L-2/T-1/NAME **Date : 09/06/2014**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2012-2013

Sub : **NAME 219** (Marine Engines and Fuels)

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** questions.

1. (a) What is prime mover? Describe with figure the hydrodynamic theory of lubrication. **(3+12=15)**

   (b) What are the effects caused due to overheating an engine? **(7)**

   (c) Discuss the closed-circuit cooling system in case of a Marine Diesel Engine? **(13)**

2. (a) Describe schematically the operation of a fuel injection pump controlled by timed by-pass. **(15)**

   (b) How are sediments separated from lubricating oil? **(10)**

   (c) What are the principal malfunctions of the fuel equipment? **(10)**

3. (a) A 2.8 L SI V6 Engine that operates on a four stroke cycle at 3500 RPM, has a compression ratio of 9.0. The length of connecting rod is 16.5 cm and a stroke to bore ratio, $\frac{S}{B} = 1.025$. At this speed the combustion ends at 22° TDC.

   Calculate- **(25)**

   (i) Cylinder bore and stroke length.

   (ii) Average piston speed.

   (iii) Clearance volume of one cylinder.

   (iv) Piston speed at the end of combustion.

   (v) Distance the piston has traveled from TDC at the end of combustion.

   (vi) Volume in the combustion chamber at the end of combustion.

   (b) Describe the major factors affecting both the performance and efficiency of a gas turbine engine. **(10)**

4. (a) What are the functions of diffuser in case of a gas turbine engine? **(8)**

   (b) Describe the operation of turbocharger and supercharger. **(12)**

   (c) Briefly discuss about different sources of renewable energy. **(11)**

   (d) What do you understand by compression ratio? **(4)**

13

Contd P/2

NAME 219

SECTION – B

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

5. (a) What is pre-combustion chamber? Mention the advantages of pre-combustion chamber. **(15)**

   (b) With a neat sketch, explain cylinder liners. **(10)**

   (c) Discuss service ratings. **(10)**

6. (a) A 4 cylinder diesel engine operates on a four stroke cycle at 450 rpm. The engine was tested for 2 hours which developed horse power 900. Air consumption rate was 1500 cfm. Fuel consumed 600 lbs. Specific volume of air = 13.8 cft/lb, calorific value of fuel = 18000 BTU/lb, Cylinder dia = 12", Stroke = 18". Find : AFR, MEP, thermal efficiency, SFC and if super charged, find the pressure of charging. **(20)**

   (b) Differentiate between octane number and cetane number. **(15)**

7. (a) Discuss schematically the diesel combustion process. **(15)**

   (b) What is ignition delay? Explain the consequences if delay period becomes longer. **(15)**

   (c) Why is it important to clean fuel before injection? **(5)**

8. (a) Write short notes on followings **(20)**

   (i) Piston rings.

   (ii) Blow down

   (iii) Diesel index

   (iv) Dry sump and wet sump.

   (b) show the changes of Specific fuel consumption (SFC) with respect to engine speed, fuel equivalence ratio and engine displacement. **(15)**

L-2/T-1/NAME **Date : 19/05/2014**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2012-2013

Sub : **HUM 113** (Economics)

Full Marks: 140 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) Briefly discuss the relationship between economics and engineering education. **(7)**

   (b) Describe the assumptions of the cardinal theory of consumer equilibrium. **(3⅓)**

   (c) Narrate the cardinal theory of consumer equilibrium. **(13)**

2. (a) Distinguish between the concepts of "change in quantity demanded" and "change in demand". Explain graphically the "change in quantity demanded" and "change in demand" with reference to the change in prices of substitute and complementary commodities. **(8⅓)**

   (b) What is meant by market demand for a commodity? Explain graphically. **(5)**

   (c) Explain the factors that affect the supply of a commodity. **(5)**

   (d) Calculate the equilibrium price and quantity from the following demand and supply functions and graphically show the results. **(5)**

$$QD_x = 1200 - 5P_x$$
$$QS_x = -500 + 12P_x$$

3. (a) Define, write and explain the concept of demand function. **(3⅓)**

   (b) Explain how the prices of other commodities affect the demand for a commodity. **(3)**

   (c) Discuss in detail price elasticity of demand, point elasticity of demand and income elasticity of demand. **(11)**

