PAPER 1

Name:

Enrolment No:



UNIVERSITY OF PETROLEUM AND ENERGY STUDIES End Semester Examination, July- 2020

Course: System Analysis & Optimization Semester: 2 Program: M.Tech. Pipeline Engineering Course Code: CHPL7007 Instructions: Attempt ANY FIVE questions

Time: 03 hrs. Max. Marks: 100

S. No.		Marks	CO
Q.1.	Gulf South Pipeline company, while transporting gas utilizes a certain part of the natural gas flowing in the pipeline as an energy source for running the compressor. Researchers found that around 3-4% of the total gas transported through pipeline was consumed in turbine run compressors. This energy consumption was quite large as huge amount of the gas is being transported through pipelines. Researches formulated the problem and found that the fuel consumed in compressor is dependent on the inlet and outlet pressure of the compressors and is obtained from the following relation: $m_f = P_1 - P_2 + 2P_1^2 + 2P_1P_2 + P_2^2$		
	Here: $m_{f=}$ Natural Gas consumed in compressor.	20	CO5
	$P_1 = Pressure at inlet of compressor$		
	$P_2 = Pressure at outlet of compressor$		
	Using Cauchy's Steepest Descent method and taking starting point as: $X = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$, calculate		
	the optimum value of the pressures P_1 and P_2 at which the fuel consumed in compressor gets		
	minimized.		
	Solve up to FOUR NUMBER of iterations.		

TUDIES" for a pipeline project wishes to minimize the cost of pipeline networks. On investigation, he found that there are two major components that contribute for the ost of pipeline networks. These are i. Investment Cost of pipe line Network (I) ii. Operating Cost of pipeline network (O). The researcher found that the total cost of pipeline networks is obtained from the following relation: $\mathbf{T.C.} = -\mathbf{I} - 2\mathbf{O} + 6\mathbf{I}^2 - 6\mathbf{I}^*\mathbf{O} + 2\mathbf{O}^2$ $\mathbf{T.C.} = \text{Total Cost of Pipeline Networks.}$ $\mathbf{I} = \text{Investment Cost of Pipeline Networks.}$	20	CO2
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Operating Cost of pipeline network (O). The researcher found that the total cost of operating cost of pipeline networks is obtained from the following relation: $T.C. = -I - 2O + 6I^2 - 6I^*O + 2O^2$ $T.C. = Total Cost of Pipeline Networks.$ $I = Investment Cost of Pipeline Networks.$	20	CO2
Signature of the following relation: $T.C. = -I - 2O + 6I^2 - 6I^*O + 2O^2$ $T.C. = Total Cost of Pipeline Networks.$ $I = Investment Cost of Pipeline Networks.$	20	CO2
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T.C. = Total Cost of Pipeline Networks. I = Investment Cost of Pipeline Networks.	20	CO2
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$\Omega = \Omega$ perating cost of pipeline networks		
0 – Operating cost of pipeline networks		
With initial starting point as $X = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$, probe length as $\theta = 0.01$ and using		
JNIVARIATE method, minimize the cost of pipeline network. Solve up to TWO NUMBER OF ITERATIONS.		
A pipeline operator wishes to minimize the formation of gas hydrates in pipeline. The		
perator found that the gas hydrates can be minimized by optimizing temperature and		
ressure in pipeline networks. Further it was found that the gas hydrate was a		
orrelated with temperature and pressure according to the following correlation:		
$f(P,T) = 6P^2 - 6P^*T + 2P^2 - P - 2T$	20	
Perform TWO ITERATIONS of the FLETCHER REEVES that helps the pipeline	20	CO3
perator to minimize the formation of gas hydrates.		
Take starting point as: $X = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$.		
A pipeline network problem involves minimizing the cost of laying the pipeline by		
inding the optimum route of pipeline. The cost of the pipeline depends on four ecision variables, R_1 , R_2 , R_3 , and R_4 and is obtained from the following co-relation	20	CO3
	NIVARIATE method, minimize the cost of pipeline network. Solve up to TWO UMBER OF ITERATIONS. pipeline operator wishes to minimize the formation of gas hydrates in pipeline. The perator found that the gas hydrates can be minimized by optimizing temperature and ressure in pipeline networks. Further it was found that the gas hydrate was a porrelated with temperature and pressure according to the following correlation: $f(P,T) = 6P^2 - 6P^*T + 2P^2 - P - 2T$ erform TWO ITERATIONS of the FLETCHER REEVES that helps the pipeline perator to minimize the formation of gas hydrates. ake starting point as: $X = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$.	<i>V</i> ith initial starting point as $X = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$, probe length as $\theta = 0.01$ and using NIVARIATE method, minimize the cost of pipeline network. Solve up to TWO UMBER OF ITERATIONS. pipeline operator wishes to minimize the formation of gas hydrates in pipeline. The perator found that the gas hydrates can be minimized by optimizing temperature and ressure in pipeline networks. Further it was found that the gas hydrate was a porrelated with temperature and pressure according to the following correlation: $f(P,T) = 6P^2 - 6P^*T + 2P^2 - P - 2T$ erform TWO ITERATIONS of the FLETCHER REEVES that helps the pipeline perator to minimize the formation of gas hydrates. ake starting point as: $X = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$. Pipeline network problem involves minimizing the cost of laying the pipeline by nding the optimum route of pipeline. The cost of the pipeline depends on four 20

