



SCHOOL OF ELECTRICAL AND ELECTRONIC ENGINEERING

CERTIFICATE IV IN ELECTRICAL ENGINEERING

EEE395- ELECTRICAL INSTALLATION TECHNOLOGY A

FINAL EXAMINATION PAPER PENSTER 4– 2017

Day/Date: TBA

Time: TBA

Room: TBA

Duration of Exam: 2hrs: 10mins

Total No. of Pages: 6 Pages including Tables

Total Marks: 100 marks

INSTRUCTIONS TO STUDENTS:

1. You are allowed 10 minutes extra reading time during which you are NOT allowed to write.
2. Begin each SECTION on a fresh page and use both sides of the sheet.
3. Write your candidate number at the top of each answer sheet.
4. Insert all foolscaps, graph paper, drawing paper etc. in their correct sequence and secure with string.
5. For all sheets of paper on which rough / draft work has been done, cross it through and you must attach to the answer booklet.
6. Write clearly the number(s) of the question(s) attempted on top of each sheet.
7. Show all workings where necessary.
8. Tables are attached at the end of the question paper; you are allowed to remove them at your discretion.
9. ATTEMPT ALL QUESTIONS

SECTION A**(40 MARKS)**

1. List three types of ladders used in electrical industry. (3marks)
2. What are the four (4) methods of determining the maximum demand of an installation? (4 marks)
3. What is lockout or Tagout? (5 marks)
4. Give four (4) advantages of having a country wide grid connected system. (4 marks)
5. Draw the appropriate diagram and show the following:
 - (a) Main earthing conductor
 - (b) Main Earthing terminal
 - (c) Earth bar
 - (d) MEN link
 - (e) Protective Earthing Conductor
 - (f) Equipotential bonding conductors (6 marks)
6. State four (4) power generation plants owned by FEA. (4 marks)
7. State the five (5) basic components of a refrigeration system and briefly explain its purpose. (5 marks)
8. Compare the star and delta system. (5 marks)
9. Give four (4) advantages of three phase system. (4 marks)

SECTION B**(20 MARKS)**

1. From the information provided for a earth fault loop impedance value the, $Z_{PH}=0.15\Omega$, $Z_A=0.19\Omega$, $Z_F=2\Omega$, $Z_{PE}=0.19\Omega$, $Z_{PEN}=0.15\Omega$, you are required to:
 - a) Draw the equivalent circuit for earth fault loop with the values.
 - b) Find equivalent Impedance.
 - c) Calculate the fault current.
 - d) Identify the touch voltage. (5 marks)
2. An electrical circuit has a nominal phase voltage of 230V and is protected by a 50A Type C circuit breaker. The size of the active and earth copper conductor is 10mm^2 and 4mm^2 respectively, Use the appropriate table attached, calculate the maximum circuit length in meters. (2 marks)
3. Sheathed cables are used for the protection of conductors in adverse conditions and also depending on environment. Name three types of sheathed cables are used. (3 marks)

4. A domestic installation draws a single phase current of 19.08A and is 100m away from the nearest FEA post, what would be the voltage drop incurred if you are using 10mm² 2 core insulated hard drawn cable which has a three phase V_c value of 4.02 mV/Am? Using the Table C7 prove cable size is correct. (10 marks)

SECTION C

(25 MARKS)

1. Determine the maximum demand of a single phase domestic electrical installation supplied at 240V, single-phase with the following loads:
- 41 × lighting points
 - 4 × 300W floodlights
 - 8 × m lighting track
 - 6 × 10A single socket outlets
 - 5 × 10A double socket outlets
 - 1 × 50W exhaust fan
 - 2 × 15A socket outlet
 - 1 × 3.6 kW Air Condition
 - 1 × 5 kW Range
 - 1 × 4.8 kW instantaneous Water Heater
- (10 marks)
2. Draw the schematic representation of vapour compression refrigeration cycle and label the diagram. (5 marks)
3. Draw a single line diagram showing the supply of electricity from Monasavu to FNU Samabula. (*The diagram MUST include the voltage levels, transformer type used and the isolators.*) (10 marks)

SECTION D

(15 MARKS)

1. What are the main functions of power system protection (3 marks)
2. What do you understand by the term **Prospective short circuit current**? (3 marks)
3. Name three types of circuit breakers and give one application of each. (6 marks)
4. Name three types of tripping mechanism installed in overloads and circuit breakers. (3 marks)

END OF PAPER

TABLE 5.1
MINIMUM COPPER EARTHING CONDUCTOR SIZE

Nominal size of active conductor mm ²	Nominal size of copper earthing conductor, mm ²	
	With copper active conductors	With aluminium active conductors
1	1	—
1.5	1.5	—
2.5	2.5	—
4	2.5	—
6	2.5	—
10	4	—
16	6	4
25	6	6
35	10	6
50	16	10
70	25	10
95	25	16
120	35	25
160	50	25
185	70	35
240	95	50
300	125	70
400	≥120 ¹	≥95 ¹
500	≥120 ¹	≥95 ¹
630	≥180 ¹	≥120 ¹

