TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Bhadra

Exam.		Regular	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Simulation and Modeling *(CT753)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Explain the steps of Simulation study. [8]

2. Explain Static mathematical model and dynamic mathematical model with example. [6]

3. What is analog method? Explain with the example of Automobile suspension problem. [2+8]

4. What are the characteristics of Queuing system? What do you mean by Kendall notation in queuing system? What is the meaning of M/D/8/15/1000/LIFO? [4+3+3]

5. Given that a chance of a Ford car user to buy a ford car in next purchase is 70% and that his next purchase will be a Scorpio car is 30% and chance of a Scorpio car user to buy a Scorpio car at the next purchase is 80% and chance that his next purchase will be ford car is 20%. What is the probability to buy a Scorpio car after three purchase of a current Ford car user? If 70% user uses Ford car today, what percentage of user will use Scorpio after 3 purchases? [6]

6. Why do we use gap test? A sequence of 1000 four-digit numbers has been generated and an analysis indicates the following combinations and frequencies: Use Poker's test to determine if these random numbers are independent, $\alpha = 0.05$ and $n = 4$ such that $\alpha_{(0.05,4)} = 9.49$. [2+8]

Combination Distribution (i)	Observed Frequency
4 different digits	540
3 like digits	50
4 like digits	20
2 Pairs	70
1 Pair	320

7. What are different random number generation methods. Explain with examples. [8]

8. Explain with example the iterative process of calibrating of model. [5]

9. How can you use estimation methods in analysis of simulation output? Explain with example. [5]

10. Briefly explain about simulation in Java. [6]

11. Explain CPU simulation with example. [6]

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1. What is simulation? Explain the steps of Simulation Study with flowchart. [2+6]

2. Differentiate between static mathematical model and dynamic mathematical model with suitable examples. [6]

3. Write down the significance of differential equations. Explain the analog computer model of liver with necessary equation and diagrams. [4+6]

4. Define queuing system with block diagram and its uses. Explain M/M/4/20/2000/FCFS and D|M|2|LIFO|18 system. [6+2+2]

5. Given that change of a Sony user to buy Sony at next purchase is 80% and that his next purchase will be Samsung is 20% and chance of a Samsung user to buy Samsung at next purchase is 85% and chance that his next purchase will be Sony is 15%. What is the probability to buy Sony after three purchase of a current Samsung user? If 60% user uses Sony today, what percentage of user uses Samsung after three purchase? [4+2]

6. What are the properties of random number? Explain the techniques of generation of random number with appropriate example. [2+6]

7. What are the properties of Random number? Using Chi-Square test the uniformity at 90% for the given random numbers. Degree of freedom for $6 = 10.645$, $7 = 12.017$, $8 = 13.362$ $9 = 14.684$, $10 = 15.987$. [3+6]

20	34	43	42	14	10	33	17	6	11
15	16	4	1	35	22	9	46	37	57
51	49	40	27	59	5	44	19	41	55
53	29	3	31	48	8	56	28	12	7

8. Explain about the Calibration and Validation of Models. [5]

9. Explain the structure of Java Simulation with example. [6]

10. How you can analyze simulation output using simulation runs statistics? Explain [6]

11. Explain CPU simulation with example. [6]

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Exam.		New Back (2066 & Later Batch)	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Simulation and Modeling (CT 753)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Define system, model and simulation. And clarify with suitable example. List various advantage and disadvantage of simulation?   [3+1+4]

2. Explain dynamic physical model with example.   [6]

3. Design and explain analog method of automobile suspension problem? Explain feedback system with suitable example?   [6+4]

4. What is queuing model, explain with figure? What is the meaning of M/D/2/60/150/FIFO in queuing notation? Explain the Kendall notation with example.   [3+2+5]

