L-4/T-2/ME Date: 19/01/2021

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, BUET

L-4/T-2 B.Sc. Engineering Examinations **2019-2020**

Sub: **ME 433** (Fluidics)

Full Marks: 180 Time: 2 Hours

The figures in the margin indicate full marks.

Symbols used have their usual meaning and interpretation.

ASSUME REASONABLE VALUES IF DATA ARE MISSING

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION-A

There are **FOUR** questions in this section. Answer any **THREE**

1. (a) Explain how a hydraulic system can be designed to have equal extension and retraction speeds for the same pump flow. **(10)**

   (b) For the extension strokes of the cylinders shown below, what pump pressure is required if the cylinder loads are F kN each and cylinder 1 has a piston area of 65 sq. cm? What pump pressure is required during the retraction stroke (loads pull to right) if the piston and rod areas of Cylinder 2 are 50 sq. cm and 15 sq. cm, respectively? Take, F = Last digit of your student ID+25 **(20)**

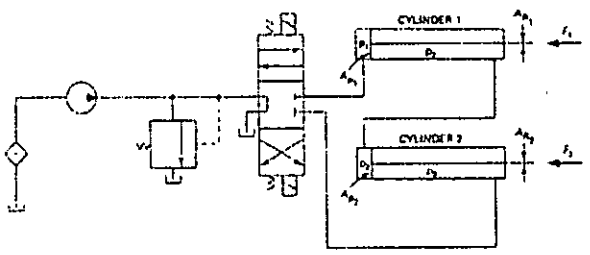
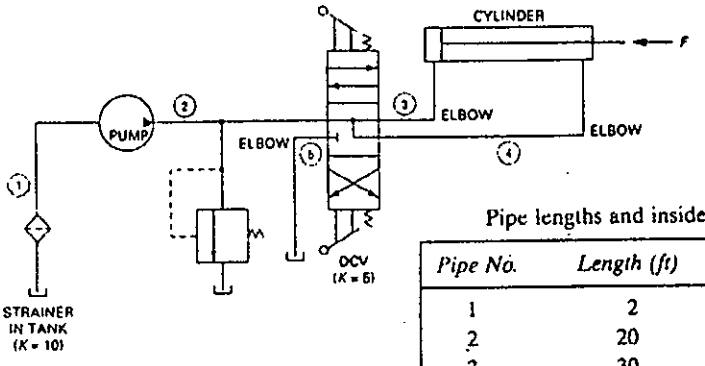


Fig. for Q-1(b)

2. The following system is powered by a 22 hp pump with 75% efficiency. Determine the external load F that the hydraulic cylinder can sustain in the regenerative mode (spring centered position of the DCV), if the pump discharge pressure is P psi. Take frictional losses into account. Use the following data: Kinematic viscosity of the oil = 0.001 ft^2/s, specific weight of the oil = 50 lb/ft^3, piston dia = 8 inch, rod dia = 4 inch and K factor for each elbow = 0.75. **(30)**

   Take, P = 1000 + Last three digits of your student ID



Pipe lengths and inside diameters.

Pipe No.	*Length (ft)*	*Dia (in)*
1	2	2
2	20	1.75
3	30	1.75
4	30	1.75
5	20	1.75

Fig. for Q-2

3. (a) What are fluid conditioners? Give at least five examples. What is FRL unit? **(8)**

   (b) What is the specialty of the following circuit? Identify different components and describe its operation. **(22)**

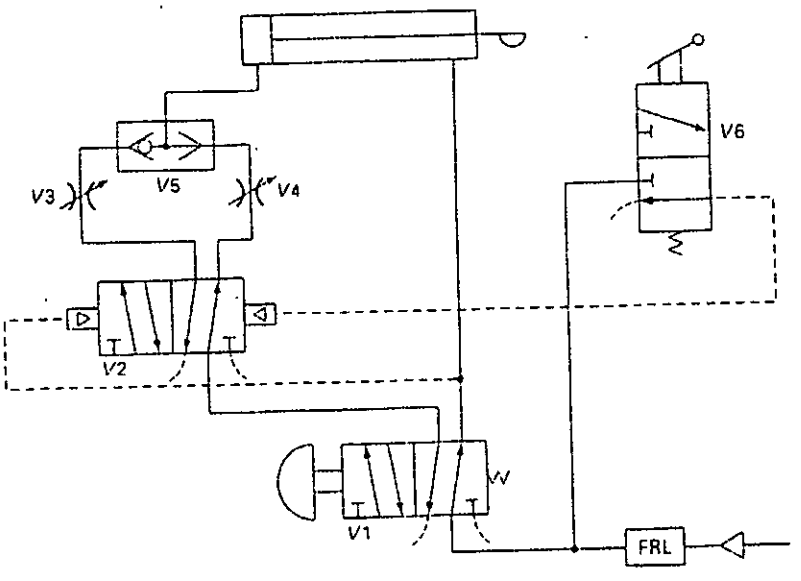
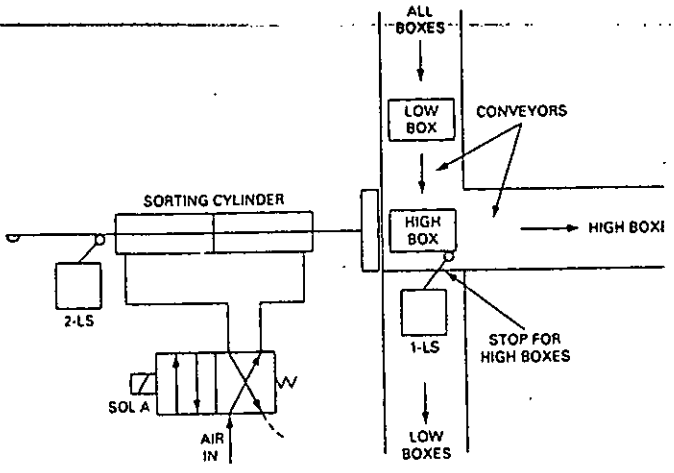