   (d) From the following table calculate the price elasticity of demand when you move from point A to point C and from point C to point A. **(6)**

Point	Price	Quantity
A	10	300
B	9	350
C	8	400

4. (a) Define an indifference curve. Make a hypothetical indifference schedule, plot the schedule on a graph and explain. **(5⅓)**

   (b) Briefly discuss the properties of indifference curve. **(8)**

   (c) Define substitution effect and income effect of a price change. Show that price effect is equal to substitution effect and income effect. Present and explain all necessary diagrams. **(10)**

Contd P/2

HUM 113/NAME

SECTION – B

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

5. (a) What do you mean by inflation? Explain different types of inflation according to causes. **(5+8=13)**

   (b) What are the effects of demand pull and cost push inflation on an economy? **(10⅓)**

6. (a) What do you mean by Gross Domestic Product (GDP) and Gross National Product (GNP)? **(8)**

   (b) What are the methods to measure GDP? What items are not counted in GDP measurement? **(15⅓)**

7. (a) Suppose the production equation of Google is **(12)**

$$TP = -6L^3 + 540L^2$$

   Sketch a graph showing the relationship between the total product, average product and marginal product curves of Google.

   (b) Define 'returns to scale'. Explain different types of 'returns to scale'. **(5⅓)**

   (c) What is 'opportunity cost'? Give an example of 'opportunity cost' with the help of Production Possibility Frontier (PPF). What will be the impact of the changes in technology and resources on the PPF? **(6)**

8. (a) What are the equilibrium conditions for a firm in a perfectly competitive market? Show graphically the 'super normal profit', 'abnormal loss' and 'normal profit' for a firm in perfect competition. **(10⅓)**

   (b) Consider an arbitrary cost function of a firm: **(13)**

$$TC = 6Q^3 - 108Q^2 + 4500Q, \text{ where } TC = \text{Total Cost}$$

   With the help of the above cost equation, derive the marginal cost and average cost curves from the total cost curve and then show the relationship between total cost, marginal cost and average cost curves.

L-2/T-1/NAME **Date : 26/05/2014**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2012-2013

Sub : **MME 293** (Shipbuilding Materials)

Full Marks: 210 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

There are **EIGHT** questions in this section. Answer any **SIX**.

1. (a) Describe various chemical reactions that occur in the bosh and Hearth region of a blast furnace. **(12½)**

   (b) What are the main components of a modern blast furnace plant? **(5)**

2. (a) Describe the L-D process of steel making. **(12)**

   (b) Why is an electric arc furnace now-a-days utilized during steel making process? **(5½)**

3. Mention two suitable techniques for subsurface and volumetric inspection of a material. With the old of sketches describe the working principle of ultrasonic testing to identify a defect in a finished product. **(17½)**

4. (a) Discuss briefly the process of producing ferritic malleable cast iron showing the microstructural changes that occur during the process. **(12½)**

   (b) Mention five advantages of alloy steel. **(5)**

5. (a) Draw the iron-iron carbide equilibrium diagram and label it with all the important temperatures, compositions and name of the structures. **(12½)**

   (b) Compute the mass fraction of ferrite and cementite in pearlite. **(3)**

   (c) Draw the room temperature microstructure of eutectoid (0.87% C) steel. **(2)**

6. (a) Describe a fatigue testing procedure. What type of information could be obtained from a fatigue test? **(13½)**

   (b) What is the primary difference between Charpy and Izod impact tests? **(4)**

7. (a) Describe composition, properties and uses of martensitic and austenitic stainless steels. **(12½)**

   (b) Write a short note on dezincification of brass. **(5)**

Contd P/2

MME 293/NAME

8. (a) Both gray cast iron and nodular cast iron are solidification products. What is the basic difference between the two production parameters that is responsible to produce graphite flake in grey cast iron and spheroidal graphite in nodular cast Fe? **(7½)**

(b) Write short notes on the following: **(2×5=10)**

(i) Modulus of elasticity

(ii) Toughness

SECTION – B

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

9. (a) Differentiate between phase and element. **(6)**

(b) Draw and label the phase diagram of two metals completely soluble in the liquid and solid states. Explain how the chemical compositions and relative amounts of different phases of an alloy at different temperatures can be determined. **(20)**

(c) Mention the effect of tempering temperature on the hardness, toughness and residual stress of a quenched high carbon steel part. **(9)**

