



**UNIVERSITI KUALA LUMPUR
Malaysia France Institute**

**FINAL EXAMINATION
SEPTEMBER 2013 SESSION**

SUBJECT CODE : FED 10402
SUBJECT TITLE : ELECTRICAL DISTRIBUTION
LEVEL : DIPLOMA
TIME / DURATION : 2 HOURS
DATE :

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper **CAREFULLY**.
2. This question paper is printed on both sides of the paper.
3. Please write your answers on the answer booklet provided.
4. Answers should be written in blue or black ink except for sketching, graphic and illustration.
5. This question paper consists of **TWO (2)** sections. Section A and B. Answer all questions in Section A. For Section B, answer two (2) questions only.
6. Answer all questions in English.

THERE ARE 6 PAGES OF QUESTIONS AND 7 PAGES OF APPENDIXES, EXCLUDING THIS PAGE.

SECTION A (Total: 60 marks)**INSTRUCTION: Answer ALL questions.****Please use the answer booklet provided.****Question 1**

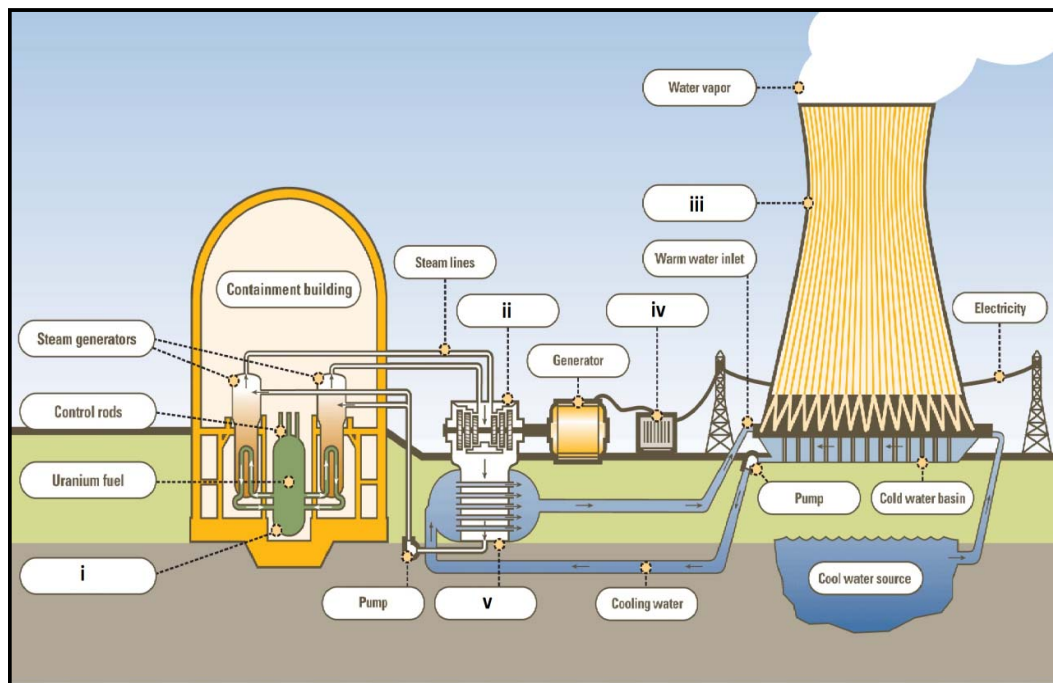
- (a) Explain the function of following components used in hydroelectric power station.

(5 marks)

- | | |
|---------------|---------------|
| (i) Dam | (ii) Penstock |
| (iii) Intake | (iv) Turbine |
| (v) Generator | |

- (b) State the type of generating power station in a **Figure 1**. Name the blank parts from **i** to **v** in the system below.

(7 marks)

**Figure 1**

- (c) List three (3) advantages of thermal power plants compared to other power plants.

(3 marks)

- (d) List four (4) types of generating system that can be categorized as the electrical renewable energy system.

(5 marks)

Question 2

- (a) State three (3) basic requirements that electrical energy provider need to comply in order to supply the electrical energy in a usable form.

