(3Hrs) **Marks: 80**

N.B.

1. **Question No.1 is Compulsory**.
2. Answer any three out of remaining five questions
3. Assume any suitable data wherever required but justify the same
4. Illustrate answer with sketches wherever required

Q 1 Answer the following **(Any four)**

a) Explain Elementary and interconnection diagram and their uses. **(05)**

b) Explain benefits of power factor improvement **(05)**

c) What is monitoring and targeting. State and explain in brief elements of M and T system. **(05)**

d) What is soft starter and what are its advantages. **(05)**

e) Discuss bench marking and its type. State two benchmarking parameters. **(05)**

Q 2 a) The details of the load in a plant are as follows **(10)**

Sr. No.	Feeder	KW	Efficiency	Pf	Df	Lf
1.	Electrical dept	200	0.87	0.84	0.6	0.8
2.	Mechanical dept	400	0.85	0.83	0.6	0.9
3.	Chemical dept	600	0.8	0.8	0.8	0.8
4.	IT dept	200	0.9	0.85	0.6	0.7

Calculate KVA rating of transformer which feeds the plant. Draw SLD showing relevant protective and metering devices. Find compensation required for each feeder.

b) Explain Energy performance assessment of illumination by ILER method. **(10)**

Q 3 a) A 100Kw heater, 415V, 3 phase 50Hz, is to be connected to PCC. Cable length is 100m. The cable will run with two similar circuits in an unenclosed cable tray. Ambient temp is 40 deg Celsius. Fault level is 40KA. Calculate the size of conductor and specify various assumptions. **(10)**

Type of Cable	Value of K(Cu)	Value of K(Al)
PVC cable $\leq 300mm^2$	115	76
PVC cable $\geq 300mm^2$	103	68
XLPE	114	92

b) Explain cable management system. **(10)**

Q 4 a) A classroom accomodates 10 standard ceiling fans with 75W consumption. Energy auditor has suggested to replace them each by a BLDC fans of 28W. The cost of one unit is Rs10 and cost of one BLDC fan is Rs. 3000. Find annual energy saving and simple payback. Assume number of working hours 08/day and 200 days in a year. **(10)**

b) What is Energy Efficient Motor. What are the advantages of EEM over standard motor. How it is beneficial from energy saving point of view. **(10)**

Q 5 a) Explain step by step approach towards load management. **(10)**

b) Explain Tendering process for the purchase of costliest equipments (open tender). **(10)**

Q6 a) Design a lighting system for a drawing Hall which measures 25m*10m*5m in dimensions. Assume and justify suitable assumptions. Find number of fixtures required to maintain average lux level of 300lux in the room. Draw lighting layout. **(10)**

b) Explain 10 Step methodology for energy auditing. **(10)**

Data for Illumination Design problems

K	R_C = 0.7			R_C = 0.5			R_C = 0.3		
	R_W = 0.5	R_W = 0.3	R_W = 0.1	R_W = 0.5	R_W = 0.3	R_W = 0.1	R_W = 0.5	R_W = 0.3	R_W = 0.1
0	0	0	0	0	0	0	0	0	0
0.6	0.43	0.39	0.36	0.42	0.38	0.36	0.41	0.38	0.36
0.8	0.45	0.41	0.38	0.44	0.40	0.38	0.43	0.40	0.38
1.00	0.51	0.47	0.44	0.55	0.47	0.44	0.49	0.46	0.40
1.25	0.55	0.51	0.49	0.53	0.50	0.48	0.52	0.50	0.48
1.50	0.57	0.54	0.52	0.56	0.53	0.51	0.54	0.52	0.50
2.00	0.61	0.58	0.56	0.59	0.57	0.55	0.57	0.56	0.54
2.50	0.63	0.61	0.59	0.61	0.59	0.57	0.59	0.58	0.56
3.00	0.65	0.63	0.61	0.63	0.61	0.59	0.61	0.59	0.58
4.00	0.67	0.65	0.63	0.64	0.63	0.62	0.62	0.61	0.59
5.00	0.68	0.67	0.65	0.65	0.64	0.63	0.63	0.62	0.61

