L-3/T-2/IPE **Date : 19/11/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **IPE 317** (Product Design II)

Full Marks: 210 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

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

The text book titled "Fundamentals of Mechanical Component Design" by K.S. Edwards and R. B. McKee is supplied.

1. The torque on a machined torsion bar varies from an unspecified maximum T_{max} to a minimum value $T_{min} = -2T_{max}/3$. Also 250 in. lb of energy must be absorbed at the peak torque with a total angle of twist less than 5^0. The diameter must be greater than 2 and less than 4 in. and length is greater than 25 in. Use FS = 2. The design objective is to minimize the peak torque. Use 1040 steel. Determine optimum values of other parameters as well. **(35)**

2. A flanged connection is shown in fig. 2(Q). Four 3/8 - 24 UNF–2A grade- 7 bolts are used. The diameter of the shaft is 3/4 in. and of the flange is 3 in. Each flange thickness is 3/8 in. If the preload in the bolts corresponds to the proof strength. What force P will cause separation of the joint? **(35)**

3. A 10 pitch 20^0 full depth involute gearset with a face width of 1.25 inches is being proposed to provide a 2 : 1 speed reduction for a conveyor drive unit. The 18 tooth pinion is to be driven by a 15 hp, 1725 rpm electric motor operating steadily at full rated power. A very long life is desired for the gearset and a reliability of 99% is required. Do the following. Use data attached to your question. **(35)**

   (a) Using simplified approach, estimate surface fatigue wear stress for meshing gear teeth.

   (b) If the Grade I 4620 gear teeth are carburized and case hardened to a hardness of Rc 60, determine surface fatigue strength.

   (c) Estimate the existing safety factor based on surface fatigue wear failure.

   (d) Using AGMA refined approach, calculate the surface fatigue contact stress for the meshing gear teeth. Use Qv = 10.

   (e) If the gear material is AISI 4620 and teeth are carburized and case hardened to hardness of Rc 60, determine the AGMA surface fatigue strength for carburized and case hardened gear teeth.

4. (a) A two-planet epicyclic gear train is sketched in fig. 4(a)(Q). If the ring gear is fixed, the sun gear is driven at 1200 rpm in CCW direction, and the carrier arm is used as output, what would be the speed and direction of rotation of carrier arm? **(20)**

   (b) A closed D tube of aluminium is sketched in fig. 4(b)(Q). If the tube is slit in middle of straight side then compute its torsional stiffness per metre of length. **(15)**

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SECTION – B

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

Symbols indicate their usual meaning.

5. (a) What do you understand by Design for Assembly? Elaborate DFA guidelines in respect of insertion guidelines and handling guidelines with proper sketches. **(18)**

(b) Explain the effects of part size and weight on handling time. **(10)**

(c) What are the difference between alpha symmetry and beta symmetry? Show with example. **(7)**

6. (a) What are the factors to be considered for fiber reinforcement in a matrix? Describe the factors with neat sketches. **(12)**

(b) What do you understand by rule of mixture in composites? **(5)**

(c) What are the advantages and limitations of Honeycomb Sandwich Structure? Describe a method to produce that structure? **(18)**

7. (a) What are the limitations of DFA guidelines? **(7)**

(b) What are the criteria of being a separate part in assembly design? **(8)**

(c) Figure 7 shows the schematic of a vertically mounted motor armature. The bearings are No. 203. The sum of the belt tensions are **(20)**

150 lb. at 945 rpm for about 50 percent of time

122 lb. at 1230 rpm for about 20 percent of time

93 lb. at 1790 rpm for about 30 percent of time

There are light shock conditions. Estimate the time in hours to the first bearing failure for 90 percent reliability.

8. Consider following information for the shaft given in Figure 8.

Shaft diameter = 33 mm; Overhang = 0.5 m; Shaft spacing = 0.5 m

Gear Radius = 0.045 m minimum, 0.35 maximum; Motor power = 75 kw

Motor speed = 1800 rpm; Axial load on shaft = 25 E + 03 N; Factor of safety = 1.5

Shaft speed = 15 rps minimum, 30 rps maximum; Material AISI 4130 Steel.

Now answer the following questions:

(a) Find stress limited torque by recursive technique and power limited torque. What is your opinion about value of gear radius to reach the optimal torque? What is the role of shaft diameter in determining the torque level? **(23)**

(b) Find the stress limited torque by direct method. Please provide necessary sketches. (12)

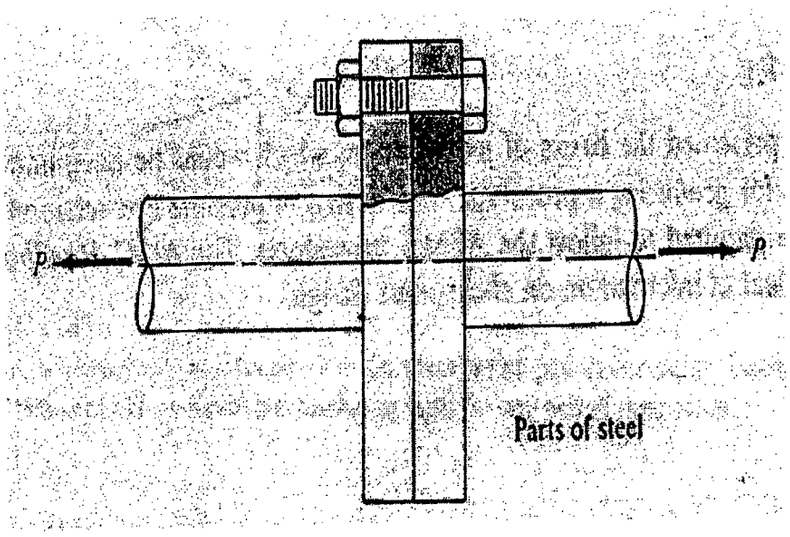

Figure 2(Q)

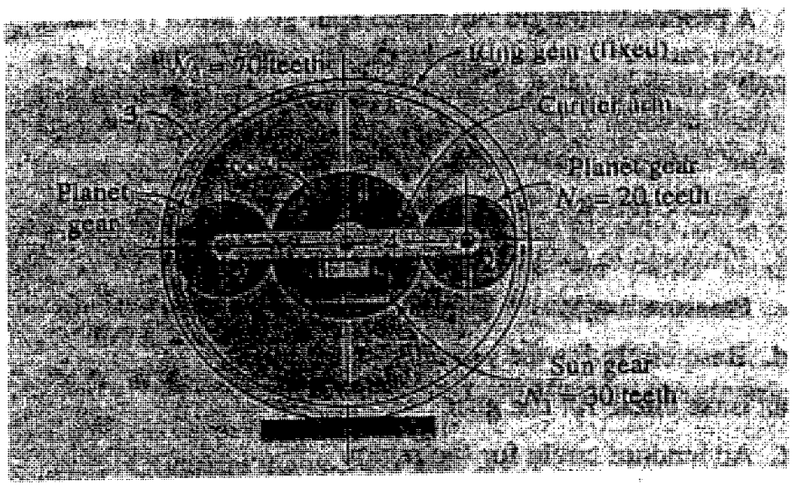

Figure 4(a) (Q)

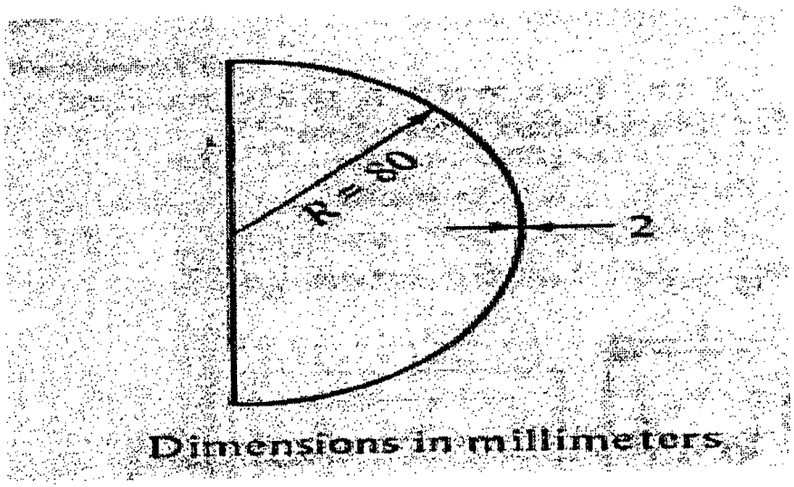

Figure 4(b) (Q)

TABLE 2.3 Strength Reliability Factors as a Function of Reliability Level

Reliability R (percent)	Corresponding Standard Normal Variable X (see Table 5.1)	Strength Reliability Factor k_r
50	0	1.00
90	1.282	0.90
95	1.645	0.87
99	2.326	0.81
99.9	3.090	0.75
99.995	3.891	0.69

