L-2/T-2/WRE **Date : 01/07/2015**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-2 B. Sc. Engineering Examinations 2013-2014

Sub : **CE 223** (Mechanics of Solids-II)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) A ductile material with a tensile yield (σ_{yp}) of 36 ksi subjected to the state of stress shown in Figure 1. Determine whether yielding occurs on the basis of maximum distortion energy theory (Von-Mises yield criterion). **(8)**

   (b) A cantilever solid shaft is subjected to axial tension of 50 kip and a torque of 25 kip-inch at free end as shown in Figure 2. Determine the state of stress of an element 'A' near the free surface and hence check whether yielding will occur or not according to maximum shear stress theory (Tresca yield criterion). Given, yield stress under uni-axial tension (σ_{yp}) = 40 ksi. **(8)**

   (c) Determine strain energy absorbed for the pin-connected truss as shown in Figure 3. Also, compute the vertical deflection of point 'B'. Given, elastic modulus (E) = 30000 ksi and bar cross-sectional areas are shown in the parantheses. **(10 ¼)**

2. (a) A flexible cable whose ends are supported at different elevation (see Figure 4) subjected to a uniformly distributed load of 0.2 kip per horizontal foot. Determine, **(16)**

   (i) horizontal component of cable tension (H), (ii) mid-span sag (f), (iii) equation of the cable having origin at left support, (iv) maximum cable tension ($T_{maximum}$), (v) cross-sectional area of the cable (A), (vi) stretched length (S), elongation (ΔS) and unstretched length (S_o) of the cable. Given, allowable tensile stress ($\sigma_{allowable}$) = 50 ksi and elastic modulus (E) = 30000 ksi.

   (b) Determine strain energy absorbed by the loaded cantilever beam as shown in Figure 5. Also, compute the vertical deflection of free-end 'B'. Given, bending stiffness (EI) = 50000 kip-feet^2. **(10 ¼)**

3. (a) Determine the maximum allowable internal pressure within the sphere which is made from joining two hemi-spherical parts by fillet weld (see Figure 6). Use E90 electrode and maximum permitted fillet weld size ($S_{maximum}$). **(20)**

   (b) Determine the fillet weld size (s) required to support a vertical load of 10,000 lb. at free end of a bracket which is connected to steel column as shown in Figure 7. Use E60 electrode. **(6 ¼)**

CE 223(WRE)

4. (a) Determine the 'kern' of circular section having radius 'r'. **(4)**

   (b) Using direct integration method, determine the equation of rotation and deflection for the indeterminate beam as shown in Figure 8. Also, compute the reaction at left support 'A', rotation at 'A' and deflection at 'B'. Given, bending stiffness (EI) = 15×10^6 lb.-feet^2. **(22 ¼)**

5. For the plane stress condition of an element as shown in Figure 9, **(26 ¼)**

   (i) determine the principal stresses and maximum shear stress (with associated normal stress) and angle of inclination of the planes over which they act. Also, show their sense on properly oriented elements.

   (ii) determine normal and shear stresses on a plane inclined at angle of 35° (see Figure 9) with vertical by using Mohr circle.

SECTION – B

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

6. Using moment area method, determine rotation of point B and D and deflection of point A and C of the loaded beam as shown in Figure 10. Given, EI = 60000 kip-ft^2. **(26 ¼)**

7. As shown in the Figure 11, determine normal stresses at corner points of section 'ABCD'. Also locate the position of neutral axis. **(26 ¼)**

8. For the eccentrically loaded riveted connection shown in Figure 12, determine force on rivet A and B. What will be the diameter of rivet A? Given, allowable stress in shear = 15000 psi; allowable stress in bearing = 32000 psi, **(26 ¼)**

9. For the bolted connection as shown in Figure 13, determine the allowable load P that the joints can transmit. Given, allowable stress in shearing = 15 ksi, allowable stress in bearing = 32 ksi, allowable stress in tearing = 20 ksi. **(26 ¼)**

10. Using AISC formula, select a lightest W shape to support an axial load of 175 kip for the pin-connected column shown in Figure 14. Given σ_{yp} = 36 ksi, E = 29000 ksi. **(26 ¼)**

