



**KOLEJ UNIVERSITI TEKNOLOGI  
TUN HUSSEIN ONN**

**PEPERIKSAAN AKHIR  
SEMESTER I  
SESI 2006/2007**

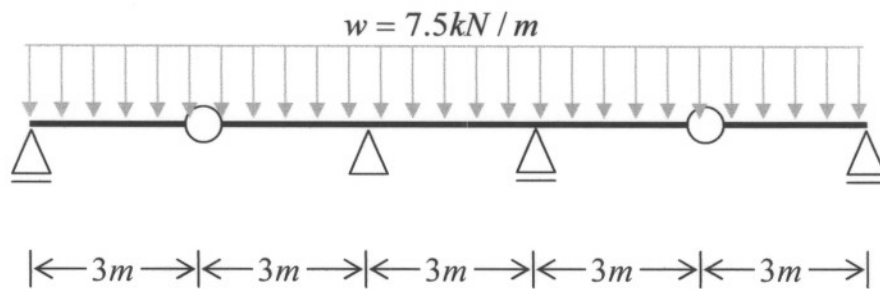
NAMA MATA PELAJARAN : REKABENTUK STRUKTUR  
KOD MATA PELAJARAN : BPD 3083  
KURSUS : 3 BPC  
TARIKH PEPERIKSAAN : NOVEMBER 2006  
JANGKA MASA : 3 JAM  
ARAHAN : JAWAB **SEMUA** SOALAN  
DI BAHAGIAN A, **SATU (1)**  
SOALAN DI BAHAGIAN B  
DAN **SATU (1)** SOALAN DI  
BAHAGIAN C.

KERTAS SOALAN INI MENGANDUNGI 15 MUKASURAT

**BAHAGIAN A (50 markah)**Jawab **SEMUA** soalan.

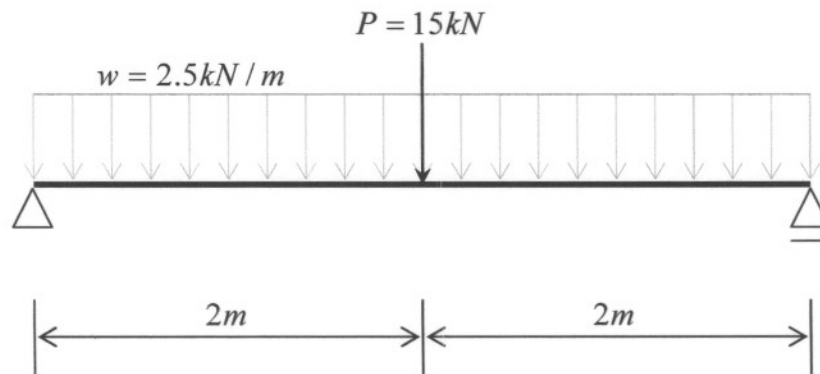
- S1 Bagi setiap rajah berikut, kira dan lakar;
- Daya tindakbalas bagi setiap penyokong
  - Gambar rajah Daya Ricih (GDR)
  - Gambar rajah Momen Lentur (GML)

(i)

**Rajah 1**

(5 markah)

(ii)

**Rajah 2**

(5 markah)

S2 **Rajah 3** adalah contoh keratan rentas bagi sebuah rasuk. Merujuk kepada data yang diberikan:

