Duration: 3hour **Max. Marks: 80**

Note:- 1. Question No1 is compulsory.
2. Solve any three questions out of remaining
3. Assume data if necessary and justify the same.

==========

Q1. **Solve the following Questions** **(20 marks)**

i Explain Maximum Demand Controller
ii What are the various elements of Energy Monitoring and Targeting
iii Explain the term Coordination and Discrimination.
iv Explain Benchmarking and what are its types?

Q2 **(20 Marks)**

An office room measuring 20m (L) + 15m (B) + 5m (H) requires an average illumination of 400 lux.

A a. State the design consideration for above lighting system
b. Calculate the number of lamps required
c. Draw the lighting layout

B What are the benefits of Power factor improvement? Also explain selection and location of capacitors for same.

Q3 **(20 Marks)**

A Discuss the role of following energy efficient technologies and corresponding saving potential
(i) Energy Efficient Motor (ii) Energy Efficient Transformer

B From the data given below,
(i) Calculate the kVA rating of transformer required for the loads
(ii) Draw a single line diagram showing various metering instruments, protections and load connections

Load No.	kW Rating	LF	DF	Efficiency	Power Factor
1	800	0.8	0.8	0.75	0.7
2	600	0.85	0.6	0.8	0.85
3	300	0.7	0.7	0.9	0.95
4	400	0.6	0.5	0.8	0.75

Q4 **(20 Marks)**

A Explain Ten step Methodology for Detailed Energy Audit
B Explain step by step approach towards electrical load management.

Q5 **(20 Marks)**

A Discuss in detail procedure involved in the selection of cable conductor size and other specifications, for a cable used for connection of a motor to a control panel through a short length.
B Discuss the energy performance assessment of lighting system

Q6 **Write a short note on (any four)** **(20 Marks)**

i Advantages of lead acid batteries.
ii UPS
iii Building Management System (BMS)
iv Single line diagram
v Variable Speed Drives

****

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**

TABLE-36

Correction factors for groups of more than three single-core cables or more than one multicore cables or 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

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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	6.2	46	7.1	40	6.2	-	-	-	- ONLY
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	188	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	461	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

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TABLE 20
IEE-Table 9K1
Current-carrying capacities and associated voltage drops for single-core p.v.c. -insulated cables, non-armoured, with sheath (Aluminium conductors)

Conductor operating temperature : 70°C

Cross sectional area of conductor	Installation methods A to C † of Table 11 ('Enclosed')					Installation methods E to H of Table 11 ('Clipped direct')					Installation method J of Table 11 ('Defined conditions')					
	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.		Flat or vertical (2 cables, single-phase a.c., or d.c. or 3 or 4 cables three-phase)				Trefoil (3 cables 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
		a.c.	d.c.				a.c.	d.c.				1 ph	d.c.	3 ph.		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
mm²	A	mV	mV	A	mV	A	mV	mV	A	mV	A	mV	mV	mV	A	mV
16	60	4.5	4.5	52	3.9	72	4.5	4.5	65	3.9	-	-	-	-	-	-
25	78	2.9	2.8	67	2.5	94	2.8	2.8	85	2.5	-	-	-	-	-	-
35	96	2.1	2.0	83	1.8	115	2.1	2.0	105	1.8	-	-	-	-	-	-
50	120	1.6	1.5	100	1.4	143	1.5	1.5	123	1.3	155	1.5	1.5	1.34	140	1.3
70	150	1.2	1.0	125	1.0	181	1.1	1.0	156	0.93	190	1.1	1.0	0.95	170	0.90
95	175	0.93	0.75	150	0.80	223	0.77	0.75	192	0.69	235	0.80	0.75	0.72	205	0.67
120	205	0.80	0.60	175	0.70	261	0.62	0.60	225	0.56	275	0.65	0.60	0.60	235	0.54
150	235	0.73	0.49	200	0.64	298	0.51	0.49	259	0.48	320	0.55	0.49	0.51	270	0.45
185	-	-	-	-	-	345	0.42	0.39	290	0.40	376	0.46	0.39	0.45	310	0.37
240	-	-	-	-	-	411	0.34	0.29	361	0.34	440	0.43	0.29	0.43	370	0.30
300	-	-	-	-	-	476	0.29	0.23	419	0.30	516	0.38	0.23	0.39	435	0.25
380	-	-	-	-	-	554	0.26	0.19	465	0.28	589	0.35	0.19	0.37	490	0.22
480	-	-	-	-	-	643	0.23	0.15	541	0.26	677	0.32	0.15	0.34	570	0.20
600	-	-	-	-	-	737	0.21	0.12	616	0.24	776	0.30	0.12	0.33	649	0.18

CORRECTION FACTORS

FOR AMBIENT TEMPERATURE

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

TABLE 21
IEE-Table 9K2
Current-carrying capacities and associated voltage drops for twin and multicore armoured p.v.c. -insulated cables, non-armoured (Aluminium conductors)

Conductor operating temperature : 70°C

Conductor cross sectional area	Installation method E, to H † 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
16	62	4.5	53	3.9	65	4.5	55	3.9
25	82	2.9	70	2.5	86	2.9	74	2.5
35	102	2.1	86	1.8	107	2.1	91	1.8
50	120	1.5	106	1.3	125	1.5	110	1.3
70	150	1.1	133	0.93	158	1.1	139	0.93
95	185	0.79	163	0.68	195	0.79	172	0.68
120	-	-	190	0.54	-	-	200	0.54
150	-	-	217	0.45	-	-	227	0.45
185	-	-	247	0.37	-	-	260	0.37
240	-	-	296	0.29	-	-	311	0.29
300	-	-	340	0.25	-	-	358	0.25

CORRECTION FACTORS

FOR AMBIENT TEMPERATURE

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

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Time: 3 hour **Max. Marks: 80**

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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 clearly.

