KATHMANDU UNIVERSITY
End Semester Examination
June/July, 2023

Marks Scored:

Level : B.Arch.
Year : III
Course : EEEG 331
Semester : II

Exam Roll No. :
Time: 30 mins.
F. M. : 10

Registration No.:
Date : 07 JUL 2023

SECTION "A"
[20 Q. × 0.5 = 10 marks]

Encircle the most appropriate answer.

1. Electrical wires for building electric systems are usually made of _____.
   a. Tin b. Steel c. Copper d. Aluminum

2. Two way switches are generally employed in _____.
   a. Staircase wiring b. Go-down wiring c. Hostel wiring d. Tunnel wiring

3. In our home, the electrical appliances are connected _____.
   a. In series with the source
   b. In parallel with the source
   c. Come in series and some in parallel with the source
   d. In parallel with the source only, if it is a high power appliance

4. The minimum cross section area of conductors used for power wiring in Nepal as power the Nepal Building Code 207 is _____.
   a. 2.5 mm^2 b. 1.5 mm^2 c. 4 mm^2 d. 6 mm^2

5. The method used for lighting calculation is/are _____.
   a. Watt per square method b. Lumen or light flux method
   b. Point to point method d. All of the mentioned

6. The reason for excess reading of the energy meter is _____.
   a. Defective wiring b. Meter manufactures defects
   c. Meter tampering d. All of the mentioned

7. The major demerit of an underground service mains is _____.
   a. Ugly appearance b. Frequent fault occurrence
   c. Costly d. Unavailability

8. The main property of an insulating material to be used in a conductor is _____.
   i. Non inflammable
   ii. High permittivity
   iii. High dielectric strength
   a. i and ii b. i and iii c. ii and iii d. i, ii and iii

9. Which of these is **NOT** a part of distribution system?
   a. Feeders b. Distributors c. Service mains d. Transmission lines

10. The maximum load permitted in a power circuit as per Nepal Building Code 207 is ____.
a. 5000 Watts b. 3000 Watts c. 2000 Watts d. 10000 Watts

11. The standard value of measured voltage available in our home is _____.
a. Single phase 180 Volts b. Single phase 220 Volts
b. Three phase 220 Volts d. Single phase 110 Volts

12. How many outlets are permitted in a power circuit as per the Nepal Building Code 207?
a. 10 points b. 5 points c. 2 points d. 3 points

13. The types of earthing used for domestic purposes is _____.
a. Plate earthing b. Rod earthing
c. Strip earthing d. Earthing is not required at all

14. A circuit breaker is a _____.
a. Power factor correcting device b. Waveform correcting device
c. Current interrupting device d. Voltage interrupting device

15. The short circuit current rating of a 16 Ampere, 'C" type MCB is approximately _____.
a. 16 Ampere b. 10 kilo Amperes
c. 100 kilo Amperes d. 16 times the rating

16. A lamp takes 10 Amperes at 250 Volts and emits 16000 lumens. The mean spherical candle power is _____.
a. 8000π b. 2000π c. 4000π d. $4000/\pi$

17. Incandescent lamps are normally operated at a power factor of _____.
a. 0.5 lagging b. 0.8 lagging c. Unity d. 0.8 leading

18. A desired illumination level on the working plane depends upon _____.
a. Age group observers and whether the object is stationary or moving
b. Size of the object to be seen and its distance from the observers
c. Whether the object is to be seen for longer duration or shorter duration of time
d. All of the above

19. For the same lumen output, the running cost of the fluorescent lamp is _____.
a. Equal to that of the filament lamp
b. Less than that of the filament lamp
c. More than that of the filament lamp
d. Any of the above

20. In case of _____ least illumination is required.
a. Skilled bench work c. Drawing offices
b. Hospital wards d. Fine machine work

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SECTION "B"
[4Q × 10 = 40 marks]

Attempt *ANY FOUR* questions. Assume any suitable data if required.

