



TECHNICAL UNIVERSITY OF MOMBASA

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ARCHITECTURE AND QUANTITY SURVEYING

UNIVERSITY EXAMINATION FOR:

BACHELOR OF ARCHITECTURE

EAR 4304: BUILDING SERVICES II (ELECTRICAL)

END OF SEMESTER EXAMINATION

SERIES: JULY 2025

TIME: 2 HOURS

DATE: Pick DateSelect MonthPick Year

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass, and student ID

This paper consists of **five** Questions; Each question carries 20 marks. Attempt any **THREE** Questions.

Do not write on the question paper.

Question ONE(Compulsory)

a) Explain any:

- i. FOUR quality aspects of an electrical power supply for a building.
- ii. SIX factors to consider while choosing an energy source for a building.

(10 Marks)

b) 3 resistors rated 50Ω , 125Ω and 25Ω are connected in series across 220V supply.

Sketch the circuit and find:

- i. voltage drops across each resistor and total voltage drop.
- ii. power dissipated by each resistor and total power.
- iii. energy utilized by circuit for 3 seconds in Joules.

(10 Marks)

- c) A roof has an area measuring 25m by 30m. Solar panels measuring 1.2m by 1.0m are to be installed. The rating of solar panels is 250Wp. Given that the efficiency of the solar system is 30%, that of the electrical circuit is 75% and storage efficiency is 80%. Take calorific value of diesel to be 45.5MJ/kg and also $1\text{kWh} = 3,600,000\text{J}$ calculate:
- the watt peak of the entire system
 - The generated energy at Wp for 3 hours
 - Equivalent fuel quantity for diesel generator with overall efficiency of 90%

(10 Marks)

Question TWO

- a)
- State any FOUR advantages of Paper Insulation over PVC.
 - Explain any FOUR disadvantage of installing very long cables.
- b) A 3-phase appliance rated 400V, 30kW, 0.8 pf is supplied by double 4-core cables over 100m length in a conduit concealed in a wall. Take grouping factor $C_g=0.78$, ambient temperature correction factor $C_a=0.84$, thermal insulation factor $C_i=0.86$ and fuse correction factor $C_f=0.92$ and calculate;
- The rated current and design current.
 - The cable size.
 - The voltage-drop.
 - The recommended supply side voltage.

(12 Marks)

Question THREE

- a)
- State any FIVE advantages of concealed wiring systems.
 - Explain any FIVE good features of Riser Wiring Systems in a building
- b) The following cables are installed in a bulding through trunk wiring system. Select a suitable size of the trunk and calculate corresponding cable fill factors:
- 3, four core 16mm^2 cables.
 - 12, single core 10mm^2 cables..
 - 24, single core 6mm^2 cables.
 - 30, single core 4mm^2 cables.

(10 Marks)

Question FOUR

- a)
- State any FOUR advantages of electric lighting.
 - Highlight key considerations in designing an outdoor lighting system.
- (8 Marks)**
- b) A Patio is having a cut-away open square section measuring 8m by 8m, at a height of 6m for natural lighting purposes. The illumination of the section at midday is 127,000 lumens/m². Assume the source is equivalent to the solid angle of a flat square pyramid. And calculate:
- Luminance of the opening.
 - Illumination at a point on the floor.
- (12 Marks)**

Question FIVE

- a) Sketch a diagram of an Air Conditioner and explain how it works.
- (8 Marks)**
- b) A room measures 4m by 5m. The room is occupied by two people during the day and 5 people during the night. It is heavily shaded and is in a very sunny region. It has a kitchen. (Take 1ft = 0.3048m)

The table below shows specifications of parameters to consider:

Property	BTU adjustments
Heavily shaded	-10%
Very sunny	+10%
It has a kitchen	+4000
Occupied by more than 2 people	+600 BTU per each additional person

Use the table to estimate the total BTU required during the day and at night.

(12 Marks)

Table 4.6 - Current ratings and volt drops for unsheathed single core p.v.c. insulated cables

Cross sectional area	In conduit in thermal insulation	In conduit in thermal insulation	In conduit on wall	In conduit on wall	Clipped direct	Clipped direct	Volt drop	Volt drop
(mm ²)	(A)	(A)	(A)	(A)	(A)	(A)	(mV/A/m)	(mV/A/m)
-	2 cables	3 or 4 cables	2 cables	3 or 4 cables	2 cables	3 or 4 cables	2 cables	3 or 4 cables
1.0	11.0	10.5	13.5	12.0	15.5	14.0	44.0	38.0
1.5	14.5	13.5	17.5	15.5	20.0	18.0	29.0	25.0
2.5	19.5	18.0	24.0	21.0	27.0	25.0	18.0	15.0
4.0	26.0	24.0	32.0	28.0	37.0	33.0	11.0	9.5
6.0	34.0	31.0	41.0	36.0	47.0	43.0	7.3	6.4
10.0	46.0	42.0	57.0	50.0	65.0	59.0	4.4	3.8
16.0	61.0	56.0	76.0	68.0	87.0	79.0	2.8	2.4

Type of conductor	Conductor cross-sectional area (mm ²)	Cable factor
Solid or Stranded	1	16
	1.5	22
	2.5	30
	4	43
	6	58
	10	105
	16	145
	25	217

Table 4.17 Trunking factors (terms)

Dimensions of trunking (mm x mm)	Factor
37.5 x 50	767
50 x 50	1037
25 x 75	738
37.5 x 75	1146
50 x 75	1555
75 x 75	2371
25 x 100	993
37.5 x 100	1542
50 x 100	2091
75 x 100	3189
100 x 100	4252

To buy the right size Air Conditioner for your room
reference these BTU calculations

Square Feet	BTU's
0-150	5,000
150-200	6,000
200-250	7,000
250-300	8,000
300-350	10,000
350-400	12,000
400-450	14,000
450-500	15,000
500-600	18,000
600-700	20,000
700-800	22,000
800-900	25,000

The above BTU figures are estimates based on an average room (2 windows, 1 door, 8 foot ceilings). Other variables will have to be taken into consideration when figuring BTU sizes e.g. Kitchens, High Ceilings, Sky Lights, Large Windows, Use of Room, and Occupants, etc. For more details or help please call Total Home Supply at 877-847-0050.