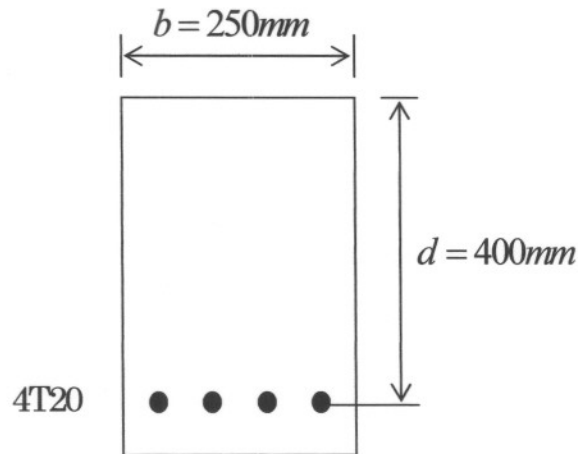
$$f_{cu} = 30 \text{ N/mm}^2$$

$$f_y = 460 \text{ N/mm}^2$$

$$M = 280 \text{ kNm}$$

$$d' = 50 \text{ mm}$$

$$K' = 0.156$$



**Rajah 3**

- (a) Kirakan momen rintangan muktamad. (8 markah)
- (b) Jika tetulang utama pada **Rajah 3** diabaikan dan menggunakan saiz keratan yang sama ( $250\text{mm} \times 400\text{ mm}$ ),
- (i) Kira nilai K (2 markah)
  - (ii) Kira luas tetulang mampatan,  $A_s$  (2 markah)
  - (iii) Kira luas tetulang tegangan,  $A_s$  (2 markah)
  - (iv) Lakar perincian bagi keratan. (1 markah)

S3 (a) Keratan keluli dibahagikan kepada empat jenis iaitu keratan plastik, keratan padat, keratan separa padat dan keratan langsing. Terangkan secara terperinci ciri-ciri setiap keratan tersebut.

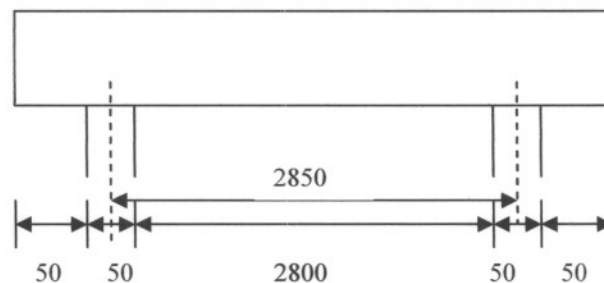
(8 markah)

(b) Nyatakan kelebihan dan kelemahan keluli dalam reka bentuk dan pembinaan kejuruteraan awam.

(4 markah)

(c) **Rajah 4** menunjukkan satu rasuk utama mempunyai panjang rentang 3m melalui bukaan lebar 2.8m dan menyokong sistem lantai yang menghasilkan beban jangka panjang  $4.1\text{kN/m}^2$ , termasuk beban sendiri merentasi rentangnya. Rasuk ini disokong oleh 50m dinding lebar (sebagai galas) di kedua-dua sisi. Semak kesesuaian reka bentuk untuk kayu kering berketam gred SG5, kering, dan bersaiz  $90\text{mm} \times 225\text{mm}$ .

(13 markah)



Dimensi dalam mm

**Rajah 4**

**BAHAGIAN B (25 markah)**

Jawab **SATU** soalan sahaja.

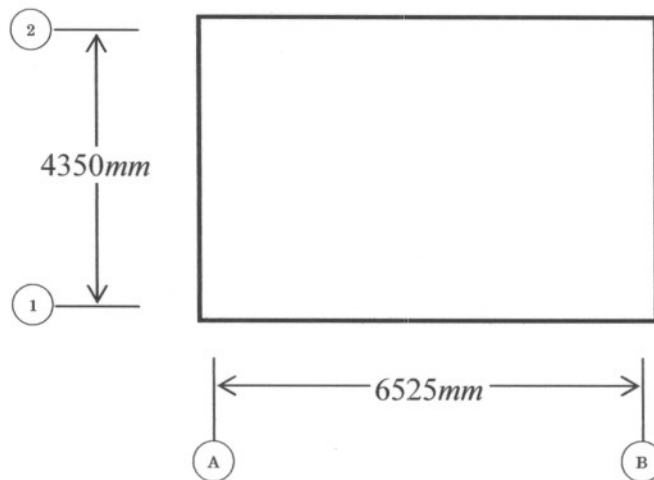
S4 Papak dua hala berukuran  $4.0\text{m} \times 4.0\text{m}$  adalah bersambungan sepanjang penyokong perantara. Dengan menggunakan data yang diberi;

