KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Mechanical Engineering
B.Sc. Engineering 4th Year Special Backlog Examination, 2023
Math 2205
(Mathematics IV)

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) Write down the Legendre's differential equation. Prove that, 22
$(1-2xz+z^2)^{-1/2} = \sum_{n=0}^{\infty} z^n P_n(x)$, $|x| \le 1, |z| < 1$.

1(b) Prove that, $\int_{-1}^{1} P_m(x)P_n(x)dx = \begin{cases} 0 & \text{if } m \neq n \\ \frac{2}{2m+1} & \text{if } m = n \end{cases}$ 13

2(a) If n is any integer, then show that $J_n(x) = (-1)^n J_n(x)$. 06

2(b) Show that, 16
(i) $\int_0^{\pi/2} \sqrt{\pi x}\, J_{1/2}(2x)dx = 1.$
(ii) $J_0(x) = \frac{2}{\pi}\int_0^1 \frac{\cos(xt)}{\sqrt{1-t^2}}\, dt.$

2(c) Show that, $J_n(x) = \frac{1}{\pi}\int_0^{\pi} \cos(n\varphi - xsin\varphi)\, d\varphi$, where n is a positive integer. 13

3(a) The vibrations of an elastic string of length l are governed by the one-dimensional wave equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$. The string is fixed at the ends. The initial deflection is $u(x,0) = x, 0 < x < l/2, u(x,0) = l - x, l/2 \le x \le l$ and $u_t(x,0) = 0$. Find the deflection of the string at any instant of time. 18

3(b) The heat flow in a rod of length 10 cm of homogeneous material is governed by the partial differential equation $u_t = 4u_{xx}$. The ends of the rod are kept at 0°C and the initial temperature $u(x,0) = 50\ sin\left(\frac{\pi x}{10}\right)$. Find the temperature distribution $u(x,t)$. 17

4(a) Consider a thin square metal plate $0 < x < 1$, $0 < y < 1$. Three sides are kept at 0°C and the top side is kept at 100°C. Find the steady-state temperature distribution. 18

4(b) A circular plate of radius 'a' is kept at 0°C and the temperature along the boundary is $u(a,\theta) = 50\ cos\theta$. Find the steady-state temperature inside the plate. 17

SECTION – B

5(a) Define unit step function. Obtain Laplace transform of the following periodic function: 10

$$f(t) = \begin{cases} \cos\left(t - \frac{2\pi}{3}\right), & t > \frac{2\pi}{3} \\ 0, & t < \frac{2\pi}{3} \end{cases}$$

5(b) Prove that $\mathcal{L}\left\{\frac{\cos at - \cos bt}{t}\right\} = \frac{1}{2} log\left(\frac{s^2+b^2}{s^2+a^2}\right)$. 13

5(c) Define Laplace transformation. Using Laplace transform, evaluate $\int_0^{\infty} t^3 e^{-t} sint$ dt. 12

6(a) State the following properties of Laplace transform: 10
(i) Second shifting property, (ii) change of scale property with example.

6(b) Find the inverse Laplace transform of $\frac{6s-4}{s^2-4s+20}$. 09

6(c) Find the solution of $\frac{\partial U}{\partial x} = 2\frac{\partial U}{\partial t} + U$, $U(x,0) = 6e^{-3x}$ which is bounded for $x \geq 0, t > 0$ using Laplace transform. 16

7(a) Write down the condition for Fourier series expansion of a function. Obtain Fourier series for the expansion of $f(x) = x\sin x$ in the invterval $-\pi < x < \pi$, hence deduce that, 22

$$\frac{\pi}{4} = \frac{1}{2} + \frac{1}{1.3} - \frac{1}{3.5} + \frac{1}{5.7} - \cdots$$

7(b) Define odd and even function. If $f(t) = t^2$, $0 \leq t \leq 1$ find its half range Fourier cosine series. 13

8(a) Write down the complex form of Fourier series. Find a series of sine and cosine multiple of x which represent $x + x^2$ in the interval $-\pi < x < \pi$ and hence deduce that, 20

$$\frac{\pi^2}{6} = \sum_{n=1}^{\infty} \frac{1}{n^2}.$$

8(b) Use parseval's identity to the function $f(x) = \sin x$, $0 < x < \pi$ and show that, 15

$$\frac{1}{1^2.3^2} + \frac{1}{3^2.5^2} + \frac{1}{5^2.7^2} + \cdots = \frac{\pi^2-8}{16}.$$

