

## UEENEEK041B+UEENEEE047B Tutorials

**Reference: Building Design 1 / 2**

- (1)What is the benefit of energy efficient building design?
- (2)What are the micro climate zones in Australia?
- (3) Briefly describe the appropriate building design for passive solar design showing orientation, thermal mass, glass, sun control, insulation,

### Activity (1)

- (4) Use street directory and location of your home, answer the followings
- (a) Orientation (b) How shading is constructed (c) How glasses are fitted (d) How heavy weight and light weight materials are allocated (e) Provide the idea how will you do to improve the comfort in summer and in winter.
- (5) How do you understand Global thermal balance?
- (6) How can thermal comfort in building be achieved?

## Activity (2)

- (7) Use daily weather broadcasting or thermometer from today to next two weeks , you record the followings and present the table

| Day      | Sunny | Cloudy | rain | Sun rise | Sun set | Temperature |
|----------|-------|--------|------|----------|---------|-------------|
| 1        |       |        |      |          |         |             |
| 2        |       |        |      |          |         |             |
| Up to 14 |       |        |      |          |         |             |

- (8) Observe the behaviour of your family members on one Sunday and fill in the given chart. You divide the time and note the most activity done by your family member. Then fill the form and calculate the heat gain.

| Family Member<br><br>Number | 6 AM TO 9 AM |   |   |   |   | 9 AM TO 12 |   |   |   |   | 12 To 3 PM |   |   |   |   | 3 PM TO 6 PM |   |   |   |   | Heat Gain |
|-----------------------------|--------------|---|---|---|---|------------|---|---|---|---|------------|---|---|---|---|--------------|---|---|---|---|-----------|
|                             | S            | W | L | M | H | S          | W | L | M | H | S          | W | L | M | H | S            | W | L | M | H |           |
| 1                           |              |   |   |   |   |            |   |   |   |   |            |   |   |   |   |              |   |   |   |   |           |
| 2                           |              |   |   |   |   |            |   |   |   |   |            |   |   |   |   |              |   |   |   |   |           |

|       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|-------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| 3 etc |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|-------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|

S-Seating W- Walking L-Light work M-Medium work, H-Heavy work

(9) Use World map and calculate the solar time for Sydney corresponding to 4PM on 5 December

(10) Describe the first law of thermodynamics and second law of thermodynamics

(11) A mud brick wall has the following dimensions: Height 2.4 m, length 5m, thickness 300 mm, If two surfaces are 19 degree C and 11 degree C respectively, Calculate (a) rate of heat flow through the wall (b) the R value of the wall.

(12) Explain (a) Convection (b) radiation

(13) Calculate U value for the brick veneer wall with reflective foil laminate (rfl) on the outside of the frame

(14) Calculate U value for pitched metal deck roof with reflective foil insulation and raked ceiling with R 1.5 bulk insulation.

(15) Calculate U value for a pitched and vented tile roof with reflective foil laminate under the tiles.

(16) Explain how the orientation of the windows and type of glass affects the heat transfer into the building.

(17) Calculate net gain or loss of heat through a month for north facing single glass window for January & July in Sydney. The window is 0.9 m height and 0.2 m from the bottom of the eaves which are 0.6m wide. Assume for window that 90% of it is glass. Transmittance is 0.76 and U value is 6.14.

(18) Explain how shading affects on heat gain.

(19) Sketch the types of shading devices

(20) Name the shading devices used in your home. Observe the depth of sun entry into your home and provide the suggestions how to improve shading

(21) Explain types of insulation, installation process and relevant Australian standards.

(22) Explain (a) Thermal mass (b) Latent Heat (c) Thermal Admittance (d) Response factor (e) Effect of thermal mass on indoor temperature (f) Installation of thermal mass

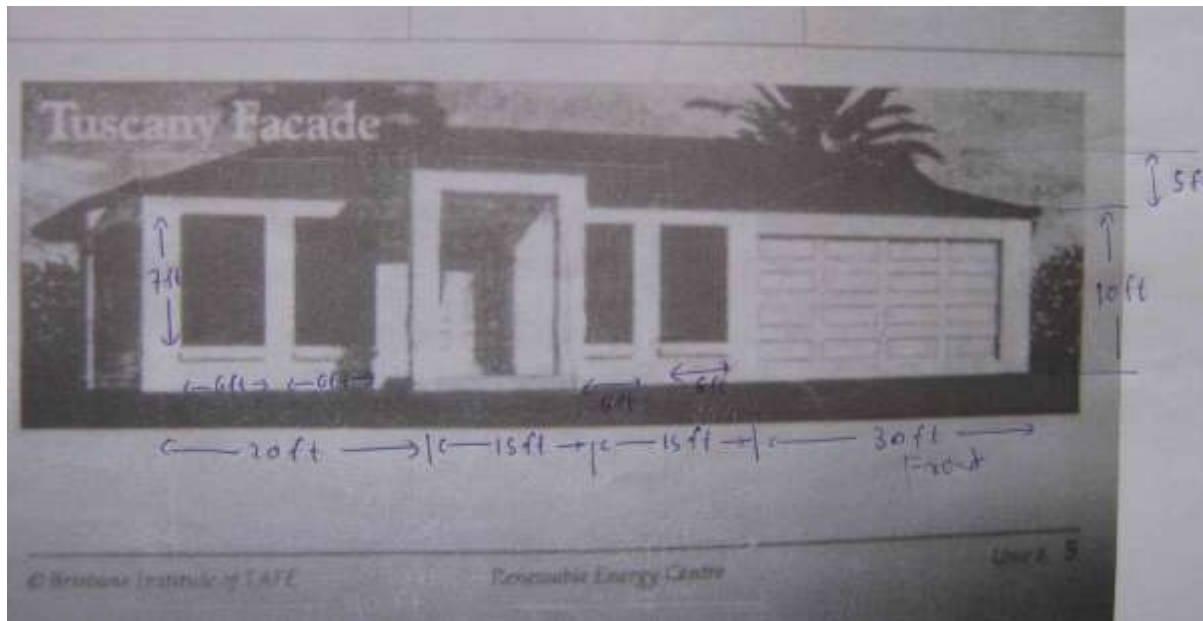
(23) Measure total wall area of your home, total windows area for all glasses