10. (a) What is the purpose of surface hardening? Explain how a hard surface on a low carbon gear part would be produced. **(16)**

(b) Compare the properties of annealed hypo-eutectoid steel with that of normalized hypo-eutectoid steel. **(14)**

(c) "Annealed hypo-eutectoid steel has higher pro-eutectoid constituents compared to normalized hypo-eutectoid steel". Explain. **(5)**

11. (a) Describe five methods of preventing corrosion. **(15)**

(b) Explain how polarization occurs in a copper-zinc cell. **(8)**

(c) Mention different types of tools along with their properties and uses. **(12)**

12. (a) Compare dry process with wet process of cement manufacturing. **(10)**

(b) Glass is a super-cooled brittle amorphous — explain. **(6)**

(c) Draw the structure of a timber tree showing different layers. **(7)**

(d) Write short notes on alloy tool steel and sintered carbide tool steel. **(6+6=12)**

L-2/T-1/NAME **Date : 02/06/2014**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2012-2013

Sub : **MATH 281** (Vector Analysis and Differential Equation)

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**.

Symbols have their usual meaning.

1. (a) Solve the differential equation by the method of factorization of the operator: **(17)**

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

(b) Solve the differential equation **(18)**

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

2. Solve in series, the following differential equation by the method of Fröbenius: **(35)**

$$(x-x^2)y''+(1-x)y'-y=0$$

3. (a) Show that **(24)**

(i) $\frac{d}{dx}[xJ_n(x)J_{n+1}(x)]=x[J_n^2(x)-J_{n+1}^2(x)]$

(ii) $x^2J_n''(x)=(n^2-n-x^2)J_n(x)+xJ_{n+1}(x)$

(b) Show that $\int_0^x x^{-n}J_{n+1}(x)dx=\frac{1}{2^n\,n!}-x^{-n}J_n(x)$ **(11)**

4. (a) Show that Legendre polynomial $p_n(x)$ is the coefficient of h^n in the expansion of descending series $(1-2xh+h^2)^{-1/2}$, that is: **(20)**

$$(1-2xh+h^2)^{-1/2}=\sum_{n=0}^{\infty}h^nP_n(x).$$

(b) Show that $P_n(1)=1$ **(5)**

(c)Show that $xP_n'(x)-P_{n-1}'(x)=xP_n(x)$ **(10)**

Contd P/2

MATH 281/NAME

SECTION – B

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

5. (a) Three vectors of magnitudes a, 2a, 3a meet in a point and their directions are along the diagonals of three adjacent faces of a cube. Determine their resultant and its direction cosines. **(15)**

(b) Prove that: $\vec{A}\times\left(\vec{B}\times\vec{C}\right)=\vec{B}\left(\vec{A}\cdot\vec{C}\right)-\vec{C}\left(\vec{A}\cdot\vec{B}\right)$ **(10)**

(c) Determine whether the vectors **(10)**

$$\underline{a}=\underline{i}+2\underline{j}+3\underline{k},\ \underline{b}=2\underline{i}+\underline{j}+3\underline{k} \text{ and } \underline{c}=\underline{i}+\underline{j}+\underline{k}$$

are linearly independent or not. If dependent, find a relation among them.

6. (a) If $\vec{P}=\vec{A}\cos kt+\vec{B}\sin kt$, where $\vec{A}$ and $\vec{B}$ are constant vectors, and k is a constant scalar, show that $\dfrac{d}{dt}\left(\vec{P}\times\dfrac{d\vec{P}}{dt}\right)=0$ **(15)**

(b) For the space curve $x=t, y=t^2, z=\dfrac{2}{3}t^3$, find the curvature and torsion. **(10)**

(c) Find the angle between the surfaces $x^2+y^2+z^2=9$ and $z=x^2+y^2-3$ at $(2,-1,2)$, vectorially. **(10)**

7. (a) Prove that $\vec{\nabla}\times\left(\vec{\nabla}\times\vec{A}\right)=\vec{\nabla}\left(\vec{\nabla}\cdot\vec{A}\right)-\nabla^2\vec{A}$ **(15)**

(b) Show that, $\nabla^2\left(r^n\right)=n(n+1)r^{n-2}$ **(10)**

(c) Test if the vector function **(10)**

$$\vec{f}=\left(y^2+z^2-x^2\right)\underline{i}+\left(z^2+x^2-y^2\right)\underline{j}+\left(x^2+y^2-z^2\right)\underline{k}$$

is solenoidal and irrotational.