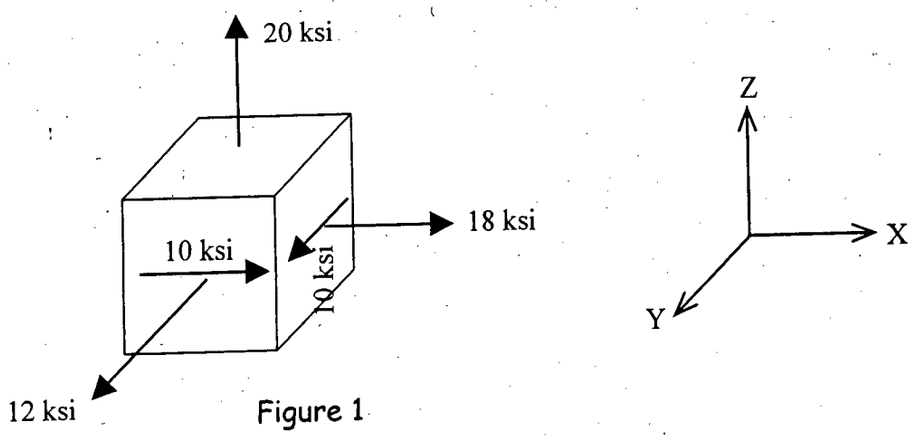


Figure 1

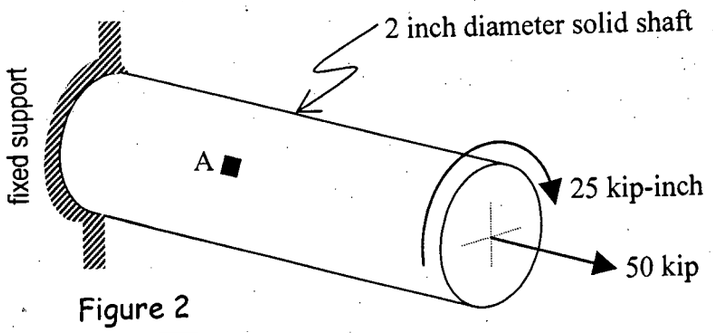


Figure 2

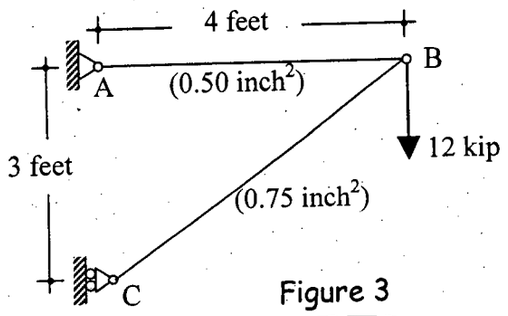


Figure 3

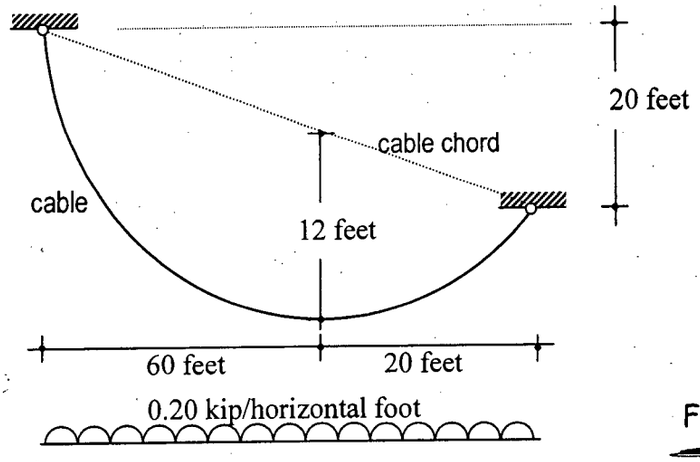


Figure 4

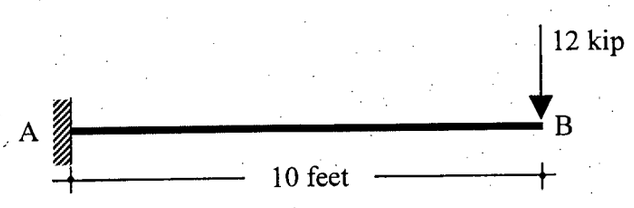


Figure 5

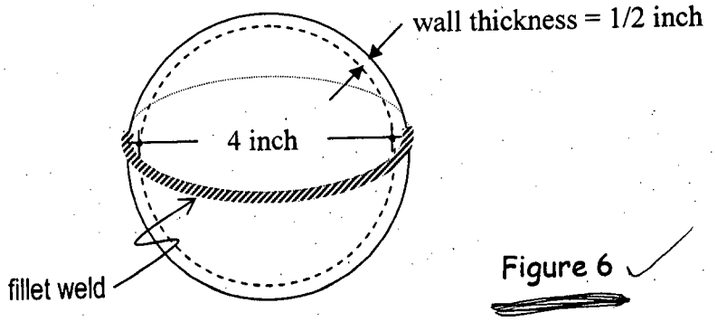


Figure 6

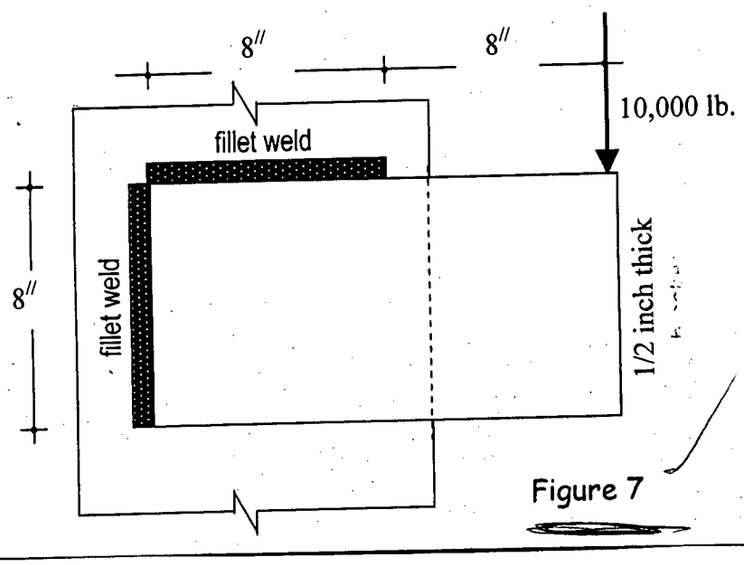


Figure 7