Kemasan lantai	=	$1.0 \text{ kN/m}^2$
Beban kenaan	=	$5.0 \text{ kN/m}^2$
Tebal papak	=	150 mm
Keadaan pendedahan	=	sederhana
Tempoh rintangan api	=	1 hour
Kekuatan ciri konkrit, $f_{cu}$	=	$35 \text{ N/mm}^2$
Kekuatan ciri tetulang, $f_y$	=	$460 \text{ N/mm}^2$
Ketumpatan konkrit	=	$24 \text{ N/mm}^3$
Dengan andaian ( $\phi_{\text{tetulang}} = \text{T10}$ , $\phi_{\text{perangkai}} = \text{R10}$ )		

- (a) Kira kesemua tetulang utama papak tersebut. (14 markah)
- (b) Buat semakan ricih dan semakan pesongan. (8 markah)
- (c) Terangkan secara ringkas kriteria utama bagi melaksanakan suatu reka bentuk struktur yang baik. (3 markah)

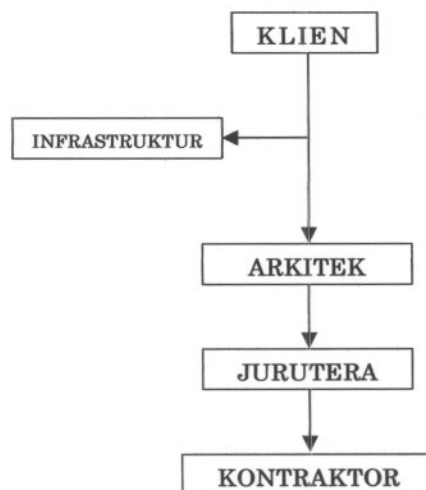
S5 **Rajah 5** menunjukkan pelan bagi papak berukuran  $4.35\text{m} \times 6.525\text{m}$ . Papak tersebut disokong mudah pada kesemua penghujung. Data yang diberikan adalah:

Kekuatan ciri konkrit, $f_{cu}$	=	$25 \text{ N/mm}^2$
Kekuatan ciri tetulang utama, $f_y$	=	$460 \text{ N/mm}^2$
Kekuatan ciri perangkai, $f_{yv}$	=	$250 \text{ N/mm}^2$
Saiz tiang	=	$150 \text{ mm} \times 150 \text{ mm}$
Penutup (rasuk)	=	30 mm
Penutup (papak)	=	25 mm
Kemasan lantai	=	$1.0 \text{ kN/m}^2$
Beban kenaan	=	$2.0 \text{ kN/m}^2$
Ketumpatan konkrit	=	$24 \text{ kN/m}^3$
Tebal papak	=	125 mm



**Rajah 5: Pelan papak**

- (a) Terangkan perbezaan antara papak satu hala dan papak dua hala. (4 markah)
- (b) Kira nilai tetulang utama bagi papak tersebut. (12 markah)
- (c) Buat semakan ricih dan semakan pesongan. (10 markah)
- (d) **Rajah 6** menunjukkan carta alir bagi pihak yang terlibat dalam sesuatu pembinaan dan reka bentuk struktur. Terangkan dengan ringkas peranan yang dimainkan oleh arkitek, jurutera dan kontraktor dalam proses ini.



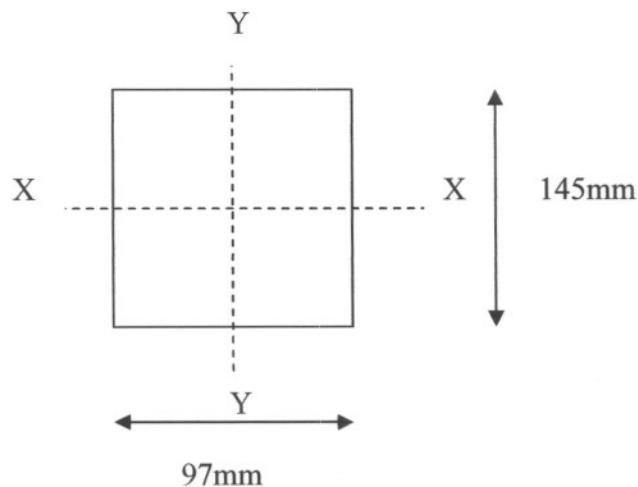
**Rajah 6: Carta alir pihak terlibat dalam pembinaan dan reka bentuk struktur**

(3 markah)

**BAHAGIAN C (25 markah)**

Jawab **SATU** soalan sahaja.

