KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

Department of Mechanical Engineering

B. Sc. Engineering 4th Year 2nd Term Examination, 2019

ME 4051

(Operations Research)

Time: 3 Hours | Total Marks: 210

N.B.: i) Answer any THREE questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.
iii) Assume reasonable data if any missing.

SECTION-A

1(a) What are the essential characteristics of linear programing? Discuss the application of linear programming in managerial decision making. 15

1(b) The manager of an oil refinery has to decide upon the optimal mix of two possible blending processes of which the input and output per production run are as follows: 20

	Input		Output	
Process	Crude–A	Crude–B	Gasoline–X	Gasoline–Y
1	5	3	5	8
2	4	5	4	4

The maximum amount available of crude A and B is 200 units and 150 units respectively. Market requirement show that at least 100 units of gasoline X and 80 units of gasoline Y must be produced. The profit per production run from process 1 and process 2 are Tk 20 and Tk 30 respectively. Formulate the problem as a linear programming problem.

2(a) Why do some problems have multiple optimal feasible solution? How such information is useful for decision making? 10

2(b) Use graphical method to solve the following problem and also identify the redundant constraints if any. 25

$$\text{Minimize, } z = 3x_1 + 2x_2$$
$$\text{Subject to, } 8x_1 + x_2 \geq 8$$
$$2x_1 + x_2 \geq 6$$
$$x_1 + 3x_2 \geq 6$$
$$x_1 + 6x_2 \geq 8$$
$$x_1, x_2 \geq 0.$$

3(a) What is duality theory? What are the advantages of duality? Discuss the various relations regarding primal and dual problem. 10

3(b) Solve the following problem by simplex method. 25

$$\text{Maximize, } z = 3x_1 + 2x_2$$
$$\text{Subject to, } 4x_1 + 3x_2 \leq 12$$
$$4x_1 + x_2 \leq 8$$
$$4x_1 - x_2 \leq 8$$
$$x_1, x_2 \geq 0.$$

4(a) Write down the dual of the following problem, Which problem will you solve? Primal or dual? Justify your answer. 15

$$\text{Minimize, } z = x_3 + x_4 + x_5$$
$$\text{Subject to, } x_1 - x_3 + x_4 - x_5 = 2$$
$$x_2 - x_3 - x_4 + x_5 = 1$$
$$x_2, x_3, x_4, x_5 \geq 0, x_1 \text{ unrestricted in sign.}$$

4(b) The optimal solution of a LP problem is given below. If the integer restriction is given on x_1 & x_2 , find the optimal integer solution. 20

Basic	x_1	x_2	S_1	S_2	S_3	S_4	Solution
z	0	0	1/3	4/3	0	0	$12\frac{2}{3}$
x_2	0	1	2/3	-1/3	0	0	4/3
x_1	1	0	- 1/3	2/3	0	0	10/3
S_3	0	0	- 1	1	1	0	3
S_4	0	0	-2/3	1/3	0	1	2/3

SECTION-B

5(a) A job has four men available for work on four separate jobs. Only one man can work on any one job. The cost of assigning each man to each job is given in the following table. The objective is to assign men to jobs such that the total cost of assignment is minimum. 15

Persons	Jobs			
	1	2	3	4
A	20	25	22	28
B	15	18	23	17
C	19	17	21	24
D	25	23	24	24

5(b) Find out the IBFS of the following transportation problem by any one method. Also find the optimum solution of the problem. 20

Source/ Destination		To				Supply capacity
		I	II	III	IV	
From	A	10	0	20	11	15
	B	12	7	9	20	25
	C	0	14	16	18	5
Demand		5	15	15	10	

6(a) What is game? Write down the characteristics of a game. 05

6(b) What is saddle point? Explain with example. 05

6(c) Solve the following game graphically 25

	B_1	B_2	B_3	B_4
A_1	8	5	- 7	9
A_2	- 6	6	4	- 2

7(a) Ahiyan is a detective fiction writer. A movie company and a TV network both want exclusive rights to one of his more popular works. If he signs with the TV network, he will receive a single lump sum, but if he signs with the movie company, the amount he will receive depends on the market response on his movie. The payoff table is given below. Draw up an appropriate decision tree and decide what he will do? 20