8. (a) Evaluate $\iint_X \vec{F}\cdot\hat{n}dS$ where $\vec{F}=x^2\underline{i}+y^2\underline{j}+z^2\underline{k}$ and S is that portion of the plane $x+y+z=1$ which lies in the first octant. **(15)**

(b) Verify the divergence theorem for $\vec{A}=4x\underline{i}-2y^2\underline{j}+z^2\underline{k}$ taken over the region bounded by $x^2+y^2=4$, $z=0$ and $z=3$. **(20)**

L-2/T-1/NAME **Date : 12/05/2014**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2012-2013

Sub : **NAME 251** (Mechanics of Structure)

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**.

Assume reasonable value of any data if missing.

1. (a) A beam ABCD is supported by a roller at A and a hinge at D. It is subjected to the loads as shown in Fig. for Q. No. 1(a), which act at the ends of the vertical members BE and CF. These vertical members are rigidly attached to the beam at B and C. Compute the support reactions. **(20)**

   (b) The beam as shown in Fig. for Q. No. 1(b) is held in position by cable AB and CD and by the pin at E. Determine the force in AB and CD due to the 500 kN force applied as shown in the Fig. for Q. No. 1(b). Beam BE is assumed not to bend and to be of negligible weight. **(15)**

2. (a) Assuming the upward reaction of the ground to be uniformly distributed, draw the shear force and bending moment diagrams for the loaded beam AB as show in Fig. for Q. No. 2(a). Also determine the maximum absolute value of the shear force and bending moment. **(20)**

   (b) Determine the shear force and bending moment as functions of x, for the loaded cantilever beam as shown in Fig. for Q. No. 2(b). **(15)**

3. (a) A beam with cross-section as shown in Fig. for Q. No. 3(a) is loaded in such a way that the maximum moments are +1.0P lb-ft and –1.5P lb-ft, where P is the applied load in pounds. Determine the maximum safe value of P if the working stresses are 4 Ksi in tension and 10 Ksi in compression. **(15)**

   (b) A 15 ft beam simply supported at the ends carries a concentrated load of 9000 lb at midspan. Select the lightest S section that can be employed using an allowable stress of 18 Ksi. What is the actual maximum stress in the beam selected? **(20)**

4. (a) Derive Euler's column formula for tall slender columns. **(20)**

   (b) Write short notes on (any three) **(15)**

   (i) Buckling,

   (ii) Critical buckling stress,

   (iii) Slenderness ratio, and

   (iv) Flexural stress.

Contd P/2

NAME 251

SECTION – B

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

Symbols have their usual meanings. Assume reasonable value of any data if missing.

5. (a) Distinguish between **(16)**

   (i) Modulus of Resilience and Modulus of Toughness

   (ii) Yield strength and ultimate strength

   (iii) Engineering stress and true stress

   (iv) Ductile material and Brittle material

   (b) A stepped shaft has the appearance shown in Fig. for Q. No 5(b). The region AB is Al 2014-T6 alloy, having G = 28 GPa, and the region BC is steel, having G = 84 GPa. The aluminum portion is of solid circular cross section 45 mm is diameter, and the steel region is circular of 60-mm outside diameter and 30-mm inside diameter. Determine the peak shearing stress in each material as well as the angle of twist at B where a torsional load of 4000 N.m is applied. Ends A and C are rigidly clamped. **(19)**

6. (a) A plane element is subject to the stresses shown in Fig. for Q. No 6(a). Determine **(20)**

   (i) the principal stresses and their directions

   (ii) the maximum shearing stresses and the directions of the planes on which they occur.