- S6 (a) Terdapat banyak faktor yang boleh mempengaruhi kekuatan kayu.
- Nyatakan faktor-faktor yang mempengaruhi kekuatan kayu. (3 markah)
  - Jelaskan dua daripada faktor-faktor tersebut. (7 markah)
- (b) Satu tiang kayu jenis Keledang, kering berketinggian 4m dengan keratan rentas segiempat tepat yang diketam bersaiz 97mm x 145mm seperti **Rajah 7**. Tiang dihalang pada posisi kedua-dua hujungnya tetapi tidak dalam arahnya.
- Tentukan beban maksimum jangka sederhana paksi tiang boleh sokong. (5 markah)
  - Pastikan sama ada tiang mencukupi untuk menahan beban paksi jangka sederhana 9kN dan momen lenturan 0.8kNm pada paksi X-Xnya. (10 markah)



**Rajah 7: Keratan rentas tiang kayu**

S7 (a) Jelaskan dengan ringkas perkara-pekerja berikut:

(i) Mampatan selari dengan ira dan mampatan seranjang dengan ira dalam kayu. (2.5 markah)

(ii) Tegasan Asas, Tegasan Gred dan Tegasan Izin dalam rekabentuk kayu. (2.5 markah)

(iii) Panjang Berkesan dan Nisbah Kelangsingan. (2.5 markah)

(iv) Lengkokan tempatan dalam keluli. (2.5 markah)

(b) Rasuk disokong mudah seperti dalam **Rajah 8** adalah dihalang sisi sepanjang rentangnya. Diberikan data berikut:

Saiz rasuk = 457 x 152 x 67Kg/m UB S275

Beban hidup = 15kN/m

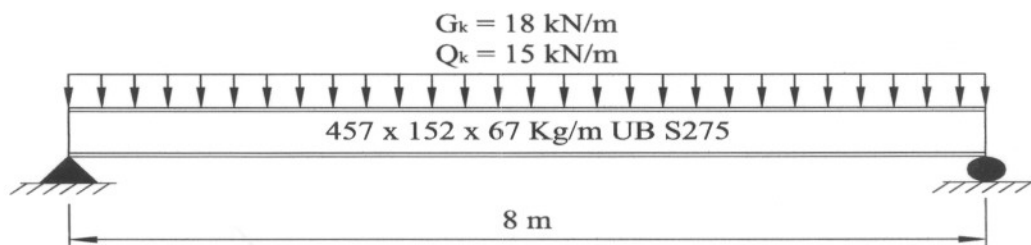
Jumlah beban mati = 18kN/m

(i) Kirakan daya ricih dan momen lentur maksimum. (4.5 markah)

(ii) Tentukan nilai keupayaan ricih. (3.5 markah)

(iii) Tentukan nilai keupayaan momen. (4 markah)

(iv) Semak pesongan. (3 markah)



**Rajah 8**

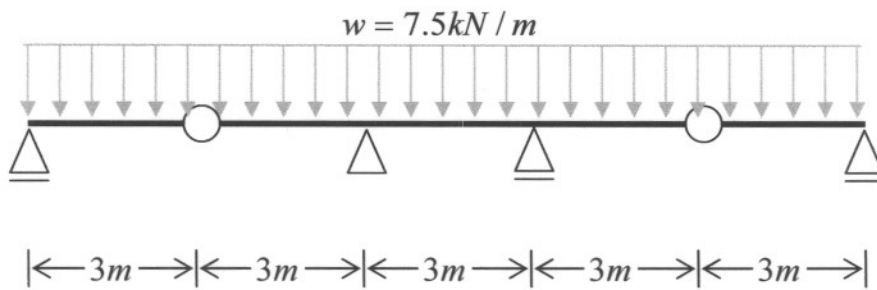


**SECTION A (50 marks)**

Answer all questions.