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KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

Department of Mechanical Engineering

B. Sc. Engineering 4th Year Special Backlog Examination, 2023

ME 3205

(Heat Transfer II)

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) Discuss the physical mechanism of convection heat transfer briefly. Also, on what factor does the convection heat transfer coefficient depend? 08

1(b) Write the energy balance in mathematical form of an elemental control volume within a laminar boundary layer with necessary assumptions. 09

1(c) Air at 1 atm and 25°C blows across a large concrete surface 20 m wide maintained at 60°C. The flow velocity is 5 m/s. Calculate the convective heat loss from the surface. 18

2(a) Derive an expression of thermal boundary layer thickness when a fluid is flowing over a heated flat plate. 18

2(b) A 4 cm diameter cylinder is subjected to a cross flow of CO_2 at 250°C and a pressure of 1 atm. The cylinder is maintained at a constant temperature at 60°C and the CO_2 velocity is 30 m/s. Calculate the heat transfer to the cylinder per meter of length. 17

3(a) Consider the laminar boundary layer flow of a liquid metal with velocity u_∞ and temperature T_∞ over a flat plate maintained at a uniform temperature. Taking the temperature profile in the form 18

$$\theta(x,y) = \frac{T(x,y)-T_w}{T_\infty - T_w} = \sin\left(\frac{\pi}{2}\frac{y}{\delta_t}\right),$$

where T_w is the wall temperature and δ_t is the thermal boundary-layer thickness. Develop an expression for the local heat transfer coefficient h_x.

3(b) Temperature inside a circular pipe with constant heat flux in laminar condition varies according to the following equation: 17

$$T = T_s - \frac{\dot{q}_s R}{K}\left(\frac{3}{4} - \frac{r^2}{R^2} + \frac{r^4}{4R^4}\right)$$

where symbols have their usual meaning. In this condition show that Nu is a constant which is equal to 4.36.

4(a) Describe the phenomena of heat transfer during turbulent flow of fluid over the surface. 09

4(b) Describe the physical interpretation of the dimensionless numbers: 06
(i) Nusselt Number, (ii) Prandlt Number, and (iii) Grashof Number.

4(c) Air at 25°C flows over a tube bank consisting of 2.5 cm–OD, 2–m long tubes in inline arrangement with S_L/D = 1.5 and S_T/D = 2. The tube bank is 10 rows deep, forming a stack 20 tubes high. The air velocity before entering the tube bank is u_∞ = 10 m/s. The tubes are maintained at a uniform temperature of 100°C. Determine the average friction factor and the pressure drop for the flow across the tube bank. 20

SECTION – B

5(a) Why are higher heat transfer rate experienced in dropwise condensation than in film condensation? 05

5(b) Derive the expression of mean heat transfer coefficient for laminar flow of condensation over a vertical plate. 15

5(c) Air-free saturated steam at 90°C (P = 70.14 kPa) condenses on the outer surface of a 3 cm-OD vertical tube maintained at a uniform temperature of 70°C. Determine the length of tube in order to condense 15 kg/hr of steam. 15

6(a) Distinguish between pool boiling and film boiling. 05

6(b) Draw the boiling curve and explain its various regimes. 15

6(c) An electrically heated copper Kettle with a flat bottom of diameter D = 25 cm is to boil water at atmospheric pressure at a rate of 3 kg/hr. What is the temperature of the bottom surface of the Kettle? 15

7(a) Discuss the classification of heat exchangers. 08

7(b) Derive an expression of effectiveness of counter flow heat exchanger. 12

7(c) A counter flow heat exchanger is to be used to heat 3 kg/s of water from 20°C to 70°C by using hot exhaust gas [C_p = 1000 J/(kg.°C)] entering at 200°C and leaving at 90°C. The overall heat transfer coefficient is 200 W/(m^2.°C). Calculate the heat transfer surface required. 15

8(a) What is meant by mass transfer? Derive an expression for one-dimensional unsteady state diffusion of fluid for constant diffusivity in rectangular coordinate. 18