   (b) Determine the force in each member of the truss shown in Fig. for Q. No 6(b). State whether each member is in tension or compression. **(15)**

7. (a) Define principal stresses and principal planes. Show that the sum of the normal stresses on any two mutually perpendicular planes remains constant for any angle theta. **(15)**

   (b) Determine the position and magnitude of the maximum upward and downward deflection of the beam shown in Fig. for Q. No 7(b) by using the method of singularity functions. **(20)**

8. (a) Determine the moment of inertia of a built up section about X-X shown in the Fig. for Q. No 8(a). **(15)**

   (b) Determine the deflection at every point of a cantilever beam subject to the uniformly distributed load w per unit length shown in the Fig. for Q. No 8(b). **(15)**

   (c) How can you measure the ductility of a material? **(5)**

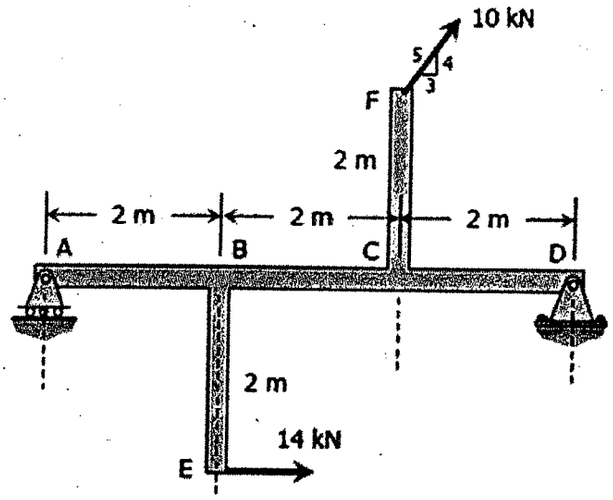


Fig. for Q. No. 1(a)

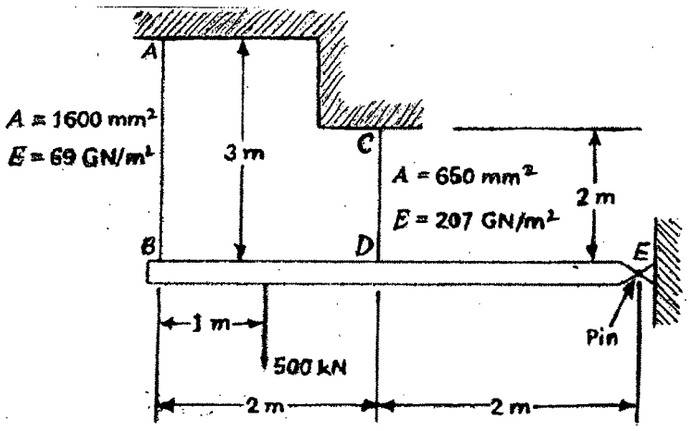


Fig. for Q. No. 1(b)

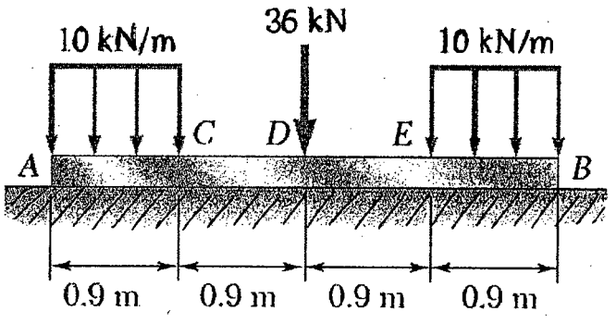


Fig. for Q. No. 2(a)

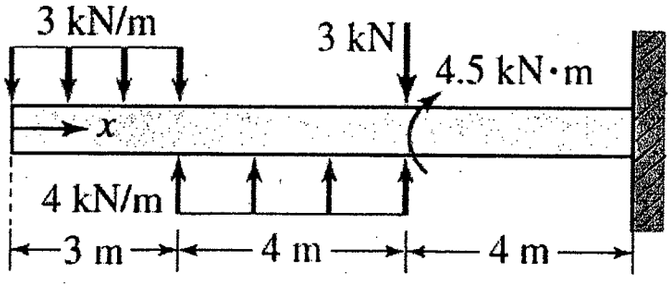


Fig. for Q. No. 2(b)

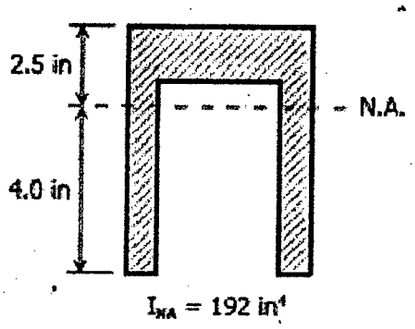
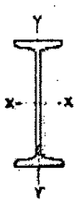


