UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Tambahan

Sidang 1988/89

Jun 1989

REW 315 - Teori Struktur dan Rekabentuk 2

Masa : (3 jam)

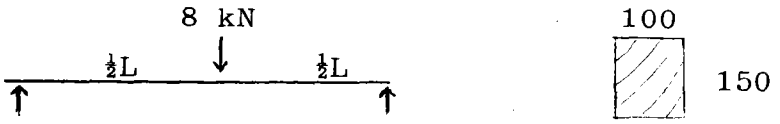
Sila pastikan bahawa kertas peperiksaan ini mengandungi LIMA muka surat yang tercetak sebelum anda memulakan peperiksaan ini.

Jawab LIMA soalan: SATU daripada Bahagian A dan EMPAT daripada Bahagian B.

Bahagian A

1. Rajah 1 menunjukkan pembebanan yang bertindak ke atas sebatang rasuk kayu saiz 100 x 150 mm yang disokong mudah.

   Sekiranya kayu Keruing Gred Pilihan digunakan buktikan saiz 100 x 150 mm sesuai dengan bebanan yang diberi.

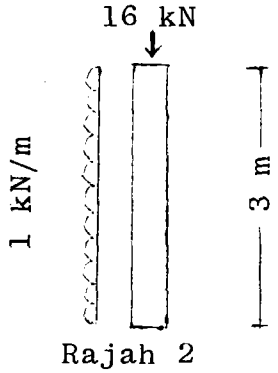


Rajah 1

(20 markah)

2. Rajah 2 menunjukkan sistem pembebanan yang bertindak ke atas tiang kayu.

   Tentukan keratan kayu Keruing Gred Pilihan yang sesuai berasaskan kepada tegasan kering dengan menggunakan jadual-jadual yang dilampirkan. Sebarang andaian hendaklah diterangkan dengan jelas.



Rajah 2

(20 markah)

TABLE VII
DRY STRESSES AND MODULI OF ELASTICITY
(Stresses and moduli expressed in N/mm^2 or Megapascal)

NOTE. These stresses apply to timber having a moisture content not exceeding 19 per cent

No	SPECIES	Bending and Tension Parallel to the Grain				Compression Parallel to the Grain				Compression Perpendicular to the Grain				Shear Parallel to the Grain				Modulus of Elasticity for all Grades	
		Basic	Select Grade	Standard Grade	Common Grade	Basic	Select Grade	Standard Grade	Common Grade	Basic	Select Grade	Standard Grade	Common Grade	Basic	Select Grade	Standard Grade	Common Grade	Mean	Minimum
1.	Balau	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2.	Balau, Red	25.2	20.1	15.9	12.6	22.3	17.8	14.0	11.1	1.93	1.59	1.52	1.45	3.24	2.78	1.79	1.45	14,800	10,800
3.	Bintangor	19.9	15.9	12.5	9.9	17.7	14.1	11.2	8.8	0.96	0.83	0.76	0.69	2.96	2.14	1.66	1.31	14,000	9,700
4.	Bitis	45.0	35.9	28.3	22.5	45.1	36.0	28.4	22.5	4.28	3.59	3.38	3.17	4.13	2.96	2.28	1.86	23,000	19,200
5.	Chengal	44.8	35.8	28.1	22.3	39.9	31.9	25.1	19.9	4.21	3.52	3.31	3.10	4.34	3.10	2.41	1.93	18,000	13,200
6.	Damar Minyak	16.4	13.1	10.3	8.2	14.3	11.4	9.0	7.1	0.76	0.62	0.59	0.55	1.93	1.38	1.03	0.83	11,700	7,000
7.	Durian	20.3	16.3	12.8	10.1	15.7	12.6	9.9	7.9	1.24	1.03	0.96	0.90	2.41	1.72	1.31	1.03	11,200	8,500