8(b) An industrial pipe line containing ammonia gas is vented to ambient air to maintain a pressure close to 1 atmosphere. Venting is done by tapping the pipe and inserting a 4 mm diameter tube which extends for 25 m into the atmosphere. With the entire system operating at 30°C, determine the mass rate of ammonia lost to atmosphere. What are the mole and mass fraction of air in the pipe when the ammonia flow rate is 8 kg/hr? [D = 0.28×10^{-4} m^2/sec]. 17

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KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Mechanical Engineering
B.Sc. Engineering 4th Year Special Backlog Examination, 2023
ME 3215
(Engineering Metallurgy)

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 is calibration? Explain the working principle of resistance thermometer. 10

1(b) Explain the factors affecting hardness test results. 10

1(c) Explain the steps of specimen preparation for metallographic study. 08

1(d) Write down the advantages and disadvantages of the optical and radiation pyrometer. 07

2(a) Depict the atomic arrangement in body centered cubic and face centered cubic crystal lattices. 13

2(b) Explain the following structures: 09
(i) Bainite; (ii) Ledeburite; (iii) Sorbite.

2(c) Using the cooling curve, explain the mechanism of crystallization with necessary sketches. 13

3 Lead melts at 600°F and Tin melts at 450°F. They form a eutectic containing 60% Tin at 350°F. The maximum solubility of Tin in Lead at this temperature is 20% and that of Lead in Tin is 3%. Assume the solubility of each in other at room temperature is 1%. 35

(i) Draw the equilibrium diagram to scale on a piece of paper labeling all the points, lines, and areas.
(ii) Describe and explain the solidification process of a 40% Tin alloy. Sketch its final microstructure at room temperature. Also, calculate the relative amount of each phases at room temperature.
(iii) Draw the cooling curve of the above alloy.

4(a) Explain case hardening. How it defer from edge hardening? 11

4(b) Determine the annealing, normalizing and hardening temperatures of a plain carbon steel containing: 12
(i) 0.3% C; (ii) 0.8% C; (iii) 1.2% C.

4(c) For a eutectoid steel, draw a T-T-T diagram and label it properly. Also, explain the process of obtaining steel containing both bainite and martensite. 12

SECTION – B

5(a) What is slag? How does it form? Write down its application. 15

5(b) Why is wrought iron considered as pure form of iron? Explain a suitable method for wrought iron production. 15

5(c) Distinguish between white iron and gray iron. 05

6(a)	Describe Bayer's process for aluminium production.	10
6(b)	What is spring steel? Briefly discuss different types of spring steels.	15
6(c)	What is stainless steel? Explain the mechanism of corrosion resistance of stainless steel.	10
7(a)	Write down the properties and major uses of the following materials: (i) Copper; (ii) Nickel; (iii) Lead.	12
7(b)	What properties of non-ferrous metals and alloys are made them suitable in many applications although we have ferrous metals and alloys?	06
7(c)	Write down the compositions and uses of the following alloys: (i) Gun metal; (ii) Hastelloy; (iii) Duralumin.	12
7(d)	Name the base metals generally used for the following objects: Compressor of a refrigerator, piston of a petrol engine, bathroom fittings, electrical cables, and car body.	05
8(a)	What are the basic characteristics of powder material?	10
8(b)	What are the methods of producing metal powders? Explain the atomization process.	15
8(c)	Explain the working principle of flame wire metal spraying.	10

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KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

Department of Mechanical Engineering

B. Sc. Engineering 4th Year Special Backlog Examination, 2023

ME 4017

(Refrigeration and Air Conditioning)

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) Define the following terms: (i) COP; (ii) Ton of refrigeration. 06

1(b) Interpret the applications of refrigeration in food processing and preservation. Also compare standard and actual vapour compressing refrigeration system. 14

1(c) A 15TR R22 vapour compression system operates between a condenser temperature of 45°C and an evaporator temperature of 5°C. Calculate: 15
(i) Refrigerant circulation rate in kg/s
(ii) Compressor power in kW
(iii) COP
(iv) Compressor discharge temperature.

