L-2/T-1/WRE **Date : 31/01/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2010-2011

Sub : **CE 221** (Mechanics of Solids-I)

Full Marks: 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

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## SECTION – A

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

1. (a) A 30 inch long aluminum rod is enclosed within a steel alloy tube as shown in Figure-1. The two materials are bonded together. If the stress-strain diagrams for the two materials can be idealized as shown in Figure-1, what end deflection will occur for P = 60 kips? The cross-sectional area of steel $A_s$ = 1 inch$^2$ and of aluminum, $A_{Al}$ = 0.5 inch$^2$. **(15)**

   (b) A rectangular steel block, such as shown in Figure-2 has the following dimensions: a = 100 mm, b = 75 mm, and c = 200 mm. The faces of this block are subjected to forces of 180 kN (tension) in the x direction, 200 kN (tension) in the y direction and 240 kN (compression) in the z direction. Determine the magnitude of a single system of force acting only in y direction that would cause the same deformation in the y direction as the initial forces. Let, v = 0.25. **(20)**

2. (a) What must be the length of a 10 mm diameter aluminum wire so that it could be twisted through one complete revolution without exceeding a shear stress of 50 MPa? Let, G = 27 GPa **(15)**

   (b) A shaft having the cross-section shown in the Figure-3 is subjected to a torque, T = 150 N.m. Estimate the percentage of torque carried by each of the two cross-sectional components, and calculate the maximum shear stresses in each part, neglecting stress concentrations. Let, G = 25 × 10$^3$ GPa. Use Table-1 for necessary data. **(20)**

3. (a) Determine the maximum stress in the concrete and the steel for a reinforced concrete beam with the section shown in Figure-4, if it is subjected to a positive bending moment of 30 kip-ft. The reinforcement consists of two #8 steel bar. Assume, $n = E_S/E_C = 15$. **(15)**

   (b) Determine the location of the shear center for the beam having the cross-sectional dimensions shown in the Figure-5. All members are to be considered thin-walled, and calculations should be based on the centerline dimensions. **(20)**

4. (a) A T beam has the cross-section shown in Figure-6. Calculate the shear stresses for the indicated six horizontal sections when the beam transmits a vertical shear of 400 kN. Also, plot the shear stress distribution diagram. **(15)**

   (b) A beam has the cross-sectional dimensions shown in Figure-7. If the allowable stresses are 7 ksi in tension, 30 ksi in compression, and 8 ksi in shear, what is the maximum allowable shear and the maximum allowable bending moment for this beam? Consider only the vertical loading of the beam and confine calculations for shear to sections a–a and b–b. **(20)**

20

Contd ..... P/2

**CE 221**

## SECTION – B

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

5. (a) Draw the shear force and bending moment diagram of the beam loaded as shown in Fig.-8. **(15)**

   (b) Draw the bending moment diagram of the beam loaded as shown in the Fig.-9. **(20)**

6. (a) Determine the required diameter of the bolt A to carry the shear caused by the applied load shown in Fig.-10. The bolt acts in double shear. The ultimate shear strength of the bolt material is 400 MPa and factor of safety is 2.5. All dimensions are in mm. **(15)**

   (b) The bars as shown in Fig.-11 are to be cut from a 1-in-thick metal plate so that both bars have a constant thickness of 1 in. Bar A is to have a constant width of 2 in throughout its entire length. Bar B is to be 3 in wide at the top and 1 in wide at the bottom. Each bar is to be subjected to the same load P. Determine the ratio $L_A/L_B$ so that both bars will be stretched by the same amount. Neglect the weight of the bar. **(20)**

7. (a) A steel I beam subjected to pure bending develops a longitudinal compressive strain of $0.4 \times 10^{-3}$ in the top flange in the locations shown on the Fig.-12. What bending moment causes the strain. Assume E = 200 GPa. **(15)**

   (b) Two 50 mm × 150 mm full sized wooden planks are glued together to form a T section, as shown in the figure-13. If a positive bending moment of 50 kN-m is applied to such a beam acting around a horizontal axis. (i) find the stresses at the extreme fibres, (ii) calculate the total compressive forces developed by the normal stresses above the neutral axis because of the bending of the beam, and (iii) find the total force due to the tensile bending stresses below the neutral axis and compare it with the result found in (ii). **(20)**

8. (a) A stainless steel sprical pressure vessel has a 36-inch inside diameter and is 0.5 inch. thick. If the tensile strength of the material is 60 ksi and the factor of safety is 4, what is the allowable working pressure? Also estimate the bursting pressure. **(15)**

   (b) A 10 mm thick low-alloy-steel plate 150 mm wide and 2000 mm long is subjected to a set of uniformly distributed frictional forces along its two edges, as shown in Fig.-14. If the total decrease in the transverse 150 mm dimension at section a–a due to the applied forces is $15 \times 10^{-3}$ mm, what is the total elongation of the bar in the longitudinal direction. Let E = 200 GPa and v = 0.25. Assume that the steel behaves as a linearly elastic material. **(20)**

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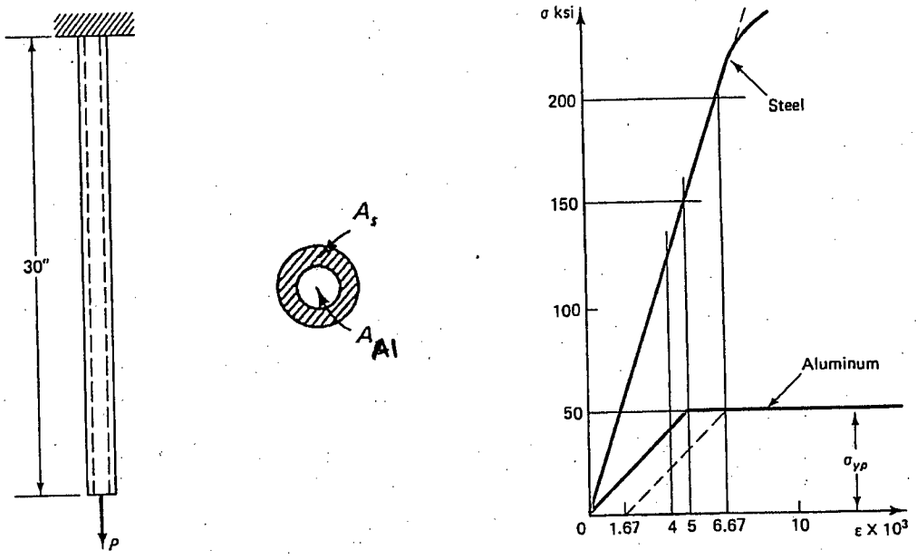


