

Name: _____

Roll No: _____



UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, Dec 2021

Program: Chemical Engg. B. Tech. (spl. RP); CE-RP

Semester: VII

Course Name: Process Optimization

Max. Marks: 100

Course Code: CHCE 3020/CHEG 455 (Semester 7)

Duration: 3 Hrs (you may be able to solve this in lesser time)

No. of page/s: 1 + 4

In this **OPEN BOOK(S) (any number and kind) and NOTES EXAM**, you are allowed to have any books, *all* handouts provided (including your textbook in xeroxed form), *your own class-notes* and your solutions to assignment problems, *etc.* EVERYTHING EXCEPT DISCUSSIONS AMONG YOURSELVES

Please REMEMBER TO return the Question Paper IF THERE IS ANY WORK DONE ON THAT

1. Show ***ALL intermediate steps*** of your answers (and not just the final answers) to earn marks
2. You are allowed to use only simple scientific calculators
3. ***Please scan YOUR ANSWERS and submit its pdf files to the questions in the sequence: 1, 2, 3***

Section A: XXX

No questions here (open books exam)

Section B: XXX

No questions here (open books exam)

Section C:

ALL THREE QUESTIONS ARE COMPULSORY [Total 100 Marks]

Q.1 Consider the parabola:

CO2

$$f(x_1, x_2) \equiv x_2^2 - 4(x_1 - 2) = 0$$

subject to the constraint:

$$g(x_1, x_2) \equiv x_1 - 2 = 0$$

and bounds

$$2 \leq x_1 \leq 6$$

(a) Fill up the Table below for a *few* specified values of x_1 *Continued Page 2*

x_1	x_2^2	x_2
2.0		
3.0		
4.0		
5.0		
6.0		

(10)

(b) On the graph provided on page 5 of this question paper, plot x_2 as a function of x_1 and also $g(x_1, x_2)$. (5)

(c) Obtain the solution **graphically** (NOTE: **graphically**) (15) CO2 (30 points)

Q2 We would like to use the **binary-coded** genetic algorithm (GA) with **two** binaries **each**, to represent chromosome Nos. 1, 2 and 3. Using binary number = 0 if $0 \leq R \leq 0.5^-$ and the binary number = 1 if $0.5^+ \leq R \leq 1.0$ (**PLEASE NOTE THIS IS THE SAME AS IN THE TEXT**). Fill up the Table (of binaries) below for **only** three chromosomes (Table of random numbers is given in Table 2.6 (on page 78) of the textbook, using the given seed of 0.88876 of the textbook). Also, these are given on Page 4 of this question paper.

Parent chromosomes (binary):

Chromosome No.	x_1		x_2	
	(binary)		(binary)	
1				
2				
3				

CO2 (30 Points)

Q. 3 (**CHALLENGE PROBLEM; do the best you can**): Consider the **modified** travelling salesman problem (TSP), with GA. There are **four** shops (local stockists/**wholesalers**), numbered 1, 2, 3 and 4, where (s)he delivers the material, as per their weekly orders. (S)he **further** distributes the material to **three** local big shopkeepers, 5, 6 and 7, in **each** of these places (sub-agents), who ALSO supply the material to shopkeepers 3 and 4 on their OWN trucks, **while keeping some to sell themselves** (so they are wholesalers as well as retailers). Use the TSP to formulate this problem. CO2-CO5 (40 points)

.... Continued Pages 3 and 4

Table 2.6 (of TEXT): 200 random numbers (generated using a seed of 0.88876) PLEASE SEE BOTH PAGES 4 and 5

<i>i</i>	<i>R_i</i>	<i>i</i>	<i>R_i</i>	<i>i</i>	<i>R_i</i>	<i>i</i>	<i>R_i</i>	<i>i</i>	<i>R_i</i>
1	0.72504	41	0.69950	81	0.28833	121	0.43216	161	0.25990
2	0.34376	42	0.69401	82	0.31568	122	0.80521	162	0.30522
3	0.33580	43	0.29729	83	0.75092	123	0.07496	163	0.61561
4	0.44082	44	0.28119	84	0.70443	124	0.06803	164	0.94657
5	0.11670	45	0.37429	85	0.07658	125	0.12021	165	0.56194
6	0.64585	46	0.85349	86	0.66042	126	0.26527	166	0.20590
7	0.93009	47	0.51598	87	0.76401	127	0.19622	167	0.90821
8	0.31195	48	0.83015	88	0.39626	128	0.91049	168	0.49304
9	0.13906	49	0.87910	89	0.07210	129	0.13772	169	0.91349
10	0.79786	50	0.70291	90	0.46606	130	0.44511	170	0.02655
11	0.25533	51	0.79802	91	0.78172	131	0.42029	171	0.37102
12	0.84748	52	0.85968	92	0.30703	132	0.38251	172	0.15055
13	0.70989	53	0.02142	93	0.97810	133	0.79054	173	0.47659
14	0.28756	54	0.49663	94	0.22712	134	0.79158	174	0.09339
15	0.12770	55	0.82216	95	0.24676	135	0.83833	175	0.04166
16	0.08663	56	0.15041	96	0.62646	136	0.05874	176	0.21350
17	0.90319	57	0.62585	97	0.12916	137	0.22244	177	0.19794
18	0.44395	58	0.16534	98	0.74499	138	0.80354	178	0.16634
19	0.25521	59	0.41345	99	0.35374	139	0.70137	179	0.64308
20	0.72547	60	0.78478	100	0.84524	140	0.47349	180	0.34871
21	0.38873	61	0.91012	101	0.15400	141	0.59980	181	0.75043
22	0.72091	62	0.03872	102	0.30538	142	0.18051	182	0.11097
23	0.70723	63	0.81062	103	0.87683	143	0.32138	183	0.09445
24	0.77548	64	0.32165	104	0.65436	144	0.60020	184	0.78187
25	0.37514	65	0.09836	105	0.41458	145	0.03390	185	0.18522
26	0.91418	66	0.56132	106	0.48234	146	0.97651	186	0.11507
27	0.48102	67	0.55020	107	0.10876	147	0.23207	187	0.76689
28	0.16437	68	0.42870	108	0.31699	148	0.91007	188	0.84397
29	0.48921	69	0.91327	109	0.42006	149	0.10691	189	0.22964
30	0.98669	70	0.27421	110	0.16174	150	0.98149	190	0.63243
31	0.69913	71	0.57065	111	0.38640	151	0.43024	191	0.15052
32	0.57463	72	0.07304	112	0.22959	152	0.21867	192	0.72940
33	0.71791	73	0.56485	113	0.09324	153	0.60727	193	0.89005
34	0.17046	74	0.55230	114	0.94739	154	0.90863	194	0.67483
35	0.02738	75	0.92745	115	0.00306	155	0.42495	195	0.10247
36	0.33192	76	0.52905	116	0.60309	156	0.77149	196	0.44925
37	0.73573	77	0.69949	117	0.06062	157	0.51484	197	0.70392
38	0.89137	78	0.21060	118	0.58350	158	0.08525	198	0.22799
39	0.50133	79	0.95332	119	0.07488	159	0.81604	199	0.55854
40	0.81741	80	0.22473	120	0.47190	160	0.35584	200	0.82040

.... Continued Page 4

NAME: _____
SAP ID: _____