	$C = R_1 + 2R_2 + 3R_3 + 4R_4 - 30$		
	The bounds on various decision variables are as follows		
	$1 < R_1 < 25$; $3 < R_2 < 30$; $4 < R_1 < 28$; $5 < R_1 < 30$		
	Using Genetic Algorithms, <i>minimize</i> the cost of Gas Pipeline Network. Show, manually the step wise procedure involved up-to one generation only.		
	Assume the number of chromosome as six, crossover rate as 25% and Mutation rate as 10%		
Q.5.	A pipeline operator wishes to minimize the cost of pipeline that goes on a hilly terrain. It was found that the cost depends on the slope of hill as per the following equation: $f(x) = 0.45 - \left[\frac{0.65}{1+x^2}\right] - 0.45x^* \tan^{-1}\left(\frac{1}{x}\right)$ Use Fibonacci Search to minimize the cost: Take the interval as [0,3] and number of experiments to be conducted $n = 6$.	20	CO4
Q.6.	Use the two phase simplex method to minimize the following function: Minimize $P = 12X+20Y$ $6X + 8Y \ge 100$ $7X + 12Y \ge 120$ $X \ge 0; Y \ge 0$	20	CO1

PAPER 2

ROLL NO: R150219002

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Name:

Enrolment No: **R150219002**



UNIVERSITY OF PETROLEUM AND ENERGY STUDIES End Semester Examination, July- 2020

Course: System Analysis & Optimization Semester: 2 Program: M.Tech. Pipeline Engineering Course Code: CHPL7007 Instructions: Attempt ANY FIVE questions

Time: 03 hrs. Max. Marks: 100

S. No.		Marks	CO
Q.1.	Gulf South Pipeline company, while transporting gas utilizes a certain part of the		
	natural gas flowing in the pipeline as an energy source for running the compressor.		
	Researchers found that around 3-4% of the total gas transported through pipeline was		
	consumed in turbine run compressors. This energy consumption was quite large as		
	huge amount of the gas is being transported through pipelines. Researches formulated		
	the problem and found that the fuel consumed in compressor is dependent on the inlet		
	and outlet pressure of the compressors and is obtained from the following relation:		
	$m_f = P_1 - P_2 + P_1^2 + P_1 P_2 + 2P_2^2$		
	Here: $m_{f=}$ Natural Gas consumed in compressor.	20	CO5
	P_1 = Pressure at inlet of compressor		
	$P_2 = Pressure at outlet of compressor$		
	Using Cauchy's Steepest Descent method and taking starting point as: $X = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$, calculate		
	the optimum value of the pressures P_1 and P_2 at which the fuel consumed in compressor gets		
	minimized.		
	Solve up to FOUR NUMBER of iterations.		