Lamp Data			
Sr. No.	**Type of Lamp**	**Wattage**	**Lumen output**
1.	**Fluorescent (T8/T5)**	**18 (Halo phosphate)**	**1015**
		36 (Halo phosphate)	**2450**
		18 (82/84/86)	**1300**
		36 (82/84/86)	**3250**
		28 (T5)	**2800**
2.	**CFL**	**9**	**600**
		11	**760**
		13	**920**
		18	**1200**

Data for Cable Design problem

TABLE 14
IEE-Table 9D2
Current-carrying capacities and associated voltage drops for twin and multicore p.v.c. -insulated cables, non-armoured (copper conductors)

Conductor operating temperature : 70°C

Conductor Cross sectional area	Installation methods A to C †of Fig. 1 ('Enclosed')				Installation methods E to H of Fig. 1 ('Clipped direct')				Installation method K of Fig. 1 ('Defined conditions')			
	One twin cable With or without protective conductor single-phase a.c. or d.c.		One three-core cable with or without protective conductor or one four-core cable, three phase		One Twin cable With or without protective conductor single-phase a.c. or d.c.		One three-core cable with or without protective conductor or one four-core cable, three phase		One Twin cable With or without protective conductor single-phase a.c. or d.c.		One three-core cable with or without protective conductor or one four-core cable, three phase.	
	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre
1	2	3	4	5	6	7	8	9	10	11	12	13
mm²	A	mV	A	mV	A	mV	A	mV	A	mV	A	mV
1.0	14	42	12	37	16	42	13	37	-	-	-	-
1.5	18	28	16	24	20	28	17	24	-	-	-	-
2.5	24	17	21	15	28	17	24	15	-	-	-	-
4	32	11	29	9.2	38	11	32	9.2	-	-	-	-
6	40	7.1	36	6.2	46	7.1	40	6.2	-	-	-	-
10	53	4.2	49	3.7	64	4.2	54	3.7	-	-	-	-
16	70	2.7	62	2.3	85	2.7	71	2.3	-	-	-	-
25	79	1.8	70	1.6	108	1.8	90	1.6	114	1.8	95	1.6
35	98	1.3	86	1.1	132	1.3	115	1.1	139	1.3	122	1.1
50	-	-	-	-	163	0.92	140	0.81	172	0.92	148	0.81
70	-	-	-	-	207	0.65 0.64	176	0.57	218	0.65 0.64	186	0.57
95	-	-	-	-	251	0.48 0.46	215	0.42	265	0.48 0.46	227	0.42
120	-	-	-	-	290	0.40 0.36	251	0.34	306	0.40 0.36	265	0.34
150	-	-	-	-	330	0.32 0.25	287	0.29	348	0.32 0.25	302	0.29
185	-	-	-	-	380	0.29 0.23	330	0.24	400	0.29 0.23	348	0.24
240	-	-	-	-	450	0.25 0.18	392	0.20	474	0.25 0.18	413	0.20
300	-	-	-	-	520	0.23 0.14	450	0.18	548	0.23 0.14	474	0.18
400	-	-	-	-	600	0.22 0.11	520	0.17	632	0.22 0.11	548	0.17

FLAT CABLES ONLY

CORRECTION FACTORS

FOR AMBIENT TEMPERATURE	25°C	35°C	40°C	45°C	50°C	55°C	60°C	65°C
Ambient temperature								
Correction factor	1.06	0.94	0.87	0.79	0.71	0.61	0.50	0.35

TABLE 15
IEE-Table 9D3
Current-carrying capacities and associated voltage drops for twin and multicore armoured p.v.c. -insulated cables (copper conductors).

Conductor operating temperature : 70°C

Conductor cross sectional area	Installation method E, F and G † of Table 11 ('Clipped direct')				Installation method K of Table 11 ('Defined conditions')			
	One twin cable single phase a.c. or d.c.		One three - or- four core cable three-phase		One twin cable single phase a.c. or d.c.		One three - or- four core cable three-phase	
	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre
1	2	3	4	5	6	7	8	9
mm²	A	mV	A	mV	A	mV	A	mV
1.5	20	29	18	25	-	-	-	-
2.5	29	18	24	16	-	-	-	-
4	37	12	31	9.6	-	-	-	-
6	48	7.4	41	6.3	50	7.3	42	6.3
10	66	4.3	56	3.8	69	4.3	58	3.8
16	86	2.7	73	2.3	90	2.7	77	2.3
25	115	1.8	97	1.6	121	1.8	102	1.6
35	142	1.3	119	1.1	149	1.3	125	1.1
50	168	0.92	147	0.81	180	0.92	155	0.81
		a.c. d.c.				a.c. d.c.		
70	209	0.65 0.64	180	0.57	220	0.65 0.64	190	0.57
95	257	0.48 0.46	219	0.42	270	0.48 0.46	230	0.42
120	295	0.40 0.36	257	0.34	310	0.40 0.36	270	0.34
150	337	0.32 0.25	295	0.29	355	0.32 0.25	310	0.29
185	390	0.29 0.23	333	0.24	410	0.29 0.23	350	0.24
240	461	0.25 0.18	399	0.20	485	0.25 0.18	420	0.20
300	523	0.23 0.14	451	0.18	550	0.23 0.14	475	0.18
400	589	0.22 0.11	523	0.17	620	0.22 0.11	550	0.17