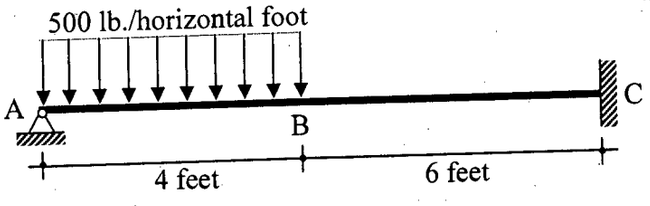


Figure 8

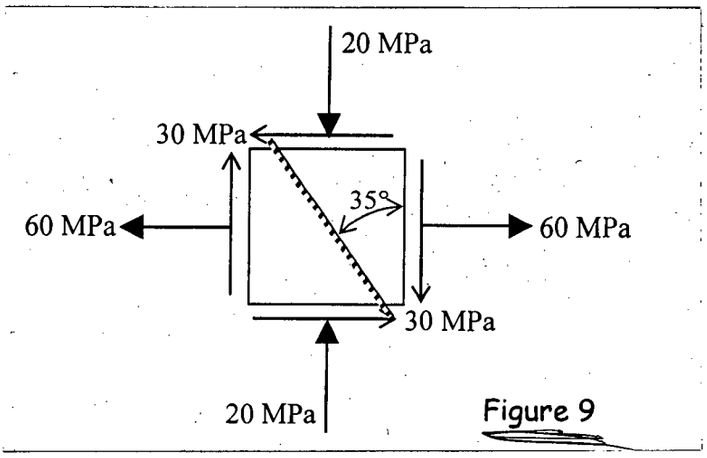


Figure 9

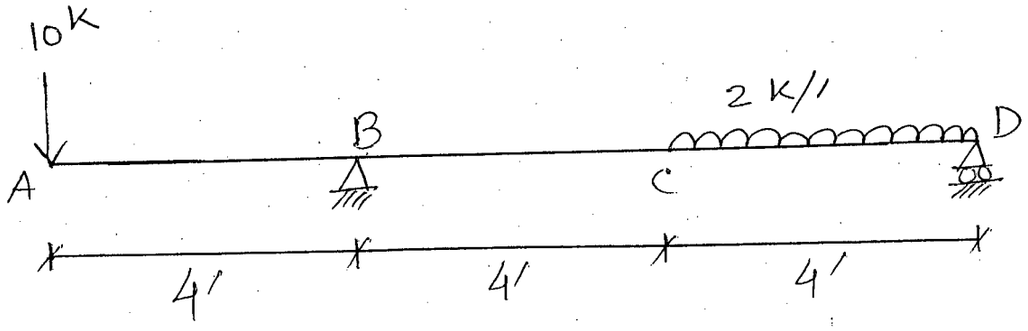


Figure 10

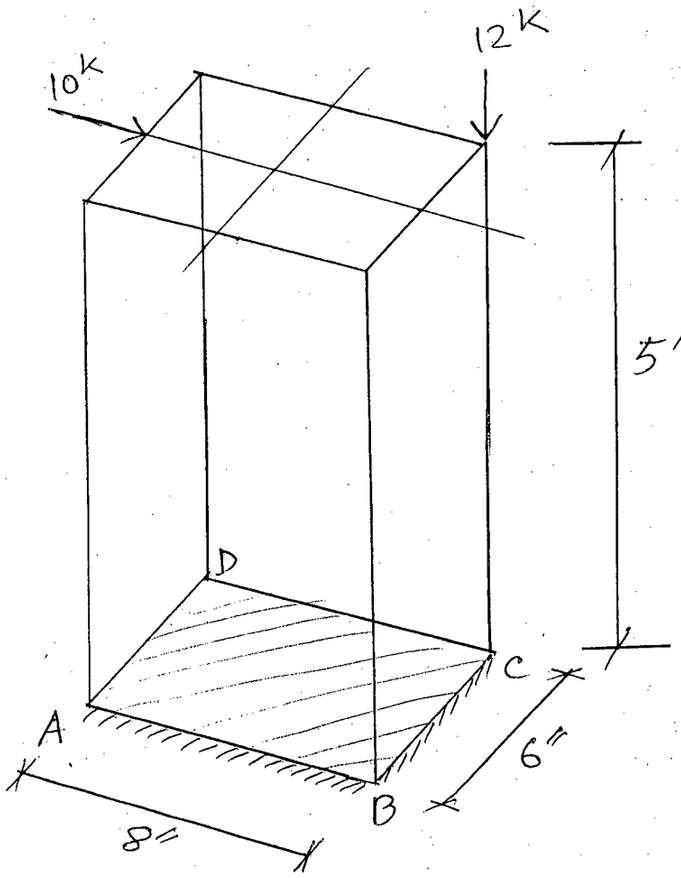


Figure 11

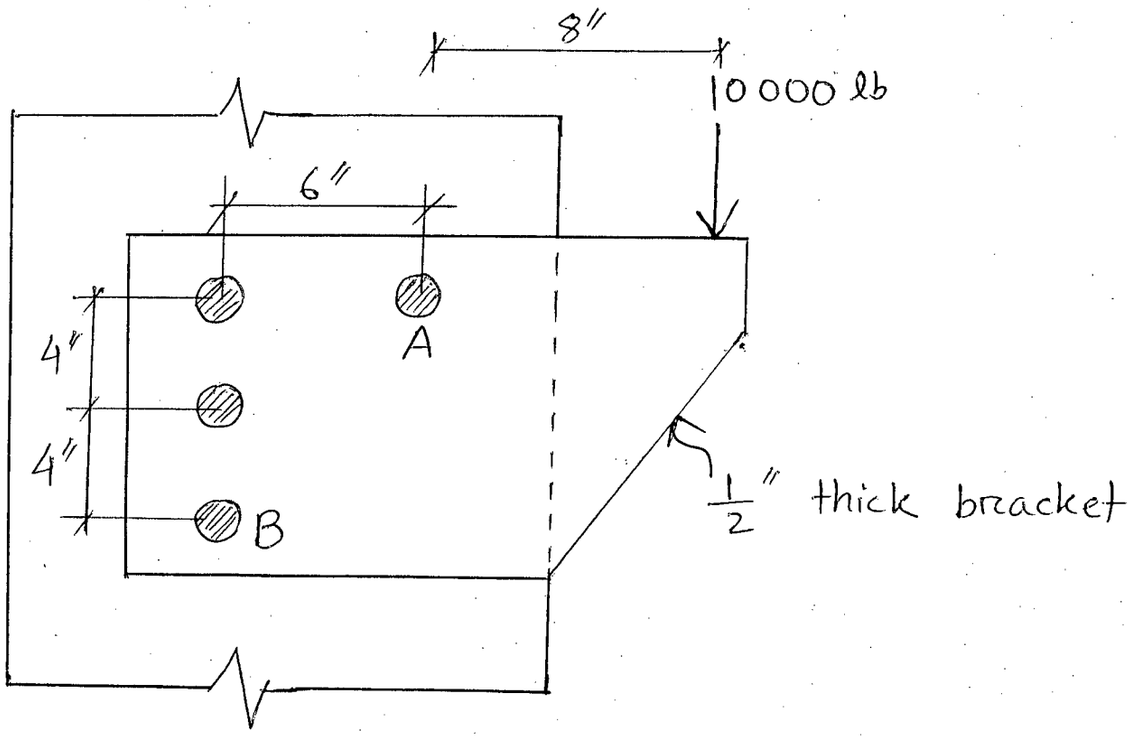


Figure 12

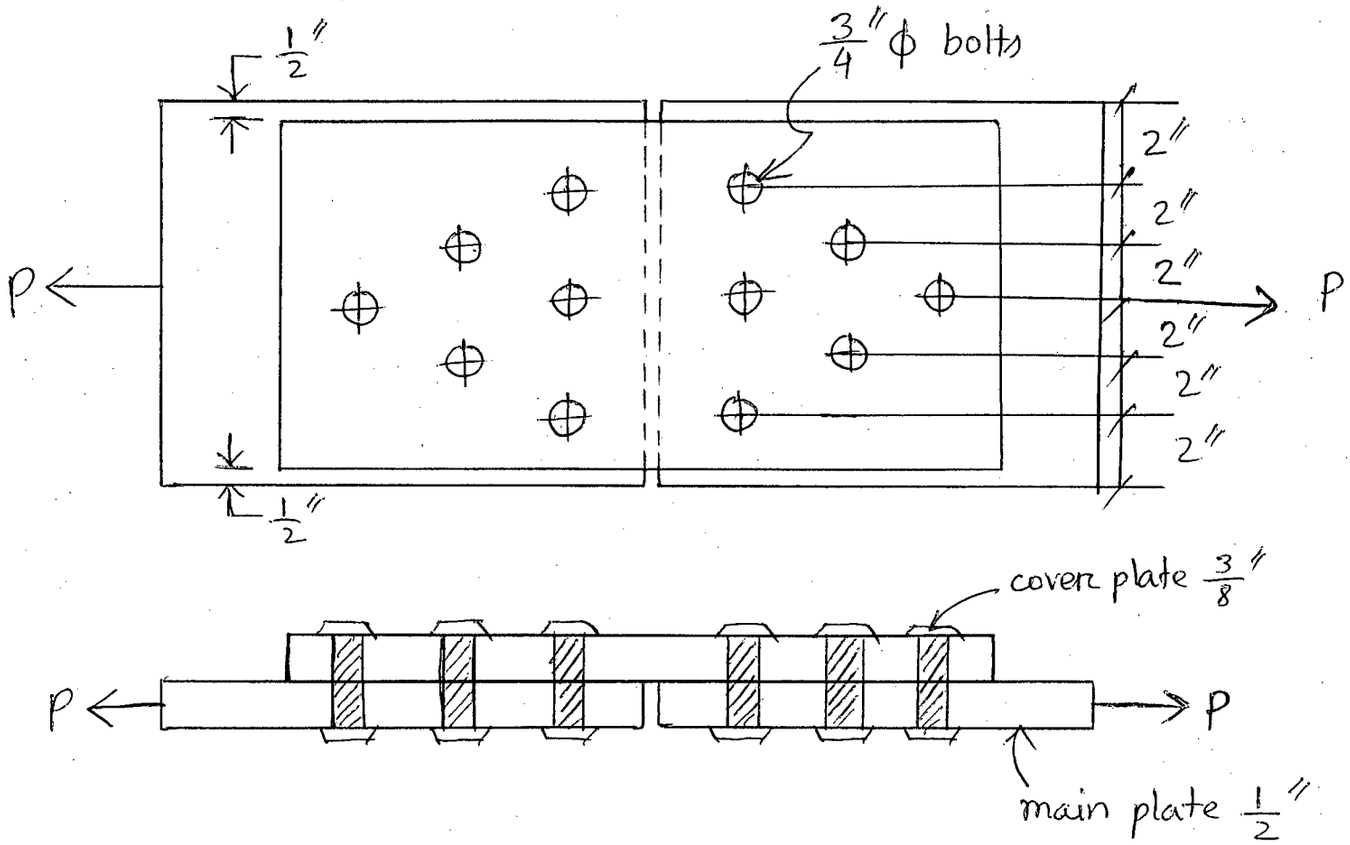


Figure 13

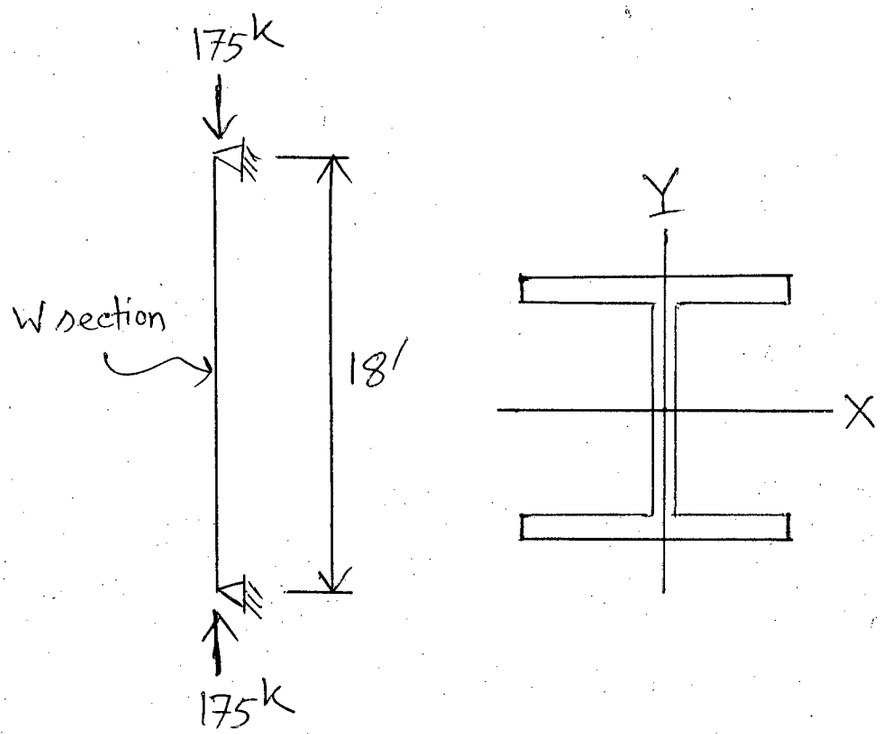


Figure 14

W shapes are provided at end.