Fig. for Q-3(b)

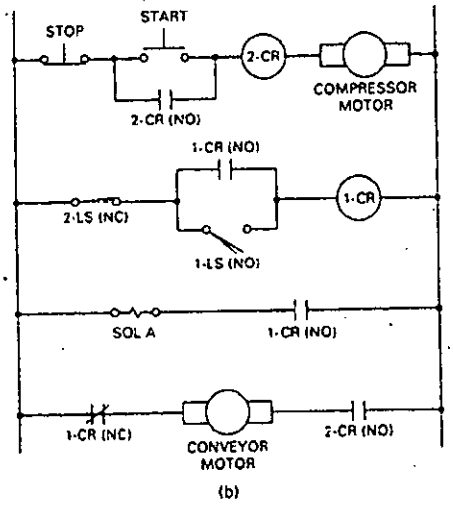
4. (a) Differentiate between MPL and Fluidic devices **(05)**

   (b) What is 'Coanda effect'? How is it applied in designing fluidic devices? **(05)**

   (c) The following figures show the operation and the ladder diagram of an electromagnetically controlled box sorting system. Explain how it works. **(20)**



(a)



(b)

Fig. for Q-4(c)

SECTION-B

There are **FOUR** questions in this section. Answer any **THREE**

5. (a) Differentiate between an In-line piston pump and a Radial piston pump. **(05)**

   (b) Write down the advantages of vane pumps over gear pumps. **(05)**

   (c) For the hydraulic system shown in Fig. for Q. No. 5(c), the following data are given: **(20)**

   (i) the pump is adding (2.0 + 0.01*ID) kW to the fluid, where ID is last three digits of your student number

(ii) pump flow rate is 2.0 liter/sec

(iii) diameter of all pipes is 25.4 mm,

(iv) the specific gravity of oil is 0.9,

(v) the kinematic viscosity of oil is 100 cSt,

(vi) the elevation between point (1) and (2) is 6.3 m,

(vii) pipe length at the pump inlet is 1.5 m and at the pump outlet up to the hydraulic motor is 5.0 m.

Find the pressure available at the inlet to the hydraulic motor. The surface level of oil is open to atmosphere. Assume friction coefficient for pipe is 0.025 if the flow is turbulent.

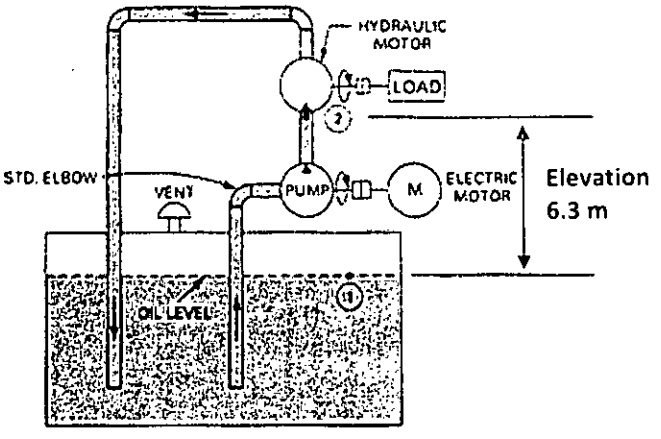


Fig. for Q. No. 5(c)

6. (a) Differentiate between second class and third class lever systems. **(05)**

(b) Write down the characteristic features of cylinder cushioning. Why is it used? **(07)**

(c) A pump supplies oil at 20 gpm to a 2 inch diameter double acting hydraulic cylinder. If the load is (1000 + ID) lb (extending and retracting) and the rod diameter is 1 inch, find the hydraulic pressure, the piston velocity and the cylinder horsepower during both the extending stroke and the retracting stroke. Is there any observation regarding retraction stroke over extending stroke? If yes, explain and mention the reasons. Take ID as the last three digits of your student number. **(18)**

7. (a) Write the advantages of solenoid actuated valves. **(05)**

(b) A hydraulic motor has a volumetric efficiency of 90% and operates at a speed of 1800 rpm and a pressure of (900 + ID) psi, where ID is the last three digits of your student number. If the actual flow rate consumed by the motor is 80 gpm and the actual torque delivered by the motor is 1350 in-lb, find the overall efficiency of the motor. **(12)**

(c) A pressure relief valve contains a poppet with a 0.75 in^2 area on which system pressure acts. **(13)**

During assembly a spring with a spring constant of (2300 + 2.0*ID) lb/in, where ID is the last three digits of your student number, is installed to the poppet against its seat. The adjustment mechanism is then set so that the spring is initially compressed 0.20 in from its free length condition. In order to pass full pump flow through the valve at the PRV pressure setting, the poppet must move 0.10 in from the fully closed position. Determine (i) the cracking pressure, and (ii) full pump flow pressure (PRV pressure setting).

