NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF THE BUILT ENVIRONMENT

DEPARTMENT OF ARCHITECTURE

BACHELOR OF ARCHITECTURE (HONOURS) DEGREE
2013-2014 ACADEMIC YEAR

PART II – FIRST SEMESTER EXAMINATIONS – DECEMBER 2013

AAR 2104 – ENVIRONMENTAL DESIGN I

Instructions ***Time: 3 hours***

Answer all questions.
Use illustrations were appropriate

QUESTION 1

a. Environmental design is a study that relies on the conditions of the atmosphere. Describe the factors that shape the climate of regions. (10)
b. Man made environments can create micro climates of their own. Explain factors causing deviations from the regional macro climate. (10)

[20]

QUESTION 2

Table 1.0 shows climatic data recorded for the period July 1951 to June 1976 for a particular place.

a. Draw a graph indicating the climatic zone the graph represents. (10)
b. Explain the principal characteristics of such a climatic zone. (15)
c. Highlight how such a climate influences the architecture of the place. (15)

[40]

QUESTION 3

A comfort zone is a range of conditions within which at least 80% of people would be thermally comfortable.

a. Explain thermal comfort influencing factors using the Bioclimatic chart and their effect on building design. (10)
b. A client wants to develop structures in a tropical climate. As a professional advise on the different means of thermal control available that they can adopt (10)

[20]

QUESTION 4

A drawing studio measures 12m by 6m by 4m in height and has drawing tables 0,8m high. Tubular fluorescent lamps (50W) are to be fitted in aluminium

reflectors at ceiling level. The surfaces have reflectance's 0,7 for ceiling and 0,5 for the walls. The maintenance factor is 0, 75. Using Appendices 9.1 to 9.3

a. Determine the illumination on the drawing table.
b. Find the utilization factor for the room.
c. Calculate the number of lamps required and suggest a layout for them.

[20]

Month	Rainfall (mm)	Rel. Humidity (%)		Sun shine (hrs/day)	Radiation (MJ/m2)		
		6am	2pm		max	ave	min
JAN	187	92	58	6.2	30	23	8
FEB	169	93	58	6.4	34	24	11
MAR	80	92	50	7.4	28	23	12
APRIL	43	91	42	8	27	22	13
MAY	11	85	36	8.5	26	18	8
JUN	5	85	34	8.6	25	17	7
JUL	0	77	27	9.2	25	15	4
AUG	3	74	25	9.6	28	15	6
SEPT	8	70	25	9.7	29	18	7
OCT	32	68	28	9.1	31	20	7
NOV	94	79	43	6.8	28	19	9
DEC	189	88	53	6	27	22	11

Month	Temperature °C				
	Ex mean min	Mean min	Mean ave	Mean max	Ex mean max
JAN	10.3	16.7	20.9	26	32.6
FEB	8.9	16.6	20.7	25.8	30.4
MAR	7.7	14.2	20.2	26.1	31.4
APRIL	6.2	12.5	19	25.6	30.7
MAY	2.8	9.2	16.4	23.7	30
JUN	1.4	7.8	14.2	21.5	27.2
JUL	1.2	6.5	14	21.6	27.7
AUG	0.6	8.6	16.4	24.1	30.7
SEPT	3.3	11.5	19.3	27	32.9
OCT	3.4	14.6	21.8	29	34.7
NOV	8.6	15.4	21.3	27.3	34.2
DEC	8.3	15.7	20.9	26.2	33.4

Table 1.0 Climatic data

Appendix 9.1

Recommended illumination and limiting glare index (based on IES Code, 1968)

visual task	illumination lux	glare index
Casual seeing	100	28
Rough task with large detail	200	25–28
Ordinary task, medium detail	400	25
Fairly severe task, small detail (e.g. drawing office, sewing)	600	19–22
Severe, prolonged task, small detail (e.g. fine assembly, hand tailoring)	900	16–22
Very severe, prolonged task, very small detail (e.g. gem cutting, hosiery mending, gauging very small parts)	1300–2000	13–16
Exceptionally severe task, with minute detail (e.g. watch and instrument making)	2000–3000	10

Appendix 9.2

Lamp lumen outputs

		watts	lumens
240 volt, standard incandescent lamps:		25	200
		40	325
		60	575
		100	1160
		150	1960
		200	2720
		300	4300
		500	7700
Tubular fluorescent lamps (warm white):	0·6 m	20	1050
		40	1550
	1·2 m	40	2650
	1·5 m	50	3100
		65	4400
		80	4850
	1·8 m	85	5550
	2·4 m	85	6400
		125	8300

Conversion factors for fluorescent lamps other than warm white

Daylight	0·95	Softone 27	0·55
Natural	0·75	Trucolor 37	0·55
Color matching	0·65	De lux natural	0·55
De luxe warm white	0·65	Artificial daylight	0·40
Colour 32 or 34	0·65		
Kolor-rite	0·65	Warmtone	0·70

Appendix 9.3

Minimum recommended daylight factors (based on BSCP* 3, chapter 1, part 1)

	%
Corridors	0·5
Entrance halls, lounges, stairs, churches, hospital wards	1
General offices, banks, reception areas, classrooms, surgeries, sports halls	2
Laboratories, pharmacies	3
Artists' studios	4