Find total glass area at the North side of the wall. Does it agree with the standard for allocating

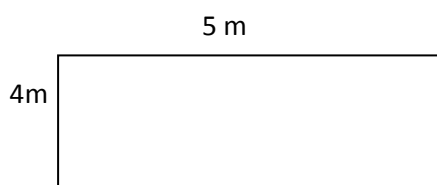
The total % of north facing glass.

(24) Explain the methods of building design for climate





(29) Calculate total heat loss by conduction for a simple one room house in Melbourne during the months of January & July.



Roof: 15 Degree. Thickness of tile 19 mm.  $K = 0.81$ . Plaster board 13 mm,  $K = 0.17$ .

Wall Aerated concrete 200 mm thick.

Outside air ( $R_{out}$ )  $0.12 \text{ m}^2 \text{ K/W}$  Inside air ( $R_{in}$ )  $0.04 \text{ m}^2 \text{ K/W}$

The house has  $1 \text{ m}^2$  window on each wall, average ceiling, no open fire space and weather stripping at the bottom of external doors. The house is  $4 \text{ m} \times 5 \text{ m}$  with  $2.4 \text{ m}$  ceiling height. The windows are single glazed.  $U_1$  and  $U_2$  are  $U_{summer}$  and  $U_{winter}$  respectively.

The roof is a double pitched and vented tile roof with reflective foil laminate under the tile. Floor is carpet on a concrete slab on ground.

(30) In the above problem, calculate infiltration heat loss/ gain in this building. (Timber window, average ceiling, no open fire place).

$$Q_v = A_c V (T_i - T_a) N \times 0.0286$$

(30) Calculate the heating required over a year (base temperature 15 degree) for the one storey house with the following roofs and walls in the winter.

Roof

-New galvanized iron ( metal deck)

-10m x 9m & 22.5 degree slope.

-Aligned East-west

- with R 1.5 foil backed insulation

-Plastered board on ceiling joists

| East wall                                 | South wall                                | Floor                                     |
|---|---|---|
| -Unglazed red brick veneer foil insulated | -Unglazed red brick veneer foil insulated | Cork tiles on concrete slab on the ground |
| 9.4 m x 2.5 m                             | 10 m x 25 m                               | 10 m x 9.4 m                              |
| One window 1 m x 0.8 m                    | Two windows 1 m x 0.7 m each              |   |

All windows are single glazed. Assume ceiling height is 2.5 m

The building has timber windows , average ceiling, no open fire space, weather stripping at the bottom of external doors.

The house is located in Kalgoorlie, western Australia.

(31)(a) Calculate heat gain per day from the customers in a  $150 \text{ m}^2$  gym, If the gym capacity is 50 customers and the gym is full between 6 am to 8 am and 5 pm to 8:30 pm. At all other times, it is 30% full on average.

(b) Calculate heating contributions from all the appliances in a communal house containing 8 people. The house has one electric hot water system for two bath rooms, 6 bed rooms and one all electric kitchen. One TV, seven music systems, two computers and twenty lights. Assume that the house uses 32 kwh per day and the hot water is 45% of the load. The cooker consumes 20% of the load and 25% of heat generated by cooker is vented outside by the range hood.

(c) In above (b) would it make any difference if the water heater was located outside the building?

(d) What would be the heat gain per month if the cooker in (b) uses bottle gas (Gas is 45MJ/Kg and the house uses 0.5 kg/ day)?

(e) The table below lists the power consumption of the appliances used in the house and the hours per day for which they are used. Calculate heat gain from appliances per month.

| Appliance    | Power (watt) | Daily usage per appliance (hr) |
|--------------|--------------|--------------------------------|
| TV           | 40           | 12                             |
| Music system | 40           | 4                              |
| Computer     | 120          | 12                             |

|         |    |   |
|---------|----|---|
| Printer | 20 | 1 |
| Lights  | 60 | 2 |

(32) A 4000 sq ft retail store near Tucson, Arizona has been calculated to have sensible heat gain of 100,000 Btuh at summer design condition. (105 DB, 66 WB for this location). Calculate heat removed and air flow rate indoor.

(33)

Based on above, 4000 sq ft needs 13227 cfm air. Calculate air requirement for the following home and allocate the layout of the duct. 66% of air is applied.

**UEENEEE047B**

**UEENEEE047B Identify building techniques, methods and materials used in electro-technology work activities**

**Assignment**

- (1) Describe the parts of building water supply system
- (2) Sketch the following hot water systems (i) hot water heater (ii) Direct heater (iii) Indirect heater (iv) Solar water system
- (3) Sketch the installation of typical boiler
- (4) Write the operation of air-conditioning plant
- (5) Classify the signal circuit used for a security fire alarm system
- (6) Explain the basic closed circuit security alarm system with a sketch
- (7) Where smoke alarms should not be installed?
- (8) Classify the hazardous areas
- (9) Which equipments & wiring systems are not permitted in hazardous area.
- (10) What are the steps to be followed for electrical system in building?
- (11) What are the energy sources in building operation?