CORRECTION FACTORS

FOR AMBIENT TEMPERATURE	25°C	35°C	40°C	45°C	50°C	55°C	60°C	65°C
Ambient temperature								
Correction factor	1.06	0.94	0.87	0.79	0.71	0.61	0.50	0.35

TABLE-36

Correction factors for groups of more than one multicore cables

Multicore cables: (Factors to be applied to the values for one cable)	Number of cables								
	2	3	4	5	6	7	8	9	10
	0.80	0.70	0.65	0.60	0.57	0.52	0.48	0.45	0.43

NOTES:
1. These factors are applicable to groups of cables all of one size equally loaded, including groups bunched in more than one plane
2. Where, spacing between adjacent cables exceeds twice their overall diameter, no reduction factor need be applied

Duration – 3 Hours **Total Marks - 80**

N.B.:- (1) Question No.**1** is compulsory.
(2) **Attempt** any **three** questions out of remaining **five** questions.
(3) Assume suitable data if necessary and justify the same.

Q 1. Answer the following questions. **20**

a) Explain the Load compensation, state its objectives.

b) Explain objectives of series compensation.

c) Why harmonics are represented by harmonic number and not with harmonic frequencies.

d) Write the advantages and disadvantages of passive filter.

Q 2 a) Enlist common power quality issues. Explain any five of them. **10**

Q 2 b) Write a note on harmonic phase rotation and phase angle relationship. **10**

Q 3 a) Explain effects of harmonics of rotating machines, transformers and cables. **10**

Q 3 b) Explain different harmonics mitigation techniques. **10**

Q 4 a) With the neat phasor diagram explain power factor compensation using capacitor. **10**

Q 4 b) With necessary diagrams explain the basic types of FACTS controller? **10**

Q 5 a) Explain various parameters which limit the loading capabilities of transmission line. **10**

Q 5 b) Explain switching converter type series compensator (SSSC). **10**

Q 6 a) Explain voltage and current characteristics of TCR and FCTCR. **10**

Q 6 b) Explain the Thyristor controlled phase angle regulator (TCPAR). **10**

****

Duration: 3hrs **[Max Marks: 80]**

N.B.: (1) Question No. 1 is compulsory.
(2) Attempt any three questions out of the remaining five.
(3) All questions carry equal marks.
(4) Assume suitable data, if required and state it properly.

1. Solve **ANY FOUR** questions from following. **[20]**

a. State and explain the laws of illumination.

b. Explain LEP's.

c. Illustrate different means and ways to minimise the glare in indoor lighting design.

d. What is DMX control?

e. Explain briefly tuneable white lighting system with LED.

2. a. Explain with neat diagram construction and working principle of incandescent lamp. **[10]**

b. With neat diagram explain Reflection, Refraction, Diffusion and Absorption type light control. **[10]**

3. a. State and explain methods of lighting calculation. **[10]**

b. A hall 13 m long and 12 m side is to be illuminated and illumination required is 50 mt-candle. Five types of lamps having lumen output have as given below are available:

Watts	100	200	300	500	1000
Lumens	1615	3650	4700	9950	21500

DF = 1.3 & UF = 0.5
Calculate number of lamps needed in each case to produce required illumination. **[10]**

4. a. Explain road lighting with its objectives and design consideration. **[10]**

b. Explain flood lighting and state its purpose. **[10]**

A The front of a building 45 m * 20 m is illuminated by twenty 1000 W lamp arranged so that uniform illumination on the surface is obtained . Assuming a luminous efficiency of 18 lumens / watt ,UF = 0.4 WF = 1.2 DF = 1.3 Determine the illumination on the surface.