TABLE 2.1 Strength Properties of Selected Materials[1]

Material	Alloy	Ultimate Tensile Strength S_u (psi)	Yield Strength S_y (psi)
Ultra-high-strength steel	AISI 4340	287,000	270,000
Stainless steel (age hardenable)	AM 350	206,000	155,000
High-carbon steel	AISI 1095	200,000	115,000
Titanium	Ti-6Al-4V	170,000	120,000
Ceramic	Silicon carbide	154,000	
Nickel-base superalloy	Inconel 718	150,000	130,000
Medium-carbon steel	AISI 1040 (HR)	102,000	55,000
Low-carbon steel	AISI 1020 (HR)	68,000	48,000
	AISI 1020 (CD)	78,000	66,000
Low-grade, low-alloy steel	AISI 4620 (HR)	87,000	70,000
	AISI 4620 (CD)	101,000	83,000
Stainless steel (austenitic)	AISI 304 (annealed)	85,000	35,000
Yellow brass	C 26800 (hard)	77,000	60,000
Commercial bronze	C 22000 (hard)	61,000	54,000
Low-carbon (mild) steel	AISI 1020 (CD)	61,000	51,000
	AISI 1020 (annealed)	59,000	43,000
	AISI 1020 (HR)	65,000	30,000
Phosphor bronze	C 52100 (annealed)	65,000	24,000
Gray cast iron	ASTM A-48 (class 30)	35,000	
Gray cast iron	ASTM A-48 (class 60)	60,000	
Aluminum (wrought)	2024-T3 (sheet, heat-treated)	70,000	50,000
Aluminum (wrought)	2024 (annealed)	27,000	11,000
Aluminum (permanent mold casting)	356.0 (T51) (heat-treated)	38,000	27,000
Magnesium (extruded)	ASTM AZ80A-T5	45,000	33,000
Magnesium (sand cast)	ASTM AZ63A	29,000	14,000
Thermosetting polymer	Epoxy (glass-reinforced)		10,000
Thermoplastic polymer	Nylon (unreinforced)		7,000

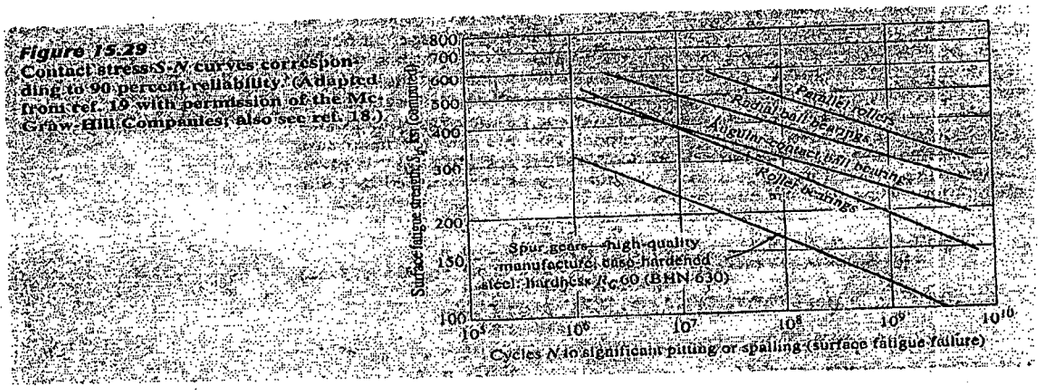

Figure 15.29 Contact stress S–N curves corresponding to 90 percent reliability. (Adapted from ref. 19 with permission of the McGraw-Hill Companies; also see ref. 18.)

TABLE 13.15 ANSI/AGMA Surface Fatigue Strength (Pitting Resistance), S_{fb} for Steel Gears[1]

		Metallurgical Quality[2]					
		Grade 1		Grade 2		Grade 3	
Material	Heat Treatment	Min. Surf. Hardness[3]	S_{fb} ksi	Min. Surf. Hardness	S_{fb} ksi	Min. Surf. Hardness	S_{fb} ksi
Steel	Through hardened	See Figure 15.30					
	Flame or induction hardened	50 R_C	170	—	190	—	—
		54 R_C	175	—	195	—	—
	Carburized and hardened (Min. core hard.)	55–64 R_C (21 R_C)	180	58–64 R_C (25 R_C)	225	58–64 R_C (30 R_C)	275
AISI 4140, AISI 4340 steel	Nitrided (through hardening)	83.5 R_{15N}	150	83.5 R_{15N}	163	83.5 R_{15N}	175
		84.5 R_{15N}	155	84.5 R_{15N}	168	84.5 R_{15N}	180
2.5% chrome (no aluminum)	Nitrided	87.5 R_{15N}	155	87.5 R_{15N}	172	87.5 R_{15N}	189
Nitralloy 135M	Nitrided	90.0 R_{15N}	170	90.0 R_{15N}	183	90.0 R_{15N}	195
Nitralloy N	Nitrided	90.0 R_{15N}	172	90.0 R_{15N}	188	90.0 R_{15N}	205
2.5% chrome (no aluminum)	Nitrided	90.0 R_{15N}	176	90.0 R_{15N}	196	90.0 R_{15N}	216

TABLE 15.6 Application Factor, K_a

Prime Mover Characteristic	Driven Machine Characteristic: Uniform	Moderate Shock	Heavy Shock
Uniform (e.g., electric motor, turbine)	1.00	1.25	1.75 or higher
Light shock (e.g., multicylinder engine)	1.25	1.50	2.00 or higher
Medium shock (e.g., single-cylinder engine)	1.50	1.75	2.25 or higher

TABLE 15.7 Mounting Factor, K_m

Support Properties and Gear Quality	Face Width, in: 0 to 2	6	9	16
Accurate mountings, small bearing clearances, minimum deflections, precision gears	1.3	1.4	1.5	1.8
Less rigid mountings; more bearing clearance, less accurate gears, contact across full face	1.6	1.7	1.8	2.2
Combinations of mounting properties and gearing precision that produce less than full face contact	2.2 or higher			

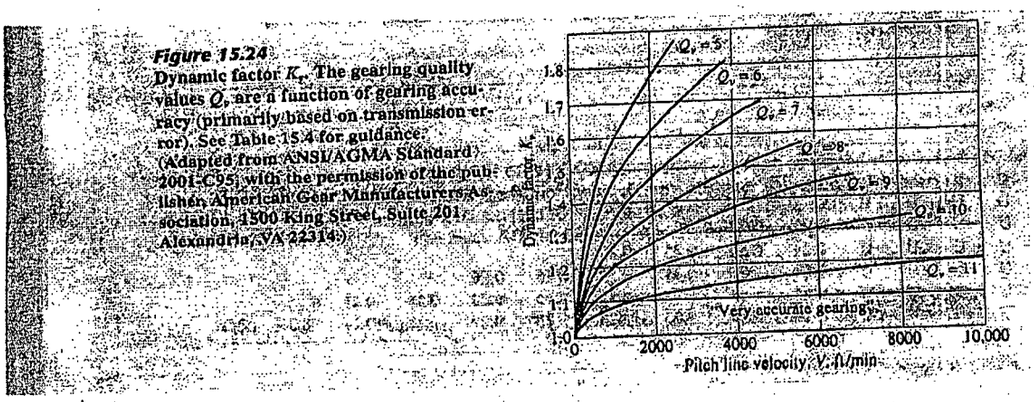

Figure 15.24
Dynamic factor K_v. The gearing quality values Q_v are a function of gearing accuracy (primarily based on transmission error). See Table 15.4 for guidance. (Adapted from ANSI/AGMA Standard 2001-C95, with the permission of the publisher, American Gear Manufacturers Association, 1500 King Street, Suite 201, Alexandria, VA 22314.)