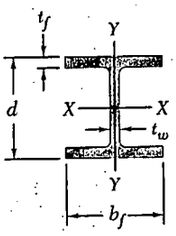
$$\sigma_{allowable} = \frac{\sigma_{yp}\left[1 - \frac{1}{2}\left(\frac{KL/r}{C_c}\right)^2\right]}{\frac{5}{3} + \frac{3}{8}\left(\frac{KL/r}{C_c}\right) - \frac{1}{8}\left(\frac{KL/r}{C_c}\right)^3} \quad \text{if } \frac{KL}{r} \leq C_c$$

$$\sigma_{allow} = \frac{12\pi^2 E}{23\left(KL/r\right)^2} \quad \text{if } \frac{KL}{r} \geq C_c$$

$$C_c = \pi\sqrt{\frac{2E}{\sigma_{yp}}}$$

9/4/15

Properties of Rolled-Steel Shapes
(U.S. Customary Units)



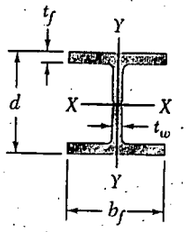
W Shapes
(Wide-Flange Shapes)

Designation†	Area A, in^2	Depth d, in	Flange Width b_f, in	Flange Thickness t_f, in	Web Thickness t_w, in	Axis X-X I, in^4	Axis X-X S, in^3	Axis X-X r, in	Axis Y-Y I, in^4	Axis Y-Y S, in^3	Axis Y-Y r, in
W12 × 96	28.2	12.7	12.2	0.900	0.550	833	131	5.44	270	44.4	3.09
72	21.1	12.3	12.0	0.670	0.430	597	97.4	5.31	195	32.4	3.04
50	14.6	12.2	8.08	0.640	0.370	391	64.2	5.18	56.3	13.9	1.96
40	11.7	11.9	8.01	0.515	0.295	307	51.5	5.13	44.1	11.0	1.94
35	10.3	12.5	6.56	0.520	0.300	285	45.6	5.25	24.5	7.47	1.54
30	8.79	12.3	6.52	0.440	0.260	238	38.6	5.21	20.3	6.24	1.52
26	7.65	12.2	6.49	0.380	0.230	204	33.4	5.17	17.3	5.34	1.51
22	6.48	12.3	4.03	0.425	0.260	156	25.4	4.91	4.66	2.31	0.848
16	4.71	12.0	3.99	0.265	0.220	103	17.1	4.67	2.82	1.41	0.773
W10 × 112	32.9	11.4	10.4	1.25	0.755	716	126	4.66	236	45.3	2.68
68	20.0	10.4	10.1	0.770	0.470	394	75.7	4.44	134	26.4	2.59
54	15.8	10.1	10.0	0.615	0.370	303	60.0	4.37	103	20.6	2.56
45	13.3	10.1	8.02	0.620	0.350	248	49.1	4.32	53.4	13.3	2.01
39	11.5	9.92	7.99	0.530	0.315	209	42.1	4.27	45.0	11.3	1.98
33	9.71	9.73	7.96	0.435	0.290	171	35.0	4.19	36.6	9.20	1.94
30	8.84	10.5	5.81	0.510	0.300	170	32.4	4.38	16.7	5.75	1.37
22	6.49	10.2	5.75	0.360	0.240	118	23.2	4.27	11.4	3.97	1.33
19	5.62	10.2	4.02	0.395	0.250	96.3	18.8	4.14	4.29	2.14	0.874
15	4.41	10.0	4.00	0.270	0.230	68.9	13.8	3.95	2.89	1.45	0.810
W8 × 58	17.1	8.75	8.22	0.810	0.510	228	52.0	3.65	75.1	18.3	2.10
48	14.1	8.50	8.11	0.685	0.400	184	43.2	3.61	60.9	15.0	2.08
40	11.7	8.25	8.07	0.560	0.360	146	35.5	3.53	49.1	12.2	2.04
35	10.3	8.12	8.02	0.495	0.310	127	31.2	3.51	42.6	10.6	2.03
31	9.12	8.00	8.00	0.435	0.285	110	27.5	3.47	37.1	9.27	2.02
28	8.24	8.06	6.54	0.465	0.285	98.0	24.3	3.45	21.7	6.63	1.62
24	7.08	7.93	6.50	0.400	0.245	82.7	20.9	3.42	18.3	5.63	1.61
21	6.16	8.28	5.27	0.400	0.250	75.3	18.2	3.49	9.77	3.71	1.26
18	5.26	8.14	5.25	0.330	0.230	61.9	15.2	3.43	7.97	3.04	1.23
15	4.44	8.11	4.01	0.315	0.245	48.0	11.8	3.29	3.41	1.70	0.876
13	3.84	7.99	4.00	0.255	0.230	39.6	9.91	3.21	2.73	1.37	0.843
W6 × 25	7.34	6.38	6.08	0.455	0.320	53.4	16.7	2.70	17.1	5.61	1.52
20	5.87	6.20	6.02	0.365	0.260	41.4	13.4	2.66	13.3	4.41	1.50
16	4.74	6.28	4.03	0.405	0.260	32.1	10.2	2.60	4.43	2.20	0.967
12	3.55	6.03	4.00	0.280	0.230	22.1	7.31	2.49	2.99	1.50	0.918
9	2.68	5.90	3.94	0.215	0.170	16.4	5.56	2.47	2.20	1.11	0.905
W5 × 19	5.56	5.15	5.03	0.430	0.270	26.3	10.2	2.17	9.13	3.63	1.28
16	4.71	5.01	5.00	0.360	0.240	21.4	8.55	2.13	7.51	3.00	1.26
W4 × 13	3.83	4.16	4.06	0.345	0.280	11.3	5.46	1.72	3.86	1.90	1.00

†A wide-flange shape is designated by the letter W followed by the nominal depth in inches and the weight in pounds per foot.

Properties of Rolled-Steel Shapes
(U.S. Customary Units)

W Shapes
(Wide-Flange Shapes)



Designation†	Area A, in^2	Depth d, in	Flange Width b_f, in	Flange Thickness t_f, in	Web Thickness t_w, in	Axis X-X I_x, in^4	Axis X-X S_x, in^3	Axis X-X r_x, in	Axis Y-Y I_y, in^4	Axis Y-Y S_y, in^3	Axis Y-Y r_y, in
W36 × 302	88.8	37.3	16.7	1.68	0.945	21100	1130	15.4	1300	156	3.82
135	39.7	35.6	12.0	0.790	0.600	7800	439	14.0	225	37.7	2.38
W33 × 201	59.2	33.7	15.7	1.15	0.715	11600	686	14.0	749	95.2	3.56
118	34.7	32.9	11.5	0.740	0.550	5900	359	13.0	187	32.6	2.32
W30 × 173	51.0	30.4	15.0	1.07	0.655	8230	541	12.7	598	79.8	3.42
99	29.1	29.7	10.50	0.670	0.520	3990	269	11.7	128	24.5	2.10
W27 × 146	43.1	27.4	14.0	0.975	0.605	5660	414	11.5	443	63.5	3.20
84	24.8	26.70	10.0	0.640	0.460	2850	213	10.7	106	21.2	2.07
W24 × 104	30.6	24.1	12.8	0.750	0.500	3100	258	10.1	259	40.7	2.91
68	20.1	23.7	8.97	0.585	0.415	1830	154	9.55	70.4	15.7	1.87
W21 × 101	29.8	21.4	12.3	0.800	0.500	2420	227	9.02	248	40.3	2.89
62	18.3	21.0	8.24	0.615	0.400	1330	127	8.54	57.5	14.0	1.77
44	13.0	20.7	6.50	0.450	0.350	843	81.6	8.06	20.7	6.37	1.26
W18 × 106	31.1	18.7	11.2	0.940	0.590	1910	204	7.84	220	39.4	2.66
76	22.3	18.2	11.0	0.680	0.425	1330	146	7.73	152	27.6	2.61
50	14.7	18.0	7.50	0.570	0.355	800	88.9	7.38	40.1	10.7	1.65
35	10.3	17.7	6.00	0.425	0.300	510	57.6	7.04	15.3	5.12	1.22
W16 × 77	22.6	16.5	10.3	0.76	0.455	1110	134	7.00	138	26.9	2.47
57	16.8	16.4	7.12	0.715	0.430	758	92.2	6.72	43.1	12.1	1.60
40	11.8	16.0	7.00	0.505	0.305	518	64.7	6.63	28.9	8.25	1.57
31	9.13	15.9	5.53	0.440	0.275	375	47.2	6.41	12.4	4.49	1.17
26	7.68	15.7	5.50	0.345	0.250	301	38.4	6.26	9.59	3.49	1.12
W14 × 370	109	17.9	16.5	2.66	1.66	5440	607	7.07	1990	241	4.27
145	42.7	14.8	15.5	1.09	0.680	1710	232	6.33	677	87.3	3.98
82	24.0	14.3	10.1	0.855	0.510	881	123	6.05	148	29.3	2.48
68	20.0	14.0	10.0	0.720	0.415	722	103	6.01	121	24.2	2.46
53	15.6	13.9	8.06	0.660	0.370	541	77.8	5.89	57.7	14.3	1.92
43	12.6	13.7	8.00	0.530	0.305	428	62.6	5.82	45.2	11.3	1.89
38	11.2	14.1	6.77	0.515	0.310	385	54.6	5.87	26.7	7.88	1.55
30	8.85	13.8	6.73	0.385	0.270	291	42.0	5.73	19.6	5.82	1.49
26	7.69	13.9	5.03	0.420	0.255	245	35.3	5.65	8.91	3.55	1.08
22	6.49	13.7	5.00	0.335	0.230	199	29.0	5.54	7.00	2.80	1.04

†A wide-flange shape is designated by the letter W followed by the nominal depth in inches and the weight in pounds per foot.