**Figure-1**

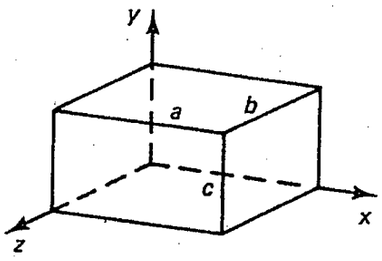


**Figure-2**

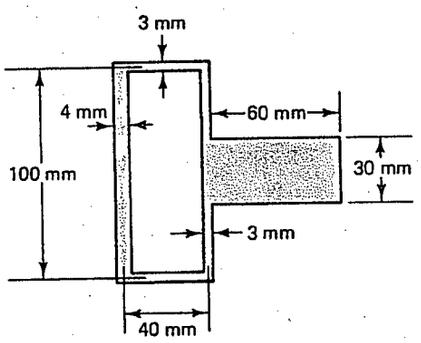


**Figure-3**

**Table of Coefficients for Rectangular Bars**

| b/t | 1.00 | 1.50 | 2.00 | 3.00 | 6.00 | 10.0 | ∞ |
|---|---|---|---|---|---|---|---|
| α | 0.208 | 0.231 | 0.246 | 0.267 | 0.299 | 0.312 | 0.333 |
| β | 0.141 | 0.196 | 0.229 | 0.263 | 0.299 | 0.312 | 0.333 |

**Table-1**

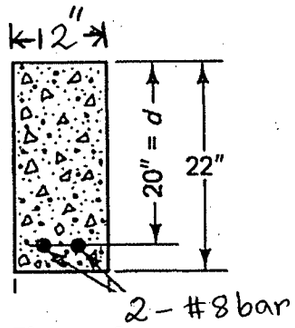


**Figure-4**

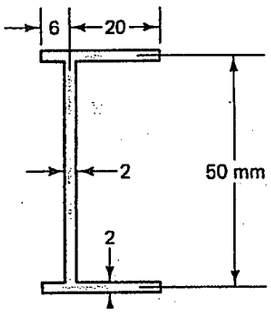


**Figure-5**

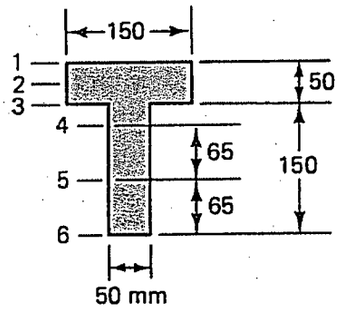


**Figure-6**

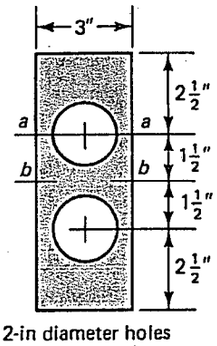


**Figure-7**

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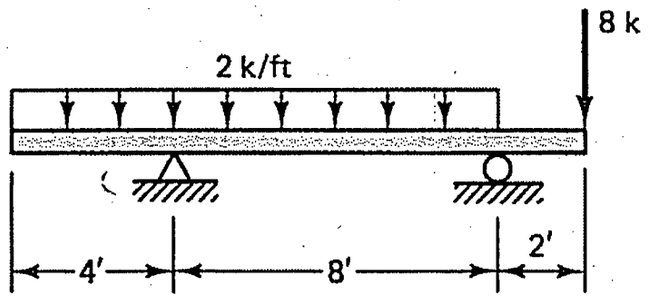


