assuming a linear trend.

7. The following data represent the monthly averages of tourist arrival in India for the years 1970 to 1975 :

Year	Monthly average tourist arrival
1970	23401
1971	25083
1972	28579
1973	34157
1974	35263
1975	38773

Fit an exponential trend to the data. Represent the original values and the trend values on a graph paper.

8. The following data represent the production of finished steel in India for the years 1972 to 1975 :

PRODUCTION OF FINISHED STEEL (000 tons)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1972	420	414	502	365	368	332	390	396	429	417	422	496
1973	491	456	516	337	342	360	409	402	372	391	394	376
1974	463	365	478	310	325	406	415	437	438	445	430	446
1975	502	487	536	404	418	429	489	492	475	456	476	476

Compute the seasonal indices by ratio to moving average method.

9. The following table gives the production of Iron ore (Lakh Tonnes) in India from 1976 to 1979 for different quarters :

Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
1976	126	108	79	113
1977	131	110	73	110
1978	116	90	72	108
1979	124	97	69	101

Obtain the sesonal indices by the method of trend ratios, assuming a linear trend.

10. Obtain the trend values for the following series by fitting a second-degree polynomial. Represent the trend values and the original data in a suitable diagram.

Year	Gross Earnings (Rs. crores)
1964-65	666
1965-66	748
1966-67	777
1967-68	823
1968-69	903
1969-70	957
1970-71	1010

11. Fit an *Autoregressive Model of order one* for the following problem :

    Consider a time series dataset representing the monthly average temperature in a specific city over a period of 24 months. The dataset is as follows:

    15.2, 14.8, 16.5, 18.2, 19.7, 21.3, 23.1, 24.8, 22.5, 20.6, 18.9, 17.3, 16.1, 15.8, 16.6, 18.3, 20.1, 21.7, 23.2, 24.4, 23.3, 21.7, 19.5, 17.7.

12. Fit an *Autoregressive Model of order two* for the following problem :

    You have a dataset for the monthly sales (in thousands of units):

    12, 15, 18, 14, 17, 20, 19, 21, 23, 25, 22, 24.

13. Forecast by *exponential smoothing* technique for the following problem :

    Suppose you are a demand planner for a retail company, and you are tasked with forecasting the sales of a particular product for the next four months. You have historical sales data for the past 12 months, which you will use to estimate the optimal smoothing factor (alpha) and make the forecast.

    The sales data for the past 12 months is as follows:

    100, 110, 120, 115, 125, 135, 130, 140, 145, 150, 155, 160.

14. Sixteen successive observations on a stationary time series are as follows :-

    1.6, 0.8, 1.2, 0.5, 0.9, 1.1, 1.1, 0.6, 1.5, 0.8, 0.9, 1.2, 0.5, 1.3, 0.8, 1.2

    Evaluate the values of the *Autocorrelation Function (A.C.F.)* for lag 1, 2, 3 and plot them.

B. INDEX NUMBER

1. Compute price index and quantity index numbers for the year 2005 with 2000 as base year, using

   (i) Laspeyre's Method,
   (ii) Paasche's Method and
   (iii) Fisher's Method.

Commodity	Quantity(Units)		Expenditure(Rs.)	
	2000	2005	2000	2005
A	100	150	500	900
B	80	100	320	500
C	60	72	150	360
D	30	33	360	297

2. Construct the wholesale price index number for 2004 and 2005 from the following data, using 2003 as the base year.

Commodity	Wholesale price (in '00 Rs.) per quintal		
	2003	2004	2005
A	140	160	190
B	120	130	140
C	100	105	108
D	75	80	90
E	250	270	300
F	400	420	450

3. An inquiry into the budgets of middle class families in a city gave the following information :

Expenses on :	Food 30%	Rent 15%	Clothing 20%	Fuel 10%	Others 25%
Prices (in Rs.) in 2002 :	100	20	70	20	40
Prices (in Rs.) in 2005 :	90	20	60	15	55

Compute the price index number using :

   (i) Weighted A.M. of price relatives, and
   (ii) Weighted G.M. of price relatives.