5. Write down the application of Markov chains? Given that chance of a Sony user to buy Sony at next purchase is 75% and that his next purchase will be Samsung is 25% and chance of a Samsung user to buy Samsung at next purchase is 85% and chance that his next purchase will be Sony is 15%. What is the probability to buy Sony user after three purchase of a current Samsung user?   [2+4]

6. A sequence of 1000 four digit number has been generated and an analysis indicates the following combination and frequencies: [8]

Combination (i)	Observed Frequency (Oi)
Four different digit	520
One pair	390
Two pair	55
Three like digit	34
Four like digit	1
	1000

7. What do you mean by pseudo random numbers? Explain Gap test algorithm with example.   [2+8]

8. Explain the iterative process of calibrating a model with example.   [5]

9. How can you use estimation method in analysis of simulation output? Explain with example.   [5]

10. Explain the overall structure of Java Simulation of a Single Server Queue.   [6]

11. Explain the simulation model of computer system that services request from www.   [6]

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1. Explain the different components of system with example. Write down the advantages and disadvantages of Simulation. [4+4]

2. Differentiate between Static mathematical model and dynamic mathematical model with suitable examples. [6]

3. Why differential equations are important in scientific and engineering studies? Explain the analog method for Automobile Suspension Problem with necessary equations and figure. [4+6]

4. What is a queuing system? List the various characteristics of queuing system. Explain role of queuing system in simulation study. Explain Kendall notation with example. [2+2+2+4]

5. Define Markov chain. List the key feature and application of Markov chain. [2+4]

6. What are different random number generation methods? Explain with examples. [8]

7. What are the properties of Random numbers? Explain the algorithm of Kolmogorov-Smirnov Test with example. [4+6]

8. Explain Naylor and Finger validation approach. [5]

9. Explain the simulation Run statistics with example. [5]

10. Explain the single server queuing simulation model using JAVA. [6]

11. Explain about simulation of a central processing unit for the lower level of abstraction. [6]

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1. What is Simulation and Modeling? Explain when simulation is appropriate and not appropriate tool. [2+6]

2. Explain static mathematical model with suitable example. [6]

3. What is analog computer; explain with its pros and cons. Explain the analog computer model for liver with necessary figures. [4+6]

4. What are the characteristics of queuing system? Discuss any one practical application of queuing system. [5+5]

5. What are the key features of Markov chain? Given that chance of a Honda Bike user to buy Honda Bike at next purchase is 70% and that his next purchase will be Yamaha Bike is 30% and change of a Yamaha Bike user to buy Yamaha Bike at next purchase is 80% and change that his next purchase will be Honda Bike is 20%. What is the probability to buy Yamaha Bike after three purchase of a current Honda Bike user? [2+4]

6. What are the properties of random numbers? Explain the steps of Gap test algorithm with example. [4+6]

7. A sequence of 10,000 five digital numbers has been generated and analysis indicates the following combinations and frequencies. [8]

Combinations (i)	Observed Frequency (O_i)
All different	3400
One pair	4500
Two pair	1150
Three of a kind	750
Full house	85
Four of a kind	40
Five of a kind	15
Total	10,000

Based on Poker Test Check whether the number are independent. Use $\alpha = 0.05$ and $N = 6$ is 12.592

8. What is calibration and validation of models? Explain with practical example. [5]

9. Define initial Bias. Explain the methods for the elimination of initial bias. [5]

10. Explain in brief the simulation in JAVA with example. [6]

11. Explain the different level of abstraction for the simulation of computer system. [6]

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Subject: - Simulation and Modelling *(CT753)*

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✓ Attempt *All* questions.
✓ The figures in the margin indicate *Full Marks*.
✓ Assume suitable data if necessary.