Figure 8

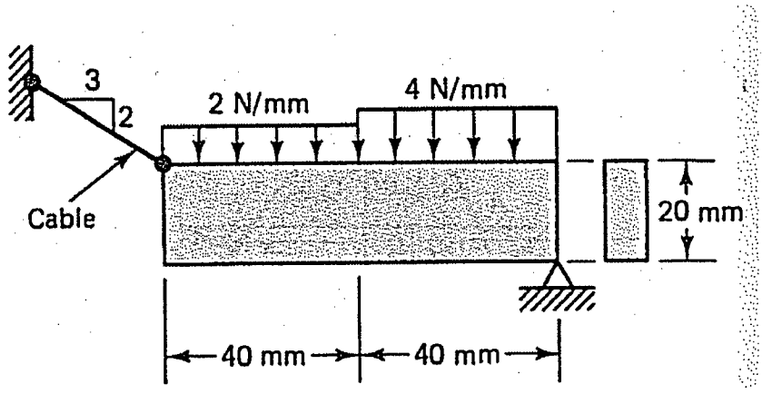


Figure 9

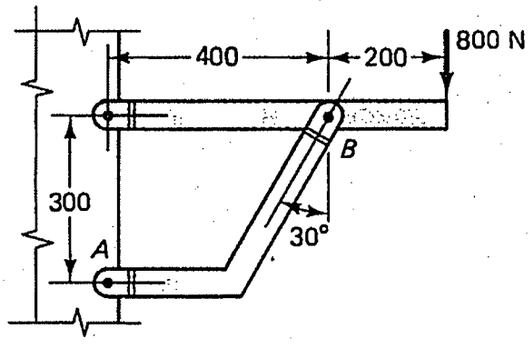


Figure 10

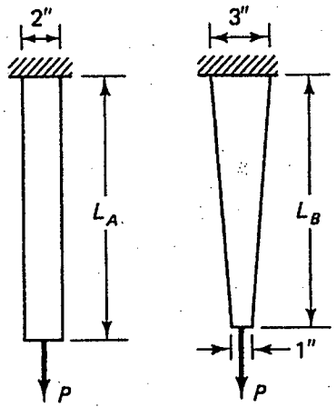


Figure 11

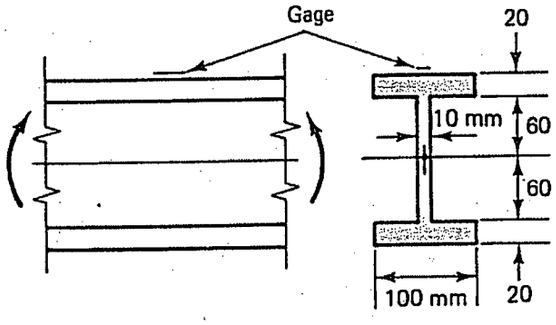


Figure 12

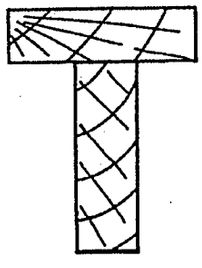

Figure 13

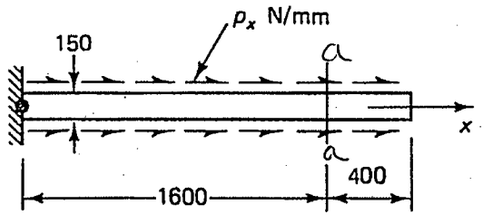


Figure 14

(9)

R. Shah
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L-2/T-1/WRE **Date : 18/02/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2010-2011

Sub : **CE 291** (Engineering Materials)

Full Marks: 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

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## SECTION – A

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

1. (a) Write down the function of four principal compounds ($C_3A$, $C_3S$, $C_2S$, $C_4AF$) in cement. **(10)**

   (b) How do the following cements differ from Ordinary Portland cement in functions and ingredients **(6)**

   (i) Low Heat cement

   (ii) Quick Setting cement

   (c) Differentiate between the Flash Setting and False Setting of cement. **($4\frac{1}{2}$)**

   (d) Define calcinations, slaking and hydraulicity. What are the constituents that are responsible for hydraulicity of lime? **(10)**

   (e) Differentiate between fat lime and quick lime. **($4\frac{1}{2}$)**

2. (a) Give a brief description of brick burning operation in the Hoffman's klin. **(12)**

   (b) What is 'Frog mark'? Why frog mark is used in brick? **(4)**

   (c) The figure-1 shows the gradation curve of two sand samples. If the sample 1 is mixed with samples 2 as a 1.5 : 2.5 ratio, what will be the fineness modulus (FM) of the combined aggregate? **(15)**

   (d) Write down the function of sand in mortar. **(4)**

3. (a) For a residential building at Gulshan, 1st class brick is required. The contractor has brought five samples of brick from the supplier. The test data of the brick samples are as follows: **(10)**

| Sl. No. | Size of full brick | | | Weight | | Crushing load of half brick |
|---|---|---|---|---|---|---|
| | Lengthe | Weidth | Height | Dry | after 24 hours soaking in water | |
| | in | in | in | lb | lb | kip |
| 1 | 9.50 | 4.50 | 2.75 | 6.1 | 6.9 | 55 |
| 2 | 9.50 | 4.50 | 2.75 | 6.2 | 7.0 | 56 |
| 3 | 9.50 | 4.50 | 2.75 | 6.1 | 6.8 | 58 |
| 4 | 9.50 | 4.50 | 2.75 | 6.3 | 7.1 | 61 |
| 5 | 9.50 | 4.50 | 2.75 | 6.2 | 6.9 | 59 |

As an engineer would you recommend use of the supplied bricks? Why?

Contd ..... P/2

L-2/T-1/WRE **Date : 18/02/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2010-2011

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| | in | in | in | lb | lb | kip |
| 1 | 9.50 | 4.50 | 2.75 | 6.1 | 6.9 | 55 |
| 2 | 9.50 | 4.50 | 2.75 | 6.2 | 7.0 | 56 |
| 3 | 9.50 | 4.50 | 2.75 | 6.1 | 6.8 | 58 |
| 4 | 9.50 | 4.50 | 2.75 | 6.3 | 7.1 | 61 |
| 5 | 9.50 | 4.50 | 2.75 | 6.2 | 6.9 | 59 |

As an engineer would you recommend use of the supplied bricks? Why?

Contd ..... P/2

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Contd ... Q. No. 3

(b) What is veneer? How is the plywood manufactured? **(4)**

(c) List the methods of preservation of timer. Describe Wolman's salts method of timber preservation. **(7)**

(d) Write down the salient features of the water seasoning of timber. **(4)**

(e) What is FRP? Write down some important civil engineering applications of GFRP and CFRP. **(10)**

4. (a) List the laboratory tests of brick. **(4)**

(b) What is efflorescence of brick? What are the effects of alkalis present in the brick? **(6)**

(c) What is bulking of sand? Explain with qualitative graph. **(4)**

(d) How does fineness affect the properties of cement? **(4)**

(e) Write short notes on light weight mortar and fire resistance mortar. **(5)**

(f) What are the advantages of artificial seasoning of timber? **(4)**

(g) Write briefly about the manufacturing process of FRP. **(8)**

## SECTION – B

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

5. (a) Draw a typical stress-strain diagram for ductile material and explain proportional limit, elastic limit and yield point from the diagram. **(7)**

(b) Draw the strain response curve for an ideal elasto – visco - plastic material under the following loading (Figure 02). **(7)**