(6 marks)

- (b) Define the level of voltage (**V1 to V5**) from Generation level to Domestic consumers level as in **Figure 2**.

(5 marks)

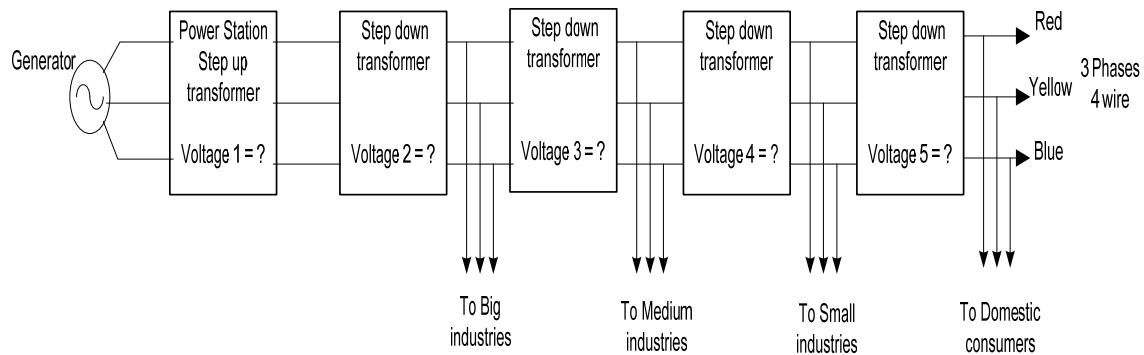


Figure 2

- (c) State two (2) main types of insulator.
- (d) Describe three (3) advantages of distributing an electrical power by parallel/ring system compared to other system.

(4 marks)

(3 marks)

- (e) Explain the most influencing factor in load forecasting power energy study.

(2 marks)

Question 3

- (a) Draw the schematic wiring diagram for supply 2 units of incandescent lamps by using one way switch.

(6 marks)

- (b) A single storey house has a single phase, 240 V, 50 Hz supply with the following load :

- 14 x 40 W fluorescent lamps
- 3 x 40 W ceiling fans
- 2 x 1.5 hp air conditioners
- 2 x 1 kW instantaneous water heaters
- 1 x 4 kW electric cooker + 5Amp switch socket outlet
- 10 nos radial circuit feeding 13Amp switch socket outlet

The single core copper with P.V.C insulation cable will be run in an initial temperature of 30°C, it enclosed in the conduit to the floor joints for most of the 15 m cable run from the Main Switch Board (MSB) or consumer unit. Determine :

- (i) the maximum demand of the house (I_b) and the suitable rating of MCB (I_N).
(10 marks)

- (ii) the minimum size of cable with the required current carrying capacity (I_z and I_t).
(4 marks)

(Refer to technical data attached for reference)

SECTION B (Total: 40 marks)**INSTRUCTION: Answer TWO (2) questions only.****Please use the answer booklet provided.****Question 4**

- (a) A hydroelectric power station is supplied from a reservoir having an area of 100km^2 and a height of 100 m. If the overall efficiency of the plant is 70%, calculate the rate at which the water level will fall when the station is generating 20 MW.

(10 marks)

- (b) The rating of nuclear power plant is 6 MW. Overall thermal efficiency is 29%. The fuel is U^{235} . Calculate the amount of natural uranium required to generate the power if the average energy released per fission for the fuel is 190 MeV.

(10 marks)

Hints :

$$1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$$

$$1 \text{ W} = 1 \text{ J/s} = 6.24 \times 10^{12} \text{ MeV/s}$$

$$\text{Avogadro's number} = 6.02 \times 10^{23}$$

Question 5

(a) A residential consumer has a connection of total connected load as follows;

- ✓ 15 lamps of 40 watts each
- ✓ 5 ceiling fans of 60 watts each
- ✓ 5 switch socket outlet (SSO) of 100 watts each

Load demand is given as in **Table 1** :

Table 1

Time	No of Load		
	Lamps	Fans	SSO
6 pm – 7 pm	5	3	3
7 pm – 8 pm	13	3	4
8 pm – 10 pm	10	4	2
10 pm – 12 am	5	1	2
12 am – 6 am	2	No load	1
6 am – 7 am	5	No load	1
7 am – 12 pm	No load	1	2
12 pm – 3 pm	No load	4	1
3 pm – 6 pm	No load	2	1