1. What is simulation and modelling? Explain the steps in simulation study. [2+6]

2. Explain the dynamic physical model with example. [6]

3. What is analog method? Explain with example of automobile suspension problem. [4+6]

4. What is the model of queuing system? What do you mean by the Kendall's notation in queuing systems? What is the meaning of M/D/8/15/LIFO in queuing system? Explain. [5+2.5+2.5]

5. Given figure shows Coke and Pepsi purchaser [6]
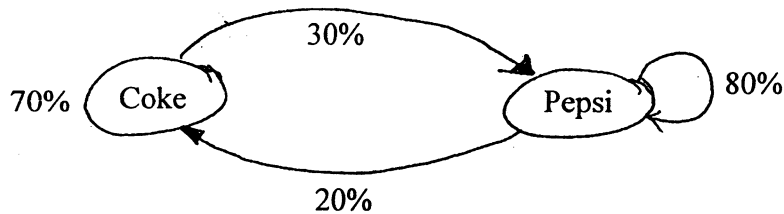
a) If currently Coke purchaser, what is the probability of Pepsi purchaser in 3rd purchase?
b) If 55% of people use Coke today, what percentage of people will use Coke after 3 purchases?

6. Write an algorithm for gap test. Formulate 4-digit poker test with suitable data with example. [4+6]

7. Define pseudo random numbers. The following numbers have been generated 0.44, 0.19, 0.88, 0.27, 0.55, 0.13, 0.63, 0.74, 0.11 and 0.33. Use the Kolmogorov-Smirnov test with $\alpha = 0.05$ to determine, if the hypothesis that the numbers are uniformly distributed on the interval [0, 1] can be rejected. (Note that the critical value of D for α 0.05 and N = 10 is 0.410. [2+6]

8. Explain the iterative process of calibrating a model with example. [5]

9. How can you use estimation methods in an analysis of simulation output? Explain with example. [5]

10. Explain with example of simulation in JAVA with single server queue model. [6]

11. Explain with CPU simulation by sketching a simulation model of computer system. [6]

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✓ __Necessary chart is attached herewith.__
✓ Scientific calculator is allowed.
✓ Assume suitable data if necessary.

1. Define modeling and simulation. Explain steps involved in simulation study. [2+6]

2. What is dynamic mathematical model? Explain with examples. [6]

3. a) Explain significance of differential equation in the context of continuous system simulation. [3]

   b) Develop an analog computer model of the liver and explain it. [7]

4. Mention the characteristics of queuing system. Explain the Kendall's notation in queuing systems. What is the meaning of M/D/6/10/FIFO in queuing system? [2.5+5+2.5]

5. Explain Markov Chain with an appropriate example. [6]

6. a) What is a random number? What are the problems associated with generating pseudo random numbers. [8]

   b) A set of 10,000 4-digit random values have been generated. An observation shows than 5065 values have all different digits, 2000 have 2 of a kind digits, 760 have 3 of a kind, 1500 have 2 pairs and 675 have all same digits. Test these values for randomness using Poker test (Use $\alpha = 0.05$). [7]

7. Explain Naylor and Finger's steps used in validation in brief. [5]

8. What is initial bias? What is the approach for elimination of initial bias? [5]

9. Explain the at least 5 GPSS block diagram symbols with example. [6]

10. Write short notes on: (any three) [3×3]

    a) Calibration of a model
    b) Application of queuing system
    c) Convolution in random number
    d) CPU simulation

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Chi-Square Distribution Table
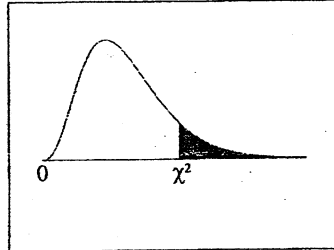
The shaded area is equal to α for $\chi^2 = \chi^2_\alpha$.