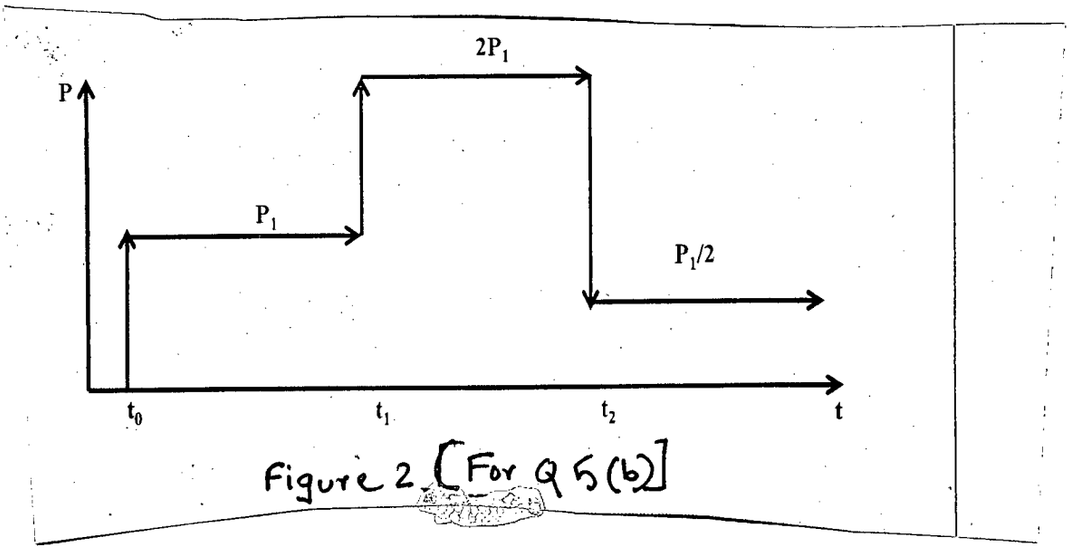


Figure 2 [For Q 5(b)]

(c) Explain isochronous stress-strain relationship of an ideal elasto – plastic material with appropriate diagram(s). **(11)**

Contd ..... P/3

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Contd ... Q. No. 5

(d) Differentiate between each of the following pairs: **(10)**

(i) Modulus of resilience and modulus of toughness;

(ii) stress-strain behaviour of ductile and brittle material.

6. (a) What is gradation of aggregate? What do you know about different types of gradation of aggregate? how do the different types of gradation of aggregate affect the concrete proportions and concrete properties? **(3+7+4=14)**

(b) Why blending of aggregate is required? From the following aggregate gradations (Table 01) determine the batch proportions of aggregate 01, aggregate 02and aggregate 03 so that 50% of the blended material passes through 3/4″ sieve, 24% of the blended material passes through No. 4 sieve and 9% of the blended material passes through No. 30 sieve. **(3+12=15)**

Table-01

| Sieve Size | Aggregate 01 | Aggregate 02 | Aggregate 03 |
|---|---|---|---|
| | % Passing | % Passing | % Passing |
| 1.5″ | 100 | 100 | 100 |
| 3/4″ | 100 | 99 | 13 |
| 3/8″ | 100 | 33 | 8 |
| No. 4 | 99 | 5 | 2 |
| No. 8 | 76 | 0 | 0 |
| No. 16 | 58 | - | - |
| No. 30 | 40 | - | - |
| No. 50 | 12 | - | - |
| No. 100 | 2 | - | - |

(c) How does the water/cement ratio and the grading of aggregate affect the properties of concrete? **(6)**

7. (a) Write short note on segregation by specifically mentioning its forms, causes and available control measures. **(7)**

(b) What is workability of concrete? How can you measure workability of concrete in the site? Why slump test is not a reliable test of workability for lean mixes? **(4+6+4=14)**

(c) Design the mix of a concrete for the mean strength of 4,000 psi at 28 days. Find out the amount of different ingredients at the SSD condition and also at the laboratory condition on weight basis. Use ACI 211.1 method. Material properties are given below and the necessary tables are attached at ANNEXURE-1 and 2. Assume reasonable value for any missing data. **(14)**

Contd ..... P/4

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Contd ... Q. No. 7(c)

| | |
|---|---|
| **Concrete :** | **Coarse Aggregate:** |
| Mean strength : 4,000 psi | Maximum size : 40 mm |
| slump: 30 – 50 mm | Absorption capacity : 2% |
| | Moisture content in the laboratory : 1% |
| | Bulk specific gravity (OD) : 2.62 |
| | Dry rodded unit weight: 1570 kg/m$^3$ |
| **Cement type:** | **Fine Aggregate:** |
| Ordinary Portland Cement (OPC) | Fineness Modulus: 2.50 |
| Specific gravity: 3.15 | Absorption capacity : 2% |
| | Moisture content in the laboratory : 5% |
| | Bulk specific gravity (OD) : 2.68 |

8. (a) How does the corrosion initiate in the RCC structures and how doest it propagate? How can corrosion be prevented in RCC structures by design considerations? **(6+6=12)**

(b) How does the ferrocement construction reduce the load on the column and footing and how does it reduce the cost of the overall construction? Explain with appropriate example. **(6)**

(c) How can laitance be distinguished from bleeding and how can you mitigate the adverse effect of laitance and bleeding on the subsequent layer of casting? **(6)**

(d) How does the water /cement ratio affect the strength of concrete? "At a given degree of hydration water/cement ratio determines the porosity of concrete." How? Explain with appropriate diagram(s). **(5+6=11)**

