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SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

JANUARY 2011 SESSION

SUBJECT CODE	:	FCB 20603
SUBJECT TITLE	:	HEATING & COOLING LOAD
LEVEL	:	BACHELOR
TIME / DURATION	:	9.00am – 12.00pm (3 HOURS)
DATE	:	11 MAY 2011

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 question paper consists of 3 questions. Answer ALL questions.
6. Answer all questions in English.

THERE ARE 4 PAGES OF QUESTIONS AND 1 PAGE OF APPENDIX, EXCLUDING THIS PAGE.

INSTRUCTION: Answer ALL questions.

Please use the answer booklet provided.

Question 1

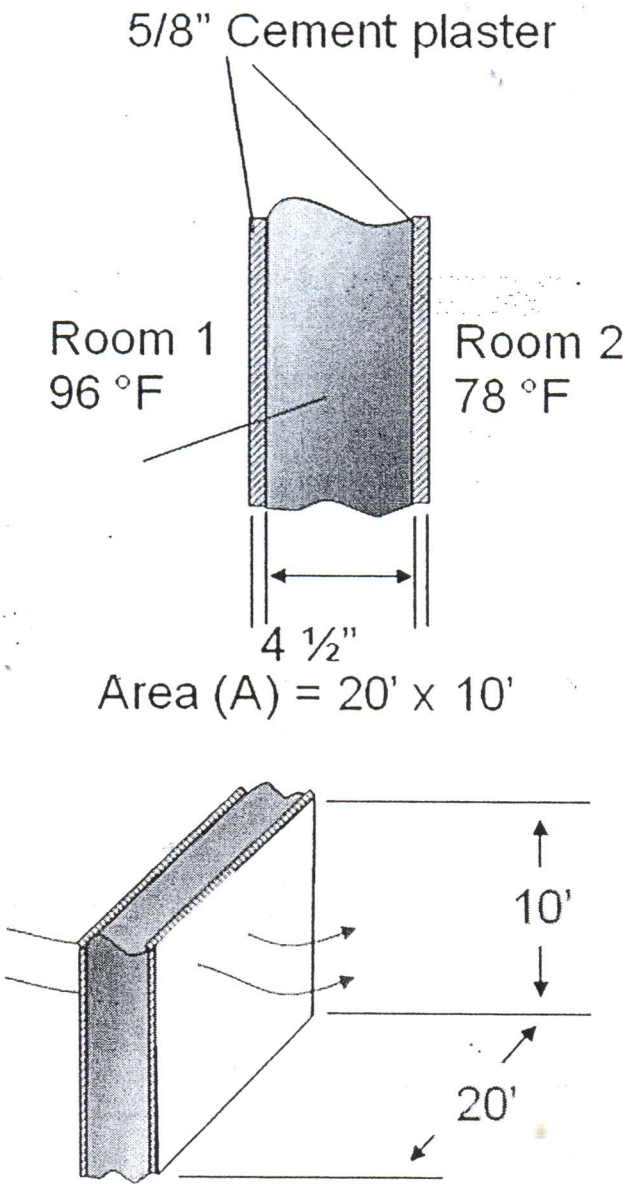

Figure Q1. The diagram above shows a wall construction of an office building. Find the heat loss, Q.

(25 marks)

Question 2.

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

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

(b) Hour angle, h (2 marks)

(c) Solar altitude, β (2 marks)

(d) Solar azimuth, Φ (2 marks)

(e) Angle of incidence, θ (2 marks)

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

(g) Direct radiation, G_D (3 marks)

(h) Diffuse radiation, G_d (4 marks)

(i) Total radiation, G_t (5 marks)

Question 3

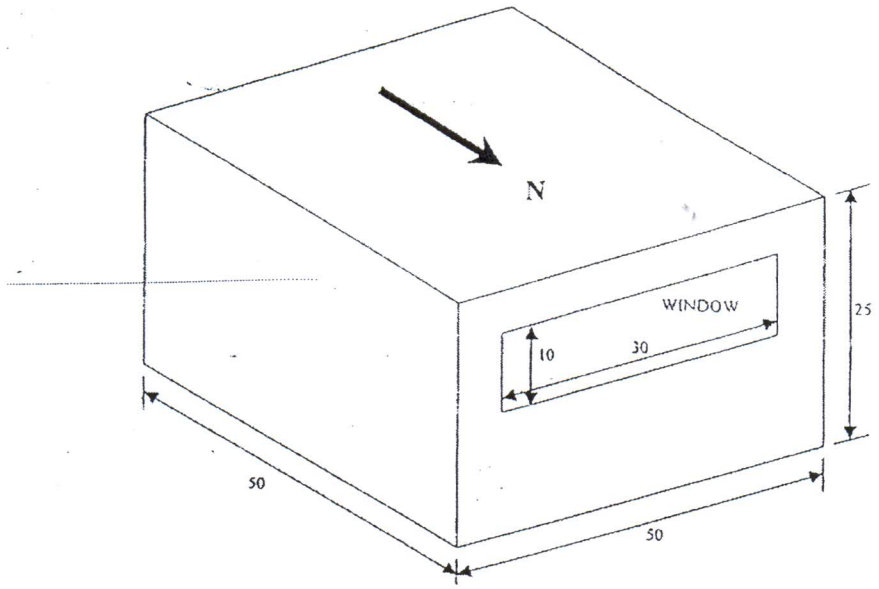

Figure Q3: Single-zone building (Units for dimension is in ft.)

A single-zone building in Kuala Lumpur is shown in Figure Q3. The building specification is as follows:

Building function	: For office use
Interior furnishing	: For office use.
Occupant	: 30 people from 8:00am to 4:00pm.
Occupants	: Seated and performing light office work.
Roof	: 4-in lightweight concrete with suspended ceiling.
Walls	: 4-in 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/ft2 and lasts from 8:00am to 4:00pm.
Heat gain from computers and other office equipment (appliances) : 1 W/ft2 and lasts from 8:00 AM to 4:00 PM.
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)**

(50 marks)

(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, 2:00pm and 5:00pm,

(e) Determine the instantaneous sensible load in the conditioned space due separately to the walls, roof, glazing, occupant, lightings, and equipment for, 2:00pm and 5:00pm,

(f) Determine the instantaneous total load of the conditioned space for, 2:00pm and 5:00pm,

(g) Determine the highest total load among 2:00pm and 5:00pm.

END OF QUESTIONS

Table 1: Cooling Load List (Must Be Returned)

	Month = July			Solar time		
		light office work=45 W			2:00pm	5:00pm
Latent loads						
	Occupant					
Sensible loads		U (W/[m2.K])	A (m.2)			
	North-facing wall					
	South-facing wall					
	East-facing wall					
	West-facing wall					
	Roof					
	Glazing (conduction)					
		SC	A (m.2)	SHGFmax		
	Glazing (solar)					
	Appliances					
	Lights					
	Occupants					
Total load						
		Window is north facing				

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