df	$\chi^2_{.995}$	$\chi^2_{.990}$	$\chi^2_{.975}$	$\chi^2_{.950}$	$\chi^2_{.900}$	$\chi^2_{.100}$	$\chi^2_{.050}$	$\chi^2_{.025}$	$\chi^2_{.010}$	$\chi^2_{.005}$
1	0.000	0.000	0.001	0.004	0.016	2.706	3.841	5.024	6.635	7.879
2	0.010	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210	10.597
3	0.072	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345	12.838
4	0.207	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277	14.860
5	0.412	0.554	0.831	1.145	1.610	9.236	11.070	12.833	15.086	16.750
6	0.676	0.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812	18.548
7	0.989	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278
8	1.344	1.646	2.180	2.733	3.490	13.362	15.507	17.535	20.090	21.955
9	1.735	2.088	2.700	3.325	4.168	14.684	16.919	19.023	21.666	23.589
10	2.156	2.558	3.247	3.940	4.865	15.987	18.307	20.483	23.209	25.188
11	2.603	3.053	3.816	4.575	5.578	17.275	19.675	21.920	24.725	26.757
12	3.074	3.571	4.404	5.226	6.304	18.549	21.026	23.337	26.217	28.300
13	3.565	4.107	5.009	5.892	7.042	19.812	22.362	24.736	27.688	29.819
14	4.075	4.660	5.629	6.571	7.790	21.064	23.685	26.119	29.141	31.319
15	4.601	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578	32.801
16	5.142	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32.000	34.267
17	5.697	6.408	7.564	8.672	10.085	24.769	27.587	30.191	33.409	35.718
18	6.265	7.015	8.231	9.390	10.865	25.989	28.869	31.526	34.805	37.156
19	6.844	7.633	8.907	10.117	11.651	27.204	30.144	32.852	36.191	38.582
20	7.434	8.260	9.591	10.851	12.443	28.412	31.410	34.170	37.566	39.997
21	8.034	8.897	10.283	11.591	13.240	29.615	32.671	35.479	38.932	41.401
22	8.643	9.542	10.982	12.338	14.041	30.813	33.924	36.781	40.289	42.796
23	9.260	10.196	11.689	13.091	14.848	32.007	35.172	38.076	41.638	44.181
24	9.886	10.856	12.401	13.848	15.659	33.196	36.415	39.364	42.980	45.559
25	10.520	11.524	13.120	14.611	16.473	34.382	37.652	40.646	44.314	46.928
26	11.160	12.198	13.844	15.379	17.292	35.563	38.885	41.923	45.642	48.290
27	11.808	12.879	14.573	16.151	18.114	36.741	40.113	43.195	46.963	49.645
28	12.461	13.565	15.308	16.928	18.939	37.916	41.337	44.461	48.278	50.993
29	13.121	14.256	16.047	17.708	19.768	39.087	42.557	45.722	49.588	52.336
30	13.787	14.953	16.791	18.493	20.599	40.256	43.773	46.979	50.892	53.672
40	20.707	22.164	24.433	26.509	29.051	51.805	55.758	59.342	63.691	66.766
50	27.991	29.707	32.357	34.764	37.689	63.167	67.505	71.420	76.154	79.490
60	35.534	37.485	40.482	43.188	46.459	74.397	79.082	83.298	88.379	91.952
70	43.275	45.442	48.758	51.739	55.329	85.527	90.531	95.023	100.425	104.215
80	51.172	53.540	57.153	60.391	64.278	96.578	101.879	106.629	112.329	116.321
90	59.196	61.754	65.647	69.126	73.291	107.565	113.145	118.136	124.116	128.299
100	67.328	70.065	74.222	77.929	82.358	118.498	124.342	129.561	135.807	140.169

Exam.		Regular / Back.	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Simulation and Modeling (EG778CT)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Explain the static mathematical models and dynamic mathematical models with example. What are the main differences between them?   (10)

2. What is queuing system? How it is useful for simulation? Explain the different types of queuing system with example.   (2+2+6)

3. Explain Markov chains with example and its applications.   (10)

4. Explain the digital analog simulator. Design the analog computer model of the liver and explain it.   (4+8)

5. What are the two statistical properties of Random number? Explain the gap test algorithm with example.   (2+8)

6. A sequence of 1000 four digit numbers has been generated and analysis indicates the following combinations with frequencies:

Combination (i)	Observed Frequency(O_i)
Four different digits	570
One pair	380
Two pairs	34
Three like digits	15
Four like digits	1
	1000

Based on poker test check whether the numbers are independent. Use $\alpha=0.10$ and N=4 is 7.78   (8)

7. Write different types of simulation output analysis. In the case of infinite population which output analysis method is applicable. Why? Explain.   (4+6)

8. Define the succession of events. Design a telephone system simulation model using GPSS symbols and explain in brief.   (2+8)

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✓ Attempt **All** questions.
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✓ **Necessary table is attached herewith.**
✓ Assume suitable data if necessary.

1. Define simulation and modeling. Explain dynamic mathematical modeling with an example. [2+6]

2. What is a distributed lag model? Explain with an example. [8]

3. What is Markov chain? Explain an application of Markov chain. [8]

4. What is a random number? Explain linear congruential method for generating random numbers with an example. [4+4]

5. Given below the sequence of 100 random numbers. Use chi-square test with $\alpha = 0.05$ to check the number for uniform distribution and serial auto correlation. [12]

09	05	92	15	10	90	23	15	84	27	20	77	35	25	72	44
30	65	43	35	60	56	40	55	63	45	47	47	42	30	57	70
66	30	91	65	24	99	70	18	8	76	13	14	80	05	72	56
21	85	96	28	90	35	94	85	40	07	78	49	10	72	56	15
63	66	20	60	70	23	58	71	30	43	87	39	49	99	40	36
98	45	30	09	50	24	14	55	18	07	92	87	64	53	22	76
35	42	11	29												

6. Explain a replication of runs in an analysis of simulation output with an example. [8]

7. Explain the significance of elimination of initial bias in modeling with an example. [8]

8. What is a GPSS? List some of the common block diagram symbols used in GPSS. [2+6]

9. Explain a GPSS simulation model of a supermarket. [12]

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TABLE A–2 : Area in Right tail of a Chi–square Distribution.

Degrees of freedom	.20	.10	.05	.02	.01
1	1.642	2.706	3.841	5.412	6.635
2	3.219	4.605	5.991	7.824	9.210
3	4.642	6.251	7.815	9.837	11.345
4	5.989	7.779	9.448	11.668	13.277
5	7.289	9.236	11.070	13.388	15.087
6	8.558	10.645	12.592	15.033	16.812
7	9.803	12.017	14.067	16.622	18.475
8	11.030	13.362	15.507	18.168	20.090
9	12.242	14.684	16.919	19.679	21.666
10	13.442	15.987	18.307	21.161	23.209
11	14.631	17.275	19.675	22.618	24.725
12	15.812	18.549	21.026	24.054	26.217
13	16.985	19.812	22.362	25.472	27.688
14	18.151	21.064	23.685	26.873	29.141
15	19.311	22.307	24.996	28.259	30.578
16	20.465	23.542	26.296	29.633	32.000
17	21.615	24.769	27.587	30.995	33.409
18	22.760	25.989	28.869	32.346	34.805
19	23.900	27.204	30.144	33.687	36.191
20	25.038	28.412	31.410	35.020	37.566
21	26.171	29.615	32.671	36.343	39.932
22	27.301	30.813	33.924	37.659	40.289
23	28.429	32.007	35.172	38.968	41.638
24	29.553	33.196	36.415	40.270	42.980
25	30.675	34.382	37.652	41.566	44.314
26	31.795	35.563	38.885	42.856	45.642
27	32.912	36.741	40.113	44.410	46.963
28	34.027	37.916	41.337	45.419	48.278
29	35.139	39.087	42.557	46.693	49.588
30	36.250	40.256	43.773	47.962	50.892

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Subject: - Simulation and Modeling

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✓ Attempt **All** questions.
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1. What is system modeling? Differentiate between static mathematical model and dynamic mathematical model with example. (3+7)