Que. 1 Attempt any four of the following:- (05-Marks each) **[20]**

a Explain is Load compensation, state its objectives.

b Explain objectives of voltage and phase angle regulator.

c What are the objectives of Series compensation?

d Explain the variable impedance type series compensation (TSSC).

e Explain power factor correction in a single phase system.

f Write a short note on the ideal load compensator.

Que. 2 a Explain midpoint voltage regulation of line segmentation. **[10]**

b Explain the factors that limit the loading capability of a transmission line. **[10]**

Que. 3 a Explain the load compensator as a phase balancing of unsymmetrical load. **[10]**

b Derive approximate formula for voltage regulation using short circuit level. **[10]**

Que. 4 a Explain switching converter type series compensator SSSC. **[10]**

b Explain voltage and current characteristics of TCR and TCR with a fixed capacitor. **[10]**

Que. 5 a Compare HVDC with FACTS. **[10]**

b Explain the Thyristor controlled phase angle regulator (TCPAR). **[10]**

Que. 6 a What is meant by reactive power biasing? Explain with V_Q characteristics. **[10]**

b Explain the basic operating principle of Unified Power Flow Controller (UPFC) with relevant diagrams. **[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 clearly.

1		Answer the following questions	**[20]**
	a	State the various laws of illumination with equation.	
	b	What are the various subsystems in LED lighting	
	c	What is DMX control.	
	d	What are the different types of luminaries.	
	e	Explain briefly circadian rhythm.	
2	a	Discuss the construction and operating characteristics of discharge lamp with figures.	**[10]**
	b	Discuss the various optical control techniques.	**[10]**
3	a	Discuss the designing of lighting system for retail store.	**[10]**
	b	State the various factors to be considered in selection and placement of lamps.	**[10]**
4	a	Discuss the design and calculations of exterior sports lighting system.	**[10]**
	b	Discuss the various smart lighting fixtures.	**[10]**
5	a	Discuss the various driver circuits used for LED system with figure.	**[10]**
	b	Discus the tun able white lighting system with LED.	**[10]**
6	a	Discuss the solar powered LED lighting system.	**[10]**
	b	Discuss the measurement of lamp efficacy.	**[10]**

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Duration: 3 Hours **[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 clearly.

Q1 Attempt any FOUR **[20]**

a Explain Lead Time in PJM Method.

b State the objectives of Generation System Planning?

c Explain any one type of outage with suitable state space diagram?

d Explain weather load model?

e Differentiate between long term & short-term planning?

Q2 a Categorize loads in power system? Explain load growth characteristics of various loads? **[10]**

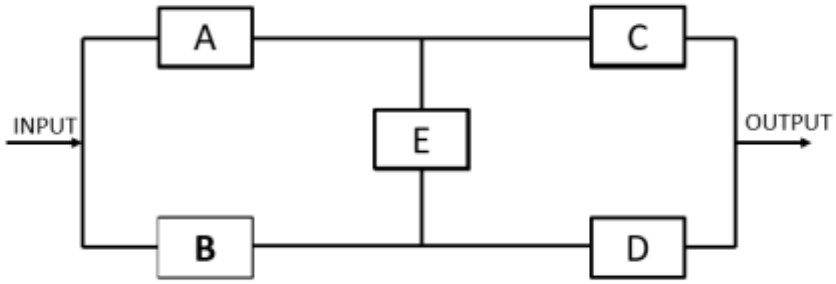
b Explain the duties of power system engineer in short term, long term and medium-term planning. **[10]**

Q3 a Explain different mathematical approaches to load forecasting? **[10]**

b Explain two state model of reliability and show that MTTF is reciprocal of failure rate. **[10]**

Q4 a Explain Individual Load Point Indices and System Load Point Indices. **[10]**

b Evaluate a general expression for system success and the reliability of the system if each component has reliability of 0.99. **[10]**



Q5 a A generating system have one generator of 25 MW and 2 generators of 50 MW with FOR 0.02. Prepare capacity outage table with the help of a recursive algorithm? **[10]**

b Explain Bath-tub curve in detail? **[10]**

Q6 a Explain modified PJM method? **[10]**

b Write short note on **[10]**

1. Area Risk curve and 2. Outage Replace Rate

****

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

N.B.: -

1. **Question Number 1 is Compulsory**
2. **Solve any three questions out of Remaining questions**
3. **Assume suitable data if required and mention it clearly**
4. **Figures to right indicate full marks**

Q.1 Solve **any four** questions

[A] Explain need of IPR in brief **5**

[B] Explain what do you mean by Geographical Indications? What is it's purpose? **5**

[C] What do you mean by patent search? Explain in brief. **5**

[D] Explain in brief history of IPR in India **5**

[E] What do you mean by patentable and non-patentable inventions. Explain in brief

[F] Write short note on Transfer of technology.

Q.2 [A] Describe the various international organizations active in IPR enforcement. **10**

[B] What do you mean by Process patent and Product Patent. Explain with help of suitable example **10**

Q.3 [A] Explain salient features if Indian Patent act. **10**

[B] Explain following concepts: - **10**

i. Patent Litigation

ii. Patent Infringement

Q.4 [A] What are the different challenges for IP in e-commerce? **10**

[B] Explain process of drafting and Filing patents **10**

Q.5 [A] Explain the factors that lead to and maintain the existence of counterfeiting and piracy. Explain the approach that can be taken to solve this problem. **10**

[B] Explain salient features of TRIPS agreement and Paris Convention **10**

Q.6 Write short notes on: -

[A] Patent Databases. **10**

[B] Conditions of patentability. **10**

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