Fig. for Q. No. 3(a)

Table for Q. No. 3 (b)

I

S SHAPES
PROPERTIES FOR DESIGNING



Designation	Area A	Depth d	Flange		Web Thickness t_w	Elastic Properties					
			Width b_f	Thickness t_f		Axis X-X			Axis Y-Y		
						I	S	r	I	S	r
	In.²	In.	In.	In.	In.	In.⁴	In.³	In.	In.⁴	In.³	In.
S24 × 120	35.3	24.00	8.048	1.102	0.798	3030	252	9.26	84.2	20.9	1.56
× 105.9	31.1	24.00	7.875	1.102	0.625	2830	236	9.53	78.2	19.8	1.58
S24 × 100	29.4	24.00	7.247	0.871	0.747	2390	199	9.01	47.8	13.2	1.27
× 90	26.5	24.00	7.124	0.871	0.624	2250	187	9.22	44.9	12.6	1.30
× 79.9	23.5	24.00	7.001	0.871	0.501	2110	175	9.47	42.3	12.1	1.34
S20 × 95	27.9	20.00	7.200	0.916	0.800	1610	161	7.60	49.7	13.8	1.33
× 85	25.0	20.00	7.053	0.916	0.653	1520	152	7.79	46.2	13.1	1.36
S20 × 75	22.1	20.00	6.391	0.789	0.641	1280	128	7.60	29.6	9.28	1.16
× 65.4	19.2	20.00	6.250	0.789	0.500	1180	118	7.84	27.4	8.77	1.19
S18 × 70	20.6	18.00	6.251	0.691	0.711	926	103	6.71	24.1	7.72	1.08
× 54.7	16.1	18.00	6.001	0.691	0.461	804	89.4	7.07	20.8	6.94	1.14
S15 × 50	14.7	15.00	5.640	0.622	0.550	486	64.8	5.75	15.7	5.57	1.03
× 42.9	12.6	15.00	5.501	0.622	0.411	447	59.6	5.95	14.4	5.23	1.07
S12 × 50	14.7	12.00	5.477	0.659	0.687	305	50.8	4.55	15.7	5.74	1.03
× 40.8	12.0	12.00	5.252	0.659	0.472	272	45.4	4.77	13.6	5.16	1.06
S12 × 35	10.3	12.00	5.078	0.544	0.428	229	38.2	4.72	9.87	3.89	0.980
× 31.8	9.35	12.00	5.000	0.544	0.350	218	36.4	4.83	9.36	3.74	1.00

S15 × 50	14.7	15.00	5.640	0.622	0.550	486	64.8	5.75	15.7	5.57	1.03
× 42.9	12.6	15.00	5.501	0.622	0.411	447	59.6	5.95	14.4	5.23	1.07
S12 × 50	14.7	12.00	5.477	0.659	0.687	305	50.8	4.55	15.7	5.74	1.03
× 40.8	12.0	12.00	5.252	0.659	0.472	272	45.4	4.77	13.6	5.16	1.06
S12 × 35	10.3	12.00	5.078	0.544	0.428	229	38.2	4.72	9.87	3.89	0.980
× 31.8	9.35	12.00	5.000	0.544	0.350	218	36.4	4.83	9.36	3.74	1.00
S10 × 35	10.3	10.00	4.944	0.491	0.594	147	29.4	3.78	8.36	3.38	0.901
× 25.4	7.46	10.00	4.661	0.491	0.311	124	24.7	4.07	6.79	2.91	0.954
S 8 × 23	6.77	8.00	4.171	0.425	0.441	64.9	16.2	3.10	4.31	2.07	0.798
× 18.4	5.41	8.00	4.001	0.425	0.271	57.6	14.4	3.26	3.73	1.86	0.831
S 7 × 20	5.88	7.00	3.860	0.392	0.450	42.4	12.1	2.69	3.17	1.64	0.734
× 15.3	4.50	7.00	3.662	0.392	0.252	36.7	10.5	2.86	2.64	1.44	0.766
S 6 × 17.25	5.07	6.00	3.565	0.359	0.465	26.3	8.77	2.28	2.31	1.30	0.675
× 12.5	3.67	6.00	3.332	0.359	0.232	22.1	7.37	2.45	1.82	1.09	0.705
S 5 × 14.75	4.34	5.00	3.284	0.326	0.494	15.2	6.09	1.87	1.67	1.01	0.620
× 10	2.94	5.00	3.004	0.326	0.214	12.3	4.92	2.05	1.22	0.809	0.643
S 4 × 9.5	2.79	4.00	2.796	0.293	0.326	6.79	3.39	1.56	0.903	0.646	0.569
× 7.7	2.26	4.00	2.663	0.293	0.193	6.08	3.04	1.64	0.764	0.574	0.581
S 3 × 7.5	2.21	3.00	2.509	0.260	0.349	2.93	1.95	1.15	0.586	0.468	0.516
× 5.7	1.67	3.00	2.330	0.260	0.170	2.52	1.68	1.23	0.455	0.390	0.522