8. (a) Select the proper size steel tube for a flow rate of 30 gpm and an operating pressure of (1000 + ID) psi, where ID is the last three digits of your student number. The maximum recommended velocity is 20 ft/s, and the tube material is SAE 1010 dead soft cold-drawn steel having a tensile strength of 55,000 psi. Use the following Table. **(15)**

Table: Common Tube Sizes

TUBE OD (in.)	WALL THICKNESS (in.)	TUBE ID (in.)	TUBE OD (in.)	WALL THICKNESS (in.)	TUBE ID (in.)	TUBE OD (in.)	WALL THICKNESS (in.)	TUBE ID (in.)
1/8	0.035	0.055	1/2	0.035	0.430	7/8	0.049	0.777
				0.049	0.402		0.065	0.745
3/16	0.035	0.118		0.065	0.370		0.109	0.657
				0.095	0.310			
1/4	0.035	0.180				1	0.049	0.902
	0.049	0.152	5/8	0.035	0.555		0.065	0.870
	0.065	0.120		0.049	0.527		0.120	0.760
				0.065	0.495			
5/16	0.035	0.243		0.095	0.435	1-1/4	0.065	1.120
	0.049	0.215					0.095	1.060
	0.065	0.183	3/4	0.049	0.652		0.120	1.010
				0.065	0.620			
3/8	0.035	0.305		0.109	0.532	1-1/2	0.065	1.370
	0.049	0.277					0.095	1.310
	0.065	0.245						

(b) Write down the advantages and disadvantages of O-rings over compression packings for sealing in hydraulic system. **(05)**

(c) What are the functions of accumulators in hydraulic power system? Discuss the characteristic features and applications of different types of accumulators. **(10)**

L-4/T-2/ME Date: 12/01/2021

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, BUET

L-4/T-2 B.Sc. Engineering Examinations **2019-2020**

Sub: **ME 449** (Composite Materials)

Full Marks: 180 Time: 2 Hours

The figures in the margin indicate full marks.

Symbols used have their usual meaning and interpretation.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION-A

There are **FOUR** questions in this section. Answer any **THREE**

1. (a) What are the advantages of using composite materials in structures? For a Boron- reinforced composite beam graphically show how the beam weight varies with changing the beam height. **(10)**

   (b) Briefly discuss the reasons behind using thin fibers in composite lamina. **(10)**

   (c) Classify different types of matrix materials. Give three examples of each of them. **(10)**

2. (a) For a generalized elastic material, what are the three major sets of equation that needs to be solved? Identify the variables. **(4)**

   (b) What is a monoclinic material? How does it differ from an orthotropic or composite material? **(4)**

   (c) For the generalized orthotropic material with on-axis system, write down the compliance matrix in terms of the mechanical properties of the materials. Also, show the form of the matrix used for 2-D stress state. **(4)**

   (d) The stresses in the global axes of a 30° ply are given as σ_x = 4 MPa, σ_y = 2 MPa, and τ_{xy} = –3 MPa. Find the stresses in the local axes. Are the stresses in the local axes independent of elastic moduli? **(10)**

   (e) The reduced stiffness matrix for a unidirectional lamina is given by **(8)**

$$Q = \begin{bmatrix} 181.8 & 2.897 & 0 \\ 2.897 & 10.35 & 0 \\ 0 & 0 & 7.17 \end{bmatrix} \text{GPa}$$

   What are the four engineering constants, E_1, E_2, ν_{12}, and G_{12}, of the lamina?

3. (a) Consider the unidirectional lamina given in Q. No. 2 (e). If the fibers were oriented at 30°, the stress component σ_x could be written as **(10)**

$$\sigma_x = A\,\varepsilon_x + B\varepsilon_y + C\,\gamma_{xy}$$

   Find the values of *A*, *B*, and *C*.

   (b) Graphically show how the normal stress σ_x varies with ply angle (0 – 90°) for a lamina according to the maximum stress failure theory. How does it differ with the prediction of Tsai-Wu theory? **(6)**

(c) Find the maximum biaxial stress, $\sigma_x = -\sigma$, $\sigma_y = -\sigma$, $\sigma > 0$, that one can apply to a 60° lamina of graphite/epoxy. Use the properties of a unidirectional graphite/epoxy lamina from the given Table. Use Tsai–Wu failure theory. (14)

4. (a) Write down the assumptions that are used to derive the orthotropic plate theory in the path of deriving the lamination theory. (7)

(b) For the laminate with code $[0°,45°]_T$ and graphite/epoxy laminae, determine the extensional stiffness coefficient A_{11}. Use properties from the given Table. Laminate total thickness is 5 mm. (15)

(c) What are meant by effective laminate properties? A laminate (thickness, h = 5 mm) has the following extensional stiffness matrix: (8)

$$A = \begin{bmatrix} 1739 & 3884 & 5663 \\ 3884 & 4553 & -1141 \\ 5663 & -1141 & 7.17 \end{bmatrix} MPa - m$$

Determine the effective laminate moduli in x-, and y-directions. Also, determine the effective Poisson's ratio and effective modulus of rigidity of the laminate in xy plane.