1.

a. The Electricity Tariff and the monthly billing methods domestic consumers, from Nepal Electricity Authority (NEA) are provided in Table 1 and Table 2:

A YEAR IN REVIEW | FISCAL YEAR 2021/22

ELECTRICITY TARIFF

TARIFF RATES

1. Domestic Consumers

1.1 Single Phase Low Voltage (203 Voltage)

kWh (Monthly)	5 Ampere		15 Ampere		30 Ampere		60 Ampere	
	Monthly Minimum Charge (Nrs.)	Energy Charge (Nrs./kWh)	Monthly Minimum Charge (Nrs.)	Energy Charge (Nrs./kWh)	Monthly Minimum Charge (Nrs.)	Energy Charge (Nrs./kWh)	Monthly Minimum Charge (Nrs.)	Energy Charge (Nrs./kWh)
0-20	30.00	0.00	50.00	4.00	75.00	5.00	125.00	6.00
21-30	50.00	6.50	75.00	6.50	100.00	6.50	125.00	6.50
31-50	50.00	8.00	75.00	8.00	100.00	8.00	125.00	8.00
51-100	75.00	9.50	100.00	9.50	125.00	9.50	150.00	9.50
101-250	100.00	9.50	125.00	9.50	150.00	9.50	200.00	9.50
Above 251	150.00	11.00	175.00	11.00	200.00	11.00	250.00	11.00

Note: If 5 Ampere consumer use more than 20 units, they have to pay NRs. 3.00 per unit

Table 1. NEA Tariff rates

Billing Method (For Single Phase 5 Ampere)

S. No.	kWh (Monthly)	Energy Charge (Nrs./kWh)
1	Up to 20 units	0.00
2	21 to 30 units	6.50
3	31 to 50 units	8.00
4	51 to 100 units	9.50
5	101 to 250 units	9.50
6	Above 251 units	11.00

Table 2. Billing method

Calculate the monthly energy consumption charge in Nepalese rupees per kilowatt hour (Nrs./kWhr) for the monthly energy consumption of [2+2]

i. 241 units in Ashad
ii. 300 units in Mangshir

1 unit = 1 kilowatt * 1 hour

Monthly energy bill or charge calculated in this month= Energy Charge *(Monthly energy consumed in this month – monthly energy consumed in previous month)

b. What is the difference between a live wire and a neutral wire? Illustrate and describe with the electrical wiring diagram from distribution utility to residential consumer for a single phase supply. [2+4]

2.

a. A workshop size 40×60 feet by 12 feet height is to be illuminated to 45 lumens square feet on the working plane. If the coefficient of utilization is 0.5 and the source gives 10 lumens per watt. Find the total wattage required and the number of lamps assuming depreciation factor of 0.8. Consider the wattage of lamp is of 200 Watts. [2+2]

b. Explain the types of distribution system based on the connections. [6]

3.

a. A room is to be wired for a single phase a.c supply directly taken from mains which has declared voltage of 220 volts. The length of the wire from the main switch to light and plug points is 30 meters. If the wire is to carry 5 amperes. Determine the size of the conductor. [6]

Current ratings and voltage drop for vulcanised rubber PVC or polythene insulated or tough Rubber PVC lead sheathed single core aluminium wires or cables

Size of Conductor		*2 Cables d.c. or Single-phase a.c.*		*3 or 4 cables of balanced 3-phase*		*4 Cables d.c.*	
Normal area sq. mm.	*Number and diameter of wire in mm.*	*Current rating in amperes*	*Approx. length of run for volt-drop in metres*	*Current rating in amperes*	*Approxi. length of run for 1 volt drop in metres*	*Current rating in amperes*	*Approx. length of run for 1 volt drop in metres*
1.5	1/1.40	10	2.3	9	2.9	9	2.5
2.5	1/1.80	15	2.5	12	3.6	11	3.4
4.0	1/2.24	20	2.9	17	3.9	15	4.1
6.0	1/2.80	27	3.4	24	4.3	21	4.3
10.0	1/3.55	34	4.3	31	5.4	27	5.4
16.0	7/1.70	43	5.4	38	7.0	35	6.8
25.0	7/2.24	59	6.8	54	8.5	48	8.5
35.0	7/2.50	69	7.2	62	9.3	55	9.0
50.0	7/3.0] 19/1.80]	91	7.9	82	10.1	69	10.0