5. a. What are the general requirement in an industrial environment? State and explain component of industrial lighting. **[10]**

b. State and explain different lighting control strategy. **[10]**

6. a. Explain LED driver types. **[10]**

b. Discuss the solar powered LED lighting system. **[10]**

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Duration: 3 Hours **Total Marks: 80**

Note: 1. Q. 1 is compulsory.
2. Solve any 3 questions out of remaining questions.
3. Assume suitable data if necessary.

Q1) Solve any four [20]

a. What is MTTF and Failure rate?
b. What do you mean by bath tub curve in reliability studies?
c. The reliability of a component is 0.8. How many such component is connected in parallel to achieve an overall reliability of at least 0.85?
d. Explain Weather Load Model
e. Explain loss of load probability & loss of load expectation in short

Q2) [20]

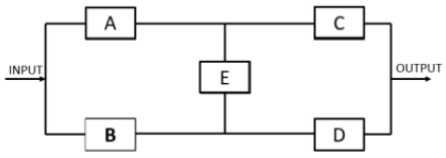
a. What is Impact of high renewable energy penetration on stability and reliability of power system?
b. Explain Peak load forecasting

Q3) [20]

a. Derive the general expression for reliability in terms of Hazard rate.
b. Define following System and load point indices
   a. Expected load curtailed
   b. Expected number of load curtailments
   c. Expected energy not supplied
   d. Expected duration of load curtailment.

Q4) [20]

a. Explain customer-oriented indices and load and energy–oriented indices.
b. Evaluate a general expression for system success and the reliability of the system if each component has reliability of 0.99.



Q5) [20]

a. Consider a system containing five units of 40MW each with FOR=0.03. Prepare the capacity outage table for the system. Find Loss of Load Expectation and risk factor if the annual peak load is 180 MW and base load if 40% of peak load.
b. Explain the concept of rate of departure. Derive the expression for state frequency in terms of state probability and rate of departure.

Q6) [20]

a. Differentiate in Short, Medium and Long Term Planning
b. A generating system has one generator of 25 MW and 2 generators of 50 MW with FOR 0.02. Prepare Capacity Outage Table for the same.

Duration – 3 Hours **Total Marks assigned to the paper- 80**

N.B.: - (1) Question No.**1** is compulsory.
(2) **Attempt** any **Three**questions out of remaining **five** questions.
(3) Assume suitable data if necessary and justify the same.

Q 1. **Each questions carry5 marks. Attempt any four questions.**

a. Discuss the processes involved in the design of battery pack for an Electric Vehicle? **05**

b. List the different methods of Electric Vehicle charging technologies. **05**

c. Discuss the role of electronic control unit (ECU) used in an Electric Vehicle? **05**

d. Compare radiated emission and conducted emissions? **05**

e. A vehicle with power plant power output at the drive drain considering all losses is 100kW. The maximum total resistance the vehicle experiences is 3.6kN. Calculate the velocity the vehicle can achieve in km/hr under this condition. **05**

Q 2 a) With the help of diagrams, explain the various components which contribute to the total tractive effort needed in EV propulsion system design. **07**

Q 2 b) Elaborate on the design considerations of DC fast charger and recommend the charging standards. **07**

Q 2 c) A 2-Wheeler electric scooter is designed to have a range of 80kms which consumes 20Wh/km on average from a battery pack to run. Considering the depth of discharge to be 80%, design a battery pack of nominal operating voltage of 60V. Power consumed by auxiliary system is 2Wh/km. Design a battery pack of suitable configuration using the cell specification given below. **06**

Cell: Li-ion; prismatic cell, nominal voltage=3.65V, ampere hour=14, weight=0.32kg.

