الكلية الإسلامية الجامعة
قسم هندسة تقنيات البناء والانشاءات
المادة: مقاومة مواد

المرحلة: الثانية
السنة الدراسية: 2017-2018
اسم التدريسي: أ.م.د علي العذاري

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TABLE B-3 (*Continued*)

ELEMENTS OF INDIAN STANDARD ROLLED STEEL BEAMS

Beam Designation	Depth of Beam	Weight per Metre	Area of Section	Width of Flange	Web Thick-ness	Axis 1 - 1			Axis 2 - 2		
						I	*Z*	*r*	*I*	*Z*	*r*
	cm	kg	cm²	cm	cm	cm⁴	cm³	cm	cm⁴	cm³	cm
ISLB 550	55.0	86.3	109.97	19.0	0.99	53161.6	1933.2	21.99	1335.1	140.5	3.48
ISLB 600	60.0	99.5	126.69	21.0	1.05	72867.6	2428.9	23.98	1821.9	173.5	3.79
ISMB 100	10.0	11.5	14.60	7.5	0.40	257.5	51.5	4.20	40.8	10.9	1.67
ISMB 125	12.5	13.0	16.60	7.5	0.44	449.0	71.8	5.20	43.7	11.7	1.62
ISMB 150	15.0	14.9	19.00	8.0	0.48	726.4	96.9	6.18	52.6	13.1	1.66
ISMB 175	17.5	19.3	24.62	9.0	0.55	1272.0	145.4	7.19	85.0	18.9	1.86
ISMB 200	20.0	25.4	32.33	10.0	0.57	2235.4	223.5	8.32	150.0	30.0	2.15
ISMB 225	22.5	31.2	39.72	11.0	0.65	3441.8	305.9	9.31	218.3	39.7	2.34
ISMB 250	25.0	37.3	47.55	12.5	0.69	5131.6	410.5	10.39	334.5	53.5	2.65
ISMB 300	30.0	44.2	56.26	14.0	0.75	8603.6	573.6	12.37	453.9	64.8	2.84
ISMB 350	35.0	52.4	66.71	14.0	0.81	13630.3	778.9	14.29	537.7	76.8	2.84
ISMB 400	40.0	61.6	78.46	14.0	0.89	20458.4	1022.9	16.15	622.1	88.9	2.82
ISMB 450	45.0	72.4	92.27	15.0	0.94	30390.8	1350.7	18.15	834.0	111.2	3.01
ISMB 500	50.0	86.9	110.74	18.0	1.02	45218.3	1808.7	20.21	1369.8	152.2	3.52
ISMB 550	55.0	103.7	132.11	19.0	1.12	64983.6	2359.8	22.16	1833.8	193.0	3.73
ISMB 600	60.0	122.6	156.21	21.0	1.20	91819.0	3060.4	24.24	2651.0	252.5	4.12
ISWB 150	15.0	17.0	21.67	10.0	0.54	839.1	111.9	6.22	94.8	19.0	2.09
ISWB 175	17.5	22.1	28.11	12.5	0.58	1509.4	172.5	7.33	188.6	30.2	2.59
ISWB 200	20.0	28.8	36.71	14.0	0.61	2624.5	262.5	8.46	328.8	47.0	2.99
ISWB 225	22.5	33.9	43.24	15.0	0.64	3920.5	348.5	9.52	448.6	59.8	3.22
ISWB 250	25.0	40.9	52.05	20.0	0.67	5943.1	475.4	10.69	857.5	85.7	4.06
ISWB 300	30.0	48.1	61.33	20.0	0.74	9021.6	654.8	12.66	990.1	99.0	4.02
ISWB 350	35.0	56.9	72.50	20.0	0.80	15521.7	887.0	14.63	1175.9	117.6	4.03
ISWB 400	40.0	66.7	85.01	20.0	0.86	23426.7	1171.3	16.60	1388.0	138.8	4.04
ISWB 450	45.0	79.4	101.15	20.0	0.92	35057.6	1558.1	18.63	1706.7	170.7	4.11
ISWB 500	50.0	95.2	121.22	25.0	0.99	52290.9	2091.6	20.77	2987.8	239.0	4.96
ISWB 550	55.0	112.5	143.34	25.0	1.05	74906.1	2723.9	22.86	3740.6	299.2	5.11
ISWB 600	60.0	133.7	170.36	25.0	1.12	106198.5	3540.0	24.97	4702.5	376.2	5.25
ISWB 600	60.0	145.1	184.86	25.0	1.18	115626.6	3854.2	25.01	5298.3	423.9	5.35
ISHB 150	15.0	27.1	34.48	15.0	0.54	1455.6	194.1	6.50	431.7	57.6	3.54
ISHB 150	15.0	30.6	38.98	15.0	0.84	1540.0	205.3	6.29	460.3	60.2	3.44
ISHB 150	15.0	34.6	44.08	15.0	1.18	1695.6	218.1	6.09	494.9	63.2	3.35
ISHB 200	20.0	37.3	47.54	20.0	0.61	3608.4	360.8	8.71	967.1	96.7	4.51
ISHB 200	20.0	40.0	50.94	20.0	0.78	3721.8	372.2	8.55	994.6	98.6	4.42
ISHB 225	22.5	43.1	54.94	22.5	0.65	5279.5	469.3	9.80	1353.8	120.3	4.96
ISHB 225	22.5	46.8	59.66	22.5	0.86	5478.8	487.0	9.58	1396.6	123.0	4.84
ISHB 250	25.0	51.0	64.96	25.0	0.69	7736.5	618.9	10.91	1961.3	156.9	5.49
ISHB 250	25.0	54.7	69.71	25.0	0.88	7983.9	638.7	10.70	2011.7	159.7	5.37
ISHB 300	30.0	58.8	74.85	25.0	0.76	12545.2	836.3	12.95	2193.6	175.5	5.41
ISHB 300	30.0	63.0	80.25	25.0	0.94	12950.2	863.3	12.70	2246.7	178.4	5.29
ISHB 350	35.0	67.4	85.91	25.0	0.83	19159.7	1094.8	14.93	2451.4	196.1	5.34
ISHB 350	35.0	72.4	92.21	25.0	1.01	19802.8	1131.6	14.65	2510.5	199.4	5.22
ISHB 400	40.0	77.4	98.66	25.0	0.91	28083.5	1404.2	16.87	2728.3	218.3	5.26
ISHB 400	40.0	82.2	104.66	25.0	1.06	28823.5	1444.2	16.61	2783.0	221.3	5.16
ISHB 450	45.0	87.2	111.14	25.0	0.98	39210.8	1742.7	18.78	2985.2	238.8	5.18
ISHB 450	45.0	92.5	117.89	25.0	1.13	40349.9	1793.3	18.50	3045.0	242.1	5.08