(i) Calculate the energy consumed per day. (6 marks)

(ii) Calculate the demand factor of overall load. (3 marks)

(iii) Calculate the daily load factor of this consumer. (3 marks)

(iv) Calculate the monthly consumption bill (for 30 days) if the supply electricity company charge RM 0.24 per unit for first 100 unit of kWh and RM 0.32 for the rest per kWh. (3 marks)

(b) State the types of tripping unit inside the circuit breaker. Name three (3) types of circuit breaker used in High Voltage applications. (5 marks)

Question 6

- (a) List five (5) types of earthing system which have been discussed in IEE Regulation 16th Edition. Draw and explain in detail only one of the earthing system.
(8 Marks)
- (b) Describe the meaning of “solidly earthed” in the earthing system.
(3 Marks)
- (c) Define three (3) methods which are mainly used in the installation of the earthing system.
(3 Marks)
- (d) State three (3) types of Protective conductor in the earthing system.
(3 Marks)
- (e) Explain briefly the purpose of the “earthed equipotential bonding” in earthing system.
(3 Marks)

END OF QUESTION PAPER

APPENDICES / ATTACHMENT FILE**FED 10402 : ELECTRICAL DISTRIBUTION**

LIST	CONTENTS
APPENDIX A	Table of Correction Factors for Ca,Cg & Ci
APPENDIX B	Table of Corrections Factors of Mineral insulated and Allowance for Diversity
APPENDIX C	Table 4D1A & Table 4D1B
APPENDIX D	Figure A : Time vs Current characteristics fuses to BS
APPENDIX E	Time vs Current characteristics MCB Type 1& Type 2 to BS 3871
APPENDIX F	Time vs Current characteristics MCB Type 3 & Type B to BS 3871
APPENDIX G	MCB Catalogue

APPENDIX A

TABLE 4C1

Correction factors for ambient temperature where protection is against short-circuit

NOTE: This table applies where the associated overcurrent protective device is intended to provide short-circuit protection only. Except where the device is a semi-enclosed fuse to BS 3036 the table also applies where the device is intended to provide overload protection.

Type of insulation	Operating temperature	Ambient temperature (°C)															
		25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	
Rubber (flexible cables only)	60 °C	1.04	1.0	0.91	0.82	0.71	0.58	0.41	-	-	-	-	-	-	-	-	
General purpose pvc	70 °C	1.03	1.0	0.94	0.87	0.79	0.71	0.61	0.50	0.35	-	-	-	-	-	-	
Paper	80 °C	1.02	1.0	0.95	0.89	0.84	0.77	0.71	0.63	0.55	0.45	0.32	-	-	-	-	
Rubber	85 °C	1.02	1.0	0.95	0.90	0.85	0.80	0.74	0.67	0.60	0.52	0.43	0.30	-	-	-	
Heat resisting pvc*	90 °C	1.03	1.0	0.97	0.94	0.91	0.87	0.84	0.80	0.76	0.71	0.61	0.50	0.35	-	-	
Thermosetting	90 °C	1.02	1.0	0.96	0.91	0.87	0.82	0.76	0.71	0.65	0.58	0.50	0.41	0.29	-	-	
Mineral	70 °C sheath	1.03	1.0	0.93	0.85	0.77	0.67	0.57	0.45	0.31	-	-	-	-	-	-	
	105 °C sheath	1.02	1.0	0.96	0.92	0.88	0.84	0.80	0.75	0.70	0.65	0.60	0.54	0.47	0.40	0.32	

NOTES:

1. Correction factors for flexible cords and for 85 °C and 180 °C rubber-insulated flexible cables are given in the relevant table of current-carrying capacity.
2. This table also applies when determining the current-carrying capacity of a cable.
3. * These factors are applicable only to ratings in columns 2 to 5 of Table 4D1A.