TABLE B1
MAXIMUM CIRCUIT LENGTHS, IN METRES, FOR DIFFERENT SIZES OF CONDUCTORS AND PROTECTIVE DEVICES USING APPROPRIATE MEAN TRIPPING CURRENTS (I_a)*

Conductor size		Protective device rating A	Circuit-breaker (see Note 1)			Fuses (see Note 2)
Active mm ²	Earth mm ²		Type B	Type C	Type D	
		Maximum circuit length, L _{max} , m				
1	1	6	170	91	55	204
1	1	10	102	55	33	114
1.5	1.5	10	163	82	49	170
1.5	1.5	15	98	51	31	82
2.5	2.5	16	160	85	51	136
2.5	2.5	20	128	68	41	93
4	2.5	25	126	67	40	90
4	2.5	32	98	62	31	70
6	2.5	40	90	48	29	60
10	4	50	117	62	37	73
16	6	63	142	76	45	85
16	6	80	112	59	36	56
25	6	80	124	66	40	66
25	6	100	99	53	32	47
35	10	100	159	85	51	75
35	10	125	127	68	41	58
50	16	125	196	106	63	90
50	16	160	155	83	50	71
70	25	160	255	126	75	108
70	25	200	185	103	60	84

TABLE C1

MAXIMUM DEMAND—SINGLE AND MULTIPLE DOMESTIC ELECTRICAL INSTALLATIONS

Load group	2 Single domestic electrical installation or individual living unit per phase ^a	3 4 5 Blocks of living units ^{a, b, c}		
		2 to 5 living units per phase	6 to 20 living units per phase	21 or more living units per phase
		Loading associated with individual units		
A Lighting				
(i) Except (ii) and load group H below ^{d, e, f}	3 A for 1 to 20 points + 2 A for each additional 20 points or part thereof	6 A	5 A + 0.25 A per living unit	0.5 A per living unit
(ii) Outdoor lighting exceeding a total of 1000 W ^g	75% connected load	No assessment for the purpose of maximum demand		
B				
(i) Socket-outlets not exceeding 10A ^h . Permanently connected electrical equipment not exceeding 10 A and not included in other load groups ⁱ	10 A for 1 to 20 points + 5 A for each additional 20 points or part thereof	10 A + 5 A per living unit	15 A + 3.75 A per living unit	50 A + 1.9 A per living unit
(ii) Where the electrical installation includes one or more 15 A socket-outlets, other than socket-outlets provided to supply electrical equipment set out in groups C, D, E, F, G, and L ^j		10 A		
(iii) Where the electrical installation includes one or more 20 A socket-outlets other than socket-outlets provided to supply electrical equipment set out in groups C, D, E, F, G, and L ^k		15 A		

(continued)

TABLE C1 (continued)

Load group	2 Single domestic electrical installation or individual living unit per phase ^a	3 4 5 Blocks of living units ^{a, b, c}		
		2 to 5 living units per phase	6 to 20 living units per phase	21 or more living units per phase
		Loading associated with individual units		
C. Ranges, cooking appliances, laundry equipment or socket-outlets rated at more than 10 A for the connection thereof ^l	50% connected load	15 A	2.8 A per living unit	
D. Fixed space heating or air conditioning equipment, saunas or socket-outlets rated at more than 10 A for the connection thereof ^{m, n}	75% connected load	75% connected load	75% connected load	
E. Instantaneous water heaters ^o	33.3% connected load	4 A per living unit	100 A + 0.8 A per living unit	
F. Storage water heaters ^p	Full-load current	6 A per living unit	100 A + 0.8 A per living unit	
G. Spas and swimming pool heaters	75% of the largest spa, plus 75% of the largest swimming pool, plus 25% of the remainder	Loading not associated with individual units—connected to each phase (communal lighting, laundry loadings, lifts, motors, etc.)		
H. Communal lighting ^{q, r}	Not applicable	Full connected load		
I. Socket-outlets not included in groups J and M below ^{s, t} . Permanently connected electrical equipment not exceeding 10 A	Not applicable	2 A per point, up to a maximum of 15 A		

**TABLE C7
VOLTAGE DROP—SIMPLIFIED METHOD**

Cable conductor size	Single-phase (230 V) circuit	Three-phase (400 V) circuit
	Am per %V _d	Am per %V _d
1 mm ²	45	80
1.5 mm ²	70	140
2.5 mm ²	125	255
4 mm ²	205	412
6 mm ²	305	615
10 mm ²	515	1 034
16 mm ²	815	1 643
25 mm ²	1 280	2 555
35 mm ²	1 775	3 550
50 mm ²	2 577	4 772
70 mm ²	3 342	6 112
95 mm ²	4 445	8 527