8.	Geronggang	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
9.	Gerutu	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
10.	Giam	37.2	29.7	23.4	18.6	29.2	23.3	18.3	14.6	3.79	3.17	3.03	2.83	4.96	3.52	2.76	2.21	16,100	9,700
11.	Jelutong	14.2	11.3	8.9	7.1	11.6	9.2	7.2	5.8	0.83	0.69	0.62	0.59	1.66	1.17	0.90	0.69	8,100	5,600
12.	Kapur	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
13.	Kedondong	21.1	16.8	13.2	10.6	18.2	14.6	11.4	9.1	1.59	1.31	1.24	1.17	2.48	1.79	1.38	1.10	11,900	8,700
14.	Kekatong	41.7	33.3	26.2	20.8	32.9	26.3	20.7	16.4	3.86	3.24	3.03	2.90	4.41	3.17	2.41	1.93	18,400	12,700
15.	Keledang	19.9	15.9	12.5	9.9	18.1	12.8	10.1	8.0	1.59	1.31	1.24	1.17	2.48	1.79	1.38	1.10	11,900	7,200
16.	Kempas	29.2	23.3	18.3	14.6	31.2	24.9	19.6	15.6	2.41	2.00	1.93	1.79	3.52	2.48	1.93	1.59	17,700	14,000
17.	Kerasi	34.3	27.4	21.6	17.2	28.6	22.9	18.0	14.3	3.65	3.10	2.90	2.69	3.38	2.41	1.86	1.52	19,800	14,700
18.	Keruing	25.6	20.5	16.1	12.8	23.2	18.5	14.6	11.6	1.52	1.24	1.17	1.10	2.69	1.93	1.45	1.17	16,300	13,300
19.	Kulim	30.9	24.7	19.4	15.4	28.1	22.5	17.7	14.1	1.68	1.38	1.31	1.24	3.24	2.28	1.79	1.47	14,300	11,000
20.	Kungkur	23.9	19.1	15.0	11.9	19.1	14.5	11.4	9.0	1.86	1.59	1.45	1.38	2.90	2.07	1.59	1.31	10,600	7,100
21.	Machang	17.4	13.9	10.9	8.7	14.8	11.9	9.3	7.4	2.07	1.72	1.66	1.52	3.24	2.28	1.79	1.45	14,100	7,000
22.	Meta-Ulat	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
23.	Medang	19.6	15.6	12.3	9.8	17.9	14.3	11.2	9.0	0.96	0.83	0.76	0.69	2.41	1.72	1.31	1.03	9,900	8,200
24.	Melantai	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
25.	Melunak	20.3	16.2	12.8	10.1	19.6	15.7	12.3	9.8	1.38	1.17	1.10	1.03	2.90	2.07	1.59	1.31	11,700	9,700
26.	Mempening	27.4	21.9	17.2	13.8	23.2	18.5	14.6	11.6	2.76	2.34	2.21	2.07	3.52	2.48	1.93	1.59	10,100	12,100
27.	Mempisang	20.1	16.1	12.7	10.1	24.1	19.2	16.1	12.0	1.31	1.10	1.03	0.96	4.00	1.86	1.45	1.17	13,700	6,700
28.	Mengkulang	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
29.	Meranti Bakau	22.8	18.2	14.3	11.4	17.4	13.9	11.0	8.7	1.24	1.03	0.96	0.90	2.62	1.86	1.45	1.17	11,900	9,400
30.	Meranti, Dark Red	22.8	18.2	14.3	11.4	17.4	13.9	11.0	8.7	1.24	1.03	0.96	0.90	2.62	1.86	1.45	1.17	11,900	9,400
31.	Meranti, Light Red	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