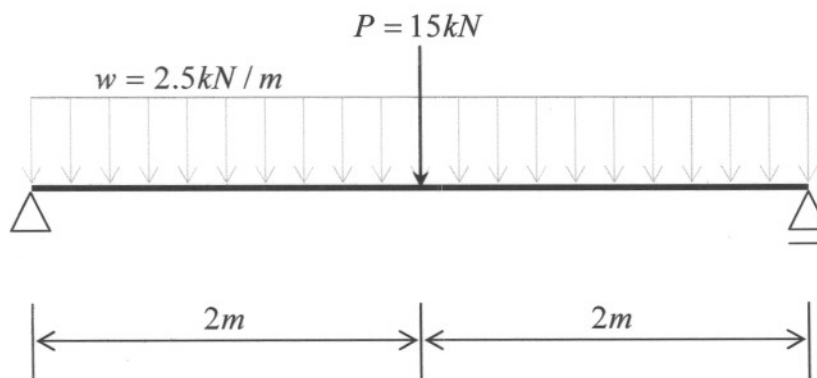
- Q1 For each following figures, calculate;
- Reaction Force at each supports
  - Shear Force Diagram (SFD)
  - Bending Moment Diagram (BMD)

(i)

**Figure 1**

(5 marks)

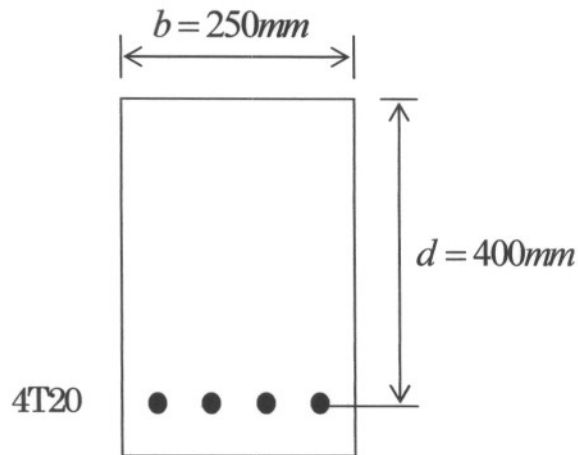
(ii)

**Figure 2**

(4 marks)

Q2 **Figure 3** represents an area cross section of a common beam. The given data are:

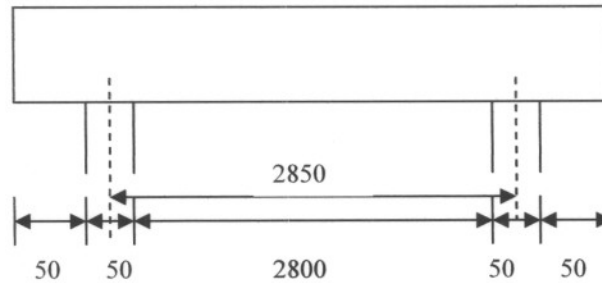
$$\begin{aligned} f_{cu} &= 30 \text{ N/mm}^2 \\ f_y &= 460 \text{ N/mm}^2 \\ M &= 280 \text{ kNm} \\ d' &= 50 \text{ mm} \\ K' &= 0.156 \end{aligned}$$



**Figure 3**

- (a) Find the ultimate moment resistance. (8 marks)
- (b) Ignore the main reinforcement on **Figure 3**. Using the same size of the cross section (250mm × 400 mm);
- Determine section type, K (2 marks)
  - Determine area of compression steel,  $A_s'$  (2 marks)
  - Determine area of tension steel,  $A_s$  (2 marks)
  - Detailed out the cross section. (2 marks)

