UNIVERSITI KUALA LUMPUR

Malaysia France Institute

FINAL EXAMINATION

JULY 2010 SESSION

SUBJECT CODE	:	FCB 20603
SUBJECT TITLE	:	HEATING & COOLING LOAD
LEVEL	:	BACHELOR
DURATION	:	9.00am – 12.00pm (3 hours)
DATE / TIME	:	20 NOVEMBER 2010

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.

2. This question paper is printed on both sides of the paper.

3. Please write your answers on the answer booklet provided.

4. Answer should be written in blue or black ink except for sketching, graphic and illustration.

5. This questions paper consists of THREE (3) questions. Answer all questions.

6. Answer all questions in English.

7. Formulae are appended.

THERE ARE 4 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

INSTRUCTION: Answer ALL questions.

Please use the answer booklet provided.

Question 1

(25 marks)
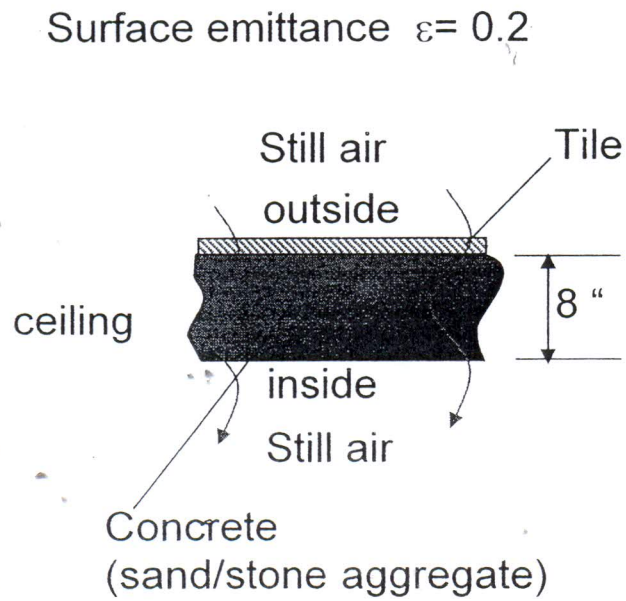
Surface emittance ε= 0.2

Figure 1. Floor construction

Figure 1 above shows a floor construction of a commercial building. From the data and tables given in the Appendix, find the overall heat transfer coefficient, U in Btu/ft².hr.°F.

Question 2.

Calculate the total radiation for a horizontal surface at 3:00 pm on 21 July in Bangi. Neglect reflected radiation. (Longitude (Bangi) = 101° 48' E, latitude (Bangi) = 2° 56' N).

2.1 Solar time, t_{sol} (2 marks)

2.2 Hour angle, h   (2 marks)

2.3 Solar altitude, β (2 marks)

2.4 Solar azimuth, Φ (2 marks)

2.5 Angle of incidence, θ (2 marks)

2.6 Direct normal radiation, G_{ND} (3 marks)

2.7 Direct radiation, G_D (3 marks)

2.8 Diffuse radiation, G_d (4 marks)

2.9 Total radiation, G_t (5 marks)
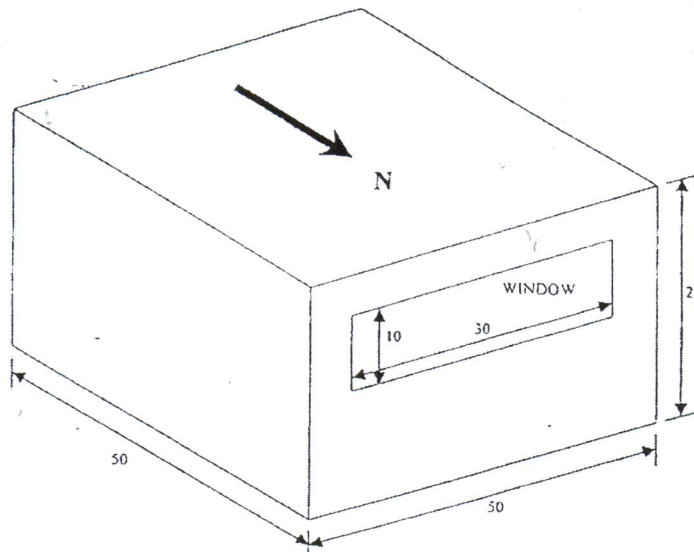
Question 3

(50 marks)

Figure 2: Single-zone building (Units for dimension is in ft.)

A single-zone building in Kuala Lumpur is shown in Figure 2. The building specification is as follows:

Building function : For office use
Interior furnishing : For office use.
Occupant : 100 people from 8:00am to 5:00pm.
Occupants : Seated and performing light office work.
Roof : 4-in lightweight concrete with suspended ceiling.
Walls : 4-in heavyweight concrete wall.
Window : Green, low-emissivity, single glazed glass pane and is internally shaded.
Floor : 75 mm concrete floor and is not carpeted.
Building's interior design condition : 25°C and 50% RH from 8:00am to 5:00pm solar time.
Heat gain from suspended fluorescent (unvented) lights : 1.5 W/ft^2 and lasts from 8:00am to 5:00pm.
Heat gain from computers and other office equipment (appliances) : 1 W/ft^2 and lasts from 8:00am to 5:00pm.
Mechanical ventilation rate : Medium
No infiltration.

For July 21 following the outdoor design conditions are as follows
1% dry-bulb temperature 32.2°C,
Mean wet-bulb temperature : 25.9°C
Daily dry-bulb temperature range: 6.3°C.

Show all your calculations for the following questions in the answer script and fill in your answers in Table 1 Cooling Load list. (To be returned)

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(a) Find the shading coefficient (SC) and the U-value of the glazing used,

(b) Find the U-values of the roof and walls,

(c) Find the sensible and latent heat gains from all the occupants,

(d) Determine the instantaneous latent load of the conditioned space for, 12:00 noon and 3:00 pm,

(e) Determine the instantaneous sensible load in the conditioned space due separately to the walls, roof, glazing, occupant, lightings, and equipment for, 12:00noon and 3:00pm,

(f) Determine the instantaneous total load of the conditioned space for, 12:00noon and 3:00pm,

(g) Determine the highest total load among 12:00noon and 3:00pm.

END OF QUESTIONS

Table 1. Cooling Load 1st

	Month = July	light office work=45 W		U (W/[m2.K]) / A'(m.2)		SC / A (m.2)	SHGFmax	Solar time	
								12:00noon	3:00pm
Latent loads	Occupant								
Sensible loads	North-facing wall								
	South-facing wall								
	East-facing wall								
	West-facing wall								
	Roof								
	Glazing (conduction)					SC			
	Glazing (solar)					A (m.2)	SHGFmax		
	Appliances								
	Lights								
	Occupants								
Total load	Window is north facing								

To change thermal conductivity, k from English unit to SI unit, multiply by 5.678 W/m².K

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