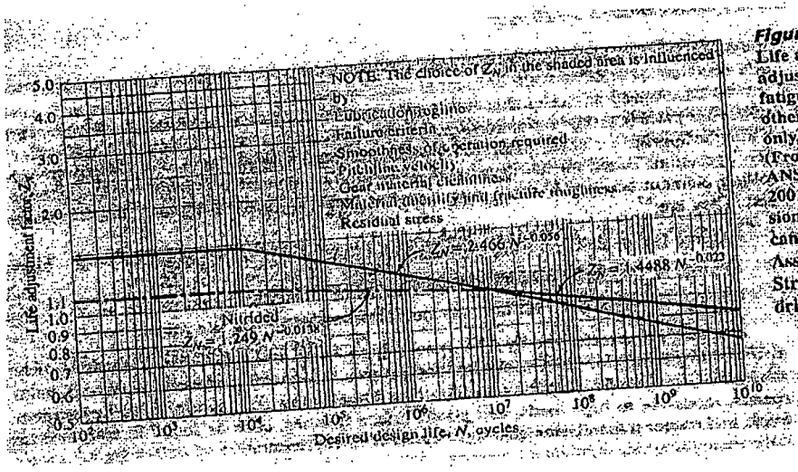

Figure 15.31
Life adjustment factor to adjust ANSI/AGMA surface fatigue strength to a life other than 10^7 cycles. Valid only for steel materials. (From ref. 10. Adapted from ANSI/AGMA Standard 2001-C95, with the permission of the publisher, American Gear Manufacturers Association, 1500 King Street, Suite 201, Alexandria, VA 22314.)

$$\sigma_{sf} = \sqrt{\frac{F_t\left(\frac{2}{d_p \sin\varphi} + \frac{2}{d_g \sin\varphi}\right)}{\pi b \cos\varphi\left(\frac{1-\nu_p^2}{E_p} + \frac{1-\nu_g^2}{E_g}\right)}}$$

ng (15-44) as

$$\sigma_{sf} = C_p\sqrt{\frac{F_t}{bd_p I}}$$

where C_p = elastic coefficient $= \sqrt{\frac{1}{\pi\left(\frac{1-\nu_p^2}{E_p} + \frac{1-\nu_g^2}{E_g}\right)}}$

$$I = \text{geometry factor} = \frac{\sin\varphi\cos\varphi}{2}\left(\frac{m_G}{m_G + 1}\right)$$

$$m_G = \text{gear ratio} = \frac{d_g}{d_p} = \frac{N_g}{N_p} \text{ (always } \geq 1.0)$$

then inserting the modifying factors to give[61]

$$\sigma_{sf} = C_p\sqrt{\frac{F_t}{bd_p I}K_a K_v K_m}$$

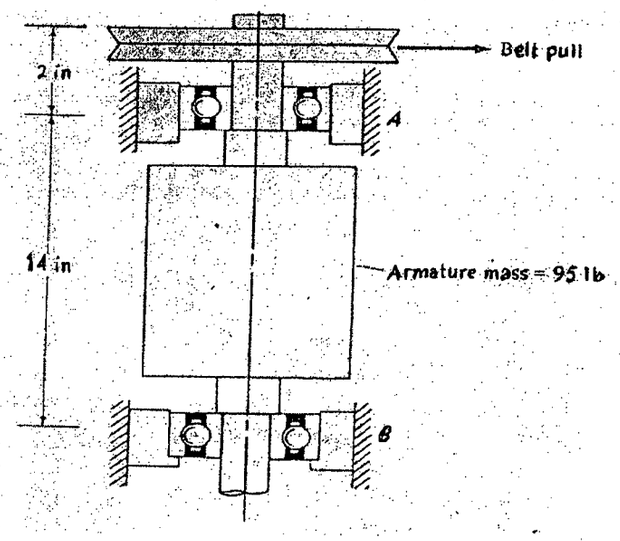

Figure: 7

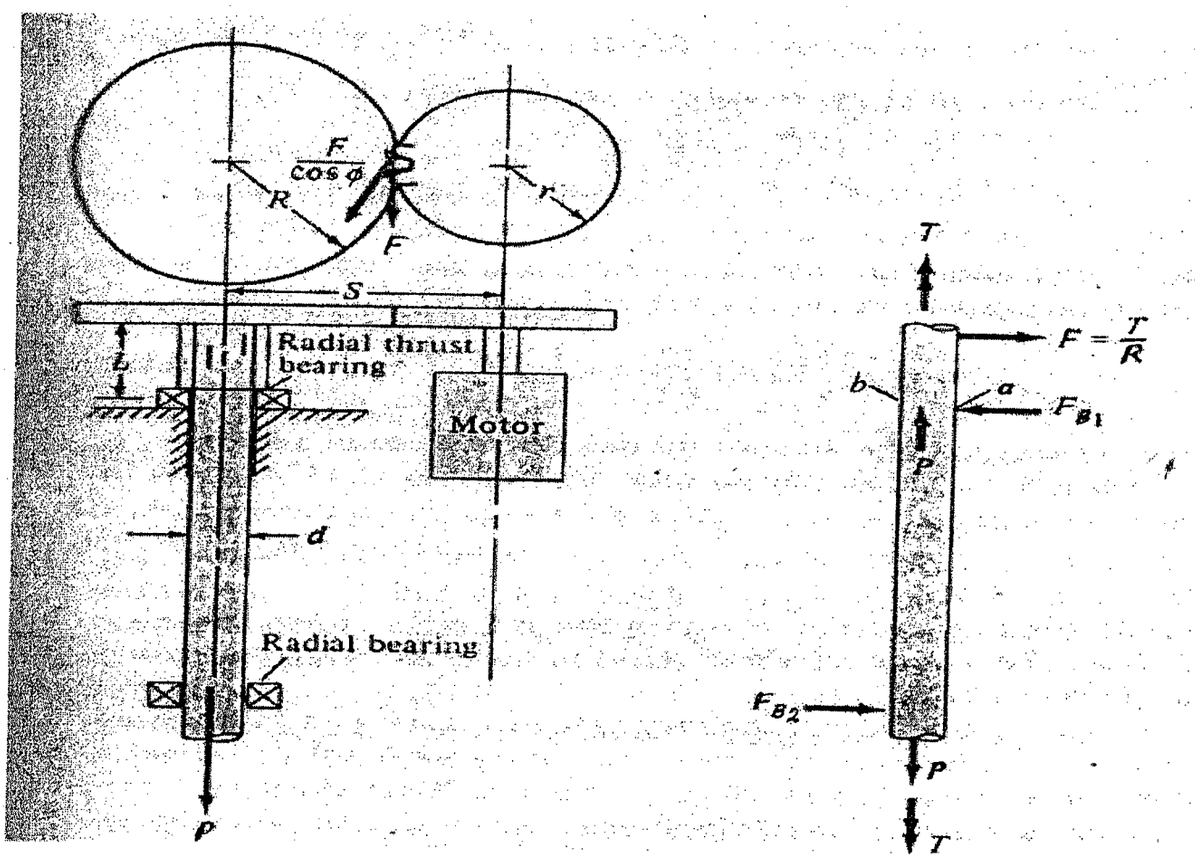

Figure: 8

A. S. M. Sohidull Islam

L-3/T-2/IPE Date : 17/12/2012

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **IPE 313** (Cost and Management Accounting)

Full Marks: 210 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

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

1. (a) Matador company manufactures a variety of ballpoint pens. The company has just received an offer from an outside supplier to provide the ink cartridge for the company's Zippo pen line, at a price of $0.48 per dozen cartridges. The company is interested in this offer, since its own production of cartridges is at capacity. **(15)**

Matador Company estimates that if the supplier's offer were accepted, the direct labor and variable overhead costs of the Zippo pen line would be reduced by 10% and the direct materials cost would be reduced by 20%.

Under present operations, Matador Company manufactures all of its own pens from start to finish. The Zippo pens are sold through wholesalers at $4 per box. Each box contains one dozen pens. Fixed overhead costs charged to the Zippo pen line total $50,000 each year. (The same equipment and facilities are used to produce several pen lines.) The present cost of producing one dozen Zippo pens (one box) is given below:

Direct materials	$1.50
Direct labor	1.00
Manufacturing overhead	0.80*
Total cost	$3.30

*Include both variable and fixed manufacturing overhead, based on production of 100,000 boxes of pens each year.

Required:

(i) Should Matador Company accept the outside supplier's offer? Show computations.

(ii) What is the maximum price that Matador Company should be willing to pay the outside supplier per dozen cartridges?

(b) What is zero based budgeting? When and why is it necessary? **(5)**

(c) How do 'Theory of Constraints' and 'Just in Time' philosophy affect cost management in a competitive business environment? **(7)**

(d) What are the major shortcomings of traditional costing system? Does activity based costing overcome those shortcomings? Discuss in brief with example. **(8)**

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2. (a) Define an give examples of cost classifications used in making decisions. **(9)**

(b) Duvernoy fabrication manufactures a variety of products in its factory. Data for the most recent month's operations appear below: **(18)**

Beginning raw materials inventory	$20,000
Purchases of raw materials	60,000
Ending raw materials inventory	35,000
Direct labor	45,000
Repair and maintenance, factory	15,000
Factory insurance	12,000
Depreciation expenses, factory	80,000
Indirect labor wages	25,000
Beginning work in process inventory	33,000
Ending work in process inventory	35,000
Sales revenue	500,000
Beginning finished goods inventory	23,000
Ending finished goods inventory	20,000
Marketing expenses	66,000
Administrative salaries	55,000

Prepare an income statement for the company for the month.

