



UNIVERSITY OF RUHUNA

Faculty of Engineering

Mid-Semester 5 Examination in Engineering: June 2014

Module Number: CE5231

Module Name: Design of Timber and Masonry Structures

[Two Hours]

[Answer all questions]

Code of Practice BS 5268 Part 2: 2002 is provided

- Q1. a) Determine the following values for the timber material of *Balau*. Clearly show relevant equations, table numbers and clause numbers used in the calculation.
- Grade stresses of compression perpendicular to grain direction and the shear modulus of the timber material of *Balau*.
[1.0 Mark]
 - The permissible compression stress for the timber material of *Balau* subjected to wet exposure condition and medium term loading. The direction of load is inclined to the grain at angle of 30 degrees. Clearly state assumptions made in the calculations.
[2.0 Marks]
- b) It is planning to construct site office at the Rathnapura District. In this site office roof members, frame and partition boards were used with different timber materials available in the particular area. Resident engineer (RE) at the site advices workers to do necessary treatment for the timber material which needs to be reused several times. With several discussions held between resident engineer (RE) and trainee engineer (TE) it was identified that one of the suitable timber materials shows very similar properties of *Balau*. RE has advised TE to check whether that a timber section of 50 mm x 100 mm can be used as a tension member in the site office. TE found that the section is subject to dead load of 10 kN in tension, an imposed load of 5 kN in tension and uplift (tension and compression) wind of 8 kN. Assume that a symmetrically arrange 04 Nos. of 20 mm bolts are adequate to use as the splice connection.
- Determine the critical loads acting on the member.
 - Check whether a propose size of the member is satisfactory at the short term load?
 - Determine the magnitude of bending moment that can be resisted by the above section at the short term load.
[4.0 Marks]
- c) Table Q1 shows typical information for five types of unknown timber materials. These sections are proposed to use in a site office construction and formworks. Resident engineer (RE) at the site advices workers to do necessary treatment for the timber material which needs to be reused several times. Cost of treatment varies from Rs. 75/= to Rs. 125/= per linear meter dependent on the ease with which timber can be treated by site worker.

Table Q1: Details of Timber Materials

Material Type	Cost per linear meter	Colour	Expected Durability	Ease of treatment at the site	Self-weight	Availability at the area
T-1A	Rs. 675/=	Dark Brown	Very High	Difficult	Very High	Scare
T-1B	Rs. 450/=	Light Brown	Very High	Difficult	High	Scare
T-2B	Rs. 275/=	Brown	High	Moderate	Medium	Plentiful
T-1C	Rs. 170/=	Yellowish Cream	Low	Easy	Low	Plentiful
T-2C	Rs. 75/=	Cream	Low	Easy	Very Low	Plentiful

Explain reasons for your selection of following timber elements for the site office and formwork.

- i) As a partition boards of the site office and bottom timber planks for supporting slab.
- ii) Timber post (or column) for supporting the roof frame of the site office and bottom frame work of the formwork.

[3.0 Marks]

- Q2. a) Masonry is the most widely used structural material in Sri Lanka. It can be divided into brickwork, block work, random rubble masonry and natural stone masonry. List down five methods which can be used to identify the quality of locally available bricks?

[2.0 Marks]

- b) Figure Q2 (i) shows the plan view of a proposed room to be constructed as the garage of a house. It consist of two similar walls; each of 245 mm x 3590 mm (including 15 mm thick plaster). Height of the room is 2710 mm. Four RC columns (225 mm x 245 mm) will be constructed as shown in Figure Q2 (i). The characteristic dead load of 6.11 kN and characteristic imposed load of 4.8 kN are acting on each wall. Wind and other lateral loads are negligible. Density of the bricks is 24 kN/m³, and 15 mm thick plaster weights is 0.25 kN/m² of surface area. Available brick size is 215 mm x 102.5 mm x 65 mm. Assume 40% of the loads will be resisted by four columns.

- i) Calculate the required amount of bricks for the construction. (consider the mortar joint thickness as 10 mm)

[2.0 Marks]

- ii) Calculate the critical design load acting on the wall by considering different load combinations.

[2.0 Marks]

- iii) After the completion of construction, the owner needs to construct another garage attached to proposed one as shown in the Figure Q2(ii). The second garage consists of a reinforced concrete slab as a roof. The wall height of the second garage is 2710 mm. The 40% of loads will be resisted by four columns at the corner. Calculate the design loads for wall A, B and C, separately. Consider characteristic dead load and imposed load from slab are 10.37 kN and 16.28 kN, respectively.

[4.0 Marks]

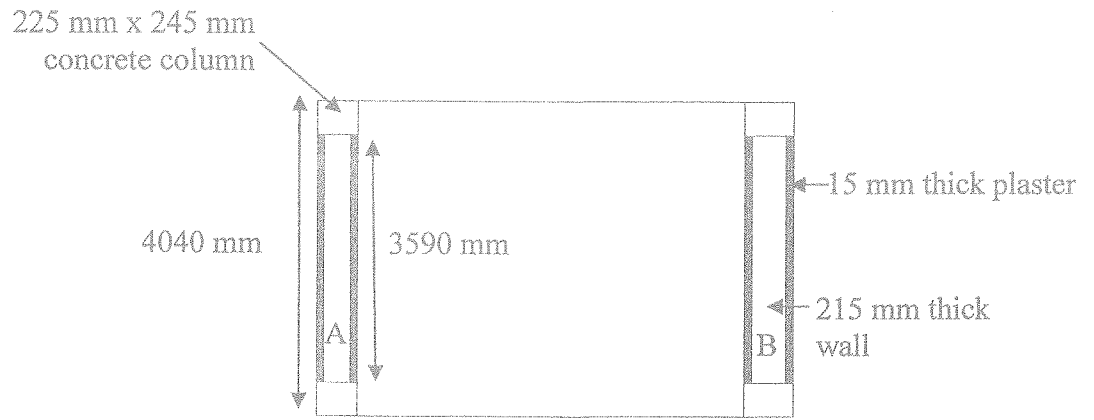


Figure Q2(i): Plan view of the proposed garage

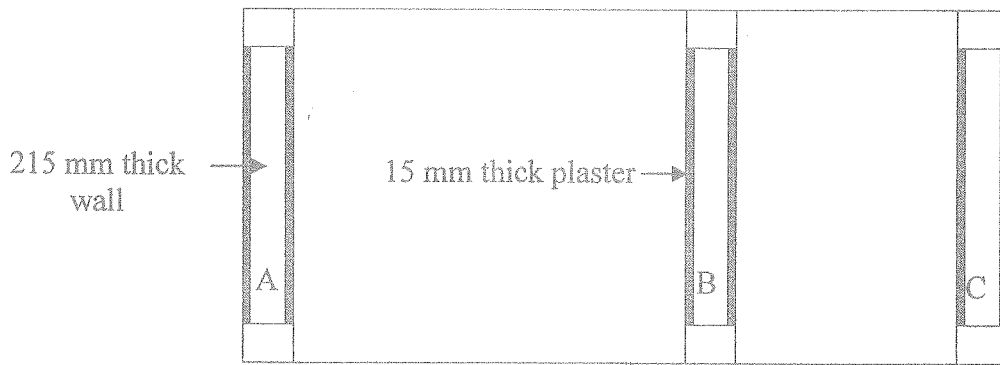


Figure 2(ii): Plan view of the proposed combined garages