- Q3 (a) There are four classes for steel cross-section which are plastic, compact, semi-compact and slender section. Explain the characteristic for each section. (8 marks)
- (b) State the advantages and disadvantages of steel in civil engineering design and construction. (4 marks)
- (c) A main beam of 3m length spans over an opening 2.8m wide (**Figure 4**) and supports a flooring system which exerts a long-duration loading of  $4.2 \text{ kN/m}^2$ , including its own self-weight, over its span. The beam is supported by 50mm wide walls on either side. Carry out design checks to show that a dry, grade SG5, dressed sawn timber with size 90mm x 225mm is suitable. (13 marks)



Dimension in mm

**Figure 4**

**SECTION B (25 marks)**

Answer only one question.

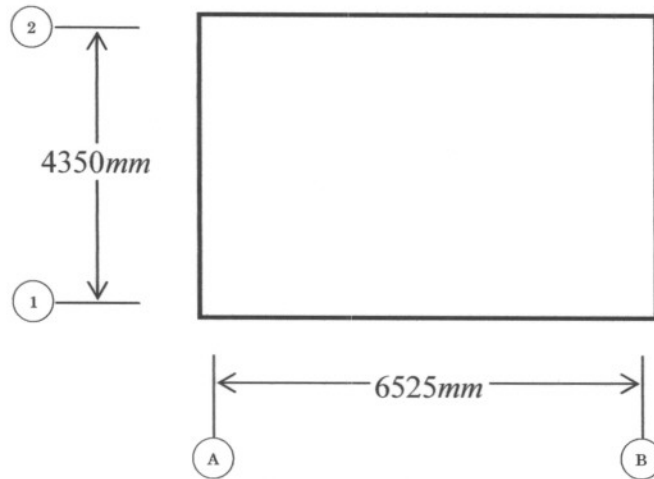
Q4 An internal two way solid slab with a dimension of 4.0 m  $\times$  4.0 m is **continuous at the interior support**. Using the following data;

Floor finishing and service	=	1.0 kN/m <sup>2</sup>
Live load	=	5.0 kN/m <sup>2</sup>
Slab thickness	=	150 mm
Expose condition	=	mild
Period of fire resistance	=	1 hour
Characteristic strength of concrete, $f_{cu}$	=	35 N/mm <sup>2</sup>
Characteristic strength of main reinforcement, $f_y$	=	460 N/mm <sup>2</sup>
Density of concrete	=	24 N/mm <sup>3</sup>
Assumption of reinforcement ( $\phi_t = T10$ , $\phi_{link} = R10$ )		

- (a) Design all the main reinforcement for the slab. (14 marks)
- (b) Perform the shear and deflection checks. (8 marks)
- (c) List down the main criteria needed for a good structural design and elaborate it using your own words. (3 marks)

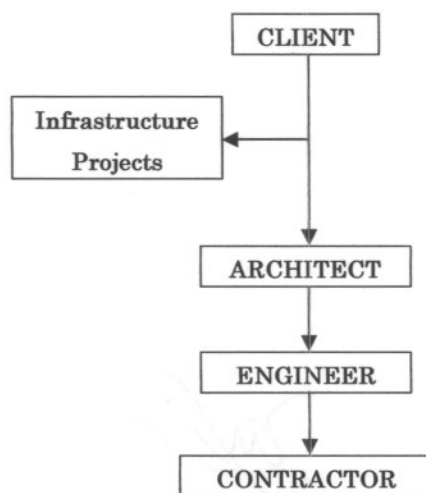
Q5 **Figure 5** shows a slab panel with the dimension of 4.35m  $\times$  6.525m. The slab is simply supported at all four edges with no provision to resist torsion. The given data are;

Characteristic strength of concrete, $f_{cu}$	=	25 N/mm <sup>2</sup>
Characteristic strength of main reinforcement, $f_y$	=	460 N/mm <sup>2</sup>
Characteristic strength of links, $f_{yv}$	=	250 N/mm <sup>2</sup>
Concrete cover	=	30 mm
Finishing and service	=	1.0 kN/m <sup>2</sup>
Live load	=	3.0 kN/m <sup>2</sup>
Density of concrete	=	24 kN/m <sup>3</sup>
Slab thickness	=	175 mm
Reinforcement diameter	=	10mm