(Table continued on page A17)

L-2/T-2/WRE **Date : 08/07/2015**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-2 B. Sc. Engineering Examinations 2012-2013

Sub : **WRE 201** (Fluid Mechanics)

Full Marks : 280 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**.

Symbols are usual meaning.

1. (a) What is viscosity of fluid? Derive the equation of viscosity of fluid. In this respect differentiate between Newtonian and Non-Newtonian fluid ideal plastic and elastic solid with examples. Support your answer with proper figures. **(10)**

(b) A space of 25 mm width between two large plane surfaces is filled with SAE 30 western lubricating oil at 25°C ($\mu = 2.1 \times 10^{-1}$ N-s/m^2). What force is required to drag a very thin plate of 0.35 m^2 area between the surfaces at a speed of 0.1 m/s; **(12)**

(i) If the plate is equally spaced between the two surfaces?

(ii) If it is at a distance of 8.5 mm from one surface?

(c) Differentiate between: **(3×4=12)**

(i) Adhesion and cohesion

(ii) Ideal and real fluid

(iii) Steady and unsteady flows.

(d) A liquid with a (s = 0.86) vapour pressure of 26 kN/m^2 abs flows through the horizontal constriction as shown in Figure 1. Atmospheric pressure is 70 cm mercury. Find the maximum theoretical flow rate (i.e. at what discharge does cavitation occur?) **(12⅔)**

2. (a) What do you mean by hydraulic grade line and energy line? State the limitations of Bernoullis energy equation. **(10)**

(b) A 15 HP pump working with an efficiency of 80% is discharging crude oil (S = 0.9) to the overhead tank as shown in Figure 2. If losses in the whole system is 1.5 m of flowing fluid, find the discharge. Given, P = 4500 kg/m^2. **(12)**

(c) Write short notes on : **(3×4=12)**

(i) Head of fluid

(ii) Cavitation

(iii) Energy correction factor

(d) A pipe line with a pump leads to a nozzle is shown in the figure 3. Find the flow rate when the pump develops a head of 24 m. Assume that the head loss in the 15 cm

Contd P/2

WRE 201

Contd ... Q. No. 2(d)

diameter pipe may be expressed by $h_L = 5\frac{v_1^2}{2g}$, while the head loss in the 10 cm diameter pipe is $h_L = \frac{12v_2^2}{2g}$. Sketch the energy line and the HGL and find the pressure head at the suction side of the pump. **(12⅔)**

3. (a) A pipe of 60 m long and 15 cm in diameter is connected to a water tank at one end and flows freely into the atmosphere at the other end. The height of the water level in the tank is 2.8 m above the center of the pipe. The pipe is horizontal with f = 0.04. Determine the change through the pipe. **(10)**

(b) Determine the diameter of steel pipe (e = 0.045 mm) to carry 30 l/s of water if the permissible head loss per meter of pipe length is 0.05 m. Use Moody diagram. Take $\nu = 1 \times 10^{-6}$ m^2/s. **(12)**

(c) Write short notes on : **(3×4=12)**

(i) Hydraulically rough boundary

(ii) Different types of losses in pipe flow

(iii) Viscous sublayer.

(d) The head loss in 60 m of 15 cm diameter pipe is known to be 8 m when oil (S = 0.9) of viscosity 0.04 N-s/m^2 flows at 0.06 m^3/s. Determine the center-line velocity , the shear stress at the wall of the pipe and the velocity at 5 cm from the center line. **(12⅔)**

4. (a) Derive the general equation of the variation of pressure in a static fluid in vertical direction. **(10)**

(b) For the pipes connected in parallel as shown in figure 4, the pipe dimensions and friction factors are as follows: **(12)**

$L_1 = 900$ m, $D_1 = 0.3$ m, $f_1 = 0.021$

$L_2 = 600$ m, $D_2 = 0.2$ m, $f_2 = 0.018$

$L_3 = 1200$ m, $D_3 = 0.4$ m, $f_3 = 0.019$

For a total discharge of 0.34 m^3/s, find the flow through each pipe and head loss from A to B.

(c) Differentiate between- **(3×4=12)**

(i) Uniform and non-uniform flow

(ii) Compressible and in-compressible fluid

(iii) Solid and liquid.

(d) Initial distribution of flows through a pipe network is shown in Figure 5. Taking n = 2 for all pipes, obtain flows in each pipe after applying correction twice. Discharge is in l/s. Use Hardy-Cross method. **(12⅔)**

Contd P/3

WRE 201

SECTION – B

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

5. (a) Derive the differential equation of continuity for steady flow of an incompressible fluid. **(12⅔)**

(b) Define (i) Rotational flow (ii) Streak line (iii) Flow Net **(6)**

(c) Check whether the stream function $\psi = 2xy$ is irrotational and if so, determine the corresponding potential function φ. **(12)**

(d) In a flow the velocity vector is given by $V = \frac{x}{1+t}i + \frac{x}{1+2t}j$. Determine the equation of the streamline and pathline passing through the point $(x_0, y_0, 0)$ at $t = t_0$. **(16)**

6. (a) Derive the equation of force exerted by single moving vane. **(12⅔)**

(b) Prove that for Laminar flow in a circular pipe $\beta = 4/3$. The velocity profile is given as, $u = u_m [1-(r/r_0)^2]$. **(10)**

(c) A reaction turbine has $r_1 = 1.65$ m and $r_2 = 1.10$ m, $\beta_1 = 60°$, $\beta_2 = 160°$ and a thickness of 0.25 m parallel to the axis of rotation. With the guide vane angle of 15° and flow rate 12 m^3/s, calculate the required speed of the runner for smooth flow at inlet. **(24)**

For this condition also calculate

(i) The torque exerted on the runner

(ii) The power development

(iii) The energy exerted from each Newton of fluid

(iv) The pressure drop through runner

7. (a) What is similitude? State the conditions for which flows will achieve dynamically similarity. **(10⅔)**

(b) A drag force of 10 N is exerted on a submerged sphere when it moves through 20°C water at 1.5 m/s. Another sphere having three times the diameter is placed in a wind tunnel where the air pressure and temperature are 1.5 MN/m^2, abs and 300 K respectively. What air velocity required for dynamic similarity and what will be the drag force for larger sphere? **(14)**

[Density of water at 20°C is 998.2 kg/m^3, Viscosity of water at 20°C si 1.002×10^{-3} $N.s/m^2$;]

Density of air at 300° K is 1.177 kg/m^3, Viscosity of air at 300° K 18.45×10^{-6} $N.s/m^2$; Gas constant of air 287 N.m/(kg.k).