2(a) What is multi pressure vapour compression refrigeration system? Why are flash tank and intercooler used in this system? 07

2(b) Demonstrate the problems raised in the actual practice in water-LiBr system. Illustrate and explain the commercial double-effect double drum water-LiBr refrigeration system. 10

2(c) Illustrate the triple fluid vapour absorption refrigeration system. How does this system operate at different pressures without any pump? 10

2(d) What are the desirable properties of a good refrigerant? How are mixture refrigerants designed? 08

3(a) Why is cooling necessary for an aircraft? Describe the Boot-strap system of aircraft cooling. 12

3(b) Explain the working principle of vortex tube refrigeration system. 10

3(c) What is meant by Cryogenics? Describe the Linde system for liquefaction of air with schematic diagram. 13

4(a) Define the hermetically sealed compressor. With the neat sketch describe the working principle of a screw compressor. 10

4(b) List out the various expansion valve used in refrigeration system. Briefly explain the working principle of the automatic expansion valve (AEV). 10

4(c) What is dry ice? What are the advantages and disadvantages of dry ice? 10

4(d) Make a short note about the evaporative condenser. 05

SECTION – B

5(a) Define human comfort. Illustrate and explain the ASHRAE comfort chart showing various effective temperatures. 08

5(b) Demonstrate an air washer by showing the various phychometric process that can take place when air comes in direct contact with the spray of water. 10

5(c) Define metabolism. "A living human body may be likened to a heat engine"- Explain with examples. 07

5(d) Interpret the importance of considering the bypass factor in designing an air conditioning system. How sensible heat and latent heat are calculated in air conditioning? 10

6(a) Interpret the reasons for increasing demand of air conditioner usage nowadays. How does summer air conditioning system differ from winter air conditioning system? 10

6(b) With a neat sketch, demonstrate the working principle of year-round air conditioning system used in a multishop. 10

6(c) An air-conditioned space of ME department, KUET is maintained at 25°C DBT and 55% RH. The ambient temperatures of air are 40°C DBT and 27°C WBT. The space has a sensible heat gain of 14 kW. The conditioned air is supplied to the space at 8°C saturated state. Calculate the (i) mass of moist air supplied to the space in kg/h, (ii) latent heat gain of space in kW, and (iii) cooling load of the air washer in kW if 20% of the air supplied to the space is fresh and the remainder being recirculated. 15

7(a) Interpret the purposes of ventilation. Explain the natural ventilation through infiltration by stack effect and wind pressure effect. 08

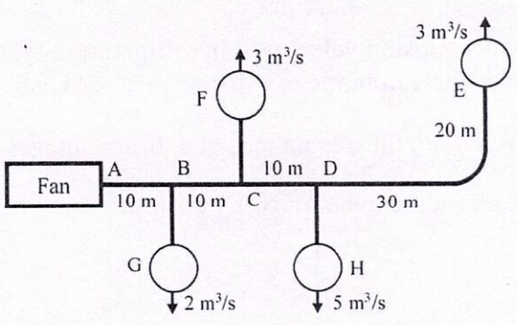
7(b) Define cooling load. Discuss the steps for estimating the cooling load of a predefined room of ME309, ME, KUET. 07

7(c) A laboratory in ME department, KUET having an unusually large latent heat gain is required to be air conditioned. The design conditions and loads are as follows: summer design conditions are 40°C DBT and 27°C WBT, while inside design conditions are 25°C DBT and 50% RH. The room sensible heat and latent heat are recorded as 34.9 kW and 18.6 kW, respectively. Again, the ventilation air requirement is 85 cmm. Determine the (i) ventilation load, (ii) room sensible heat factor (SHF) and effective SHF, (iii) apparatus dew point and amount of reheat for economical design, (iv) condition of air entering and leaving coil and supply air temperature, and (v) grand total heat. Taking the bypass factor, BPF = 0.05. 20

8(a) What factors are to be taken into consideration in locating the supply air outlets and return air inlets? 08

8(b) What are the methods of duct design? Describe the equal friction method of duct design. 12

8(c) For the duct system shown in figure, determine the dimensions of the rectangular ducts AB, BC, CD, and DE with aspect ratio 2.5:1 assuming friction rate of 0.2 mm H_2O/m length duct. 15



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KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

Department of Mechanical Engineering

B. Sc. Engineering 4th Year Special Backlog Examination, 2023

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.
ii) Figures in the right margin indicate full marks.
iii) Assume reasonable data if any missing.