(c) Describe how the income statement of a manufacturing company differs from the income statement of a merchandising company. **(8)**

3. (a) Winkle, Kotter, and Zale is a small law firm that has 10 partners and 10 support persons. The firm employs a job-order costing system to accumulate costs chargeable to each client, and it is organized into two departments—the Research and Documents Department and the Litigation Department. The firm uses predetermined overhead rates to charge the costs of these departments to its clients. At the beginning of the current year, the firm's management made the following estimates for the year: **(27)**

	Department	
	Research and Documents	Litigation
Research-hours	20,000	---
Direct attorney-hours	9,000	16,000
Materials and supplies	$18,000	$5,000
Direct attorney cost	$430,000	$800,000
Departmental overhead cost	$700,000	$320,000

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Contd Q. No. 3(a)

The predetermined overhead rate in the Research and Documents Department is based on research-hours, and the rate in the Litigation Department is based on direct attorney cost.

The costs charged to each client are made up of three elements: materials and suppliers used, direct attorney costs incurred, and an applied amount of overhead from each department in which work is performed on the case. Case 618-3 was initiated on February 10 and completed on June 30. During this period, the following costs and time were recorded on the case:

	Department	
	Research and Documents	Litigation
Research-hours	18	---
Direct attorney-hours	9	42
Materials and supplies	$50	$30
Direct attorney cost	$410	$2,100

Required:

(i) Compute the predetermined overhead rate used during the year in the Research and Documents Department. Compute the rate used in the Litigation Department.

(ii) Using the rates you computed in (i) above, compute the total overhead cost applied to case 618-3.

(iii) What would be the total cost charged to case 618-3? Show computations by department and in total for the case.

(iv) At the end of the year, the firm's records revealed the following *actual* cost and operating data for all cases handled during the year:

	Department	
	Research and Documents	Litigation
Research-hours	23,000	---
Direct attorney-hours	8,000	15,000
Materials and supplies	$19,000	$6,000
Direct attorney cost	$400,000	$725,000
Departmental overhead cost	$700,000	$300,000

Determine the amount of underapplied or overapplied overhead cost in each department for the year.

(b) What factors should be considered in selecting a base to be used in computing the predetermined overhead rate? **(8**

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4. (a) Selzik Company makes super-premium cake mixes that go through two processes, blending and packaging. **(25)**

The following activity was recorded in the Blending Department during July:

Production data:		
Units in processes, July 1; 30% complete as to conversion costs		10,000
Units started into production		170,000
Units completed and transferred to Packaging		?
Units in process, July 31; 40% complete as to conversion costs		20,000
Cost data:		
Work in process inventory, July 1		
Materials cost	$8,500	
Conversion cost	4,900	$13,400
Cost added during the month:		
Materials cost	139,400	
Conversion cost	244,200	383,600
Total cost		$397,000

All materials are added at the beginning of work in the Blending Department. Conversion costs are added uniformly during processing. The company uses the FIFO cost method.

Required:

Prepare a production report for the Blending Department for July. Use the following three steps as a guide in preparing your report:

(i) Prepare a quantity schedule and compute the equivalent units.

(ii) Compute the costs per equivalent unit for the month.

(iii) Using the data from (i) and (ii) above, prepare a cost reconciliation.

(b) What are the similarities and differences between job-order costing and process costing system? **(10)**

SECTION – B

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

5. (a) In the past, Big piney Resort has had great difficulty in predicting its costs at various levels of activity through the year. The reason is that the company has never attempted to study its cost structure by analyzing cost behavior patterns. The president has now

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Contd Q. No. 5(a)

become convinced that such an analysis is necessary if the company is to maintain its profits and its competitive position. Accordingly, an analysis of cost behavior patterns has been undertaken. The company has managed to identify variable and fixed costs in all areas of its operation except for food services. Costs in this area do not seem to exhibit either a strictly variable or a strictly fixed pattern. Food costs over the past several months, along with the number of meals served, are given below: **(20)**

Month	Number of Meals served (000)	Total Food Cost
January	4	$18,000
February	5	21,000
March	6	24,000
April	10	33,000
May	12	35,000
June	11	33,000
July	9	30,000
August	8	27,000
September	7	26,000

The president believes that the costs above contain a mixture of variable and fixed costs elements. He has assigned you the responsibility of determining whether this is correct.

Required:

(i) Prepare a scattergraph using the data given above and fit a straight line to the plotted points.

(ii) Is the president correct in assuming that food costs contain both variable and fixed cost elements. If so, what is the approximate total fixed cost and the approximate variable cost per meal served? Express the cost formula for food in linear equation form.

(b) CompuDesk, Inc., makes an oak desk specially designed for personal computers. The desk sells for $200. Data for last year's operation follow: **(15)**

Units in beginning inventory	0
Units produced	10,000
Units sold	9000
Units in ending inventory	1000

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Contd Q. No. 5(b)

Variable cost per units:	
Direct materials	$60
Direct labor	30
Variable manufacturing overhead	10
Variable selling and administrative	20
Total variable cost per unit	$120
Fixed costs:	
Fixed manufacturing overhead	$300,000
Fixed selling and administrative	$450,000
Total fixed cost	$750,000

Required:

(i) Assume that the company uses variable costing. Compute the unit product cost for one computer desk.

(ii) Assume that the company uses variable costing. Prepare an income statement for the year using the contribution format.

6. (a) Mylar Company manufactures and sells a product that has seasonal variations in demand, with peak sales coming in the third quarter. The following information concerns operations for Year 2-the coming year-and for the first two quarters of Year3: **(27)**

(i) The company's single product sells for $8 per unit. Budgeted sales in units for the next six quarters are as follows:

	Year 2 Quarter				Year 3 Quarter	
	1	2	3	4	1	2
Budgeted sales in units	40,000	60,000	100,000	50,000	70,000	80,000

(ii) Sales are collected in the following pattern: 75% in the quarter the sales are made, and the remaining 25% in the following quarter. On January 1, Year 2, the company's balance sheet showed $65,000 in accounts receivable, all of which will be collected in the first quarter of the year. Bad debts are negligible and can be ignored.

(iii) The company desires an ending inventory of finished units on hand at the end of each quarter equal to 30% of the budgeted sales for the next quarter. On December 31, year 1, the company had 12,000 units on hand.

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Contd Q. No. 6(a)

(iv) Five pounds of raw materials are required to complete one unit of product. The company requires an ending inventory of raw materials on hand at the end of each quarter equal to 10% of the production needs of the following quarter. On December 31, year 1, the company had 23,000 pounds of raw materials on hand.

(v) The raw material costs $0.80 per pound. Purchases of raw material are paid for in the following pattern: 60% paid in the quarter the purchases are made, and the remaining 40% paid in the following quarter. On January 1, Year 2, the company's balance sheet showed $81,500 in accounts payable for raw material purchases, all of which will be paid in the first quarter of the year.

Required:

Prepare the following budget and a schedules for the year, showing both quarterly and total figures:

(i) A sales budget and a schedule of expected cash collections

(ii) A production budget

(iii) A direct materials purchases budget and a schedule of expected cash payments for material purchases.

(b) Priangle company sells a single product. The company's sales and expenses for a recent month follow: **(8)**

	Total	Per unit
Sales	$600,000	$40
Less variable expense	420,000	28
Contribution margin	180,000	$12
Less fixed expense	150,000	
Net operating income	$30,000	

Required:

(i) What is the monthly break-even point in units sold and in sales dollars?

(ii) Compute the company's margin of safety in both dollars and percentage terms.

7. (a) Theatre Seating, Inc. makes high quality adjustable seats for theatres. The company's activity based costing system has four activity cost pools, which are listed below along with their activity measures and activity rates: **(22)**

Activity Cost Pool	Activity Measures	Activity Rate
Volume	Number of direct labor-hour	$12 per direct labor-hour
Batch processing	Number of batches	$96 per batch
Order processing	Number of orders	$284 per order
Customer service	Number of customers	$2620 per customer

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Contd Q. No. 7(a)

The company just completed a single order from CineMax Entertainment Corporation for $2,400 custom seats. The order was produced in four batches. Each seat required 0.8 direct labor hour. The selling price was $137.95 per seat, the direct material cost was $112.00 per seat, and the direct labor cost $14.40 per seat. This was the only order from CineMax Entertainment for the year.

Required:

(i) Prepare a report showing the product margin for this order. Ignore the customer service cost.

(ii) Prepare a report showing the customer margin on sales to Cine Max Entertainment for the year.

(b) Wriston Company has $300,000 to invest. The company is trying to decide between two alternative uses of the funds. The alternatives are as follows: **(13)**

Cost of equipment required	$300,000	$0
Working capital investment required	0	$300,000
Annual cash inflows	80,000	60,000
Salvage value of equipment in seven years	20,000	0
Life of the project	7 years	7 years

The working capital needed for project B will be released for investment elsewhere at the end of seven years. Wriston Company uses a 20% discount rate.

Required:

Which investment alternative (if either) would you recommend that the company accept? Show all computations using the net present value format. Prepare separate computations for each project. (Ignore income taxes in computation)

8. (a) "That old equipment for producing subassemblies is worn out", said Paul Taylor, president of Timkin Company. "We need to make a decision quickly." The company is trying to decide whether it should rent new equipment and continue to make its subassemblies internally or whether it should discontinue production of its subassemblies and purchase them from an outside supplier. The alternative is follow: **(23)**

Alternative 1: New equipment for producing the subassemblies can be rented for $60,000 per year.