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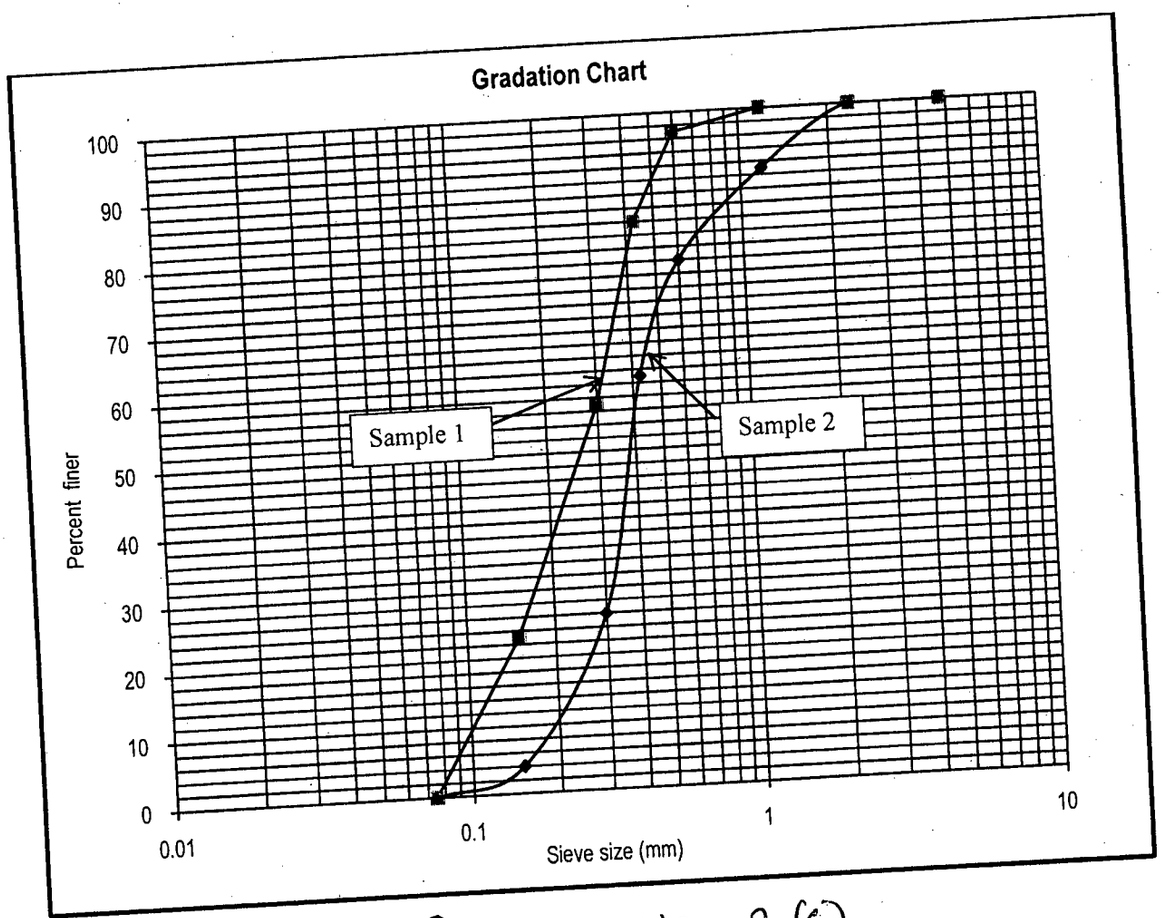
for Q. 2(c)




For Question No. 2(c)

Figure 1.

(4)

Proof 28.12.2011

# ANNEXURE -1

**Table 2: Recommended Slumps for Various Types of Construction**

| Types of construction | Slumps, inch (mm) | |
|---|---|---|
| | Maximum | Minimum |
| Reinforced Foundation walls and footings | 3 (80) | 1 (20) |
| Plain Footings, Caissons and Substructure walls | 3 (80) | 1 (20) |
| Beams and reinforced walls | 4 (100) | 1 (20) |
| Building columns | 4 (100) | 1 (20) |
| Pavement and Slabs | 3 (80) | 1 (20) |
| Mass Concrete | 3 (80) | 1 (20) |

**Table 3: ACI Recommended mixing water content for unit volume of concrete (Non-Air Entrained)**

| Max. Size of Aggregate → (mm) | 10 | 12.5 | 20 | 25 | 40 | 50 | 70 | 150 |
|---|---|---|---|---|---|---|---|---|
| Slump Value ↓ (mm) | Amount of mixing water in kg per 1 $m^3$ concrete | | | | | | | |
| 25 – 50 | 207 | 199 | 190 | 179 | 166 | 154 | 130 | 113 |
| 75 – 100 | 228 | 216 | 205 | 193 | 181 | 169 | 145 | 124 |
| 150 – 175 | 243 | 228 | 216 | 202 | 190 | 178 | 160 | - |
| Entrapped Air (%) | 3 | 2.5 | 2 | 1.5 | 1 | 0.5 | 0.3 | 0.2 |

**Table 4: ACI Recommended mixing water content for unit volume of concrete (Air Entrained)**

| Max. Size of Aggregate → (mm) | 10 | 12.5 | 20 | 25 | 40 | 50 | 70 | 150 |
|---|---|---|---|---|---|---|---|---|
| Slump Value ↓ (mm) | Amount of mixing water in kg per 1 $m^3$ concrete | | | | | | | |
| 25 – 50 | 181 | 175 | 166 | 160 | 148 | 142 | 133 | 107 |
| 75 – 100 | 202 | 193 | 181 | 175 | 163 | 157 | 148 | 119 |
| 150 – 175 | 216 | 204 | 193 | 184 | 172 | 166 | 160 | - |
| Air Content | | | | | | | | |
| Mild (%) | 4.5 | 4.0 | 3.5 | 3.0 | 2.5 | 2.0 | 1.5 | 1.0 |
| Moderate (%) | 6.0 | 5.5 | 5.0 | 4.5 | 4.5 | 4.0 | 3.5 | 3.0 |
| Extreme (%) | 7.5 | 7.0 | 6.0 | 5.5 | 5.5 | 5.0 | 4.5 | 4.0 |

**Table 5: ACI Recommended w/c ratio for concrete**

| 28 day Compressive Strength | | w/c Ratio | |
|---|---|---|---|
| psi | MPa | Air Entrained | Non-Air Entrained |
| 6,000 | 41 | 0.32 | 0.41 |
| 5,000 | 34 | 0.40 | 0.48 |
| 4,000 | 28 | 0.48 | 0.57 |
| 3,000 | 21 | 0.59 | 0.68 |
| 2,000 | 14 | 0.74 | 0.82 |