SECTION – A

1(a)	Define material handling. Discuss the objectives of material handling.	08
1(b)	Classify and briefly describe industrial transports which are used in material handling.	08
1(c)	Describe the term mobility and angle of repose. How can you determine angle of repose of a bulk material?	09
1(d)	Describe the relation for calculating the capacity and efficiency of a conveying machine.	10
2(a)	Describe general construction of belt conveyor with neat sketch and label its important components.	10
2(b)	Why ply is used in rubberized belt conveyor? How belt end can be fastened by vulcanization? Describe briefly.	08
2(c)	Why apron conveyor is used? What are the advantages and disadvantages of apron conveyor over flight conveyor? Discuss.	10
2(d)	Describe the function of idler and driving sprockets in an apron conveyor.	07
3(a)	Describe the operation principle of a hydraulic loader.	08
3(b)	Draw the different types of screw used in screw conveyor. What are the advantages and disadvantages of paddle flight and cut flight screw conveyor over continuous screw conveyor?	14
3(c)	A horizontal screw is designed to convey molding sand of a bulk weight $Y = 1.8$ ton/m^3; required capacity, $Q = 50$ ton/hr; Conveying run length, $L = 25$ m. Calculate the main parameters: μ, D, N, Mg, S, q and P of the conveyor with usual meaning. Assume any data if required.	13
4(a)	Mention the working principle of a loader chute with necessary sketches.	07
4(b)	Describe the working principle of a V-bucket conveyor.	10
4(c)	Sketch and explain different types of feeders used in conveyors.	08
4(d)	Draw a typical escalator step and label its important components.	10

SECTION – B

5(a) Explain preventive maintenance and corrective maintenance. Discuss the preventive maintenance of an IC engine. 12

5(b) What are the main challenges and risks associated with maintenance engineering and how can they be mitigated? 11

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

6(a) How would you maintain an industrial boiler? Mention the safety measures to be taken before starting a steam boiler. 10

6(b) When is wear encouraged rather than avoided? Discuss. 08

6(c) How does friction modifier work? Write the differences between grease and oil. 12

6(d) How can facilities get the benefits from predictive maintenance? 05

7(a) Why are additives used in lubricating oil? State the advantages and disadvantages of synthetic oil. 09

7(b) Mention the main wear out problems of steam turbine and how condition monitoring can detect them. 09

7(c) Briefly describe the sequential failure of seals and their remedies for common seal failure. 12

7(d) What are the factors upon which the life of a ball bearing and journal bearing depends? 05

8(a) What are the common faults arise during pump operation in agriculture fields? How to repair it? 10

8(b) Describe the maintenance of the brake system of a vehicle for its proper functioning. 08

8(c) Write down stand clearance between shaft and journal bearing for 25 mm shaft, 50 mm shaft, and 100 mm shaft. 05

8(d) Discuss the typical causes and remedies of the following faults: 12
(i) Excessive oil consumption in an engine
(ii) Poor ignition
(iii) Engine overheats.

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KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Mechanical Engineering
B.Sc. Engineering 4th Year Special Backlog Examination, 2023
ME 4127
(Operations Management)

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) Describe the input output model of a production system. Does a university represent a production system? If so, identify the input, output, and processes of it. 12

1(b) Identify six production processes from real life and state why they are called production processes. Justify your answer. 12

1(c) Explain the role of operation management in an organization. 11

2(a) What is meant by depreciation of an asset? When to use double declining balance method for calculating depreciation of an asset? Explain. 10

2(b) Define and explain the following terms: 12
(i) Marginal cost, (ii) Opportunity cost, and (iii) Sunk cost.

2(c) The *ABC* company wanted to purchase a shaper machine. Two suppliers submitted their proposals to supply the machine. The related data are as follows: 13

Parameters	Supplier *X*	Supplier *Y*
Initial cost	TK 1,50,000	TK 1,20,000
Salvage value	TK 25,000	TK 18,000
Economic life	8 Years	10 Years
Annual operating cost	TK 2,500	TK 1,800

Considering the rate of annual interest 12 percent, which machine should be purchased by the company applying equivalent annual cost method.