(c) Using dimensional analysis, derive an expression for small flow rates over a spillway, in the form of a function including dimensional quantities. The parameters involved are height of spillway P, head on the spillway H, acceleration due to gravity g, viscosity of liquid μ, density of the liquid ρ and surface tension σ. **(22)**

Contd P/4

WRE 201

8. (a) Briefly discuss the measuring mechanism of the following devices- (i) Falling-sphere type viscometer (ii) Hot-wire Anemometer. **(10)**

(b) What do you understand by free flow and submerged flow? Explain briefly. **(6⅔)**

(c) A 5 cm diameter orifice at the end of a 7.5 cm diameter pipe discharges into the atmosphere a measured flow of 17 L/s of water when the pressure in the pipe is 70 kPa. The jet velocity is determined by a pitot tube to be 12 m/s. Find the values of coefficients C_c, C_v and C_d. **(14)**

(d) State the reason for using a flow nozzle. A pipe 3.2 km long and 90 cm in diameter is fitted with a nozzle of 20 cm diameter at the discharge end. Find the velocity of water through the nozzle if the head of water is 50 m above centerline of the pipe. Take friction factor is 0.024 for the pipe. **(4+12=16)**

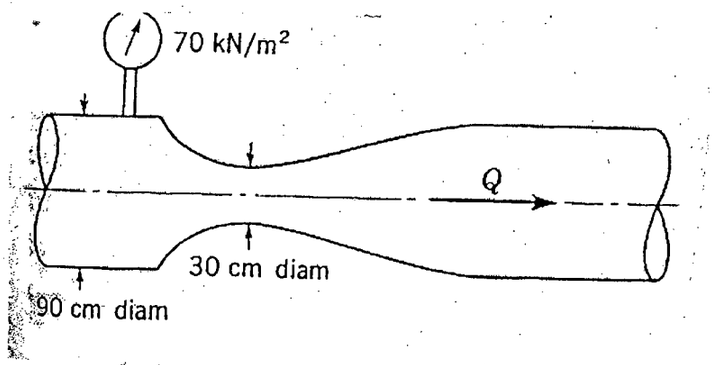


Figure 1 for Ques. No. 1 (d)

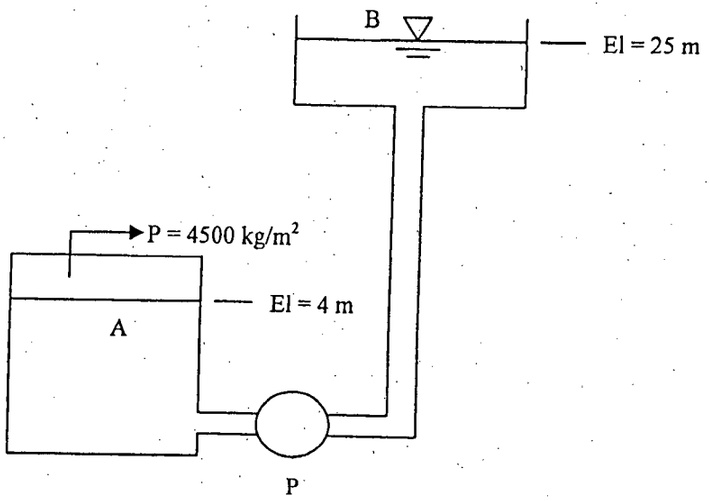


Figure 2 for Ques No. 2(b)

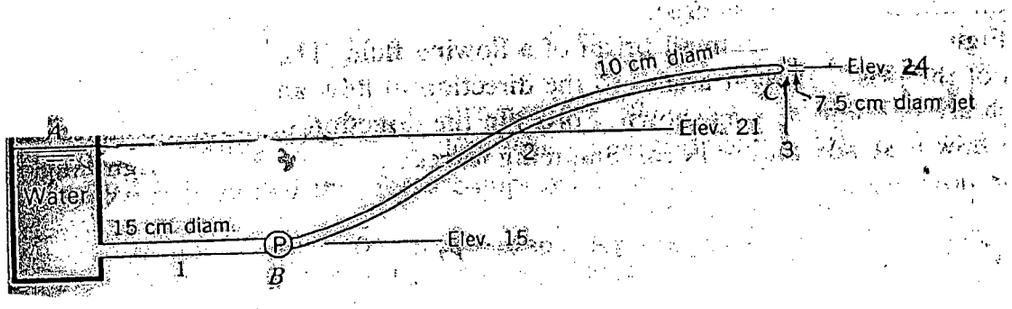


Figure 3 for Ques No. 2(d)

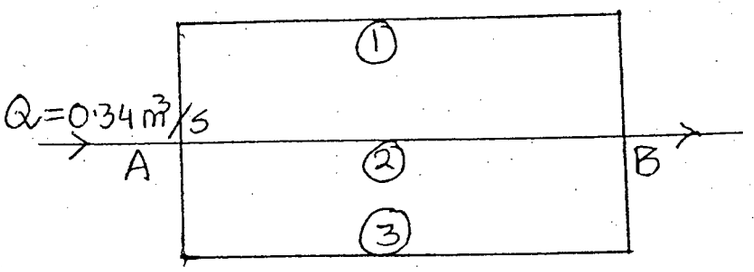


Figure 4 for Ques No. 4(b)

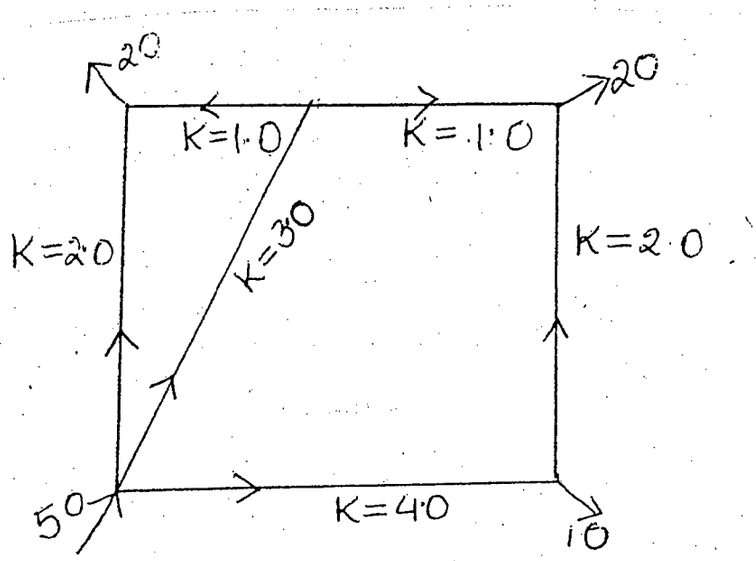


Figure 5 for Ques No. 4(d)