Q.2.	A research scholar working at "UNIVERSITY OF PETROLEUM AND ENERGY		
	STUDIES" for a pipeline project wishes to minimize the cost of pipeline networks.		
	On investigation, he found that there are two major components that contribute for the		
	cost of pipeline networks. These are i. Investment Cost of pipe line Network (I) ii.		
	Operating Cost of pipeline network (O). The researcher found that the total cost of		
	pipeline networks is obtained from the following relation:		
	$T.C. = -2I - O + 5I^2 - 7I^*O + 3O^2$		
	T.C. = Total Cost of Pipeline Networks.	20	CO2
	I = Investment Cost of Pipeline Networks.		
	O = Operating cost of pipeline networks		
	With initial starting point as $X = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$, probe length as $\theta = 0.01$ and using		
	UNIVARIATE method, minimize the cost of pipeline network. Solve up to TWO NUMBER OF ITERATIONS.		
Q.3.	A pipeline operator wishes to minimize the formation of gas hydrates in pipeline. The		
	operator found that the gas hydrates can be minimized by optimizing temperature and		
	pressure in pipeline networks. Further it was found that the gas hydrate was a		
	correlated with temperature and pressure according to the following correlation:		
	$f(P,T) = 5P^2 - 7P^*T + 3P^2 - P - 2T$	20	
	Perform TWO ITERATIONS of the FLETCHER REEVES that helps the pipeline	_•	CO3
	operator to minimize the formation of gas hydrates.		
	Take starting point as: $X = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$.		
Q.4.	A pipeline network problem involves minimizing the cost of laying the pipeline by		
	finding the optimum route of pipeline. The cost of the pipeline depends on four decision variables, R_1 , R_2 , R_3 , and R_4 and is obtained from the following co-relation	20	CO3

	$C = R_1 + R_2 + 3R_3 + 4R_4 - 40$ The bounds on various decision variables are as follows $1 < R_1 < 25$; $3 < R_2 < 30$; $4 < R_1 < 28$; $5 < R_1 < 30$ Using Genetic Algorithms, minimize the cost of Gas Pipeline Network. Show, manually the step wise procedure involved up-to one generation only. Assume the number of chromosome as six, crossover rate as 25% and Mutation rate as 10%		
Q.5.	A pipeline operator wishes to minimize the cost of pipeline that goes on a hilly terrain. It was found that the cost depends on the slope of hill as per the following equation: $f(x) = 0.35 - \left[\frac{0.65}{1+x^2}\right] - 0.35x^* \tan^{-1}\left(\frac{1}{x}\right)$ Use Fibonacci Search to minimize the cost: Take the interval as [0,3] and number of experiments to be conducted <i>n</i> = 6.	20	CO4
Q.6.	Use the two phase simplex method to minimize the following function: $Minimize P = 11X+19Y$ $6X + 8Y \ge 100$ $7X + 12Y \ge 120$ $X \ge 0; Y \ge 0$	20	CO1

PAPER 3

ROLL NO: R150219003

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Name:

Enrolment No: **R150219003**



UNIVERSITY OF PETROLEUM AND ENERGY STUDIES End Semester Examination, July- 2020

Course: System Analysis & Optimization Semester: 2 Program: M.Tech. Pipeline Engineering Course Code: CHPL7007 Instructions: Attempt ANY FIVE questions

Time: 03 hrs. Max. Marks: 100

S. No.		Marks	CO
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I = Investment Cost of Pipeline Networks.		
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With initial starting point as $X = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$, probe length as $\theta = 0.01$ and using		
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Q.5.	A pipeline operator wishes to minimize the cost of pipeline that goes on a hilly terrain. It was found that the cost depends on the slope of hill as per the following equation: $f(x) = 0.55 - \left[\frac{0.65}{1+x^2}\right] - 0.55x^* \tan^{-1}\left(\frac{1}{x}\right)$ Use Fibonacci Search to minimize the cost: Take the interval as [0,3] and number of experiments to be conducted $n = 6$.	20	CO4
Q.6.	Use the two phase simplex method to minimize the following function: Minimize $P = 12X+19Y$ $6X + 8Y \ge 100$ $7X + 12Y \ge 120$ $X \ge 0; Y \ge 0$	20	CO1