.../3/-

Table II Geometrical properties of processed timber (reproduced from table 56 CP 112)

Basic size mm	Minimum size mm	Area 10^3 mm^2	Section modulus About x-x 10^3 mm^3	Section modulus About y-y 10^3 mm^3	Second moment of area (I) About x-x 10^6 mm^4	Second moment of area (I) About y-y 10^6 mm^4	Radius of gyration About x-x mm	Radius of gyration About y-y mm
40 × 75	37 × 72	2·66	32·0	16·4	1·15	0·304	20·8	10·7
40 × 100	37 × 97	3·59	58·0	22·1	2·81	0·409	28·0	10·7
40 × 125	37 × 120	4·44	88·8	27·4	5·33	0·507	34·6	10·7
40 × 150	37 × 145	5·36	130	33·1	9·40	0·612	41·9	10·7
40 × 175	37 × 169	6·25	176	38·6	14·9	0·713	48·8	10·7
40 × 200	37 × 194	7·18	232	44·3	22·5	0·819	56·0	10·7
40 × 225	37 × 219	8·10	296	50·0	32·4	0·924	63·2	10·7
44 × 75	41 × 72	2·95	35·4	20·2	1·28	0·414	20·8	11·8
44 × 100	41 × 97	3·98	64·3	27·2	3·12	0·557	28·0	11·8
44 × 125	41 × 120	4·92	98·4	33·6	5·90	0·688	34·6	11·8
44 × 150	41 × 145	5·94	144	40·6	10·4	0·833	41·9	11·8
44 × 175	41 × 169	6·93	195	47·3	16·5	0·971	48·8	11·8
44 × 200	41 × 194	7·95	257	54·4	24·9	1·11	56·0	11·8
44 × 225	41 × 219	8·98	328	61·4	35·9	1·26	63·2	11·8
44 × 250	41 × 244	10·0	407	68·4	49·6	1·40	70·4	11·8
44 × 300	41 × 294	12·1	591	82·4	86·8	1·69	84·9	11·8
50 × 75	47 × 72	3·38	40·6	26·5	1·46	0·623	20·8	13·6
50 × 100	47 × 97	4·56	73·7	35·7	3·57	0·839	28·0	13·6
50 × 125	47 × 120	5·64	113	44·2	6·77	1·04	34·6	13·6
50 × 150	47 × 145	6·82	165	53·4	11·9	1·25	41·9	13·6
50 × 175	47 × 169	7·94	224	62·2	18·9	1·46	48·8	13·6
50 × 200	47 × 194	9·12	295	71·4	28·6	1·68	56·0	13·6
50 × 225	47 × 219	10·3	376	80·7	41·1	1·89	63·2	13·6
50 × 250	47 × 244	11·5	466	89·9	56·9	2·11	70·4	13·6
50 × 300	47 × 294	13·8	677	108	99·5	2·54	84·9	13·6
63 × 100	60 × 97	5·82	94·1	58·2	4·56	1·75	28·0	16·3
63 × 125	60 × 120	7·20	144	72·0	8·64	2·16	34·6	17·3
63 × 150	60 × 145	8·70	210	87·0	15·2	2·61	41·9	17·3
63 × 175	60 × 169	10·1	286	101	24·1	3·04	48·8	17·3
63 × 200	60 × 194	11·6	376	116	36·5	3·49	56·0	17·3
63 × 225	60 × 219	13·1	480	131	5·25	3·94	63·2	17·3
75 × 100	72 × 97	6·98	113	83·8	5·48	3·02	28·0	20·8
75 × 125	72 × 120	8·64	173	104	10·4	3·73	34·6	20·8
75 × 150	72 × 145	10·4	252	125	18·3	4·51	41·9	20·8
75 × 175	72 × 169	12·2	343	146	29·0	5·26	48·8	20·8
75 × 200	72 × 194	14·0	452	168	43·8	6·03	56·0	20·8
75 × 225	72 × 219	15·8	576	189	63·0	6·81	63·2	20·8
75 × 250	72 × 244	17·6	714	211	87·2	7·59	70·4	20·8
75 × 300	72 × 294	21·2	1040	284	152	9·14	84·9	20·8
100 × 100	97 × 97	9·41	152	152	7·38	7·38	28·0	28·0
100 × 150	97 × 145	14·1	340	227	24·6	11·0	41·9	28·0
100 × 200	97 × 194	18·8	608	304	59·0	14·8	56·0	28·0
100 × 250	97 × 244	23·7	902	383	117	18·6	70·4	28·0
100 × 300	97 × 294	28·5	1400	461	205	22·4	84·9	28·0
150 × 150	145 × 145	21·0	506	506	36·8	36·8	41·9	41·9
150 × 200	145 × 194	28·1	910	680	88·2	49·3	56·0	41·9
150 × 300	145 × 294	42·6	2090	1030	307	74·7	84·9	41·9
200 × 200	194 × 194	37·6	1220	1220	118	118	56·0	56·0
250 × 250	244 × 244	59·5	2420	2420	295	295	70·4	70·4
300 × 300	294 × 294	86·4	4240	4240	623	623	84·9	84·9

Table I: Maximum depth-to-breadth ratios (solid and laminated members)

Degree of lateral support	Maximum depth-to-breadth ratio
No lateral support	2
Ends held in position	3
Ends held in position and member held in line, as by purline or tie rods	4
Ends held in position and compression edge held in line, as by direct connection of sheathing, deck or joists	5
Ends held in position and compression edge held in line, as by direct connection of sheathing, deck or joists, together with adequate bridging or blocking spaced at intervals not exceeding 8 times the depth	6
Ends held in position and both edges firmly held in line	7

Table III Modification factor K_{13} for duration of loading on flexural members and members in tension

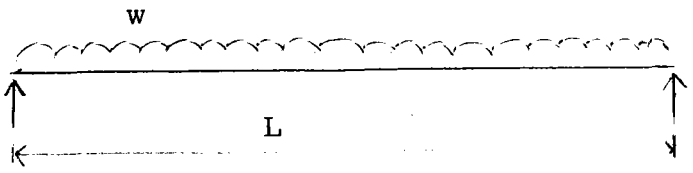
Duration of loading	Value of K_{13}
Long term (eg dead + permanent imposed)	1·00
Medium term (eg dead + snow, dead + temporary loads)	1·25
Short term (eg dead + imposed + wind, dead + imposed + snow + wind)	1·5

Table IV Modification factor K_{12} for slenderness ratio and duration of loading on compression members of 40 grade and 50 grade softwood

Slenderness ratio		Values of K_{12}		
Length/radius of gyration	Length/breadth	Long-term loads	Medium-term loads	Short-term loads
Less than 5	1·4	1·00	1·25	1·50
5	1·4	0·99	1·24	1·48
10	2·9	0·96	1·23	1·47
20	5·8	0·96	1·20	1·44
30	8·7	0·94	1·17	1·40
40	11·5	0·91	1·13	1·34
50	14·4	0·87	1·08	1·27
60	17·3	0·83	1·00	1·16
70	20·2	0·77	0·90	1·01
80	23·0	0·70	0·79	0·86
90	26·0	0·61	0·68	0·72
100	28·8	0·53	0·58	0·60
120	34·6	0·40	0·42	0·44
140	40·4	0·31	0·32	0·33
160	46·2	0·24	0·25	0·26

Bahagian B

3.