26.12.11

8

# ANNEXURE -2

**Table 6: Required Average Compressive Strength when data are not available to establish a standard deviation**

| Specified Compressive Strength, $f'_c$, psi | Required Average Compressive Strength, $f'_{cr}$, psi |
|---|---|
| Less than 3,000 | $f'_c + 1{,}000$ |
| 3,000 to 5,000 | $f'_c + 1{,}200$ |
| Over 5,000 | $1.10f'_c + 700$ |
| **Specified Compressive Strength, $f'_c$, MPa** | **Required Average Compressive Strength, $f'_{cr}$, MPa** |
| Less than 21 | $f'_c + 7.0$ |
| 21 to 35 | $f'_c + 8.5$ |
| Over 35 | $1.10f'_c + 5.0$ |

**Table 7: Maximum Permissible water-cement or water-cementitous material ratios for concrete in seven exposures**

| Types of Structure | Structure wet continuously or frequently and exposed to freezing and thawing* | Structures exposed to sea water or sulphates |
|---|---|---|
| Thin sections (railings, curbs, sills, ledges, ornamental work) and Sections with less than 1" clear cover over steel | 0.45 | 0.40** |
| All other structures | 0.50 | 0.45** |
| *Concrete should be air entrained | | |
| **If sulfate resisting cement (Type II or Type V of ASTM C 150) is used, permissible water-cement ratio may be increased by 0.05 | | |

**Table 8: ACI recommended dry rodded bulk volume of coarse aggregate per unit volume of concrete**

| Max. size of Aggregate (mm) | FM of fine aggregate | | | |
|---|---|---|---|---|
| | **2.40** | **2.60** | **2.80** | **3.00** |
| **9.5** | 0.50 | 0.48 | 0.46 | 0.44 |
| **12.5** | 0.59 | 0.57 | 0.55 | 0.53 |
| **19** | 0.66 | 0.64 | 0.62 | 0.60 |
| **25** | 0.71 | 0.69 | 0.67 | 0.65 |
| **37.5** | 0.75 | 0.73 | 0.71 | 0.69 |
| **50** | 0.78 | 0.76 | 0.74 | 0.72 |
| **75** | 0.82 | 0.80 | 0.78 | 0.76 |
| **150** | 0.87 | 0.85 | 0.83 | 0.81 |

**Table 9: Estimate of density of fresh concrete**

| Nominal Maximum Size (mm) | Density of Fresh Concrete (kg/m$^3$) |
|---|---|
| 9.5 | 2280 |
| 12.5 | 2310 |
| 19 | 2345 |
| 25 | 2380 |
| 37.5 | 2410 |
| 50 | 2445 |
| 75 | 2490 |
| 150 | 2530 |

26.12.11

**L-2/T-1/WRE** **Date : 11/03/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 20010-2011

Sub : **HUM 313** (Principle of Accounting)

Full Marks : 140 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

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## SECTION – A

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

1. (a) Discuss the steps of recording transactions into the basic accounting equation. **(3)**

   (b) State any two assumptions you need to follow to do accounting. Explain each of them in brief. **(3)**

   (c) Mr. Arif opened a law office, Arif, Attorney at law, on July 1, 2011. On July 31, the Balance Sheet showed Cash Tk. 4,000, Accounts Receivable Tk. 1500, Supplies Tk. 500, Office Equipment Tk. 5,000, Accounts payable Tk. 4,200 and capital Tk. 6,800. During August, the following transactions occurred: **(17 ⅓)**

   (i) Collected Tk. 1400 of accounts receivable.

   (ii) Paid Tk. 2700 cash on accounts payable.

   (iii) Earned revenue of Tk. 7500 of which Tk. 3000 is collected in cash and the balance is due in September.

   (iv) Purchased additional office equipment for Tk. 1000 paying Tk. 400 in cash and the balance on account.

   (v) Paid salaries Tk. 3000, rent for August Tk. 900 and advertising expense Tk. 350.

   (vi) Withdraw Tk. 550 in cash for personal use.

   (vii) Received Tk. 2000 from standard Bank-money borrowed on a note payable.

   (viii) Incurred utility expenses for the month on account Tk. 250.

   Required: Prepare a tabular analysis of the August transactions beginning with July 31 balances.

2. (a) Discuss the importance of ratio analysis as a way of Financial statement analysis. Give examples. **(3 ⅓)**

   (b) Lineea started her own consulting firm, Lineea Consulting, on May 1, 2011. The trial balance at May 31 is as follows: **(20)**

**Lineea Consulting**

**Trial Balance**

**May 31, 2011**

| Account title | Debit (Tk.) | Credit (Tk.) |
|---|---|---|
| Cash | 7,700 | |
| Accounts Receivable | 4,000 | |
| Prepaid Insurance | 2,400 | |
| Supplies | 1,500 | |

Contd ..... P/2

## HUM 313(WRE)

**Contd ... Q. No. 2(b)**

| | | |
|---|---|---|
| Office Furniture | 12,000 | |
| Accounts Payable | | 3,500 |
| Unearned Service Revenue | | 3,000 |
| Capital | | 19,100 |
| Service Revenue | | 6,000 |
| Salaries expense | 3,000 | |
| Rent expense | 1,000 | |
| Totals | 31,600 | 31,600 |

Other data:

→ Tk. 500 of supplies have been used during the month.

→ Travel expense incurred but not paid on May 31, 2011, Tk. 200.

→ The insurance policy is for 2 years

→ Tk. 1000 of the balance in the unearned service revenue account remains unearned at the end of the month.

→ May 31 is Tuesday and employees are paid on Fridays. Lineea Consulting has two employees, who are paid Tk. 500 each for a 5-day work week.

→ The office furniture has a 5-year life with no salvage value. It is being depreciated at Tk. 200 per month for 60 months.

→ Invoices representing Tk. 1000 of services performed during the month have not been recorded as of May 31.

Required: (i) Prepare the adjusting entries for the month of May.

(ii) Prepare an adjusted trial balance on May31, 2011.