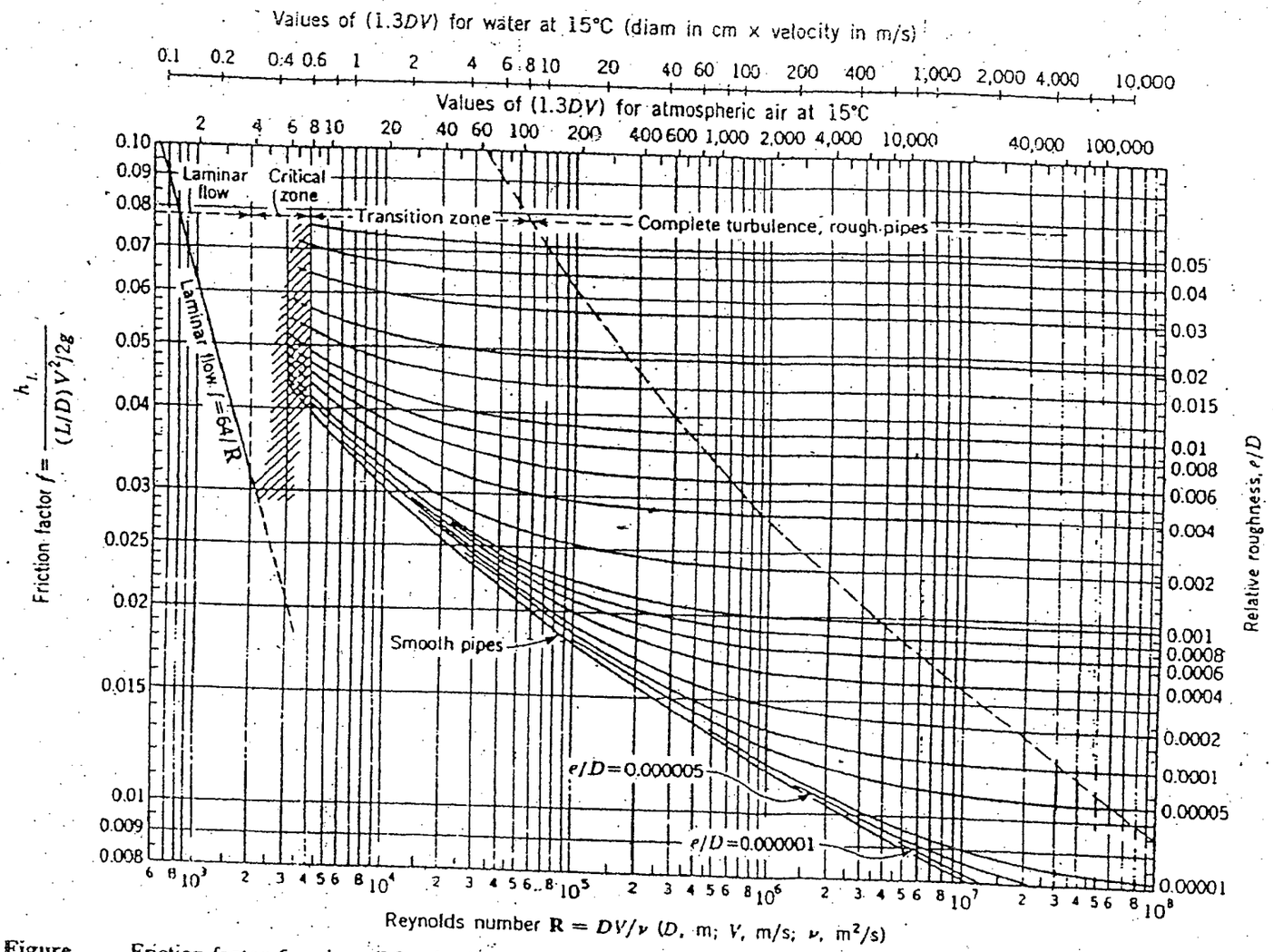


Figure Friction factor for pipes (Moody diagram).

L-2/T-2/WRE **Date : 02/08/2015**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-2 B. Sc. Engineering Examinations 2013-2014

Sub : **HUM 213** (Government)

Full Marks : 140 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) Discuss the constituent elements of a modern state. **(11 ⅓)**

   (b) Make a brief discussion on the increasing factors of internationalism. **(12)**

2. (a) What is constitution? Describe the qualities of a good constitution. **(11 ⅓)**

   (b) Explain the functions of legislature in a state. **(12)**

3. (a) Define rights. Discuss the political rights and duties of a citizen in a state. **(11 ⅓)**

   (b) Analyze the constraints in ensuring good governance. **(12)**

4. Write short notes on any three (3) of the following: **(23 ⅓)**

   (a) Democratic types of Government

   (b) Popular Sovereignty

   (c) Nature of Dictatorship

   (d) Theory of Surplus value

SECTION – B

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

5. (a) Define democracy. Which conditions are necessary for the success of democracy? **(11 ⅓)**

   (b) Analyze the merits and demerits of parliamentary form of government. **(12)**

6. (a) Illustrate the salient features of the constitution of Bangladesh. **(11 ⅓)**

   (b) Explain the function of city corporation as an urban local government institution in Bangladesh. **(12)**

7. (a) Make a comparison between the political systems of Uk and USA. **(11 ⅓)**

   (b) Discuss the determinants of the foreign policy of Bangladesh. **(12)**

8. Write short notes on any three (3) of the following: **(23 ⅓)**

   (a) Language Movement

   (b) Mass upsurge of 1969

   (c) Ideal Type of Bureaucracy

   (d) United Nations Organizations.

L-2/T-2/WRE **Date : 02/08/2015**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-2 B. Sc. Engineering Examinations 2013-2014

Sub : **HUM 211** (Sociology)

Full Marks : 140 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 do you mean by natural environment and artificial environment? How would you explain the negative impacts of global wringing? **(13 ⅓)**

   (b) Briefly discuss how the socio-economic development depends on physical environment. **(10)**

2. (a) Define capitalism. Write down the important characteristics of capitalism. **(13 ⅓)**

   (b) Briefly describe the social Consequences of industrial revolutions. **(10)**

3. (a) What forces have led to the development of town, city? Metropolitan and finally mega cities? **(10)**

   (b) Discuss the classification of cities according to urban sociologists. **(5 ⅓)**

   (c) Define social change. Briefly describe the sources of social change. **(8)**

4. Write short notes on any THREE of the following: **(23 ⅓)**

   (a) The demographic transition theory

   (b) Globalization and modern life.

   (c) The major effects of rural to urban migration.

   (d) Evolution of cities.

SECTION – B

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

5. (a) What aspects of the social and work environment in a fast-food restaurant would be of a particular interest to a sociologist because of his or her 'sociological imagination'? **(13 ⅓)**

   (b) 'When a system of social inequality is based on a hierarchy of groups, sociologists refer to it as stratification' – (R. T. Schaefer). Discuss. **(10)**

Contd P/2

HUM 211(WRE)

6. (a) Write a short report on 'social impact assessment of Padma Bridge' by using steps used in social research method. **(13 ⅓)**

   (b) What are the focal points of Ogburn's cultural lag? Cite examples from your own society. **(10)**

7. (a) Define socialization. In what ways are agents of socialization important to society as a whole? **(13 ⅓)**

   (b) Describe the key differences between crime and deviance. **(10)**

8. Write short notes on any THREE of the following **(23 ⅓)**

   (a) Cultural shock
   (b) Intergenerational mobility
   (c) Juvenile delinquency
   (d) Merton's types of deviance

L-2/T-2/WRE **Date : 10/08/2015**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-2 B. Sc. Engineering Examinations 2013-2014

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

SECTION – A

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

1. (a) Find the differential equation of all circles passing through the origin and having their centers on the y-axis. **(11)**

   (b) Solve the differential equation: **(12)**

$$(x+y)^2\left(x\frac{dy}{dx}+y\right)=xy\left(1+\frac{dy}{dx}\right)$$

   (c) Solve the homogeneous differential equation: **(12)**

$$2y^3dx+\left(x^2-3y^2\right)xdy=0$$

2. (a) Solve $x\frac{dy}{dx}+y=(xy)^{3/2}$ subject to the initial condition y(1) = 4. **(11)**

   (b) For what value of λ the differential equation $\left(xy^2+\lambda x^2y\right)dx+(x+y)x^2dy=0$ is exact? Hence solve the differential equation. **(12)**

   (c) Solve $p^2+2py\cot x=y^2$, where $p=\frac{dy}{dx}$. **(12)**

3. (a) Solve $\left(D^2-7D+12\right)y=2^x$ **(11)**

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

   (c) Solve the Cauchy-Euler equation $\left(x^3D^3+2x^2D^2+2\right)y=x+\frac{1}{x}$ **(12)**

4. (a) Solve the differential equation

$$x(1-x))\frac{d^2y}{dx^2}-3x\frac{dy}{dx}-y=0$$

   by method of Fröbenius. **(35)**

Contd P/2

MATH 231(WRE)

SECTION – B

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

5. (a) Form a partial differential equation by eliminating the arbitrary function ϕ from

$\phi = \left(x^2 + y^2 + z^2,\ z^2 - 2xy\right) = 0$. **(12)**

(b) Solve: $x\left(y^2 + z\right)p - y\left(x^2 + z\right)q = z\left(x^2 - y^2\right)$ **(11)**

(c) Find the equation of the surface satisfying $4yzp + q + 2y = 0$ and passing through $y^2 + z^2 = 1,\ x + z = 2$. **(12)**

6. (a) Find the complete integral of $p^2x + q^2y = z$, by Charpits method. **(12)**

(b) Solve: $\left(D^2 + DD' - 6D'^2\right)z = y\sin x$. **(12)**

(c) Solve: $\left(x^2D^2 - y^2D'^2\right)z = xy$ **(11)**

7. (a) Express $2 - 3x + 4x^2$ in terms of Legendre polynomial. **(8)**

(b) Prove that $\int_{-1}^{1} P_m(x)P_n(x)dx = 0$, if $n \neq m$. **(17)**

(c) Prove that $\int_{-1}^{1} xP_n(x)P_{n-1}(x)dx = \frac{2n}{4n^2 - 1}$. **(10)**

8. (a) Prove that $xJ_n'(x) = nJ_n(x) - xJ_{n+1}(x)$. **(11)**

(b) Prove that $\frac{d}{dx}\left(xJ_n(x)J_{n+1}(x)\right) = x\left(J_n^2(x) - J_{n+1}^2(x)\right)$ and deduce that