Table of Properties for Composite Lamina

Typical Mechanical Properties of a Unidirectional Lamina (SI System of Units)

Property	Symbol	Units	Glass/ epoxy	Boron/ epoxy	Graphite/ epoxy
Fiber volume fraction	V_f		0.45	0.50	0.70
Longitudinal elastic modulus	E_1	GPa	38.6	204	181
Transverse elastic modulus	E_2	GPa	8.27	18.50	10.30
Major Poisson's ratio	ν_{12}		0.26	0.23	0.28
Shear modulus	G_{12}	GPa	4.14	5.59	7.17
Ultimate longitudinal tensile strength	$(\sigma_1^T)_{ult}$	MPa	1062	1260	1500
Ultimate longitudinal compressive strength	$(\sigma_1^C)_{ult}$	MPa	610	2500	1500
Ultimate transverse tensile strength	$(\sigma_2^T)_{ult}$	MPa	31	61	40
Ultimate transverse compressive strength	$(\sigma_2^C)_{ult}$	MPa	118	202	246
Ultimate in-plane shear strength	$(\tau_{12})_{ult}$	MPa	72	67	68
Longitudinal coefficient of thermal expansion	α_1	μm/m/°C	8.6	6.1	0.02
Transverse coefficient of thermal expansion	α_2	μm/m/°C	22.1	30.3	22.5
Longitudinal coefficient of moisture expansion	β_1	m/m/kg/kg	0.00	0.00	0.00
Transverse coefficient of	β_2	m/m/kg/kg	0.60	0.60	0.60

Formulas for Determining Stiffness Matrix Coefficient

$$\overline{Q}_{11} = Q_{11} m^4 + 2(Q_{12} + 2Q_{66}) m^2 n^2 + Q_{22} n^4$$

$$\overline{Q}_{12} = (Q_{11} + Q_{22} - 4Q_{66}) m^2 n^2 + Q_{12} (m^4 + n^4)$$

$$\overline{Q}_{22} = Q_{11} n^4 + 2(Q_{12} + 2Q_{66}) m^2 n^2 + Q_{22} m^4$$

$$\overline{Q}_{16} = (Q_{11} - Q_{12} - 2Q_{66}) m^3 n + (Q_{12} - Q_{22} + 2Q_{66}) m n^3$$

$$\overline{Q}_{26} = (Q_{11} - Q_{12} - 2Q_{66}) m n^3 + (Q_{12} - Q_{22} + 2Q_{66}) m^3 n$$

$$\overline{Q}_{66} = (Q_{11} + Q_{22} - 2Q_{12} - 2Q_{66}) m^2 n^2 + Q_{66} (m^4 + n^4)$$

L-4/T-2/ME Date: 16/01/2021

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, BUET

L-4/T-2 B.Sc. Engineering Examinations **2019-2020**

Sub: **ME 461** (Control Engineering)

Full Marks: 180 Time: 2 Hours

The figures in the margin indicate full marks.

Symbols used have their usual meaning and interpretation.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION-A

There are **FOUR** questions in this section. Answer any **THREE**

1. (a) Obtain the transfer functions $X_1(s)/U(s)$ and $X_2(s)/U(s)$ of the mechanical system shown in Fig. for Q-1(a). **(22)**

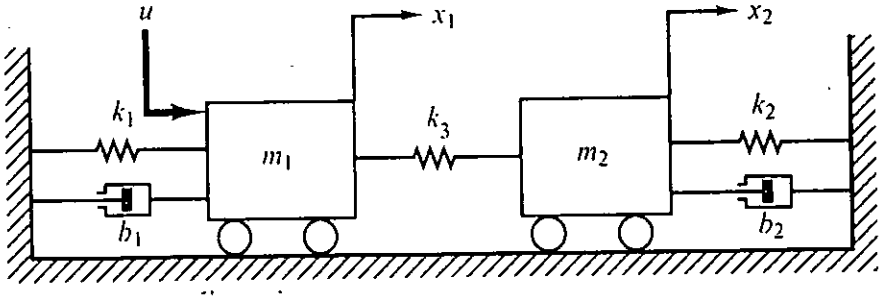


Fig. for Q-1(a)

(b) Obtain the transfer function $E_o(s)/E_i(s)$ of the op-amp circuit shown in Fig. for Q-1(b). **(8)**

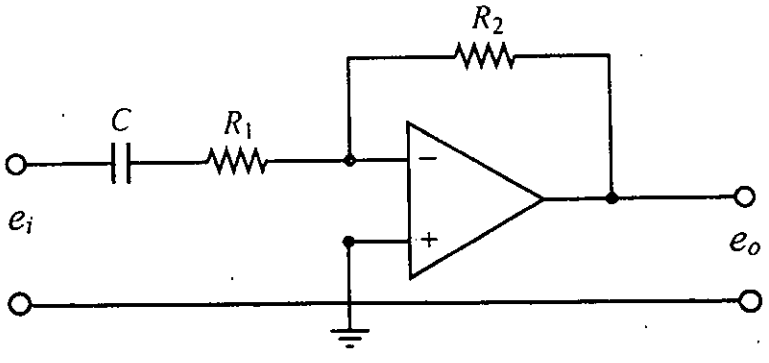


Fig. for Q-1(b)

2. (a) Simplify the block diagrams shown in Fig. for Q-2(a) and obtain the transfer function $C(s)/R(s)$. **(15)**