TABLE 4B1

Correction factors for groups of more than one circuit of single-core cables, or more than one multicore cable (to be applied to the corresponding current-carrying capacity for a single circuit in Tables 4D1 to 4D4, 4E1 to 4E4, 4F1 and 4F2, 4J1, 4K1 to 4K4, 4L1 to 4L4)**

Reference method of installation (see Table 4A)		Correction factor (C _g)													
		Number of circuits or multicore cables													
		2	3	4	5	6	7	8	9	10	12	14	16	18	20
Enclosed (Method 3 or 4) or bunched and clipped direct to a non-metallic surface (Method 1)		0.80	0.70	0.65	0.60	0.57	0.54	0.52	0.50	0.48	0.45	0.43	0.41	0.39	0.38
Single layer clipped to a non-metallic surface (Method 1)	Touching	0.85	0.79	0.75	0.73	0.72	0.72	0.71	0.70	-	-	-	-	-	-
	Spaced*	0.94	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Single layer <i>multicore</i> on a perforated metal cable tray, vertical or horizontal (Method 11)	Touching	0.86	0.81	0.77	0.75	0.74	0.73	0.73	0.72	0.71	0.70	-	-	-	-
	Spaced*#	0.91	0.89	0.88	0.87	0.87	-	-	-	-	-	-	-	-	-
Single layer <i>single-core</i> on a perforated metal cable tray, touching (Method 11)	Horizontal	0.90	0.85	-	-	-	-	-	-	-	-	-	-	-	-
	Vertical	0.85	-	-	-	-	-	-	-	-	-	-	-	-	-
Single layer multicore touching on ladder supports (Method 13)		0.86	0.82	0.80	0.79	0.78	0.78	0.78	0.77	-	-	-	-	-	-

* Spaced by a clearance between adjacent surfaces of at least one cable diameter (D_e). Where the horizontal clearances between adjacent cables exceeds 2 D_e no correction factor need be applied.

** When cables having differing conductor operating temperatures are grouped together, the current rating shall be based upon the lowest operating temperature of any cable in the group.

- Correction factor not tabulated.

Not applicable to mineral insulated cables see Table 4B2.

Table 52A : Cable surrounded by thermal insulation (Ci)	
Length in insulation mm	Derating factor
50	0.89
100	0.81
200	0.68
400	0.55

APPENDIX B

Table 4B2 : Corrections factors for Mineral insulated cables installed on Performed Tray								
Tray Orientation	Arrangement of Cables	Number of Trays	Number of multicore cables of circuits					
			1	2	3	4	6	9
Horizontal	Multiconductor cables touching	1	1.0	0.90	0.80	0.80	0.75	0.75
Horizontal	Multiconductor cables spaced	1	1.0	1.0	1.0	0.95	0.90	-
Vertical	Multiconductor cables touching	1	1.0	0.90	0.80	0.75	0.75	0.70
Vertical	Multiconductor cables spaced	1	1.0	0.90	0.90	0.90	0.85	-
Horizontal	Multiconductor cables trefoil separated	1	1.0	1.0	0.95			
Vertical	Multiconductor cables trefoil separated	1	1.0	0.90	0.90			

Maximum demand = Diversity allowance x Sum of total connected load

Table 6.2 - Allowance for diversity

Note the following abbreviations :

X is the full load current of the largest appliance or circuit
 Y is the full load current of the second largest appliance or circuit
 Z is the full load current of the remaining appliances or circuits

Type of final circuit	Type of premises		
	Households	Small shops, stores, offices	Hotels, guest houses
Lighting	66% total demand	90% total demand	75% total demand
Heating and power	100% up to 10 A + 50% balance	100%X + 75%(Y+Z)	100%X + 80%Y + 60%Z
Cookers	10 A + 30% balance + 5 A for socket	100%X + 80%Y + 60%Z	100%X + 80%Y + 60%Z
Motors (but not lifts)		100%X + 80%Y + 60%Z	100%X + 50%(Y+Z)
Instantaneous water heaters	100%X + 100%Y + 25%Z	100%X + 100%Y + 25%Z	100%X + 100%Y + 25%Z
Thermostatic water heaters	100%	100%	100%
Floor warming installations	100%	100%	100%
Thermal storage heating	100%	100%	100%
Standard circuits	100%X + 40%(Y+Z)	100%X + 50%(Y+Z)	100%X + 50%(Y+Z)
Sockets and stationary equip.	100%X + 40%(Y+Z)	100%X + 75%(Y+Z)	100%X + 75%Y + 40%Z

