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CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

JULY 2010 SESSION

SUBJECT CODE	:	FCD 20203
SUBJECT TITLE	:	COOLING LOAD
LEVEL	:	DIPLOMA
TIME / DURATION	:	9.00 am – 12.00 noon (3 HOURS)
DATE	:	21 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 question paper consists of TWO (2) sections. Section A and B. Answer all questions in Section A. For Section B, answer two (2) question only.
6. Answer all questions in English.
7. Formula is appended.

THERE ARE 6 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 60 marks)

INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

Question 1

a) A roof declined 40° from the vertical and facing 30° from south to west in Bandar Baru Bangi on 21st February at 5.30 pm. From the above statement, find:

i) Solar Time,

(3 marks)

ii) Hour angle,

(3 marks)

b) You are staying at Pulau Pinang on 21st September. Knowing that the solar time is 12 pm. By using the data, calculate:

i) Local time

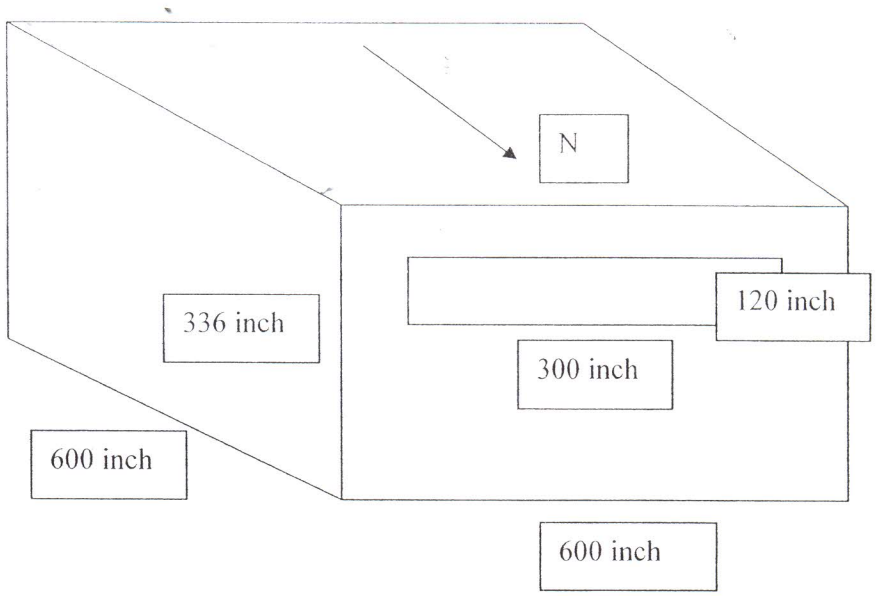
(3 marks)

ii) Economic time (2 marks)

Question 2

A single zone black color building in Kuala Lumpur is shown in figure Q2.The roof comes with the suspended ceiling and made of 6 in lightweight concrete, while the face brick walls are made of 4-in common bricks. The window is made of green, low emissivity, single glazed glass panel, internally shaded and not seatback. The floor is made of 150mm concrete floor and have not carpeted. The interior furnishing is basically functional for office use. The date is November 21, The outdoor condition is taken to be 1% and a mean wet-bulb temperature of 25,9°c.The daily dry bulb temperature range is 6.0°c. The building interior is maintained at 25°c and 50% RH during from 6.00 am to 5.00pm solar time. The building is designed for office use and houses for 60 occupants from 8 am to 4 pm. There is no significant infiltration into the building and mechanical ventilation rate is considered to be medium. The heat gain from electrical lights is 3.0 W/ft^2 and lasts from 8 am to 4 pm. At the same time period, the heat gain from photostat machine and other office equipment (appliances) is 4.0 W/ft^2.For most of the occupied period, the occupant are expected to be seated and performing light office work.

Figure Q2: Building



a) Identify the shading coefficient (SC) and U value for glazing and U value for roof and wall.

(10 marks)

b) Identify the latent heat gains from all the occupants for 10:00 and 14:00.

(5 marks)

c) Determine the hourly instantaneous sensible load in the conditioned space due to the walls, roof, gazing solar and conduction, appliances, lights and occupants for 10:00 and 14:00.

(25 marks)

d) Hence, determine the hourly instantaneous total load of the conditioned space for 10:00 and 14:00.

(2 marks)

e) Determined the peak load of the conditioned space.

(2 marks)

f) Fill your answer in the attached table. (Must be returned with answer booklet).

(5 marks)