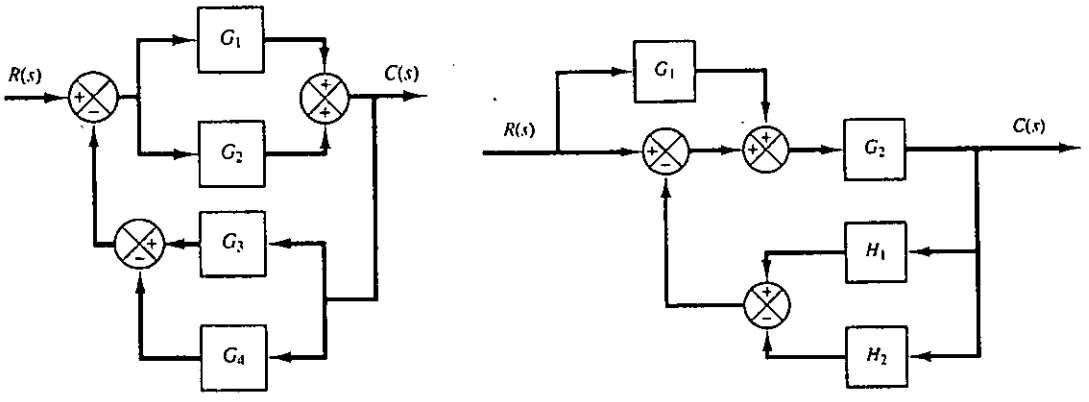


Fig. for Q-2(a)

(b) A laser printer uses a laser beam to print rapidly for a computer. The laser is positioned by a control input $r(t)$, so that we have, **(15)**

$$C(s) = \frac{4(s + 50)}{s^2 + 30s + 200} R(s).$$

The input $r(t)$ represents the desired position of the laser beam.
(i) If $r(t)$ is a unit step input, find the output $c(t)$.
(ii) What is the final value of $c(t)$?

3. (a) What pole locations characterize (i) the underdamped system, (ii) the overdamped system, and (iii) the critically damped system? Name two conditions under which the response generated by a pole can be neglected. **(10)**

(b) Consider the system shown in Fig. for Q-3(b). Determine the value of k such that the damping ratio ζ is 0.5. Then obtain the rise time T_r, peak time T_p, % overshoot, and settling time T_s for the unit-step response. **(20)**

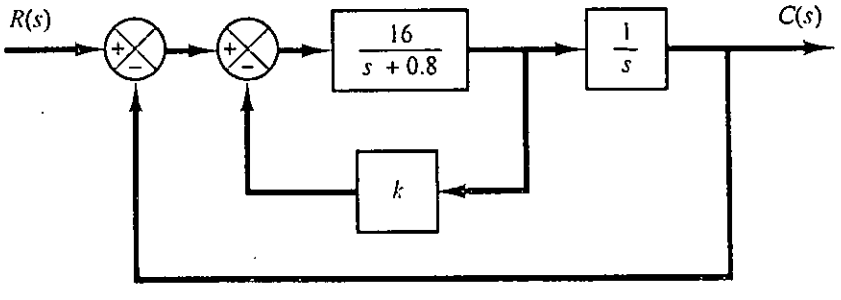


Fig. for Q-3(b)

4. (a) Fig. for Q-4(a) shows a closed-loop system with a reference input $R(s)$ and disturbance input $D(s)$. Obtain the expression for the output $C(s)$ when both the reference input and disturbance input are present. **(12)**

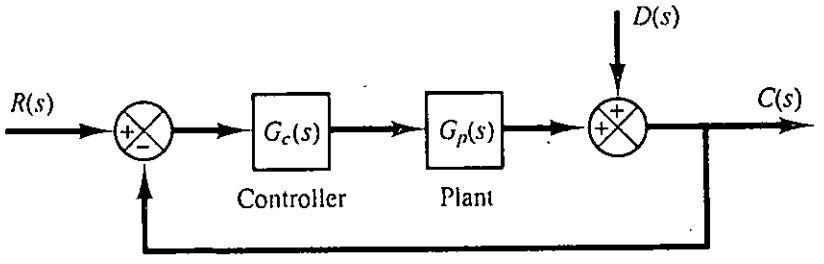


Fig. for Q-4(a)

(b) A feedback system is shown in Fig. for Q-4(b). Determine the steady-state error for a unit step when $K = 0.4$ and $G_p(s) = 1$. **(13)**

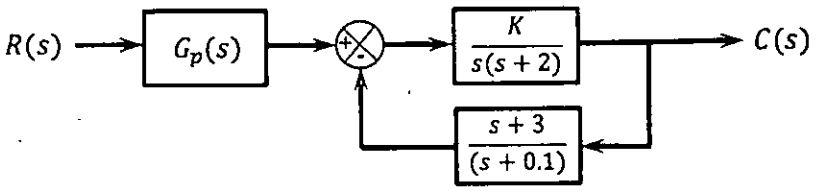


Fig. for Q-4(b)

(c) Functionally, how do closed-loop systems differ from open-loop systems? **(5)**