APPENDIX C

TABLE 4D1A
Single-core pvc-insulated cables, non-armoured, with or without sheath
(COPPER CONDUCTORS)

COPPER CONDUCTORS

BS 6004
BS 6231
BS 6346

Ambient temperature: 30 °C
Conductor operating temperature: 70 °C

CURRENT-CARRYING CAPACITY (amperes):

Conductor cross-sectional area	Reference Method 4 (enclosed in conduit in thermally insulating wall etc.)		Reference Method 3 (enclosed in conduit on a wall or in trunking etc.)		Reference Method 1 (clipped direct)		Reference Method 11 (on a perforated cable tray horizontal or vertical)		Reference Method 12 (free air)		
	2 cables, single-phase a.c. or d.c.	3 or 4 cables, three-phase a.c.	2 cables, single-phase a.c. or d.c.	3 or 4 cables, three-phase a.c.	2 cables, single-phase a.c. or d.c. flat and touching	3 or 4 cables, three-phase a.c. flat and touching or trefoil	2 cables, single-phase a.c. or d.c. flat and touching	3 or 4 cables, three-phase a.c. flat and touching or trefoil	2 cables, single-phase a.c. or d.c. or 3 cables three-phase a.c.	2 cables, single-phase a.c. or d.c. or 3 cables three-phase a.c.	3 cables trefoil, three phase a.c.
1	2	3	4	5	6	7	8	9	10	11	12
(mm ²)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)
1	11	10.5	13.5	12	15.5	14	-	-	-	-	-
1.5	14.5	13.5	17.5	15.5	20	18	-	-	-	-	-
2.5	19.5	18	24	21	27	25	-	-	-	-	-
4	26	24	32	28	37	33	-	-	-	-	-
6	34	31	41	36	47	43	-	-	-	-	-
10	46	42	57	50	65	59	-	-	-	-	-
16	61	56	76	68	87	79	-	-	-	-	-
25	80	73	101	89	114	104	126	112	146	130	110
35	99	89	125	110	141	129	156	141	181	162	137
50	119	108	151	134	182	167	191	172	219	197	167
70	151	136	192	171	234	214	246	223	281	254	216
95	182	164	232	207	284	261	300	273	341	311	264
120	210	188	269	239	330	303	349	318	396	362	308
150	240	216	300	262	381	349	404	369	456	419	356
185	273	245	341	296	436	400	463	424	521	480	409
240	320	286	400	346	515	472	549	504	615	569	485
300	367	328	458	394	594	545	635	584	709	659	561
400	-	-	546	467	694	634	732	679	852	795	656
500	-	-	626	533	792	723	835	778	982	920	749
630	-	-	720	611	904	826	953	892	1138	1070	855
800	-	-	-	-	1030	943	1086	1020	1265	1188	971
1000	-	-	-	-	1154	1058	1216	1149	1420	1337	1079

NOTES:

- Where the conductor is to be protected by a semi-enclosed fuse to BS 3036, see item 6.2 of the preface to this appendix.
- The current-carrying capacities in columns 2 to 5 are also applicable to flexible cables to BS 6004 table 1(a) and to 90 °C heat resisting pvc cables to BS 6231 tables 8 and 9 where the cables are used in fixed installations.

TABLE 4D1B

VOLTAGE DROP (per ampere per metre):