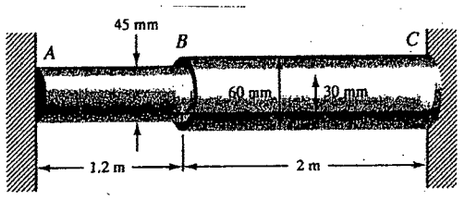


Fig. for Q. No. 5 (b)

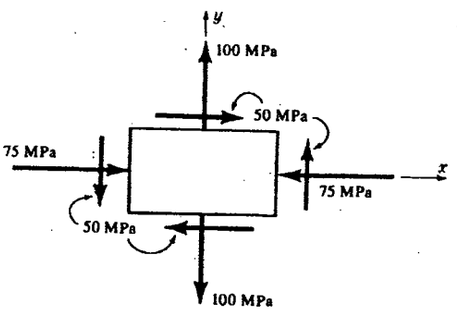


Fig. for Q. No. 6 (a)

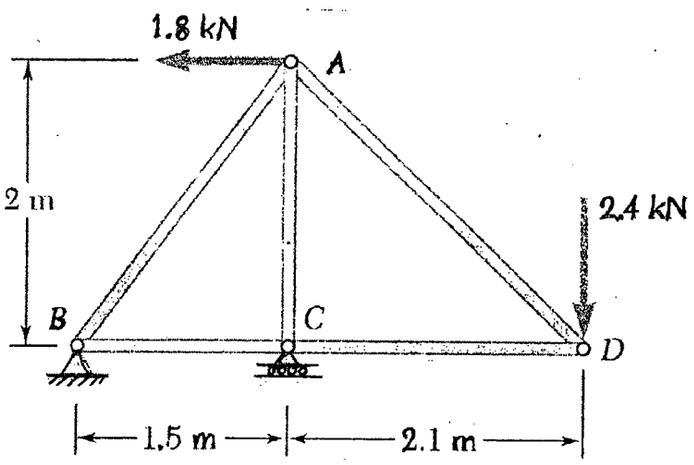


Fig. for Q. No. 6 (b)

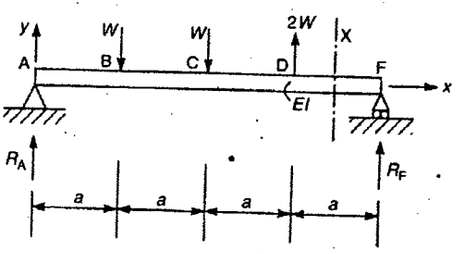


Fig. for Q. No. 7 (b)

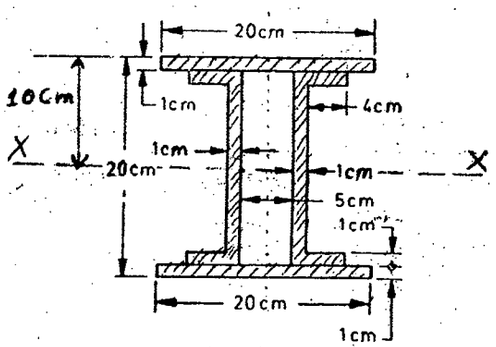


Fig. for Q. No. 8(a)

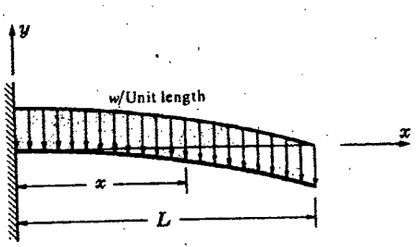


Fig. for Q. No. 8 (b)