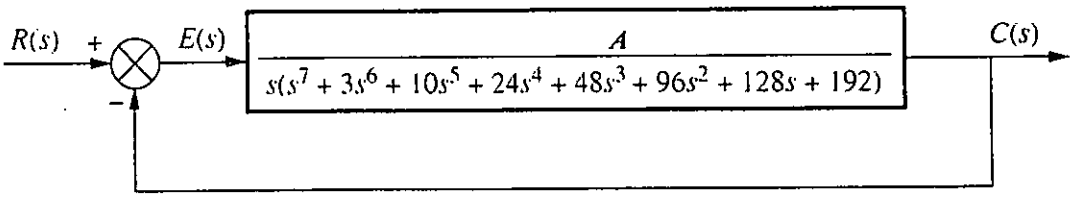
SECTION-B

There are **FOUR** questions in this section. Answer any **THREE**

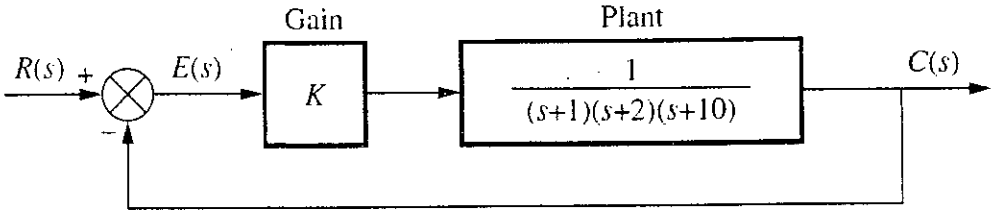
ASSUME REASONABLE VALUES IF DATA ARE MISSING

5. (a) Define stability, instability, and marginal stability **(6)**

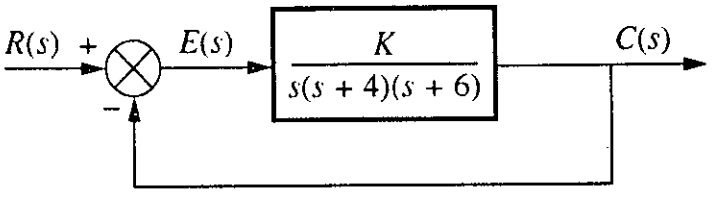
(b) Using Routh table, find the number of poles in the left half-plane, the right half-plane, and on the jω-axis for the following system. Also, ascertain the stability of the system. Take, A = Last three digits of your student ID + 125. **(24)**



6. Using Root Locus method design a compensator for the system of the following figure to improve the steady-state error by a factor of 10 if the system is operating with a damping ratio of ζ. Take, ζ = (Last three digits of your student ID + 150)/1000. **(30)**

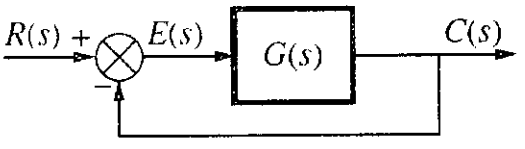


7. For the following system, design an ideal derivative compensator to yield a 20% overshoot, with a threefold reduction in settling time. Use Root Locus method. **(30)**



8. Draw the Bode magnitude plot for the system shown below, where **(30)**

$$G(s) = K(s + 3)/[s(s + 1)(s + 2)]$$



Properly label the plot.

BANGLADESH UNIVERSIRTY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B.Sc. Engineering Examination **2019-2020**

Sub: **ME 469** (Nuclear Engineering)

Full Marks:180 Time: 2 Hours

The figures in the margin indicate full marks.
Abbreviations and Symbols used have their usual meaning and interpretation.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION-A

There are **FOUR** questions in this section. Answer any **THREE**

1. (a) Describe the nuclear fuel cycle with a free hand simplified schematic diagram for "open fuel cycle today" and "prospective closed end fuel cycle". **(15)**

   (b) Why is there always a steady state distribution of void across the channel in a Boiling Water Reactor? Explain this phenomenon with relevant curves with thermal parameters. Also identify the change of trend in the curves due to the presence of control rods in the reactor. **(15)**

2. Why does the burnup depth of a nuclear fuel rod need to be considered for the safer design and operation of the fuel rod? Provide the typical curves for all cases in your explanation. Briefly describe the consequences and measures due to burnup of fuel rod for efficient operation of nuclear reactor. **(30)**

3. (a) How does the geometry of a fuel pellet effect the cooling of the pellet's itself? Draw and compare the pellet geometry of VVER design and Western design in this context. **(15)**

   (b) How does a core catcher minimize the consequences of an accident in a nuclear power plant? Show the position of a core catcher in a nuclear reactor by drawing a simplified free hand schematic diagram. **(15)**

4. "Passive heat removal is one of the important features for the safety system of a nuclear reactor"-justify this statement. In this regard, describe the working principles of a passive heat removal system with necessary sketches. **(30)**

SECTION-B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Draw a schematic diagram identifying the components of a FBR. How is it different from a PWR? **(16)**

   (b) Briefly discuss the comparative features of PWR and BWR plants. **(14)**

6. (a) What do you understand by a VVER type nuclear power plant? Give an example. **(12)**

   (b) What do you understand by Cladding? Briefly discuss the purpose of using it. **(10)**

   (c) Using a schematic diagram show the temperature distribution in typical fuel rod of circular shape with cladding. **(8)**

7. (a) Identify all the main radioactive wastes created in a typical nuclear power plant. **(12)**

   (b) State the role of Boric acid solution in operation of a nuclear plant. **(8)**

   (c) How long is it needed to preserve spent fuels? Write a short note on spent fuel storage pool. **(10)**

8. (a) What do you understand by equivalent cooling channel in a fuel lattice? Briefly explain how does it influence heat transfer from adjacent fuel rods? **(16)**

   (b) Briefly discuss the external impact factors that need to be considered for safe protection of a typical nuclear plant. **(14)**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-2 B. Sc. Engineering Examinations (January 2020 Term)

Sub: **IPE 481 (Industrial Management)**

Full Marks: 240 Section Marks: 120 Time: 2 Hours (Sections A + B)

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

There are **THREE** questions in this section. Answer any **TWO**.