Alternative 2: The subassemblies can be purchased from an outside supplier who has offered to provide them for $8 each.

Contd P/9

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Contd Q. No. 8(a)

Timkin company's present costs per unit of producing the subassemblies internally (with the old equipment) are given below. These costs are based on a current activity level of 40,000 subassemblies per year:

Direct materials	$2.75
Direct Labor	4.00
Variable overhead	0.60
Fixed overhead ($0.75 supervision, $0.90 depreciation, and $2 general company overhead)	3.65
Total cost per unit	$11.00

The new equipment would be more efficient and, according to the manufacturer, would reduce direct labor costs and variable overhead costs by 25%. Supervision cost ($30,000 per year) and direct materials cost per unit would not be effected by the new equipment. The new equipment's capacity would be 60,000 subassemblies per year. Total general company overhead would be unaffected by this decision.

Required:

(i) The president is unsure what the company should do and would like an analysis showing what unit costs and what total costs would be under each of the two alternatives given above. Assume that 40,000 subassemblies are needed each year. Which course of action would you recommend to the president?

(ii) Would your recommendation in (i) above be same if the company's needs were 60,000 assemblies per year? Show computations to justify your decision.

(b) Suppose you have two investment opportunities A and B as shown below: **(12)**

		Return(%)	Return (%)
Economic Condition	Probability	A	B
Good	0.5	40	0
Bad	0.5	0	40

Do you think that by investing equal amounts in A and B, rather than the entire amount only in A or B, you can eliminate the risk altogether? Show computations to support your opinion.

Exhibit 14C–3 Present Value of $1; $\frac{1}{(1+r)^n}$

Periods	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%	21%	22%	23%	24%	25%
1	0.962	0.952	0.943	0.935	0.926	0.917	0.909	0.901	0.893	0.885	0.877	0.870	0.862	0.855	0.847	0.840	0.833	0.826	0.820	0.813	0.806	0.800
2	0.925	0.907	0.890	0.873	0.857	0.842	0.826	0.812	0.797	0.783	0.769	0.756	0.743	0.731	0.718	0.706	0.694	0.683	0.672	0.661	0.650	0.640
3	0.889	0.864	0.840	0.816	0.794	0.772	0.751	0.731	0.712	0.693	0.675	0.658	0.641	0.624	0.609	0.593	0.579	0.564	0.551	0.537	0.524	0.512
4	0.855	0.823	0.792	0.763	0.735	0.708	0.683	0.659	0.636	0.613	0.592	0.572	0.552	0.534	0.516	0.499	0.482	0.467	0.451	0.437	0.423	0.410
5	0.822	0.784	0.747	0.713	0.681	0.650	0.621	0.593	0.567	0.543	0.519	0.497	0.476	0.456	0.437	0.419	0.402	0.386	0.370	0.355	0.341	0.328
6	0.790	0.746	0.705	0.666	0.630	0.596	0.564	0.535	0.507	0.480	0.456	0.432	0.410	0.390	0.370	0.352	0.335	0.319	0.303	0.289	0.275	0.262
7	0.760	0.711	0.665	0.623	0.583	0.547	0.513	0.482	0.452	0.425	0.400	0.376	0.354	0.333	0.314	0.296	0.279	0.263	0.249	0.235	0.222	0.210
8	0.731	0.677	0.627	0.582	0.540	0.502	0.467	0.434	0.404	0.376	0.351	0.327	0.305	0.285	0.266	0.249	0.233	0.218	0.204	0.191	0.179	0.168
9	0.703	0.645	0.592	0.544	0.500	0.460	0.424	0.391	0.361	0.333	0.308	0.284	0.263	0.243	0.225	0.209	0.194	0.180	0.167	0.155	0.144	0.134
10	0.676	0.614	0.558	0.508	0.463	0.422	0.386	0.352	0.322	0.295	0.270	0.247	0.227	0.208	0.191	0.176	0.162	0.149	0.137	0.126	0.116	0.107
11	0.650	0.585	0.527	0.475	0.429	0.388	0.350	0.317	0.287	0.261	0.237	0.215	0.195	0.178	0.162	0.148	0.135	0.123	0.112	0.103	0.094	0.086
12	0.625	0.557	0.497	0.444	0.397	0.356	0.319	0.286	0.257	0.231	0.208	0.187	0.168	0.152	0.137	0.124	0.112	0.102	0.092	0.083	0.076	0.069
13	0.601	0.530	0.469	0.415	0.368	0.326	0.290	0.258	0.229	0.204	0.182	0.163	0.145	0.130	0.116	0.104	0.093	0.084	0.075	0.068	0.061	0.055
14	0.577	0.505	0.442	0.388	0.340	0.299	0.263	0.232	0.205	0.181	0.160	0.141	0.125	0.111	0.099	0.088	0.078	0.069	0.062	0.055	0.049	0.044
15	0.555	0.481	0.417	0.362	0.315	0.275	0.239	0.209	0.183	0.160	0.140	0.123	0.108	0.095	0.084	0.074	0.065	0.057	0.051	0.045	0.040	0.035
16	0.534	0.458	0.394	0.339	0.292	0.252	0.218	0.188	0.163	0.141	0.123	0.107	0.093	0.081	0.071	0.062	0.054	0.047	0.042	0.036	0.032	0.028
17	0.513	0.436	0.371	0.317	0.270	0.231	0.198	0.170	0.146	0.125	0.108	0.093	0.080	0.069	0.060	0.052	0.045	0.039	0.034	0.030	0.026	0.023
18	0.494	0.416	0.350	0.296	0.250	0.212	0.180	0.153	0.130	0.111	0.095	0.081	0.069	0.059	0.051	0.044	0.038	0.032	0.028	0.024	0.021	0.018
19	0.475	0.396	0.331	0.277	0.232	0.194	0.164	0.138	0.116	0.098	0.083	0.070	0.060	0.051	0.043	0.037	0.031	0.027	0.023	0.020	0.017	0.014
20	0.456	0.377	0.312	0.258	0.215	0.178	0.149	0.124	0.104	0.087	0.073	0.061	0.051	0.043	0.037	0.031	0.026	0.022	0.019	0.016	0.014	0.012
21	0.439	0.359	0.294	0.242	0.199	0.164	0.135	0.112	0.093	0.077	0.064	0.053	0.044	0.037	0.031	0.026	0.022	0.018	0.015	0.013	0.011	0.009
22	0.422	0.342	0.278	0.226	0.184	0.150	0.123	0.101	0.083	0.068	0.056	0.046	0.038	0.032	0.026	0.022	0.018	0.015	0.013	0.011	0.009	0.007
23	0.406	0.326	0.262	0.211	0.170	0.138	0.112	0.091	0.074	0.060	0.049	0.040	0.033	0.027	0.022	0.018	0.015	0.012	0.010	0.009	0.007	0.006
24	0.390	0.310	0.247	0.197	0.158	0.126	0.102	0.082	0.066	0.053	0.043	0.035	0.028	0.023	0.019	0.015	0.013	0.010	0.008	0.007	0.006	0.005
25	0.375	0.295	0.233	0.184	0.146	0.116	0.092	0.074	0.059	0.047	0.038	0.030	0.024	0.020	0.016	0.013	0.010	0.009	0.007	0.006	0.005	0.004
26	0.361	0.281	0.220	0.172	0.135	0.106	0.084	0.066	0.053	0.042	0.033	0.026	0.021	0.017	0.014	0.011	0.009	0.007	0.006	0.005	0.004	0.003
27	0.347	0.268	0.207	0.161	0.125	0.098	0.076	0.060	0.047	0.037	0.029	0.023	0.018	0.014	0.011	0.009	0.007	0.006	0.005	0.004	0.003	0.002
28	0.333	0.255	0.196	0.150	0.116	0.090	0.069	0.054	0.042	0.033	0.026	0.020	0.016	0.012	0.010	0.008	0.006	0.005	0.004	0.003	0.002	0.002
29	0.321	0.243	0.185	0.141	0.107	0.082	0.063	0.048	0.037	0.029	0.022	0.017	0.014	0.011	0.008	0.006	0.005	0.004	0.003	0.002	0.002	0.002
30	0.308	0.231	0.174	0.131	0.099	0.075	0.057	0.044	0.033	0.026	0.020	0.015	0.012	0.009	0.007	0.005	0.004	0.003	0.003	0.002	0.002	0.001
40	0.208	0.142	0.097	0.067	0.046	0.032	0.022	0.015	0.011	0.008	0.005	0.004	0.003	0.002	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000

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Exhibit 14C–4 Present Value of an Annuity of $1 in Arrears; $\frac{1}{r}\left[1 - \frac{1}{(1+r)^n}\right]$