Q 3 a) What are the design considerations of On-board charger for Electric Vehicle Charging? **07**

Q 3 b) Discuss the selection and sizing of fuel cell for Fuel cell Electric Vehicle. Also briefly explain the design considerations of fuel cell Electric Vehicle. **07**

Q 3c) A 4W passenger car of total mass 1364kg, with a tire radius of 0.31m. Drag coefficient is 0.109, area is 1.543 sq. m, rolling resistance coefficient is 0.02, gradient is and air density is 1.16kg/m^3. Compute total traction force, power and torque assuming pick up from 0 to 96km/hr in 10 seconds. Suitably decide the rating of motor required to achieve the above conditions. **06**

Q 4 a)	Explain on the design considerations and charging standards of AC chargers.	**07**
Q 4 b)	Discuss on the effect of road conditions and environmental impacts on the design of energy storage for EV.	**07**
Q 4 c)	Explain the importance of drive cycle in EV propulsion system design.	**06**
Q 5 a)	Discuss on EMI EMC measurements and testing.	**07**
Q 5 b)	Elaborate on the importance of ISO 26262 for electric vehicles.	**07**
Q 5 c)	List and explain the factors to be considered for the design of a HVAC controller for an EV.	**06**
Q 6 a)	Describe the acceleration and braking control used in Electric Vehicle.	**07**
Q 6 b)	What is ASIL? What are the methods adopted to ensure protection against unintended vehicle movement and thermal or explosive environment in EV?	**07**
Q 6c)	Interpret why EMC designs are crucial for EV charging stations.	**06**

****

(3 Hours) **[Total Marks : 80]**

Question No .01 is compulsory
Attempt any three from Q. No 2 to Q. No 6.

Q.1 **Attempt any Four out of Five** [20]
a) State scope and importance of Human Resource Management.
b) How do you control workplace harassment?
c) State HRM functions.
d) What is human resource planning.
e) Write a note on Organizational behavior.

Q.2 a) Write a note on Group Behavior and Group Dynamics. [10]
b) Define personality and Explain personality types. [10]

Q.3 a) Explain the concepts and skills of leadership. [10]
b) Explain Theories of Motivation and their Applications for Behavioral Change [10]

Q.4 a) Explain Traditional & modern methods of Performance Appraisal Systems. [10]
b) Explain Need, purpose, objective and role of information system in HR. [10]

Q.5 a) Explain effect of perception on Individual Decision-making, Attitude and Behavior. [10]
b) Discuss the various types of labor welfare practices in organizations [10]

Q.6 **Attempt any Four out of Five** [20]
a) IR issues in organizations
b) Approaches to Strategic Decision Making.
c) Training Methods
d) Business Process Re-engineering.
e) Job enrichment

[Time: 3 **Hours]** **[Marks:80]**

N.B: 1. **Questions No. 1 is Compulsory.**
2. **Attempt any three out of remaining Questions.**
3. **Figures to the right Indicate full marks.**

Q.1 Attempt any Four write short notes on **20**

a) Significance of Environment

b) Global Warming

c) Scope of Environment Management

d) EMS certification

e) Forest Act

f) Eco-system and its types

Q.2 a) Discuss on environmental issues related to Indian context. **10**

b) Discuss on Air [P & CP] Act **10**

Q.3 a) Explain limiting factor and food chain as related to ecosystem. **10**

b) Write a note on each. Ozone layer depletion & Acid rain. **10**

Q.4 a) Discuss on corporate environment responsibity. **10**

b) What is sustainable development? What are the parameter effecting it? **10**

Q.5 a) What is ISO-14000? How does adoption of ISO-14000 practices benefits industries as well Environment. **10**

b) Discuss the functions of government as planning and regulatory agency. **10**

Q.6 a) Discuss the Atomic and Biomedical hazards as related to Global environmental concern. **10**

b) Discuss on Total Quality environmental management. **10**

———————————-

Duration: - 3 Hrs **Max. Marks: - 80**

Note: - 1. Question number 1 is compulsory.
2. Attempt any Three questions out of remaining.
3. Assume any data if necessary and justify the same.

Q1 Attempt any Four. **(20)**

a) Explain SLD in details.
b) Explain soft starters
c) State elements of monitoring and targeting
d) What is Bench Marking and what are its type.
e) Explain power factor improvement and its cost benefits

Q2 A) Explain electrical load management. **(10)**

B) Explain lead acid battery and its advantages **(10)**

Q3 A) The details of the load which are connected to a distribution transformer in a plant are as follows. **(10)**

Type of load	Load in KW	Efficiency	Power factor	Load factor	Diversity Factor
Washing Plant	500	0.8	0.75	0.8	0.7
Cutting shop	250	0.85	0.7	0.6	0.5
Misc load	200	0.85	0.85	0.5	0.5
Machine shop	300	0.8	0.75	0.75	0.7