1. (a) In the ongoing pandemic situation, a manufacturing company is having cash crisis. The company is planning to reduce fixed costs in order to manage the crisis. According to you, which types of costs can be reduced while maintaining existing capacity and production volume and why? Does this decision have any long term impact over the company? **(15)**

(b) Managers often assume a strictly linear relationship between cost and production volume. How can this practice be defended in light of the fact that many costs are curvilinear? Explain the negative consequences of this practice if there is any. **(15)**

(c) Gallatin Carpet Cleaning is a small, family-owned business operating out of Bozeman, Montana. For its services, the company has always charged a flat fee per hundred square feet of carpet cleaned. The current fee is $28 per hundred square feet. However, there is some question about whether the company is actually making any money on jobs for some customers—particularly those located on remote ranches that require considerable travel time. The owner's daughter, home for the summer from college, has suggested investigating this question using activity-based costing. After some discussion, a simple system consisting of four activity cost pools seemed to be adequate. The activity cost pools and their activity measures appear below: **(30)**

Activity Cost Pool	Activity Measure	Activity for the Year
Cleaning carpets	Square feet cleaned (00s)	20,000 hundred square feet
Travel to jobs	Miles driven	60,000 miles
Job support	Number of jobs	2,000 jobs
Other (costs of idle capacity and organization-sustaining costs)	None	Not applicable

The total cost of operating the company for the year is $430,000, which includes the following costs:

Wages	$150,000
Cleaning supplies	40,000
Cleaning equipment depreciation	20,000
Vehicle expenses	80,000
Office expenses	60,000
President's compensation	80,000
Total cost	$430,000

Resource consumption is distributed across the activities as follows:

Distribution of Resource Consumption Across Activities

	Cleaning Carpets	Travel to Jobs	Job Support	Other	Total
Wages	70%	20%	0%	10%	100%
Cleaning supplies	100%	0%	0%	0%	100%
Cleaning equipment depreciation	80%	0%	0%	20%	100%
Vehicle expenses	0%	60%	0%	40%	100%
Office expenses	0%	0%	45%	55%	100%
President's compensation	0%	0%	40%	60%	100%

Job support consists of receiving calls from potential customers at the home office, scheduling jobs, billing, resolving issues, and so on.

i. Prepare the first-stage allocation of costs to the activity cost pools.
ii. Compute the activity rates for the activity cost pools.
iii. The company recently completed a 500 square foot carpet-cleaning job at the flying N Ranch—a 75-mile round-trip journey from the company's offices in Bozeman. Compute the cost of this job using the activity-based costing system.
iv. The revenue from the flying N ranch was $140 (500 square feet@ $28 per hundred square feet). Prepare a report showing the margin from this job.
v. What do you conclude concerning the profitability of the Flying N ranch job? Explain.
vi. What advice would you give the president concerning pricing jobs in the future?

2. (a) Due to fluctuation in sales, Company Y is experiencing some problems. Company's income statement for the most recent month is given below: **(40)**

Sales (30,200 units * $42)	$1,268,400
Less variable expense	815,400
Contribution margin	453,000
Less fixed expenses	380,000
Net Income	73,000

i. Compute the company's CM ratio and its break-even point in both unit and dollars.
ii. The president is certain that a $26,000 increase in the monthly advertising budget, combined with an intensified effort by the sales staff will result in a $90,000 increase in monthly sales. If the President is right, what will be the effect on the company's net income or loss?
iii. Refer to the original data, the sales manager is convinced that a 8% percent reduction in the selling price, combined with an increase of $50,000 in the monthly advertising budget, will cause unit sales to double. What will be the new income statement look like if these changes are adopted?
iv. Refer to the original data, the marketing department thinks that a fancy new package would increase would help sales. The new package would increase packaging costs by $1.2 per unit. Assuming no other changes in cost behavior, how many units would have to be sold each month to earn a net income of $95,000?
v. Refer to the original data, by automating certain operations; the company could reduce variable costs by $3 per unit. However, fixed costs would increase by $72,000 each month. Compute the new CM ratio and the new break-event point in both units and dollars. Assume that the company expects to sell 38,000 units next month. Prepare two income statements, one assuming that operations are not automated and one assuming that operations are automated. Would you recommend that the company automate its operations and why?

vii. Refer to the original data, a large distributor has offered to make a bulk purchase of extra 5,000 units each month on a special price basis. Variable selling expenses of $1 per unit could be avoided on this sale. What price per unit should the company quote to the distributor if the company wants to make an overall net income of $98,000 each month for the company as a whole?

(b) Define operating leverage and explain its significance. **(08)**

(c) Explain how the concept of the Equity theory can play a significant role in motivating employees. **(12)**

3. (a) E Mines Inc. is contemplating the purchase of equipment to exploit a mineral deposit that is located on land to which company has mineral rights. An engineering and cost analysis has been made and it is expected that the following values would be associated with opening and operating a mine in the area: **(20)**

Cost of new equipment and timbers	$480,000
Working capital required	$220,000
Annual cash receipts for year 1-4	$190,000
Annual cash receipts for year 5-8	$220,000
Annual maintenance costs for year 2-8	$22,000
Cost to construct new roads in fourth years	$80,000
Salvage value of equipment	$85,000

It is estimated that mineral deposit would be exhausted after eight years. At that point, the working capital required would be released for reinvestment elsewhere. The company's cost of capital is 12%. Determine the net present value of the proposed mining project. Should the project be undertaken and why?