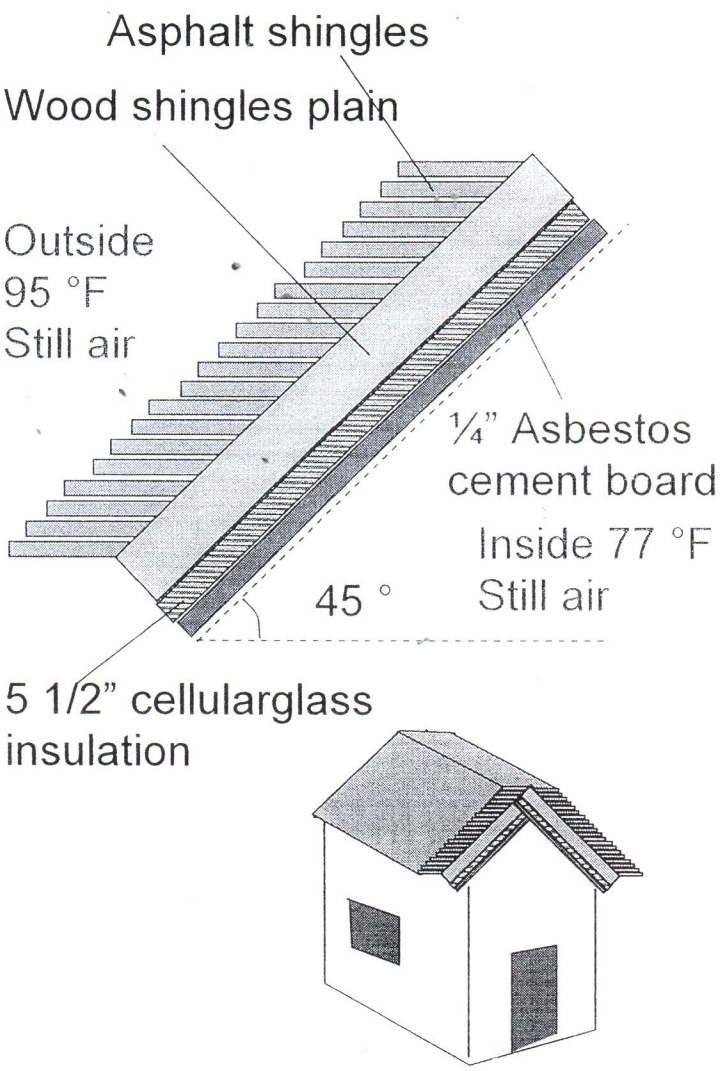
SECTION B (Total: 40 marks)

INSTRUCTION: Answer only TWO questions.

Please use the answer booklet provided.

Question 3

Figure Q3: Roof



The roof is shown in figure Q3.Knowing that its surface emittance is 0.2. Calculate:

a) Thermal resistance for each material.

(10 marks)

b) Total thermal resistance.

(5 marks)

c) Overall heat transfer coefficient.

(5 marks)

Question 4

There is one vertical surface in Bandar Baru Bangi facing S60°W.In front of the surface is the swimming pool. You can assume the reflected factor is 0.45 and Gth is 300 Btu/hr.ft^2.Given that the hour angle is 43.5°.From the statement, on 21st September at 4.30 pm, find:

a) Solar Altitude

(5 marks)

b) Solar Azimuth Angle

(5 marks)

c) Wall Solar Azimuth

(5 marks)

d) Angle of Incidence

(5 marks)

Question 5

Determine the solar azimuth angle on 21st February in Johor Bahru. Given that, the economic time there is 4.30 pm.

(20 marks)

END OF QUESTION

Attachment for Question 2 (Must be returned with answer booklet).

Month					**Solar Time**	
					10	**14**
Latent loads						
	Occupants					
Sensible loads		**U ($W/[m^2.K]$)**	**A (m^2)**			
	North-facing wall					
	South-facing wall					
	East-facing wall					
	West-facing wall					
	Roof					
	Glazing (conduction)					
		SC	**A (m^2)**	**$SHGF_{max}$**		
	Glazing (solar)					
			A (ft^2)			
	Appliances					
	Lights					
	Occupants					
Total load						

Formula:

- $1ft = 12inch$
- $1\ m = 3.28\ ft$
- $1\ hr = 15°$
- $1° = 60'$
- $R = 1/c \text{ or } \Delta x/k \text{ where } \Delta x = thickness$
- $U = 1/R \text{ or } 1/\sum R$
- $Q = UA\,\Delta T$
- $t_{sol} = t_{std} (- ((L_{std} - L_{loc})) 4min/° + E_t)$
- $H = t_{sol} - 12{:}00$
- $\sin\beta = \cos l \cos h \cos d + \sin l \sin d$
- $\cos\phi = (\sin\beta \sin l - \sin d) / (\cos\beta \cos l)$
- $\gamma = \phi \pm \psi$
- $\cos\theta = \cos\beta \cos\gamma \sin\alpha + \sin\beta \cos\alpha$
- $G_{ND} = A/e^{(B/\sin\beta)}$
- $G_D = G_{ND}\cos\theta$
- $G_R = G_{th}\,\rho\, Fwg$
- $Fwg = (1 - \cos\sum)/2, \text{ where } \sum = 90 - \alpha\ (\alpha = 0 \text{ for horizontal})$
- $Gd = (C)(G_{ND})$
- $Gt = GD + Gd + GR \text{ or } Gt = GD + Gd$
- $L_{std} = 120°E$
- Bangi = $L_{loc} = 101° 48'E,\ l = 2° 56'N$
- Pulau Pinang = $L_{loc} = 100° 38'E$
- Johor Bahru = $L_{loc} = 103° 55'E,\ l = 1° 28'N$
- Kuching = $L_{loc} = 110° 19'E,\ l = 1° 28'N$
- Kota Bahru = $L_{loc} = 102° 15'E,\ l = 7° 48'N$
- Q wall = U x A x CLTD corr
- Q roof = U x A x CLTD corr
- CLTD corr = (((CLTD + Lm) x 5/9) x K) + (25.5 °C – Ti) + (To – 29.4 °C)
- Lm = Correction Latitude
- K = Correction of color, black = 1, light color = 0.5
- Ti = Inside temperature
- °F to °K = multiply by 5/9
- English to S.I unit (U value) = multiply by 5.678 $(W/m^2.K)/(Btu/hr.ft^2.F)$
- To = Outdoor Temperature – (RH x Temperature Range)
- Q cond = U x A x CLTDcorr
- CLTDcorr = (CLTD x 5/9) + (25.5 °C – Ti) + (To – 29.4 °C)
- Q sol = A x SC x SHGF x CLF
- Qapp = A x q appl x CLF
- Q light = A x q light x CLF
- Q occ = No.of Occupants x q occ x CLF