3. Mr. Siham opened a business. During May, the following transactions occurred: **(23 ⅓)**

| | |
|---|---|
| May-1: | Services reformed but not yet received Tk. 5000. |
| May-5: | Purchased furniture Tk. 10,000 on account. |
| May-7: | Earned revenue of Tk. 5,000 of which Tk. 2,000 is collected in cash and the balance due for next month. |
| May-10: | Paid salaries Tk. 5,000, rent Tk. 900, and advertising expense Tk. 500. |
| May-12: | Withdraw Tk. 500 in cash for personal use. |
| May-20: | Received Tk. 3,000 from a local bank signed as a note payable. |
| May-30 | Incurred utility expenses for the moth on account Tk. 750. |

Required:

(i) Journalize each transactions.

(ii) Post the journal entries to the ledger accounts.

(iii) Prepare trial balance on May 31.

Contd ..... P/3

## HUM 313(WRE)

4. The adjusted trial balance of XYZ Co. Ltd on December 31, 2011 has the following balance of accounts. **(23 ⅓)**

**XYZ Co. Ltd**

**Adjusted Trial Balance**

| Accounts titles | Debit (Tk.) | Credit(Tk.) |
|---|---|---|
| Cash | 19,600 | |
| Accounts receivable | 23,600 | |
| Prepaid Insurance | 1,400 | |
| Land | 56,000 | |
| Building | 106,000 | |
| Equipment | 49,000 | |
| Accounts payable | | 10,400 |
| Unearned rent revenue | | 2,800 |
| Notes payable | | 200,000 |
| Capital | | 120,000 |
| Drawings | 18,000 | |
| Service Revenue | | 75,600 |
| Rent revenue | | 26,200 |
| Salaries expenses | 35000 | |
| Advertising expenses | 17,000 | |
| Utility expenses | 15,800 | |
| Patents | 100000 | |
| Insurance expenses | 1,700 | |
| Depreciation expenses Building | 2,500 | |
| Depreciation expense-Equipment | 3,900 | |
| Interest expenses | 900 | |
| Accumulated Depreciation Building | | 2,500 |
| Accumulated Depreciation Equipment | | 3,900 |
| Interest payable | | 9,000 |
| Total | 450400 | 450400 |

Required :

(i) Prepare income statement and owner's Equity Statement.

(ii) Prepare a classified Balance Sheet.

Contd ..... P/4

# HUM 313(WRE)

## SECTION – B

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

5. (a) Differentiate between direct method and reciprocal service method for cost allocation. Which one is the best and why? **(4⅓)**

(b) Savanna Pharmaceuticals has two producing departments-Molding and Finishing and two service departments- Plant Maintenance and Marketing. The overhead costs across the departments and other relevant data for allocating service departments costs over production departments are given below: **(14)**

| | Service Departments | | Production Departments | |
|---|---|---|---|---|
| | Plant Maintenance | Marketing | Molding | Finishing |
| Overhead costs before allocation (Tk.) | 600,000 | 116,000 | 400,000 | 200,000 |
| Services rendered by | | | | |
| Plant Maintenance Deptt: Budgeted machine hours in % | - | 20% | 30% | 50% |
| Marketing Deptt: Budgeted sales in % | 10% | - | 80% | 10% |

Required: Allocate the service department costs to the production departments using Direct Method and Reciprocal Service Method.

(c) A production department of a manufacturing company has five different groups of machines. The overhead incurred for these five groups machines and machine working hours are: **(5)**

| Machine group | I | II | III | IV | V |
|---|---|---|---|---|---|
| Machine overhead costs (Tk.) | 55,922 | 122,314 | 47,963 | 96,759 | 133,042 |
| Machine working hours | 24,000 | 40,000 | 16,000 | 20,000 | 60,000 |

Required:

(i) Calculate a machine hour rate for each of the five groups of machines.

(ii) Calculate the overhead cost that will be absorbed by one unit of product A and one unit of product B on the manufacture of which the following time (in hours) are spent in the machine groups of this department:

| Machine groups | I | II | III | IV | V |
|---|---|---|---|---|---|
| Product A (each unit) | 2 | - | 7 | 1 | 2 |
| Product B (each unit) | 4 | 1 | - | 6 | 1 |

Contd ..... P/5

## HUM 313(WRE)

6. (a) What is degree of operating leverage? The degree of operating leverage for 'X' company is 5 times where as it is 7 times for 'Z' company. What does it imply? **(4)**

(b) Angie Silva has recently opened the Sandal shop in Brisbane. She has prepared the following analysis for her new shop: **(19⅓)**

| | Tk. |
|---|---|
| Sales price per pair of sandals | 40 |
| Variable costs per pair of sandals | 16 |
| Contribution margin per pair of sandals | 24 |
| Fixed costs per year: | |
| Building rental | 15,000 |
| Equipment depreciation | 7000 |
| Selling expenses | 20,000 |
| Administrative expenses | 18,000 |
| Total fixed costs | 60,000 |

Required:

(i) Compute contribution margin ratio;

(ii) How many pairs of sandals must be sold each year to break-even? What does this represent in total sales taka?

(iii) Prepare a contribution break-even chart for the shop from a zero level of activity upto 4000 pairs of sandals sold each year. Indicate the break-even on your graph and also specify different terms in the chart (use of graph paper is not necessary).

(iv) Angie has decided that she must earn at least Tk. 18,000 in the first year to justify her time and effort. How many pairs of sandals must be sold to reach her target profit?

(v) Angie now has two sales persons working in the store, one full time and one part time. It will cost her an additional Tk. 8000 per year to convert the part time position to a full time position. Angie believes that the change would bring in an additional Tk. 25,000 in sales each year. Should she convert the position?

(vi) Compute degree of operating leverage and use it to forecast the changes in net income of next year if sales increase by 15%. Verify your answer by preparing income statement.

