NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF THE BUILT ENVIRONMENT

DEPARTMENT OF ARCHITECTURE

ENVIRONMENTAL DESIGN I

AAR 2104

Examination Paper

December 2015

This examination paper consists of 3 pages

Time Allowed: 3 hours

Total Marks: 100

Special Requirements: Table

Examiner's Name: B. NCUBE

INSTRUCTIONS

1. Answer ALL questions

MARK ALLOCATION

QUESTION	MARKS
1.	**25**
2.	**25**
3.	**25**
4.	**25**
TOTAL	**100**

Question 1

a) Use definitions, units and examples to carefully explain the difference between the following terms:
   I. Thermal conductivity
   II. Thermal resistance; and
   III. Thermal transmittance **(6)**

b) Choose three different insulating materials used in modern building and list their physical properties. **(9)**

c) Use the principles of heat transfer to explain why the material acts as a good thermal insulator. **(10)**

[25]

Question 2

A workshop is 12m by 6m by 6m high and has workbenches 1m high. Discharge lamps, each with an output of 3700lm, are to be fitted in aluminum industrial reflectors at ceiling level. The surfaces have reflectances of 0.7 for the ceiling and 0.5 for the walls. The light loss factor is 0.7, and the illuminance requirement on workbenches is 400lx.

a) Find the utilization Factor for the room. **(10)**

b) Calculate the number of lamps required and distribute them on a sketch. **(15)**

[25]

Question 3

Draw a scaled plan and a section of a hall, or use any suitable drawings of an auditorium.

a) Choose a sound source situated on the center of stage and draw geometrically accurate sound path diagrams to show the reflections off the ceiling and off the walls. **(9)**
b) Describe the influences of shape in your proposed design and acoustic effects **(16)**

[25]

Question 4

Sick Building Syndrome is a common problem in buildings, it has been suggested that up to 30% of new and refurbished buildings have given rise to complaints of sick building illness;

a) Describe the physical, chemical and microbial causes of sick buildings. **(15)**
b) Discuss the impacts that the above mentioned causes have on human beings. **(10)**

[25]

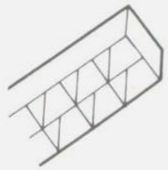
Description of fitting	Typical outline LOR	Basic downward LOR %	Ceiling	Reflectances 0.7			0.5			0.3		
			Walls	0.5	0.3	0.1	0.5	0.3	0.1	0.5	0.3	0.1
			Room index									
Aluminium industrial reflector, Aluminium or enamel high-bay reflector		70	0.6	0.39	0.36	0.33	0.39	0.36	0.33	0.39	0.35	0.33
			0.8	0.48	0.43	0.40	0.46	0.43	0.40	0.46	0.43	0.40
			1.0	0.52	0.49	0.45	0.52	0.48	0.45	0.52	0.48	0.45
			1.25	0.56	0.53	0.50	0.56	0.53	0.49	0.56	0.52	0.42
			1.5	0.60	0.57	0.54	0.59	0.57	0.53	0.59	0.55	0.53
			2.0	0.65	0.62	0.59	0.63	0.60	0.58	0.63	0.59	0.57
			2.5	0.67	0.64	0.62	0.65	0.62	0.61	0.65	0.62	0.60
			3.0	0.69	0.66	0.64	0.67	0.64	0.63	0.67	0.64	0.62
			4.0	0.71	0.68	0.67	0.69	0.67	0.65	0.69	0.66	0.64
			5.0	0.72	0.70	0.69	0.71	0.69	0.67	0.71	0.67	0.66
Near-spherical diffuser, open beneath		50	0.6	0.28	0.22	0.18	0.25	0.20	0.17	0.22	0.18	0.16
			0.8	0.39	0.30	0.26	0.33	0.28	0.23	0.27	0.25	0.22
			1.0	0.43	0.36	0.32	0.38	0.34	0.29	0.31	0.29	0.26
			1.25	0.48	0.41	0.37	0.42	0.38	0.33	0.34	0.32	0.29
			1.5	0.52	0.46	0.41	0.46	0.41	0.37	0.37	0.35	0.32
			2.0	0.58	0.52	0.47	0.50	0.48	0.43	0.42	0.39	0.36
			2.5	0.62	0.56	0.52	0.54	0.50	0.47	0.45	0.42	0.40
			3.0	0.65	0.60	0.56	0.57	0.53	0.50	0.48	0.45	0.43
			4.0	0.68	0.64	0.61	0.60	0.56	0.54	0.51	0.48	0.46
			5.0	0.71	0.60	0.65	0.62	0.59	0.57	0.53	0.50	0.48
Recessed louvre trough with optically designed reflecting surfaces		50	0.6	0.28	0.25	0.23	0.28	0.25	0.23	0.28	0.25	0.23
			0.8	0.34	0.31	0.28	0.33	0.30	0.28	0.33	0.30	0.28
			1.0	0.37	0.36	0.32	0.37	0.34	0.32	0.37	0.34	0.32
			1.25	0.40	0.38	0.35	0.40	0.37	0.35	0.40	0.37	0.35
			1.5	0.43	0.41	0.38	0.42	0.40	0.38	0.42	0.39	0.38
			2.0	0.46	0.44	0.42	0.45	0.43	0.41	0.44	0.42	0.41
			2.5	0.48	0.46	0.44	0.47	0.45	0.43	0.46	0.44	0.43
			3.0	0.49	0.47	0.46	0.48	0.46	0.45	0.47	0.45	0.44
			4.0	0.50	0.49	0.48	0.49	0.48	0.47	0.48	0.47	0.46
			5.0	0.51	0.50	0.49	0.50	0.49	0.48	0.49	0.48	0.47

Table 6.3 Utilisation factors for some luminaires