(b) The company G prepares its master budget on a quarterly basis. The following data have been estimated to assist in preparation of the master budget for the first quarter of 2021: **(40)**

- As of December 2020, the company's general ledger showed the following account balance:

	Debits	**Credits**
Cash	$48,000	
Accounts Receivables	$224,000	
Inventory	$60,000	
Plant and Equipment	$370,000	
Accounts Payable		$93,000
Capital Stock		$500,000
Retained Earnings		$109,000
	$702,000	**$702,000**

- Actual sales for December and budgeted sales for the next four months are as follows:

December	$280,000
January	$400,000
February	$600,000
March	$300,000
April	$200,000

- Sales are 20% for cash and 80% on credit. Payments are collected in the month following sales. Accounts receivables at December 31 are a result of December credit sales.
- The company's gross profit rate is 40% of sales.

- Monthly expenses are budgeted as follows: salaries and wages, $27,000 per month; advertising, $70,000 per month; freight-out, 5% of sales; depreciation, $14,000 per month; other expenses, 3% of sales.
- At the end of each month, inventory is to be on hand equal to 25% of the following month's sales needs, stated at cost.
- 50% of a month's inventory purchase is paid for in the month of purchase; the other 50% is paid for in the following month.
- During February, the company will purchase a new copy machine for $1,700 cash. During March, other equipment will be purchased for cash at a cost of $84,500.
- During January, the company will declare and pay $45,000 in cash dividend.
- The company must maintain a minimum cash balance of $30,000. An open line of credit is available at a local bank for any borrowing that may be needed during the quarter. All borrowing is done at the beginning of a month, and all repayments are made at the end of a month. Borrowings and repayments of principals must be in multiples of $1,000. Interest is paid only at the time of payment of principal. The interest rate is 12% per year. (Figure interest on whole month, e.g., 1/12, 2/12.)

Using the data above, complete the following statements and schedules for the first quarter of 2021:

i. Schedule of expected cash collections:

	January	February	March	Quarter
Cash Sales	$80,000			
Credit Sales	$224,000			
Total Cash Collections	$304,000			

ii. Inventory purchase budget:

	January	February	March	Quarter
Budgeted cost of goods sold	$240,000	$360,000		
Add: Desired ending inventory	$90,000			
Total needs	$330,000			
Deduct: Beginning inventory	$60,000			
Required purchase	$270,000			

For January sales: $400,000 sales * 60% = $240,000; $360,000* 25% = $90,000.

iii. Schedule of cash disbursements for purchases:

	January	February	March	Quarter
December purchase	$93,000			
January purchase ($270,000)	$135,000	$135,000		
February purchase				
March purchase				
Total cash disbursements	$228,000			

iv. Schedule of cash disbursements for expenses:

	January	February	March	Quarter
Salaries and wages	$27,000			
Advertising	$70,000			
Freight-out	$20,000			
Other expenses	$12,000			
Total cash disbursements	$129,000			

v. Cash budget:

	January	February	March	Quarter
Cash balance, beginning	$48,000			
Add cash collections	$304,000			
Total cash available	$352,000			
Less disbursements				
Purchase of inventory	$228,000			
Operating expenses	$129,000			
Purchase of equipment	-			
Cash dividends	$45,000			
Total disbursements	$402,000			
Excess (deficiency) of cash	(52,000)			
Financing				

vi. Prepare an income statement for the quarter ending March 31, 2021 (Ignore income taxes).

viii. Prepare a balance sheet as of March 31, 2021.

SECTION – B

There are **THREE** questions in this section. Answer any **TWO**.

4. (a) "The intermediaries, sometimes called resellers, are critical to the success of a company's marketing program" – justify this statement with the help of an example. **(10)**

(b) How product line-filling can help a company keep its competitors out? **(10)**

(c) What type of distribution channel is typically used for consumer products? Was this typical scenario disrupted under the situation of COVID-19? Explain with necessary examples. **(15)**

(d) What are the dimensions in which a product can be differentiated? Discuss their effect on customer satisfaction. **(25)**

5. (a) How a leader can build trust among his/her followers? **(10)**

(b) "When a company is geographically dispersed, centralized decision making is more appropriate" – do you agree to this statement? Justify your answer. **(10)**

(c) Explain the three stages of technology life cycle (TLC) with the help of the S-curve of technological progress. **(20)**

(d) Describe "The Hawthorne Experiments" conducted at Western Electric Company. Discuss the outcomes and conclusions of the studies. **(20)**

6. (a) What are the sources of competition for an industry? Discuss with necessary examples. **(14)**

(b) Discuss the different challenges of management with necessary examples. **(16)**

(c) Assess the performance of a given team leader according to Fiedler model of leadership using the following information: **(30)**

- The leader was scored 60 using least preferred co-worker (LPC) questionnaire
- The leader has limited power to reward or punish the members of his team
- The leader is trusted by his team members
- The task assigned to the team is well structured

Justify your answer with the help of the graphical representation of the findings of the Fiedler model.