7. (a) Discuss the concept - costs, expenses, losses and assets. Give one example illustrating the relationship among these four. **(4)**

(b) "Manufacturing cost is composed of three components - direct materials, direct labour and manufacturing overhead". Define each of the components and give examples of each component for a pump manufacturing plant. **(5)**

Contd ..... P/6

**HUM 313(WRE)**

**Contd ... Q. No. 7**

(c) What is the major disadvantage of high and low point method? **(2 ⅓)**

(d) The data below have been taken from the cost records of Atlanta Processing company. The data relate to the cost of operating one of the company's processing facilities at various levels of activity: **(12)**

| Month | Unit processed | Total cost (Tk.) |
|---|---|---|
| January | 8,000 | 14,000 |
| February | 4,500 | 10,000 |
| March | 7,000 | 12,500 |
| April | 9,000 | 15,500 |
| May | 3,750 | 10,000 |
| June | 6,000 | 12,500 |

Required:

(i) Using the high-low point method, determine the cost formula for processing cost of the company;

(ii) What will be the total processing cost, if the company processed 3000 units during the month of July (Use the cost formula you derived above).

8. (a) Name the various user groups of accounting information. **(3 ⅓)**

(b) Listed below are a number of costs typically found in an organisation: **(6)**

(i) Boxes used for packing detergent produced by the company;

(ii) Lubricants for machine;

(iii) Advertising cost;

(iv) Power and electricity

(v) Account's salary;

(vi) Cost of x-ray film at Matro Clinic Radiology lab;

(vii) Sales person's commission;

(viii) Wages of workers assembling computers;

(ix) Executive life insurance;

(x) Shipping costs or merchandise sold;

(xi) Thread in a garment factory

(c) "There could be three types of inventories on a manufacturer's balance sheet" - What are these three types of inventories? Define each of them with an example. **(4)**

(d) Haaki Shop, Inc., is a large retailer of water sports equipment. An income statement for the company's surfboard department for the most recent quarter is presented below: **(10)**

Contd ..... P/7

# HUM 313(WRE)

**Contd ... Q. No. 8(d)**

**The Haak Shop Inc.**
**Income Statement-Surfboard Department**
**For the Quarter Ended May 31**

| | | |
|---|---|---|
| Sales | | Tk. 800,000 |
| Less: Cost of goods sold | | 300,000 |
| Gross margin | | 500,000 |
| Less: Operating expenses: | | |
| Selling expenses | Tk. 250,000 | |
| Administrative expenses | 160,000 | 410,000 |
| Net income | | Tk. 90,000 |

The surfboards sell, on the average, for Tk. 400 each. The departments' variable expenses are Tk. 50 per surfboard sold. The remaining selling expenses are fixed. The administrative expenses are 25% variable ad 75% fixed. The company purchases its surfboards from a supplier at a cost of Tk. 150 per surfboard.

Required:

Prepare an income statement for the quarter using the contribution approach.

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**L-2/T-1/WRE** **Date : 25/02/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2010-2011

Sub : **MATH 231** (Differential equations )

Full Marks: 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

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## SECTION – A

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

1. Solve the following differential equations.

   (a) $xy - \frac{dy}{dx} = y^3 e^{-x^2}$ **(12)**

   (b) $(6x - 4y + 3)dx - (3x - 2y + 1)dy = 0$ **(12)**

   (c) $x^2ydx - x^3dy = y^3dy$ **(11)**

2. (a) Define integrating factor. Write down the different rules of finding the integrating factors of differential equations. **(11)**

   (b) Solve $(x^2 + y^2 + 1)dx - 2xy\,dy = 0$ **(12)**

   (c) Solve the differential equation $\frac{d^3y}{dx^3} + 2\frac{d^2y}{dx^2} - 5\frac{dy}{dx} - 6y = 0$ given that $y = 0$, $\frac{dy}{dx} = 0$, $\frac{d^2y}{dx^2} = 1$ at $x = 0$ **(12)**

3. Solve the following:

   (a) $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 13y = x^2e^{3x}$ **(11)**

   (b) $\frac{d^5y}{dx^5} - \frac{d^4y}{dx^4} + 2\frac{d^3y}{dx^3} - 2\frac{d^2y}{dx^2} + \frac{dy}{dx} - y = \cos x$ **(12)**

   (c) $x^3\frac{d^3y}{dx^3} - x^2\frac{d^2y}{dx^2} + 2x\frac{dy}{dx} - 2y = x^3 + 3x$ **(12)**

4. Solve the following differential equation in series by Fröbenius method. **(35)**

   $$(2x + x^3)\frac{d^2y}{dx^2} - \frac{dy}{dx} - 6xy = 0.$$

## SECTION – B

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

5. (a) Solve the following first order PDES

   (i) $x(y^2 + z)p - y(x^2 + z)q = z(x^2 - y^2)$ **(7)**

   (ii) $Z = px + qy + a\sqrt{x^2 + y^2 + z^2}$ **(8)**

Contd ..... P/2

**MATH 231**

Contd … Q. No. 5

(b) Solve the following PDES by Charpit's method

(i) $2xz - px^2 - 2qxy + pq = 0$ **(12)**

(ii) $Z = px + qy + p^2 + q^2$ **(8)**

6. Solve the following higher order PDES

(i) $\left(D_x^2 - 7D_xD_y + 12D_y^2\right)Z = y^2\text{Sin}(x - 2y)$ **(12)**

(ii) $(2D_x - 3D_y + 4)(3D_x + 4D_y - 5)Z = e^{x+y}x^2y^2$ **(14)**

(iii) $\left(x^2D_x^2 + 2xyD_xD_y - xD_x\right)Z = \frac{x^3}{y^3}$ **(9)**

7. (a) Find a surface satisfying $t = 12x^3y$ containing the two lines $y = 0 = Z$, $y = 1 = Z$ **(11)**

(b) Show that $P_n(x) = \frac{1}{2^n \angle n}\frac{d^n}{dx^n}\left(x^2 - 1\right)^n$ **(14)**

(c) Prove that $x\,p_n'(x) - p_{n-1}'(x) = nP_n(x)$ **(10)**

8. (a) Show that $\frac{2nJ_n(x)}{x} = J_{n+1}(x) + J_{n-1}(x)$ **(17)**

(b) Show that $\int_0^1 x^3J_0(ax) = \frac{a^2 - 4}{a^3}J_1(a) + \frac{2}{a^2}J_0(a)$ **(18)**

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