Conductor operating temperature: 70 °C

Conductor cross-sectional area	2 cables d.c.	2 cables, single-phase a.c.			3 or 4 cables, three-phase a.c.			Reference Method 12 (flat spaced*)
		Reference Methods 3 & 4 (enclosed in conduit etc. in or on a wall)	Reference Methods 1 & 11 (clipped direct or on trays, touching)	Reference Method 12 (spaced*)	Reference Methods 3 & 4 (enclosed in conduit etc. in or on a wall)	Reference Methods 1, 11 & 12 (in trefoil)	Reference Methods 1 & 11 (flat and touching)	
1	2	3	4	5	6	7	8	9
(mm ²)	(mV/A/m)	(mV/A/m)	(mV/A/m)	(mV/A/m)	(mV/A/m)	(mV/A/m)	(mV/A/m)	(mV/A/m)
1	44	44	44	44	38	38	38	38
1.5	29	29	29	29	25	25	25	25
2.5	18	18	18	18	15	15	15	15
4	11	11	11	11	9.5	9.5	9.5	9.5
6	7.3	7.3	7.3	7.3	6.4	6.4	6.4	6.4
10	4.4	4.4	4.4	4.4	3.8	3.8	3.8	3.8
16	2.8	2.8	2.8	2.8	2.4	2.4	2.4	2.4
25	1.75	1.80 0.33 1.80	1.75 0.20 1.75	1.75 0.29 1.80	1.50 0.29 1.55	1.50 0.175 1.50	1.50 0.25 1.55	1.50 0.32 1.55
35	1.25	1.30 0.31 1.30	1.25 0.195 1.25	1.25 0.28 1.30	1.10 0.27 1.10	1.10 0.170 1.10	1.10 0.24 1.10	1.10 0.32 1.15
50	0.93	0.95 0.30 1.00	0.93 0.190 0.95	0.93 0.28 0.97	0.81 0.26 0.85	0.80 0.165 0.82	0.80 0.24 0.84	0.80 0.32 0.86
70	0.63	0.65 0.29 0.72	0.63 0.185 0.66	0.63 0.27 0.69	0.56 0.25 0.61	0.55 0.160 0.57	0.55 0.24 0.60	0.55 0.31 0.63
95	0.46	0.49 0.28 0.56	0.47 0.180 0.50	0.47 0.27 0.54	0.42 0.24 0.48	0.41 0.155 0.43	0.41 0.23 0.47	0.40 0.31 0.51
120	0.36	0.39 0.27 0.47	0.37 0.175 0.41	0.37 0.26 0.45	0.33 0.23 0.41	0.32 0.150 0.36	0.32 0.23 0.40	0.32 0.30 0.44
150	0.29	0.31 0.27 0.41	0.30 0.175 0.34	0.29 0.26 0.39	0.27 0.23 0.36	0.26 0.150 0.30	0.26 0.23 0.34	0.26 0.30 0.40
185	0.23	0.25 0.27 0.37	0.24 0.170 0.29	0.24 0.26 0.35	0.22 0.23 0.32	0.21 0.145 0.26	0.21 0.22 0.31	0.21 0.30 0.36
240	0.180	0.195 0.26 0.33	0.185 0.165 0.25	0.185 0.25 0.31	0.17 0.23 0.29	0.160 0.145 0.22	0.160 0.22 0.27	0.160 0.29 0.34
300	0.145	0.160 0.26 0.31	0.150 0.165 0.22	0.150 0.25 0.29	0.14 0.23 0.27	0.130 0.140 0.190	0.130 0.22 0.25	0.130 0.29 0.32
400	0.105	0.130 0.26 0.29	0.120 0.160 0.20	0.115 0.25 0.27	0.12 0.22 0.25	0.105 0.140 0.175	0.105 0.21 0.24	0.100 0.29 0.31
500	0.086	0.110 0.26 0.28	0.098 0.155 0.185	0.093 0.24 0.26	0.10 0.22 0.25	0.086 0.135 0.160	0.086 0.21 0.23	0.081 0.29 0.30
630	0.068	0.094 0.25 0.27	0.081 0.155 0.175	0.076 0.24 0.25	0.08 0.22 0.24	0.072 0.135 0.150	0.072 0.21 0.22	0.066 0.28 0.29
800	0.053	-	0.068 0.150 0.165	0.061 0.24 0.25	-	0.060 0.130 0.145	0.060 0.21 0.22	0.053 0.28 0.29
1000	0.042	-	0.059 0.150 0.160	0.050 0.24 0.24	-	0.052 0.130 0.140	0.052 0.20 0.21	0.044 0.28 0.28

NOTE: * Spacings larger than those specified in Method 12 (see table 4A) will result in larger voltage drop.