Rajah 3

(a) Jika W ialah beban teragih ke atas rasuk konkrit yang disokong mudah yang mempunyai rentang L (Rajah 3), dapatkan rumus untuk:

(i) Momen lentur maksimum, M

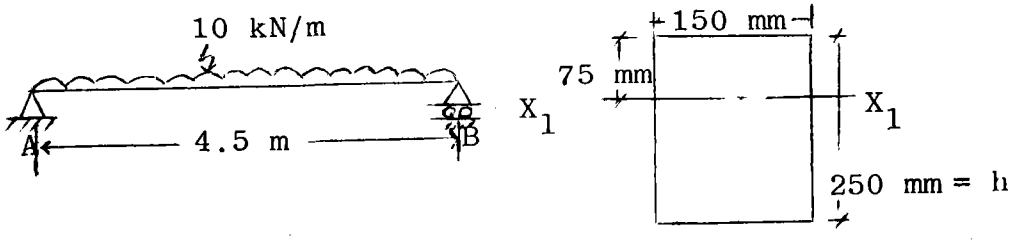
(ii) Daya ricih maksimum, V

(b) Jika rasuk tersebut yang mempunyai rentang 8 m dan memikul beban teragih bernilai 10 kN/m tentukan momen lentur maksimum.

(c) Tentukan juga saiz rasuk yang diperlukan untuk memikul beban tersebut serta semak jawapan anda dengan menggunakan konsep lenturan.

(20 markah)

4.



(a) Kira tegasan tegang maksimum pada rasuk AB.

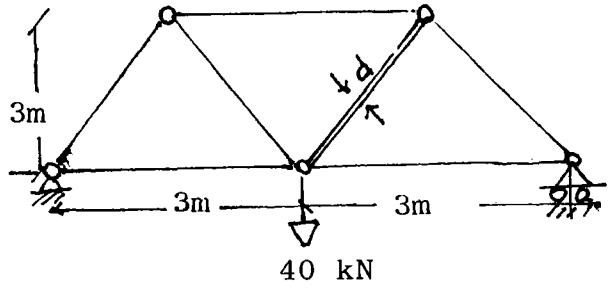
(b) Jika tinggi rasuk dikurangkan kepada h = 200 mm apakah peratus pertukaran tegasan tegang maksimum pada rasuk AB.

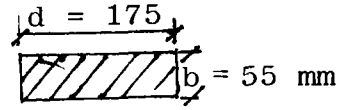
(c) Kira tegasan ricih pada paras 75 mm daripada bahagian atas rasuk.

(20 markah)

...5/-

5.





Rajah 2(a)

Rajah 2 (b)

$E = 2.34\ kN/mm^2$

(a) Kirakan daya-daya untuk kesemua anggota kekuda yang ditunjukkan di dalam Rajah 2.

(b) Tentukan tegasan tepat pada semua ahli yang mengalami daya mampatan.

(c) Jika lenturan hanya boleh berlaku dalam satah XY dan kesemua anggota mempunyai keratan 175 x 50 mm dan mempunyai nilai $E = 2.34\ kN/mm^2$ seperti yang ditunjukkan dalam Rajah 2 b, tentukan:

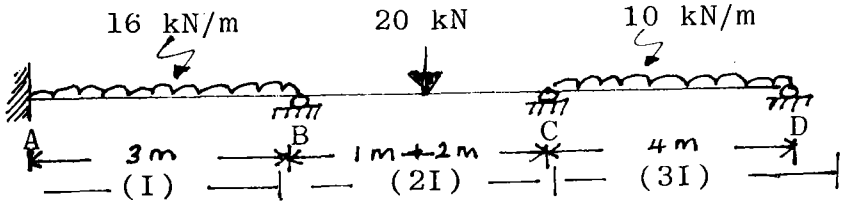
(i) Kesesuaian dan saiz minimum lebar "b" anggota yang perlukan supaya kegagalan "buckling" tidak terjadi.

(ii) Tegasan "Euler" pada kesemua anggota yang mengalami mampatan.

Bandingkan dengan nilai yang didapati di dalam (b).

(20 markah)

6.



Kirakan kesemua tindakbalas dipenatang A, B. C. dan D serta lukiskan gambarajah daya ricih dan Momen Lentur untuk keseluruhan rasuk.

(20 markah)

-oooOOooo-