Periods	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%	21%	22%	23%	24%	25%
1	0.962	0.952	0.943	0.935	0.926	0.917	0.909	0.901	0.893	0.885	0.877	0.870	0.862	0.855	0.847	0.840	0.833	0.826	0.820	0.813	0.806	0.800
2	1.886	1.859	1.833	1.808	1.783	1.759	1.736	1.713	1.690	1.668	1.647	1.626	1.605	1.585	1.566	1.547	1.528	1.509	1.492	1.474	1.457	1.440
3	2.775	2.723	2.673	2.624	2.577	2.531	2.487	2.444	2.402	2.361	2.322	2.283	2.246	2.210	2.174	2.140	2.106	2.074	2.042	2.011	1.981	1.952
4	3.630	3.546	3.465	3.387	3.312	3.240	3.170	3.102	3.037	2.974	2.914	2.855	2.798	2.743	2.690	2.639	2.589	2.540	2.494	2.448	2.404	2.362
5	4.452	4.329	4.212	4.100	3.993	3.890	3.791	3.696	3.605	3.517	3.433	3.352	3.274	3.199	3.127	3.058	2.991	2.926	2.864	2.803	2.745	2.689
6	5.242	5.076	4.917	4.767	4.623	4.486	4.355	4.231	4.111	3.998	3.889	3.784	3.685	3.589	3.498	3.410	3.326	3.245	3.167	3.092	3.020	2.951
7	6.002	5.786	5.582	5.389	5.206	5.033	4.868	4.712	4.564	4.423	4.288	4.160	4.039	3.922	3.812	3.706	3.605	3.508	3.416	3.327	3.242	3.161
8	6.733	6.463	6.210	5.971	5.747	5.535	5.335	5.146	4.968	4.799	4.639	4.487	4.344	4.207	4.078	3.954	3.837	3.726	3.619	3.518	3.421	3.329
9	7.435	7.108	6.802	6.515	6.247	5.995	5.759	5.537	5.328	5.132	4.946	4.772	4.607	4.451	4.303	4.163	4.031	3.905	3.786	3.673	3.566	3.463
10	8.111	7.722	7.360	7.024	6.710	6.418	6.145	5.889	5.650	5.426	5.216	5.019	4.833	4.659	4.494	4.339	4.192	4.054	3.923	3.799	3.682	3.571
11	8.760	8.306	7.887	7.499	7.139	6.805	6.495	6.207	5.938	5.687	5.453	5.234	5.029	4.836	4.656	4.486	4.327	4.177	4.035	3.902	3.776	3.656
12	9.385	8.863	8.384	7.943	7.536	7.161	6.814	6.492	6.194	5.918	5.660	5.421	5.197	4.988	4.793	4.611	4.439	4.278	4.127	3.985	3.851	3.725
13	9.986	9.394	8.853	8.358	7.904	7.487	7.103	6.750	6.424	6.122	5.842	5.583	5.342	5.118	4.910	4.715	4.533	4.362	4.203	4.053	3.912	3.780
14	10.563	9.899	9.295	8.745	8.244	7.786	7.367	6.982	6.628	6.302	6.002	5.724	5.468	5.229	5.008	4.802	4.611	4.432	4.265	4.108	3.962	3.824
15	11.118	10.380	9.712	9.108	8.559	8.061	7.606	7.191	6.811	6.462	6.142	5.847	5.575	5.324	5.092	4.876	4.675	4.489	4.315	4.153	4.001	3.859
16	11.652	10.838	10.106	9.447	8.851	8.313	7.824	7.379	6.974	6.604	6.265	5.954	5.668	5.405	5.162	4.938	4.730	4.536	4.357	4.189	4.033	3.887
17	12.166	11.274	10.477	9.763	9.122	8.544	8.022	7.549	7.120	6.729	6.373	6.047	5.749	5.475	5.222	4.990	4.775	4.576	4.391	4.219	4.059	3.910
18	12.659	11.690	10.828	10.059	9.372	8.756	8.201	7.702	7.250	6.840	6.467	6.128	5.818	5.534	5.273	5.033	4.812	4.608	4.419	4.243	4.080	3.928
19	13.134	12.085	11.158	10.336	9.604	8.950	8.365	7.839	7.366	6.938	6.550	6.198	5.877	5.584	5.316	5.070	4.843	4.635	4.442	4.263	4.097	3.942
20	13.590	12.462	11.470	10.594	9.818	9.129	8.514	7.963	7.469	7.025	6.623	6.259	5.929	5.628	5.353	5.101	4.870	4.657	4.460	4.279	4.110	3.954
21	14.029	12.821	11.764	10.836	10.017	9.292	8.649	8.075	7.562	7.102	6.687	6.312	5.973	5.665	5.384	5.127	4.891	4.675	4.476	4.292	4.121	3.963
22	14.451	13.163	12.042	11.061	10.201	9.442	8.772	8.176	7.645	7.170	6.743	6.359	6.011	5.696	5.410	5.149	4.909	4.690	4.488	4.302	4.130	3.970
23	14.857	13.489	12.303	11.272	10.371	9.580	8.883	8.266	7.718	7.230	6.792	6.399	6.044	5.723	5.432	5.167	4.925	4.703	4.499	4.311	4.137	3.976
24	15.247	13.799	12.550	11.469	10.529	9.707	8.985	8.348	7.784	7.283	6.835	6.434	6.073	5.746	5.451	5.182	4.937	4.713	4.507	4.318	4.143	3.981
25	15.622	14.094	12.783	11.654	10.675	9.823	9.077	8.422	7.843	7.330	6.873	6.464	6.097	5.766	5.467	5.195	4.948	4.721	4.514	4.323	4.147	3.985
26	15.983	14.375	13.003	11.826	10.810	9.929	9.161	8.488	7.896	7.372	6.906	6.491	6.118	5.783	5.480	5.206	4.956	4.728	4.520	4.328	4.151	3.988
27	16.330	14.643	13.211	11.987	10.935	10.027	9.237	8.548	7.943	7.409	6.935	6.514	6.136	5.798	5.492	5.215	4.964	4.734	4.524	4.332	4.154	3.990
28	16.663	14.898	13.406	12.137	11.051	10.116	9.307	8.602	7.984	7.441	6.961	6.534	6.152	5.810	5.502	5.223	4.970	4.739	4.528	4.335	4.157	3.992
29	16.984	15.141	13.591	12.278	11.158	10.198	9.370	8.650	8.022	7.470	6.983	6.551	6.166	5.820	5.510	5.229	4.975	4.743	4.531	4.337	4.159	3.994
30	17.292	15.372	13.765	12.409	11.258	10.274	9.427	8.694	8.055	7.496	7.003	6.566	6.177	5.829	5.517	5.235	4.979	4.746	4.534	4.339	4.160	3.995
40	19.793	17.159	15.046	13.332	11.925	10.757	9.779	8.951	8.244	7.634	7.105	6.642	6.233	5.871	5.548	5.258	4.997	4.760	4.544	4.347	4.166	3.999

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L-3/T-2/IPE **Date : 07/01/2013**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **IPE 319** (Quality Management)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) State three major requirements of clause 5 (Management Requirements or Management Responsibility) of ISO 9000. **(10)**

   (b) In ISO 9001 : 2008, what requirements have been stated regarding "outsourcing"? **(5)**

   (c) Write a short note on Audit and Certification Process in ISO 9000 Quality Management System. **(20)**

2. (a) Explain the following expression: **(10)**

   $P\{\text{Fail to reject } H_0 | H_0 \text{ is false}\}$

   (b) Draw OC curves for variables β and process shift (δ) with respect to different sample sizes. **(5)**

   (c) A dairy product company produces chocolates. The mean weight of the chocolates needs to be 12 grams. From the production records, it was found that the standard deviation of weights of chocolates is 0.25 gram. As part of quality control, samples of sizes 10 are taken and the mean weight was obtained as 12.2 grams. Probability of Type I error is specified as 0.05. What is the probability of detecting the shift of process mean? **(20)**

3. (a) Which control chart will you suggest for measuring painting defects on a car body? Which distribution does it follow? **(15)**

   (b) A company follows a c-chart. Their Upper and Lower Control Limits are 18.82 and 0.72 respectively. What is the probability of rejecting a good lot? **(20)**

4. (a) Which award is considered as "Nobel prize for manufacturing"? Explain in brief. **(5)**

   (b) Which maintenance is known as "condition based maintenance"? **(10)**

   (c) What are the 12 major losses stated in "Office TPM"? **(15)**

   (d) What are major aspects of Lean Manufacturing? **(5)**

SECTION – B

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

5. (a) Classify cost of quality with suitable examples. **(10)**

   (b) Differentiate between SQC and TQM. **(7)**

   (c) What are the consequences of poor quality? Explain. **(8)**

   (d) How Marketing, Procurement, Engineering and Personnel departments in a manufacturing organization are responsible for the quality of a product? **(10)**

Contd P/2

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6. (a) Name the seven basic tools of TQM. Describe Ishikawa diagram with it's classification. How these diagram is used for quality control? **(15)**

   (b) Draw different types of correlation diagrams and explain. **(10)**

   (c) "Quality appraisal means quality evaluation" – Justify this statement. **(10)**

7. (a) The basic QFD methodology involves four basic phases – Explain each phases with appropriate example. **(10)**

   (b) What is Kaizen? How is it implemented for quality management? **(8)**

   (c) How can PDCA cycle be applied in a Hospital for Total Quality Management? **(7)**

   (d) Briefly describe the "Malcolm Baldrige National Quality Award". **(10)**

8. (a) A company and its customer have agreed to follow a double sampling plan, with the following parameters: **(18)**

   Lot size N = 3000

   First sample size $n_1 = 40$, $c_1 = 2$

   Second sample size $n_2 = 80$, $c_2 = 4$

   Here c_1 and c_2 are acceptance number for the first trial and for both trials together respectively. Find the total probability of acceptance in the combined first and second sample. Consider fraction non-conforming value of P = 0.05.