Table 3. Current rating and voltage drop

b. An office 30 meters × 15 meters is illuminated by twin 40Watt fluorescent luminaries of lumen output 5600 lumens. The lamps being mounted at a height of 3 meters from the work place. The average illumination required is 240 lux. Calculate the number of lamps required to be fitted in the office, assuming the coefficient of utilization is 0.6 and maintenance factor of 0.8. Show with a neat sketch the arrangements of the lamps in the office area. Assume the height of the building to be 5 meters. [2+2]

4.

a. Describe the working mechanism of a run of river type hydropower plant. [4]

b. What is the function of an earth wire? Why is it necessary to earth metallic appliances? [3]

c. Design a solar photovoltaic system to be supplied for a residential purpose based on the data as provided in Table 4: [3]

S.N	Name of appliance	Watts	Number	No. of hours in use
1	Tube light	50	2	5
2	Compact Fluorescent Lamp	18	5	8
3	LCD TV	80	1	5

Table 4. Appliances ratings

Assume inverter efficiency =93% and battery efficiency of 95%. Consider equivalent solar radiation of 6 hours per day. Choose 100 Watt peak, (W_p) module and battery system voltage of 12 Volt.

5.

a. Explain the protection devices employed in the residential distribution system. [3]

b. The layout plan for a single floor resident is shown in Figure 1. Prepare a light layout plan indicating switch location, power layout plan, and single line diagram showing arrangement of miniature circuit breakers for protection.

[2+2+3]

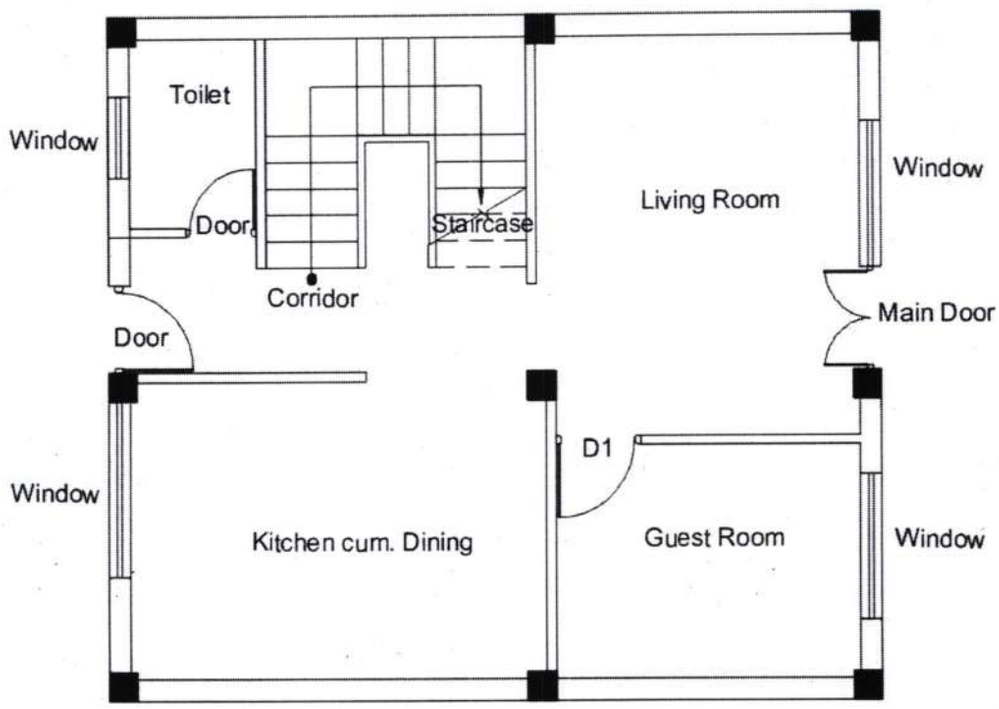

Figure 1 Resident layout plan