Calculate the capacity of distribution transformer feeding a plant and draw SLD showing relevant metering and protections

B) Explain need and types of Energy Audit. **(10)**

Q4 A) A room measuring 30m*15m*4m is to be illuminated at 200lux. Find the number of lamps required. Mention all the assumptions. Draw physical layout. **(10)**

B) Explain Energy efficient controls in lighting **(10)**

Q5 A) Explain important provisions of Energy Conservation Act 2001. **(10)**

B) Explain cable management systems **(10)**

Q6 A) A 415V, 0.8 pf, 50HP, 3 phase, 0.85 efficiency, 1440rpm Delta connected induction motor is to be connected to a MCC by a cable of length 500m. The cable is running with 2 other similar cables. Ambient temp is 45 deg Celsius, Fault level at that point is 20KA. Select the cable and its size of conductor. State various assumptions made. **(10)**

Type of Cable	**Value of k (Cu)**	**Value of k (Al)**
PVC cable $\leq 300mm^2$	115	76
PVC cable $\geq 300mm^2$	103	68
XLPE cable	114	92

B) Explain different types of distribution systems. **(10)**

Data for Illumination Design problems

K	R_C = 0.7			R_C = 0.5			R_C = 0.3		
	R_W = 0.5	R_W = 0.3	R_W = 0.1	R_W = 0.5	R_W = 0.3	R_W = 0.1	R_W = 0.5	R_W = 0.3	R_W = 0.1
0	0	0	0	0	0	0	0	0	0
0.6	0.43	0.39	0.36	0.42	0.38	0.36	0.41	0.38	0.36
0.8	0.45	0.41	0.38	0.44	0.40	0.38	0.43	0.40	0.38
1.00	0.51	0.47	0.44	0.55	0.47	0.44	0.49	0.46	0.40
1.25	0.55	0.51	0.49	0.53	0.50	0.48	0.52	0.50	0.48
1.50	0.57	0.54	0.52	0.56	0.53	0.51	0.54	0.52	0.50
2.00	0.61	0.58	0.56	0.59	0.57	0.55	0.57	0.56	0.54
2.50	0.63	0.61	0.59	0.61	0.59	0.57	0.59	0.58	0.56
3.00	0.65	0.63	0.61	0.63	0.61	0.59	0.61	0.59	0.58
4.00	0.67	0.65	0.63	0.64	0.63	0.62	0.62	0.61	0.59
5.00	0.68	0.67	0.65	0.65	0.64	0.63	0.63	0.62	0.61

Lamp Data			
Sr. No.	**Type of Lamp**	**Wattage**	**Lumen output**
1.	**Fluorescent (T8/T5)**	**18 (Halo phosphate)**	**1015**
		36 (Halo phosphate)	**2450**
		18 (82/84/86)	**1300**
		36 (82/84/86)	**3250**
		28 (T5)	**2800**
2.	**CFL**	**9**	**600**
		11	**760**
		13	**920**
		18	**1200**

Data for Cable Design problem

TABLE-36

Correction factors for groups of more than one multicore cables

Multicore cables: (Factors to be applied to the values for one cable)	Number of cables								
	2	3	4	5	6	7	8	9	10
	0.80	0.70	0.65	0.60	0.57	0.52	0.48	0.45	0.43

NOTES:
1. These factors are applicable to groups of cables all of one size equally loaded, including groups bunched in more than one plane
2. Where, spacing between adjacent cables exceeds twice their overall diameter, no reduction factor need be applied

TABLE 14
IEE-Table 9D2
Current-carrying capacities and associated voltage drops for twin and multicore p.v.c. -insulated cables, non-armoured (copper conductors)