   (b) Metlab Casting Company Ltd produce steel pipes of a certain diameter, considered as a critical quality characteristic. The company decided to use $\overline{X}-R$ chart to control diameter. From a day's production, a sample of 5 pipes is selected randomly from the production line and their diameters are recorded. The average diameter and range of this sample (of size 5) are computed and recorded in the following table. The inspector collected this type of sample in 22 working days in the month of February.

   Calculate the control limits for $\overline{X}-R$ chart and draw $\overline{X}-R$ chart. Interpret your chart. **(17)**

Table: $\overline{X}$ and R values for steel pipe diameter (in centimeters)

Day	$\overline{X}$	R	Day	$\overline{X}$	R
1	10.724	0.040	12	10.730	0.026
2	10.730	0.016	13	10.735	0.028
3	10.718	0.040	14	10.726	0.041
4	10.728	0.014	15	10.724	0.025
5	10.730	0.027	16	10.720	0.017
6	10.720	0.020	17	10.727	0.035
7	10.720	0.038	18	10.720	0.037
8	10.711	0.026	19	10.726	0.030
9	10.713	0.027	20	10.724	0.012
10	10.718	0.008	21	10.718	0.030
11	10.717	0.039	22	10.722	0.012

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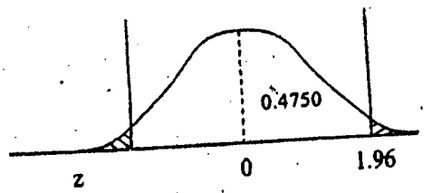
le A. Standard Normal Distribution Values (Areas under the normal curve).



z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0/09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990

Table B. Factors used in 3σ Quality Control Charts.

Sample size n	$\bar{X}$ charts			S charts					R charts					
	Factors for control limits			Factors for central line	Factors for control limits				Factors for central line	Factors for control limits				
	A	A_2	A_3	c_4	B_3	B_4	B_5	B_6	d_2	d_3	D_1	D_2	D_3	D_4
2	2.121	1.880	2.659	0.7979	0	3.267	0	2.606	1.128	0.853	0	3.686	0	3.267
3	1.732	1.023	1.954	0.8862	0	2.568	0	2.276	1.693	0.888	0	4.358	0	2.574
4	1.500	0.729	1.628	0.9213	0	2.266	0	2.088	2.059	0.880	0	4.698	0	2.282
5	1.342	0.577	1.427	0.9400	0	2.089	0	1.964	2.326	0.864	0	4.918	0	2.114
6	1.225	0.483	1.287	0.9515	0.030	1.970	0.029	1.874	2.534	0.848	0	5.078	0	2.004
7	1.134	0.419	1.182	0.9594	0.118	1.882	0.113	1.806	2.704	0.833	0.204	5.204	0.076	1.924
8	1.061	0.373	1.099	0.9650	0.185	1.815	0.179	1.751	2.847	0.820	0.388	5.306	0.136	1.864
9	1.000	0.337	1.032	0.9693	0.239	1.761	0.232	1.707	2.970	0.808	0.547	5.393	0.184	1.816
10	0.949	0.308	0.975	0.9727	0.284	1.716	0.276	1.669	3.078	0.797	0.687	5.469	0.223	1.777
11	0.905	0.285	0.927	0.9754	0.321	1.679	0.313	1.637	3.173	0.787	0.811	5.535	0.256	1.744
12	0.866	0.266	0.886	0.9776	0.354	1.646	0.346	1.610	3.258	0.778	0.922	5.594	0.283	1.717
13	0.832	0.249	0.850	0.9794	0.382	1.618	0.374	1.585	3.336	0.770	1.025	5.647	0.307	1.693
14	0.802	0.235	0.817	0.9810	0.406	1.594	0.399	1.563	3.407	0.763	1.118	5.696	0.328	1.672
15	0.775	0.223	0.789	0.9823	0.428	1.572	0.421	1.544	3.472	0.756	1.203	5.741	0.347	1.653
16	0.750	0.212	0.763	0.9835	0.448	1.552	0.440	1.526	3.532	0.750	1.282	5.782	0.363	1.637
17	0.728	0.203	0.739	0.9845	0.466	1.534	0.458	1.511	3.588	0.744	1.356	5.820	0.378	1.622
18	0.707	0.194	0.718	0.9854	0.482	1.518	0.475	1.496	3.640	0.739	1.424	5.856	0.391	1.608
19	0.688	0.187	0.698	0.9862	0.497	1.503	0.490	1.483	3.689	0.734	1.487	5.891	0.403	1.597
20	0.671	0.180	0.680	0.9869	0.510	1.490	0.504	1.470	3.735	0.729	1.549	5.921	0.415	1.585
21	0.655	0.173	0.663	0.9876	0.523	1.477	0.516	1.459	3.778	0.724	1.605	5.951	0.425	1.575
22	0.640	0.167	0.647	0.9882	0.534	1.466	0.528	1.448	3.819	0.720	1.659	5.979	0.434	1.566
23	0.626	0.162	0.633	0.9887	0.545	1.455	0.539	1.438	3.858	0.716	1.710	6.006	0.443	1.557
24	0.612	0.157	0.619	0.9892	0.555	1.445	0.549	1.429	3.895	0.712	1.759	6.031	0.451	1.548
25	0.600	0.153	0.606	0.9896	0.565	1.435	0.559	1.420	3.931	0.708	1.806	6.056	0.459	1.541

A.S.M. Sohidul Islam
31-12

L-3/T-2/IPE **Date : 31/12/2012**

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L-3/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **IPE 311** (Materials Handling and Maintenance Management)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) What are the types of planned maintenance? Describe them with real life examples. **(13)**

   (b) Briefly discuss the concept of Overall Equipment Efficiency (OEE). State the 16 major losses in TPM. **(12)**

   (c) Suppose in an industry, a machine loading time is 450 minutes, downtime is 50 minutes, standard cycle time for each product is 0.6 minutes and actual cycle time for each product is 0.7 minutes. This factory produces 420 units per day with 10 numbers of defective products per day. Calculate the OEE for the factory. **(10)**

2. (a) What do you mean by 'Kaizen'? Discuss the benefits resulting from Kaizen. **(10)**

   (b) Describe the concept of MTBF and MTTR. Explain how MTBF can be improved and MTTR can be reduced. **(15)**

   (c) What is why-why analysis? What are the two approaches in why-why analysis? State the important considerations in case of implementing why-why analysis. **(10)**

3. (a) Discuss the difference between TPM, TQP and Tero Technology. **(10)**

   (b) Describe small autonomous group concept of TPM. **(10)**

   (c) What are the necessary training to be performed in TPM? Discuss the additional benefits of TPM. **(15)**

4. (a) What are the main components of an apron conveyor? Discuss about applications and geometry of apron conveyors. **(10)**

   (b) An apron conveyor is to be designed to deliver hot castings from the shakeout to the fettling shop. The castings have a diameter of 600 mm, a height of 250 mm and piece weight of 180 kg. The diagram of the conveyor is given in Fig. Q. 4(b). The conveyor capacity Z is 300 pieces/hr, Irregularity factor is 2. Determine – **(25)**

   (i) Main parameters of the conveyor

   (ii) Load per running meter

   (iii) Pull in different points of the conveyor

Contd P/2

IPE 311

Contd ... Q. No. 4(b)

(iv) Power of the electric motor, pull/chain and total resistance factor on the conveyor Assume A = 110, B = 0.8, $\omega' = 0.13$, $k' = 0.03$, $K' = 2$, $K = 1.08$, $\eta_g = 0.7$ (All have their usual meaning).