**Figure 5: Panel slab**

- (a) Explain the differences between one way slab and two way slab. (2 marks)
- (b) Design the reinforcement for the slab (12 marks)
- (c) Perform the shear and deflection checks. (6 marks)
- (d) Draw the detailing. (2 marks)
- (d) **Figure 6** represents a basic flowchart of works in design and construction of structures. Discuss the main role played by architect, engineer and contractor. (3 marks)

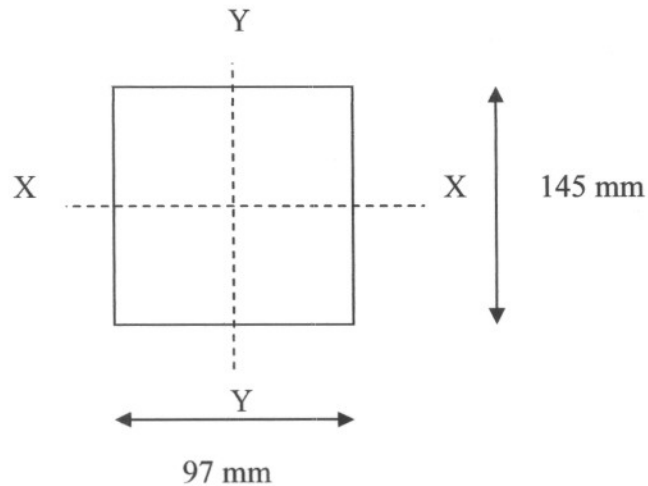


**Figure 6: Flowchart of works in design and construction of structures**

**SECTION C (25 marks)**

Answer only one question.

- Q6 (a) There are several factors that affect the strength of the timber.
- (i) State what those factors are. (3 marks)
  - (ii) Explain only TWO of those factors. (7 marks)
- (b) A timber column of Keledang type, dry is 4m in height with a rectangular cross-section of 97mm x 145mm as shown in **Figure 7**. The column is restrained at both ends in position but not in direction.
- (i) Determine the maximum axial medium-term load that the column can support. (5 marks)
  - (ii) Check that the column is adequate to resist a long-term axial load of 9kN and a bending moment of 0.8 kNm about its x-x axis. (10 marks)

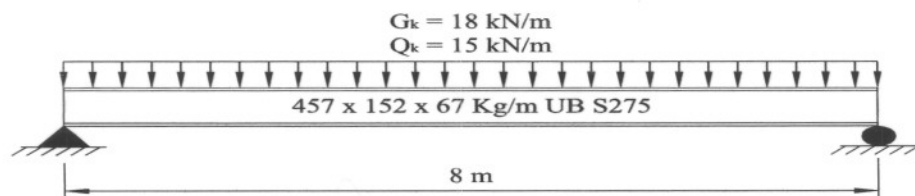


**Figure 7: Cross-section of timber column**

- Q7 (a) Explain briefly the following:-
- (i) Compression parallel to grain and compression perpendicular to grain in timber  
(2.5 marks)
  - (ii) Basic Stress, Grade Stress and Permissible Stress in timber design  
(2.5 marks)
  - (iii) Effective length and slenderness ratio  
(2.5 marks)
  - (iv) Local buckling in steel  
(2.5 marks)
- (b) The simply supported beam shown in **Figure 8** is fully restrained along its length. Given the following data:-

Beam size = 457 x 152 x 67 Kg/m UB S275  
 Imposed load = 15 kN/m  
 Live Load = 18 kN/m

- (i) Calculate the maximum shear force and bending moment.  
(4.5 marks)
- (ii) Check the shear capacity.  
(3.5 marks)
- (iii) Check the moment capacity.  
(4 marks)
- (iv) Check the deflection.  
(3 marks)



**Figure 8**

(15 marks)