2. Define Markov Chains. Explain the key features and applications of Markov Chains. (4+6)

3. Explain the analog method with example of automobile suspension problem. (10)

4. What are the components of a queuing system? How can you measures of system performance of queuing system? Explain. (4+6)

5. Explain the gap test and its algorithm with example. (10)

6. Explain the pseudo random numbers and its applications. The following numbers have been generated 0.54, 0.73, 0.98, 0.11, 0.29, 0.23, 0.65, 0.84 and 0.37. Use the Kolmogorov – Smirnov test with $\alpha=0.05$ to determine, if the hypothesis that the numbers are uniformly distributed on the interval [0, 1] can be rejected. (Note that the critical value of D for $\alpha=0.05$ and N=9 is 0.432. (4+6)

7. Why an analysis of simulation output is important? Explain the elimination of initial bias with example. (2+8)

8. Design the manufacturing shop model using GPSS and explain it. (10)

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2066 Magh

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Subject: - Simulation and Modeling

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✓ Attempt All questions.
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1. Define simulation. What are the various steps in simulation study? Explain.(2+6)

2. Explain the Markov chains with example and its applications. (8)

3. What are the characteristics of queuing systems? Explain the Kendall notation for queuing systems. Define the meaning of D/M/1/LIFO/8/40. (4+6+2)

4. Mention the properties of random numbers. Explain the methods of generating pseudo random numbers. (4+8)

5. State the various test for random numbers and explain briefly any one of uniformity test method. (4+6)

6. A sequence of 1000 four-digit numbers has been generated and an analysis indicates the following combinations and frequencies.

Combinations i	Observed Frequency , O_i
Four Different digits	540
One pair	320
Two pairs	70
Three like digit	50
Four like digit	20
	1000

Based on the poker test, test these numbers are independent. Use $\alpha=0.05$. (Note that the critical value, $\alpha=0.05$ and N=4 is 9.49. (8)

7. Explain the estimation method with example. Where we can apply this method? (3+2)

8. Explain the discrete systems modeling and simulation with GPSS. Explain the telephone system in GPSS model. (4+8)

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8

Exam.		Back	
Level	BE	**Full Marks**	80
Programme	BCT	**Pass Marks**	32
Year / Part	IV / II	**Time**	3 hrs.

Subject: - Simulation and Modeling

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. What do you mean by simulation and modeling? Explain the types of models.   [4+4]

2. Explain the static physical model, dynamic physical model and compare them.   [8]

3. Explain the Markov chains and its application with example.   [8]

4. What do you mean by distributed lag models in system simulation? Explain with example.   [8]

5. What are the properties of random numbers? Explain the algorithm of Gap Test.   [3+5]

6. What do you mean by digital-analog simulators? Explain the analog methods with example.   [4+6]

7. Why poker test is used? Develop the poker test for four digit numbers.   [4+6]

8. How can you use simulation run statistics in an analysis of simulation output?   [8]

9. What do you mean by GPSS? Explain the simulation of telephone system.   [4+8]

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Exam.		Regular/Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - Simulation and Modeling

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. What do you mean by system modeling? Explain the advantages and disadvantages of simulation. [4+4]

2. Explain the static mathematical model, dynamic mathematical model and compare them. [8]

3. What do you mean by calibration and validation of model? Explain the iterative process of calibrating of model with example. [4+5]

4. Write down the characteristics of queueing system. Explain the queueing notation with example. [4+5]

5. Why random numbers are used in simulation? Explain the random number generation method with example. [3+5]

6. What do you mean by continuous system model? Design the analog computer model of liver with example. [3+5]

7. Why poker test is used? Develop the poker test for five-digit numbers. [4+6]

8. How can you use replication of runs in an analysis of simulation output? Explain. [8]

9. What do you mean by GPSS program? Explain the simulation of manufacturing shop. [4+8]

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