$x = 2J_0J_1 + 6J_1J_2 + 10J_2J_3 + \cdots$ **(14)**

(c) Show that **(10)**

$$\sqrt{\left(\frac{1}{2}\pi x\right)}J_{3/2}(x) = \frac{\sin x}{x} - \cos x.$$

L-2/T-2/WRE **Date : 10/08/2015**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-2 B. Sc. Engineering Examinations 2013-2014

Sub : **MATH 235** (Vector Analysis and Statistics)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

Symbols have their usual meaning.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) If **a**, **b**, **c** are non-co-plannar vectors then prove that the following four points are coplanar: **(12)**

$$6\mathbf{a} - 4\mathbf{b} + 10\mathbf{c}, -5\mathbf{a} + 3\mathbf{b} - 10\mathbf{c}, 4\mathbf{a} - 6\mathbf{b} - 10\mathbf{c} \text{ and } 2\mathbf{b} + 10\mathbf{c}$$

(b) By vector method find the perpendicular distance of a corner of a unit cube from a diagonal not passing through it. **(12)**

(c) Find the volume of the tetrahedron formed by the coordinate planes and the plane $5x + 3y + 6z = 30$. **(11)**

2. (a) Find the directional derivative of $f(x) = x^2y^2z^2$ at the point (1, 1, 1) in the direction of the tangent to the curve $x = 3\cos t$, $y = 3\sin t$, $z = 4t$ at $t = 0$. **(12)**

(b) If $\mathbf{r} = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$ and $r = |\mathbf{r}|$, prove that $div\left\{\frac{f(r)\mathbf{r}}{r}\right\} = \frac{1}{r^2}\frac{d}{dr}\left\{r^2 f(r)\right\}$. **(12)**

(c) If $\mathbf{v} = \frac{x}{x^2+y^2}\mathbf{i} + \frac{y}{x^2+y^2}\mathbf{j}$, show that $\int_C \mathbf{v}.d\mathbf{r} = 0$ for every closed path that does not include the origin. What is the value of the integral over the circle $x^2 + y^2 = 1$? **(11)**

3. (a) Determine whether the vector field $\mathbf{F} = 3x^2y\mathbf{i} + (x^3 + 2yz)\mathbf{j} + y^2\mathbf{k}$ can be derived from a scalar potential or a vector potential. Then find its potential. **(15)**

(b) State Green's theorem in plane and verify this theorem for $\oint_C (3x^2 + 2y)dx - (x + 3\cos y)dy$ around the parallelogram having vertices at (0, 0), (2, 0), (3, 1) and (1, 1). **(20)**

4. (a) Evaluate $\iint_S \mathbf{A}.\mathbf{n}dS$ where $\mathbf{A} = y\mathbf{i} + 2x\mathbf{j} - z\mathbf{k}$ and S is the surface of the plane $2x + y = 6$ in the first octant cut off by the plane $z = 4$. **(17)**

(b) By converting the surface integral into a volume integral, evaluate $\iint_S \left(y^2z^2\mathbf{i} + z^2x^2\mathbf{j} + x^2y^2\mathbf{k}\right)\cdot d\mathbf{S}$, where S is the upper part of the sphere $x^2 + y^2 + z^2 = 9$ above x-y plane. **(18)**

Contd P/2

MATH 235(WRE)

SECTION – B

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

5. (a) For the following data compute the values of quartiles, 6^{th} decile and 20^{th} percentile. **(17)**

Marks	Below 10	10-20	20-30	30-40	40-50	50-60	60-70	Above 70
No of Students	5	25	40	70	90	40	20	10

Comment on your result.

(b) In a survey, data on daily wages paid to workers of two factories A and B are as follows: **(18)**

Daily Wages	20-30	30-40	40-50	50-60	60-70	70-80	80-90
Factory A	15	30	44	60	30	14	7
Factory B	25	40	60	35	20	15	5

Find out:

(i) Which factory pays higher average wages?

(ii) Which factory has greater variability about paying wages?

6. (a) To study the tensile strength of a certain type of wire, the following pairs of observations were recorded, where x is the diameter in cm and y is the mass supported in kg/cm. **(18)**

x	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4
y	14	26	50	56	42	98	82	88	134	124

(i) Calculate the least-square regression line $y = b_0 + b_1x$ for above data.

(ii) Find the predicted tensile strength for a wire with diameter 1.5 cm.

(b) Analysis of production rejects resulted in the following table: **(17)**

No. of rejects per operator	21-25	26-30	31-35	36-40	41-45	46-50	51-55
No of operators	5	15	28	42	15	12	3

Calculate Karl Pearson's coefficient of skewness and comment on its value.

7. (a) An important factor in solid missile fuel is the particle size distribution. Significant problems occur if the particle sizes are too large. From production data in the past, it has been determined that the particle size (in micrometers) distribution is characterized by **(12)**

$$f(x)=\begin{cases}3x^{-4}, & x>1,\\ 0, & \text{elsewhere.}\end{cases}$$

(i) Verify that this is a valid density function. Plot the density function.

(ii) Evaluate $F(x)$.

(iii) What is the probability that a random particle from the manufactured fuel exceeds 4 micrometers?

(iv) Give the mean particle size.

Contd P/3

MATH 235(WRE)
Contd ... Q. No. 7

(b) If X is a binomial random variable with probability distribution $b(x; n, p)$. When $n \to \infty$, $p \to 0$, and $np \to \mu$ remains constant then prove that $b(x; n, p) \to p(x, \mu)$. **(17)**

(c) Service calls come to a maintenance center according to a Poisson process, and on average, 2.7 calls are received per minute. Find the probability that **(6)**

(i) no more than 4 calls come in any minute;

(ii) more than 10 calls come in a 5 minute period.

8. (a) A soft-drink machine is regulated so that it discharge an average of 200 milliliters per cup. If the amount of drink is normally distributed with a standard deviation equal to 15 milliliters, **(12)**

(i) What fraction of the cups will contain more that 224 milliliters?

(ii) What is the probability that a cup contains between 191 and 209 milliliters?

(iii) How many cups will probably overflow if 230 milliliter cups are used for the next 1000 drinks? (Necessary table 1 attached).

(b) An electrical firm manufactures light bulbs that have a length of life that is approximately normally distributed, with mean equal to 800 hours and a standard deviation of 40 hours. Find the probability that a random sample of 16 bulbs will have an average life of less than 775 hours. (Necessary table 1 attached). **(6)**

(c) A manufacturer claims that the average tensile strength of thread A exceeds the average tensile strength of thread B by at least 12 kilograms. To test this claim, 50 pieces of each type of thread were tested under similar conditions. Type A threads had an average tensile strength of 86.7 kilograms with a standard deviation of 6.28 kilograms, while type B thread had an average tensile strength of 77.8 kilograms with a standard deviation of 5.61 kilograms. Test the manufacturer's claim using a 0.05 level of significance. (Necessary table 2 attached). **(17)**

Table 1

=A=

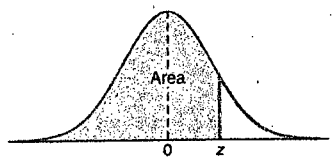


Table A.3 Areas under the Normal Curve

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
−3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
−3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
−3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
−3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
−3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
−2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
−2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
−2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
−2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
−2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
−2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
−2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
−2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
−2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
−2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
−1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
−1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
−1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
−1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
−1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
−1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
−1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
−1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
−1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
−1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
−0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
−0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
−0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
−0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
−0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
−0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
−0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
−0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
−0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
−0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641

Table for Question 8(a)

Table 1

=5=

Table A.3 (continued) Areas under the Normal Curve

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998

Table for Question 8(b)

Table 2

~~Table 10.1~~

Level of significance, α	0.10	0.05	0.01	0.005	0.002
Critical values of z for one-tailed tests	-1.28 *or* 1.28	-1.645 *or* 1.645	-2.33 *or* 2.33	-2.58 *or* 2.58	-2.88 *or* 2.88
Critical values of z for two-tailed tests	-1.645 *and* 1.645	-1.96 *and* 1.96	-2.58 *and* 2.58	-2.81 *and* 2.81	-3.08 *and* 3.08

Table for QN(8)(b) (c)