Decisions	State of nature		
	Small box office	Medium box office	Large box office
Sign with movie company	Tk. 200,000	Tk. 1,000,000	Tk. 3,000,000
Sign with TV network	Tk. 900,000	Tk. 900,000	Tk. 900,000
Probabilities	0.3	0.6	0.1

7(b) The following matrix gives the payoff of different strategies (alternatives) S_1, S_2, and S_3 against conditions (events) N_1, N_2, N_3 and N_4. 15

Basic	N_1	N_2	N_3	N_4
S_1	Tk. 4,000	Tk. –100	Tk. 6,000	Tk. 18,000
S_2	Tk. 20,000	Tk. 5,000	Tk. 400	Tk. 0
S_3	Tk. 20,000	Tk. 15,000	Tk. –2,000	Tk. 1000

Indicate the decision taken under the following approach: (i) Pessimistic, (ii) Optimistic, (iii) Regret and (iv) Equal probability.

8(a) Define dynamic programming. Write down the characteristics of dynamic programming. 05

8(b) Three research teams are independently working on the same project. The project is successful in any team does so. Find the distribution of two scientists to maximize the probability of success of the project. 25

New scientist	Probability of failure		
	Team 1	Team 2	Team 3
0	0.4	0.6	0.8
1	0.2	0.4	0.5
2	0.11	0.2	0.3

8(c) Consider the central library of KUET. With the arrival of student in front of the counter for the issue an renew of books, demonstrate that it is a queuing system by describing it's components. 05

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B. Sc. Engineering 4th Year 2nd Term Examination, 2019

ME 4207
(Tool Engineering & Machine Tools)

Time: 3 Hours Total Marks: 210

N.B.: i) Answer any THREE questions from each section in separate scripts.
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SECTION-A

1(a) What is work holder? What are the selection guidelines of a work holder? 08

1(b) Explain the working principle of a Latch clamp. 08

1(c) State and explain the 3–2–1 principle of workpiece location. 11

1(d) What is partial nesting? Write down the advantages of partial nesting. 08

2(a) Write down the differences between jigs and fixtures. Describe leaf jig and indexing jig with sketches. 15

2(b) Mention various types of fixtures in common use. 08

2(c) Classify drill bushings according to ANSI. Also describe them with necessary sketches. 12

3(a) What are meant by die clearance and angular clearance? Mention the effects of excessive and insufficient die clearance. 10

3(b) Explain the methods of reducing cutting force in die cutting operation. 07

3(c) Write short note on: (i) Piercing and (ii) Lancing. 08

3(d) Describe the mathematical procedure to determine the center of pressure for blanking operation. 10

4(a) What is meant by spring back? How it can be prevented? Explain. 10

4(b) Mathematically explain how to determine the followings: 12
(i) Bend allowance, (ii) Bending pressure and (iii) Bend length.

4(c) Describe the procedure to determine the blank size, percent reduction, number of drawn required and drawing force for a cup or shell drawing operation. 13

SECTION-B

5(a) Differentiate among tool, machine and machine tool. Show power transmission in a lathe machine. 13

5(b) What are the kinematics of a machine tool? Discuss the basic features of it. 10

5(c)	Explain 'stepless drive' and 'stepped drive' with examples. Also prove for a G.P. the useful value of common ratio lies between 1 and 2.	12
6(a)	Explain with necessary sketches the working principle of a Meander gearbox.	12
6(b)	Design a gearbox for a drilling machine to give speed variation between 120 to 300 rpm in 6 steps. The driving shaft is to run at a constant speed of 350 rpm (Assume a G.P. series).	17
6(c)	Differentiate between ray diagram and saw diagram.	06
7(a)	What is numerical control of machine tool? Write down the advantages and disadvantages of NC system.	10
7(b)	Differentiate CNC and DNC. Mention the function of MCU.	15
7(c)	What are the steps required for developing the CNC part program? Discuss in short.	10
8(a)	What are the probable causes of vibration in machine tool operation? Describe its effects.	10
8(b)	What is meant by maintenance of machine tools? Briefly describe the major types of machine tool maintenance.	10
8(c)	Write short notes on the following: (i) Automation (ii) Transfer machine and (iii) CAM.	15