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APPENDIX B-1

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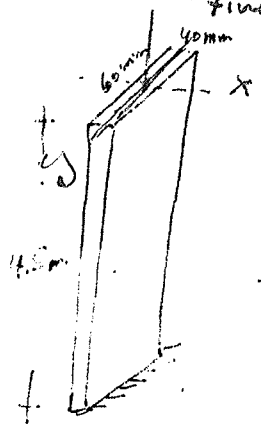
Problem 1: for the fixed shaft in the foundation find the critical load (P_c) using $E = 200 \times 10^3$ MPa



$\frac{bh^3}{12}$

Solution:

$$I_x = \frac{40 \times 60^3}{12} = 72 \times 10^4 \text{ mm}^4$$

$$I_y = \frac{60 \times 40^3}{12} = 32 \times 10^4 \text{ mm}^4$$

about the major axis:

$$P_c = \frac{\pi^2 E I_x}{4 L^2} = \frac{\pi^2 \times 200 \times 10^3 \times 72 \times 10^4}{4 \times 4500^2} = 17.54 \text{ kN}$$

about the minor axis:

$$P_c = \frac{\pi^2 E I_y}{4 L^2} = \frac{\pi^2 \times 200 \times 10^3 \times 32 \times 10^4}{4 \times 4500^2} = 7.798 \text{ kN}$$

for the stresses at buckling,

$$\sigma = \frac{P}{A} = \frac{7.798}{40 \times 60} = 3.25 \text{ MPa}$$

$$r = \sqrt{\frac{I}{A}} = \sqrt{\frac{32 \times 10^4}{40 \times 60}} = 11.54 \text{ mm}$$

$$\lambda = \frac{2 \times 4500}{11.54} = 779$$

Problem 2: Solve the previous Problem (1) when the end condition for the shaft are:

a) hinge - hinge ends

b) fixed - hinge ends

c) fixed - fixed ends

89.9

178,9 x

10^6

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Types of Coloumn: a) pin-end 
b) both-end fixed 
b) pin and fixed end 
c) one-end fixed

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from the following table we can take:

Euler load, effective length, Slenderness ratio $\lambda = \frac{\ell_e}{r_y}$

Case	P_E	ℓ_e	$\frac{P_E}{P_E}$	Euler Case
	$\frac{\pi^2 EI}{4\ell^2}$	2ℓ	0.25	I
	$\frac{\pi^2 EI}{\ell^2}$	ℓ	1.0	II
	$2.04\frac{\pi^2 EI}{\ell^2}$	0.7ℓ	2.046	III
	$\frac{4\pi^2 EI}{\ell^2}$	0.5ℓ	4	V