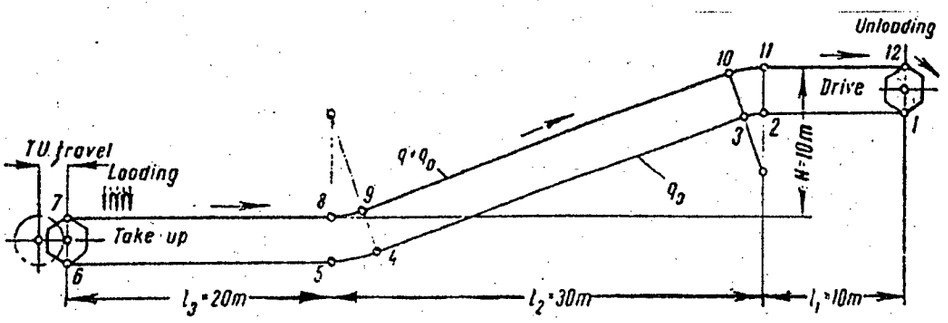

Fig. Q4(b)

SECTION – B

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

5. (a) How does material handling contribute to industrial economy? What are the principles of material handling? Briefly explain. **(17)**

   (b) Explain different types of facility layout designs. Also mention their relative advantages and disadvantages. **(18)**

6. (a) What are the main benefits and areas of application for belt conveyors? With neat sketches explain different components of a belt conveyor. **(17)**

   (b) Discuss different techniques for keeping belt tension constant even after changes in belt length due to long time use. Provide necessary diagrams. **(18)**

7. (a) Screw conveyor is not an efficient method for material handling. Do you agree? Explain your decision. With neat sketches discuss different types of screw design. **(18)**

   (b) Mention specific applications of bucket elevators. Discuss charging and discharging techniques of material for bucket elevators. **(17)**

8. (a) Distinguish powered and unpowered roller conveyors. Derive the equation for resistance to motion factor for unpowred roller conveyor. **(17)**

   (b) Write short notes on: **(18)**

   (i) Joining rubberized textile belt

   (ii) Different configuration of belt and driving pulley

   (iii) Static and dynamic angle of repose

A.S.M Sohidull Islam
31-12

L-3/T-2/IPE **Date : 31/12/2012**

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L-3/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **IPE 311** (Materials Handling and Maintenance Management)

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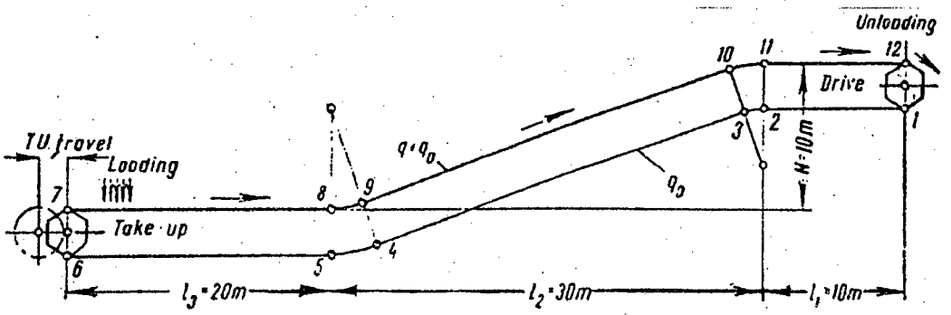
Contd P/2

IPE 311

Contd ... Q. No. 4(b)

(iv) Power of the electric motor, pull/chain and total resistance factor on the conveyor

Assume A = 110, B = 0.8, ω' = 0.13, k' = 0.03, K' = 2, K = 1.08, η_g = 0.7 (All have their usual meaning).



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L-3/T-2/IPE **Date : 24/12/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **IPE 315** (Operations Management)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) Define production planning and control (PPC). What processes are involved in PPC? **(12)**

   (b) Explain smoothing constant and Trend effects in exponential smoothing technique. Prove that, in exponential smoothing each increment in the past is decreased by $(1 - \alpha)$, where the sign has its usual meaning. **(6+7=13)**

   (c) Considering opinions of all employees, what qualitative forecasting techniques should be used? Explain. **(10)**

2. (a) For any kind of factory, there are several types of material kept in a warehouse. Do you think all these material are stored in the same way? If not, which principle is followed to store different kinds of material? Explain. **(10)**

   (b) Explain the following terms related to inventory (i) EOQ (ii) Effective lead time (iii) Shortage cost. **(9)**

   (c) An automobile manufacturing company is purchasing an item from outside suppliers. Demand is 10,000 units per annum. Cost of item is Rs. 5 per unit and procurement cost is estimated to be Rs. 100 per order. Cost of carrying inventory is 25 percent. If the consumption rate is constant, determine EOQ.

   In the above problem, if the company decides to manufacture the above item with an equipment which produce 100 units per day. The cost of units thus produced is Rs. 3.5 per unit, setup cost is Rs. 150. How your answer is changed in the second case? **(16)**

3. (a) Explain dependent demand and independent demand. **(10)**

   (b) Speaker kits has determined that, for the 12 inch speaker unit, setup cost is $ 100 and holding cost is $ 1 per period. The production schedule is as follows: **(25)**

		Period									
		1	2	3	4	5	6	7	8	9	10
Gross requirements		35	30	40	0	10	40	30	0	30	55
Projected on hand	35										

Lead time is 1 (one) week. Determine the total cost using Lot-for-Lot and EOQ lot-sizing techniques. (Assume 52 weeks per year).

Contd P/2

IPE 315

4. (a) JIT is a technique which can be applied to both production and service environment. How can you distinguish the implementation technique in these two different environments? Provide example. **(15)**

   (b) What are the different types of kanban used in JIT? Discuss. **(10)**

   (c) In fixed position layout, product is more prioritized compared to product layout – explain. **(10)**

SECTION – B

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

5. (a) Capacity refers to an upper limit on the load an operating unit can handle. Along with the volume, what is the other important factor to define capacity? Justify. **(5)**

   (b) How can you distinguish pull system from push system? In which areas pull system is preferred over push system and why? **(6)**

   (c) Total cost and business climate are two important criteria in selecting a factory/office location – Discuss. **(9)**

   (d) For the following table, find the job sequence and map the jobs accordingly using Johnson's rule: **(15)**

	Duration (day)	
Job	Station 1	Station 2
A	5	5
B	4	9
C	7	3
D	5	8
E	2	6
F	7	8
G	6	5
H	9	2

6. (a) Cellular layout can be termed as a miniature version of product/process layout – Explain. **(8)**

   (b) Elaborate the concept of aggregation in planning. **(6)**

   (c) Time study is calculation whereas work sampling is estimation – Justify. **(6)**

   (d) From the following table, decide the machine you want to purchase and explain the logic behind your decision: **(15)**

Machine	Fixed cost (Tk.)	Capacity (Unit)
A	8000	400
B	9000	450
C	10000	500

Total demand = 400 ~ 500 unit

Revenue = Tk 30/unit

Variable cost = Tk 10/unit

Contd P/3

IPE 315

7. (a) Aggregate planning is termed as "rolling planning horizon" – Discuss. **(6)**

   (b) What are the benefits and limitations of breaking down a task into its elements? **(5)**

   (c) Mention four limitations of cellular layout over product layout. **(6)**

   (d) For the following task table, calculate minimum number of station and line efficiency to have a desired output of 48 units/hr. Also assign the tasks into workstations. **(18)**

Task	Predecessor	Time (sec)
A	---	40
B	---	30
C	A, B	50
D	C	45
E	C, D	15
F	E	25
G	E, F	18
H	F, G	27
I	G	42
J	H	37

8. (a) Briefly explain the human factor and external factors in determining capacity requirements. **(9)**

   (b) Hiring and layoff workers is important for balancing capacity with demand. However this scheme is not preferable in current manufacturing environment. Why? **(6)**

   (c) Complete the following plans and compute total cost for both plans: **(20)**

	January	**February**	**March**	**April**	**May**	**June**	**Total**
Beginning Inventory	400						
Demand Forecast	1800	1500	1100	900	1100	1600	
Safety Stock	200	200	200	200	200	200	
Production Requirement							
Working days per month	22	19	21	21	22	20	**125**
Ending Inventory							

Plan 1: Constant workforce - Vary inventory & Stockout

Beginning Inventory							
Working days per month							
Available hrs per month (8hrs/day)							
Actual Production (5hrs/unit)							
Demand Forecast							
Ending Inventory							
Shortage cost ($5/unit)							
Safety stock							
Unit excess							
Inventory cost ($1.5/unit)							
Straight time cost ($4/hr)							

TOTAL COST	

Plan 2: Constant low workforce - Subcontract

Production Requirement							
Working days per month							
Production requirement per day							
Available hrs per month (8hrs/day)							
Actual Production (5hrs/unit)							
Units subcontracted							
Subcontracting cost ($20/unit)							
Straight time cost ($4/hr)							

TOTAL COST	