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ME 4057
(Material Handling & Maintenance Engineering)

Time: 3 Hours | Total Marks: 210

N.B.: i) Answer any THREE questions from each section in separate scripts.
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SECTION-A

1(a)	Define material handling. Discuss the importance of material handling in industrial economy.	10
1(b)	What are the impacts of angle of repose in conveying material? How do you measure angle of repose of a bulk material?	09
1(c)	State the components of conveying machine.	06
1(d)	Deduce the relation for calculating the capacity and efficiency of a continuous conveying machine.	10
2(a)	Mention the functions of: (i) Fork lift, (ii) Industrial truck, (iii) Plies of belt.	09
2(b)	Describe the general construction of a belt conveyor with a neat sketch.	10
2(c)	Write down the advantages and disadvantages of using pneumatic conveyor over hydraulic conveyor.	08
2(d)	What is vibrating conveyor? Classify vibratory conveyor and explain them.	08
3(a)	Describe the working principle of a V–bucket conveyor.	08
3(b)	Write a short note about swing tray conveyor.	05
3(c)	What is pneumatic conveyor? Describe the negative low–pressure pneumatic system in a pipe line conveyor.	10
3(d)	A horizontal screw is designed to convey molding sand (of a bulk weight $\gamma = 1.9$ ton/m^3); required capacity $Q = 40$ ton per hour; the conveying run length $L = 25$m; Calculate the main parameters: D, N, M_0, V, q, p of the conveyor with usual meaning. Let loading efficiency of 0.125.	12
4(a)	Distinguish between feeder and conveyor. Sketch and explain different types of feeder used in conveyors.	10
4(b)	Discuss different categories of roller conveyor.	08
4(c)	Mention various types of crane. What are the most common crane accidents?	08
4(d)	Describe the working principle of hydraulic elevator.	09

SECTION-B

5(a) Write down the purpose of Maintenance Engineering. Briefly discuss the preventive maintenance of an IC engine. 10

5(b) Describe the factors that are essential in developing a sound maintenance department of an organization. 08

5(c) Explain bathtub curve with example. What are the possible adverse effects: 12
(i) if tire pressure is not sufficient?
(ii) if engine oil is not changed periodically?

5(d) How can facilities get the benefit from predictive maintenance? 05

6(a) Define viscosity. Explain the effects of pressure and temperature on viscosity with necessary equations. 10

6(b) Why additives are used in lubricating oil? Write down difference between grease and oil. 10

6(c) Define viscosity index. Find the viscosity index of an oil which has a kinematic viscosity at 40°C of $\nu_{40} = 135$ cS and at 100°C of $\nu_{100} = 17$ cS. 10

ν_{100}	L	H
16	331.90	164.60
18	408.60	196.20

6(d) What are the factors responsible for shorter life of bearing? 05

7(a) Write down the procedure to start a steam boiler. What are the issues that must be considered during operation of a steam boiler? 13

7(b) Mention the main wear out problems of steam turbine and how condition monitoring can detect them. 12

7(c) Describe the causes of failures and wear of machines and machine components. 10

8(a) Define CMS. Draw the block diagram of monitoring of a hydraulic system. 10

8(b) What are the causes of 10
(i) vibration and noise in plant fan?
(ii) System giving alarm in a steam boiler?

8(c) What is tribology? Is there any situation when wear is desirable? If yes, then explain your answer with example. 10

8(d) What are the common failures of aviation gas turbine blades? 05