Assignment – Module 6

1. Consider the annual flow X, (in m^3/sec)from a subcatchment to a river for 40 years

Year	X	Year	X	Year	X	Year	X
1966	1506	1976	5602	1986	3951	1996	4200
1967	2264	1977	5612	1987	4280	1997	6704
1968	1897	1978	7173	1988	5910	1998	5776
1969	1967	1979	5496	1989	5145	1999	6869
1970	2473	1980	7797	1990	6384	2000	5733
1971	1801	1981	7392	1991	5679	2001	4664
1972	1692	1982	7061	1992	6021	2002	4671
1973	2027	1983	6564	1993	6733	2003	4659
1974	2251	1984	5919	1994	8151	2004	5677
1975	1854	1985	5053	1995	4151	2005	7107

Obtain the return period equaling or exceeding 5000 m^3/sec annual flow from the subcatchment.

2. (a) What is the probability that the annual maximum discharge in the river will exceed or equal 3000 m^3/sec for the data in problem no. 1 .

(b) Obtain the probability that the annual maximum discharge in the river will equal or exceed 3000 m^3/sec at least once in the next five years for the data in problem no. 1.

3. Consider the annual flow in problem no. 1,

- Develop a model for annual flow frequency analysis using Extreme Value Type-I distribution

- Calculate the maximum annual discharge values corresponding to 20-year and 100-year return periods

4. The annual flood peak at a particular site on a stream is estimated as 2400 m^3/sec and 2730 m^3/s corresponding to return periods of 50 years and 100 years respectively. Obtain the annual flood peak corresponding to 200-year return period assuming that the annual flood peak follow Gumbel's distribution.

5. Consider the annual maximum 24 hr rainfall, in mm, given below for 30 years in a subcatchment

65.2	89.8	152.5	95.3	71.7	61.9	57.5	135.6	89.1	68.5
77.2	75.2	122.4	104.2	67.5	448.7	78.1	81.6	147	83.1
70.5	50.8	72.4	90.4	191.3	120.5	90.9	97.2	100.8	106.8

Determine the frequency factor and obtain the maximum annual 24 hr rainfall value corresponding to 10 year return period using (a) Normal distribution, (b) Gumbel's distribution, (c) Log Pearson Type III distribution.

6. Construct probability paper for exponential distribution with $\lambda = 2$.

7. Consider the annual maximum discharge (in cumec) of a river for 40 years

208	218	261	269	258	112	279	205	186	316
177	127	189	227	247	214	242	145	196	180
304	237	372	309	100	227	169	216	206	247
232	228	217	230	221	192	219	290	270	293

Check whether the data follows a normal distribution using Chi-Square goodness of fit test at 10% significance level

8. Check whether the data given in problem no.7, follows normal distribution using Kolmogorov Smirnov test.

9. Estimate the peak discharge corresponding to a return period of 50 years, given the peak discharge for 20 years (see table below) by plotting the data on Gumbel's probability paper

Year	1	2	3	4	5	6	7	8	9	10
Q peak (cum/s)	286	309	405	163	184	45	161	65	163	43

Year	11	12	13	14	15	16	17	18	19	20
Q peak (cum/s)	36	51	100	35	63	145	267	514	122	206

10. Check whether the annual runoff of a river, given in the table below, follows normal distribution. Obtain the parameters of the distribution graphically.

Year	1	2	3	4	5	6	7	8	9	10
Runoff (cum)	136	73	170	235	447	383	197	257	220	83

Year	11	12	13	14	15	16	17	18	19	20
Runoff (cum)	195	290	243	220	98	101	199	68	86	244

11. Obtain the IDF curves for the rainfall data (in mm) at a site, given below for 30 years.

Year	1H	2H	6H	12H	24H
1960	33	45	60	64	73
1961	45	60	62	81	100
1962	58	69	93	104	170
1963	66	105	106	106	106
1964	25	48	69	72	80
1965	47	50	53	67	69
1966	39	41	58	60	64
1967	66	130	147	151	151
1968	54	63	91	97	99
1969	46	65	72	72	76
1970	42	49	56	85	86
1971	41	67	78	80	84
1972	67	82	85	136	136
1973	73	82	109	116	116
1974	52	62	72	73	75
1975	166	235	420	482	499
1976	46	52	58	60	87
1977	46	80	89	91	91
1978	46	55	71	104	164
1979	35	63	85	91	92
1980	38	41	59	77	78
1981	26	43	47	51	57
1982	49	69	75	80	81
1983	63	83	95	96	101
1984	56	79	162	203	213
1985	80	105	125	134	144
1986	66	70	92	101	101
1987	69	87	94	99	108
1988	52	78	99	107	112
1989	59	96	118	128	149

12. Obtain the design rainfall intensity for 2 year return period with 15 minutes duration for New Delhi.