Conductor operating temperature : 70°C

Conductor Cross sectional area	Installation methods A to C †of Fig. 1 ('Enclosed')				Installation methods E to H of Fig. 1 ('Clipped direct')				Installation method K of Fig. 1 ('Defined conditions')			
	One twin cable With or without protective conductor single-phase a.c. or d.c.		One three-core cable with or without protective conductor or one four-core cable, three phase		One Twin cable With or without protective conductor single-phase a.c. or d.c.		One three-core cable with or without protective conductor or one four-core cable, three phase		One Twin cable With or without protective conductor single-phase a.c. or d.c.		One three-core cable with or without protective conductor or one four-core cable, three phase	
	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre
1	2	3	4	5	6	7	8	9	10	11	12	13
mm²	A	mV	A	mV	A	mV	A	mV	A	mV	A	mV
1.0	14	42	12	37	16	42	13	37	-	-	-	-
1.5	18	28	16	24	20	28	17	24	-	-	-	-
2.5	24	17	21	15	28	17	24	15	-	-	-	- FLAT
4	32	11	29	9.2	36	11	32	9.2	-	-	-	- CABLES
6	40	7.1	36	6.5	46	7.1	40	6.2	-	-	-	- ONLY
10	53	4.2	49	3.9	64	4.2	54	3.7	-	-	-	-
16	70	2.7	62	2.3	85	2.7	71	2.3	-	-	-	-
25	79	1.8	70	1.6	108	1.8	90	1.6	114	1.8	95	1.6
35	98	1.3	86	1.1	132	1.3	115	1.1	139	1.3	122	1.1
50	-	-	-	-	163	0.92	140	0.81	172	0.92	148	0.81
70	-	-	-	-	207	0.65 0.64	176	0.57	218	0.65 0.64	186	0.57
95	-	-	-	-	251	0.48 0.46	215	0.42	265	0.48 0.46	227	0.42
120	-	-	-	-	290	0.40 0.36	251	0.34	306	0.40 0.36	265	0.34
150	-	-	-	-	330	0.32 0.25	287	0.29	348	0.32 0.25	302	0.29
185	-	-	-	-	380	0.29 0.23	330	0.24	400	0.29 0.23	348	0.24
240	-	-	-	-	450	0.25 0.18	392	0.20	474	0.25 0.18	413	0.20
300	-	-	-	-	520	0.23 0.14	450	0.18	548	0.23 0.14	474	0.18
400	-	-	-	-	600	0.22 0.11	520	0.17	632	0.22 0.11	548	0.17

CORRECTION FACTORS

FOR AMBIENT TEMPERATURE	25°C	35°C	40°C	45°C	50°C	55°C	60°C	65°C
Ambient temperature								
Correction factor	1.06	0.94	0.87	0.79	0.71	0.61	0.50	0.35

TABLE 15
IEE-Table 9D3
Current-carrying capacities and associated voltage drops for twin and multicore armoured p.v.c. -insulated cables (copper conductors).

Conductor operating temperature : 70°C

Conductor cross sectional area	Installation method E, F and G † of Table 11 ('Clipped direct')				Installation method K of Table 11 ('Defined conditions')			
	One twin cable single phase a.c. or d.c.		One three - or- four core cable three-phase		One twin cable single phase a.c. or d.c.		One three - or- four core cable three-phase	
	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre
1	2	3	4	5	6	7	8	9
mm²	A	mV	A	mV	A	mV	A	mV
1.5	20	29	18	25	-	-	-	-
2.5	29	18	24	16	-	-	-	-
4	37	12	31	9.6	-	-	-	-
6	48	7.4	41	6.3	50	7.3	42	6.3
10	66	4.3	56	3.8	69	4.3	58	3.8
16	86	2.7	73	2.3	90	2.7	77	2.3
25	115	1.8	97	1.6	121	1.8	102	1.6
35	142	1.3	119	1.1	149	1.3	125	1.1
50	168	0.92	147	0.81	180	0.92	155	0.81
		a.c d.c.				a.c. d.c.		
70	209	0.65 0.64	180	0.57	220	0.65 0.64	190	0.57
95	257	0.48 0.46	219	0.42	270	0.48 0.46	230	0.42
120	295	0.40 0.36	257	0.34	310	0.40 0.36	270	0.34
150	337	0.32 0.25	295	0.29	355	0.32 0.25	310	0.29
185	390	0.29 0.23	333	0.24	410	0.29 0.23	350	0.24
240	461	0.25 0.18	399	0.20	485	0.25 0.18	420	0.20
300	523	0.23 0.14	451	0.18	550	0.23 0.14	475	0.18
400	589	0.22 0.11	523	0.17	620	0.22 0.11	550	0.17

CORRECTION FACTORS

FOR AMBIENT TEMPERATURE	25°C	35°C	40°C	45°C	50°C	55°C	60°C	65°C
Ambient temperature								
Correction factor	1.06	0.94	0.87	0.79	0.71	0.61	0.50	0.35