3(a) Define project. How is it different from program? Why is it used? 06

3(b) Write down the characteristics of a project. 06

3(c) Write down the advantages and disadvantages of a network scheduling. 08

3(d) The construction of oil industry requires the activities shown below 15

Activity	Immediate predecessors	Duration (hrs)
A	—	45
B	A	25
C	A	85
D	A	50
E	D	25
F	A, C	60
G	C	10
H	A, B	30
I	F	40
J	D, G, E	25
K	G, H, I, J	30

(i) Identify the redundant activity.
(ii) Draw the activity on arc network.
(iii) Find the critical path.

4(a) Define method study. Justify why method study should proceed before work measurement. 10

4(b) Draw a man-machine chart for making a bolt in a workshop. 07

4(c) Write down the principles of motion economy related to the human body. 08

4(d) What is meant by THERBLIG? How many are they? Mention ten of them with symbols. 10

SECTION – B

5(a) What are the factors that lead to consideration of a plant relocation? How do uncontrollable factors affect the facility relocation decisions? 12

5(b) Write down the short note on- 08
(i) Combined layout, and (ii) Fixed position layout.

5(c) A bearing manufacturing company decided to expand its existing factory to another city with alternatives Satkhira, Jashore, and Kushtia available. The total estimated annual costs are TK 6.7 million for Satkhira, TK 6.3 million for Jashore, and TK 6.2 million for Kushtia. The most important subjective factors are (i) housing, (ii) education, and (iii) community attitude. All these are equally important. It is also considered that objective factors are equally important as subjective factors. The following results are obtained by pairwise comparison. 15

Sites	Housing			Education			Community Attitude		
	1	2	3	1	2	3	1	2	3
Satkhira	0	1	—	1	1	—	1	0	—
Jashore	1	—	1	1	—	0	1	—	1
Kushtia	—	0	1	—	0	1	—	1	0

Determine the best location for the expansion of the company according to Brown-Gibson approach.

6(a) Define demand forecasting. What are the different methods of demand forecasting? Write down the components of a demand forecasting system. 12

6(b) Quarterly unit demand for a product is given below 23

Year	Q_1	Q_2	Q_3	Q_4
1	85	69	79	89
2	86	76	89	79
3	88	64	74	78
4	103	77	79	70

Calculate the seasonal indices for each quarter, and with the help of these indices, calculate the forecast value for each quarter of the fifth year.

7(a) What are meant by safety stock and reorder point? 05

7(b) The lead time demand for a spare part used by service department of an imported car dealer is as follows: 15

The lead time demand	20	21	22	23	24	25	26
Probability	0.05	0.05	0.25	0.25	0.30	0.25	0.05

Determine the appropriate reorder point and safety stock for a 90% service level.

7(c) The maintenance department of KUET requires 6000 gallons of paint annually for schedule maintenance of its buildings. It has been estimated that the cost of holding an inventory is 25 percent of the investment in inventories and the cost of placing an order is TK 16. The pricing policy of the vendor is as follows: 15

$$b(Q) = \begin{cases} b_1 = TK\ 8\ per\ gallon\ if\ Q > 300\ gallons \\ b_2 = TK\ 6\ per\ gallon\ if\ 300 \leq Q < 500\ gallons \\ b_3 = TK\ 4\ per\ gallon\ if\ Q \geq 500\ gallons \end{cases}$$

Determine the optimal ordering policy.

8(a) Suppose that six jobs are waiting at the beginning of a shift to be processed on two machines. Their operation times in hours have been estimated as follows: 15

Job	A	B	C	D	E	F
Machine *X*	5	3	6	1	4	7
Machine *Y*	2	7	5	2	5	9

(i) Find job sequence to minimize the total elapsed time applying Johnson rule.
(ii) Draw Gantt chart.
(iii) Determine the percentage of idle time for each machine over the total elapsed time.

8(b) The Mithai Bakery Shop prepares a delux cake each weekend for its best customers. The statistical distribution for demand of cake is shown below- 20

Demand, y	0	1	2	3	4	5
Probability, P(y)	0.05	0.15	0.20	0.25	0.20	0.15

The owner sells the cakes for TK 800 each when the prepared cost is TK 500. The left over cakes are sold on special discount of price TK 300. Find the optimum quantity of cakes the Bakery shop should prepare. Verify your answer using the Baye's criterion as well.

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