



# CAPITAL SCHOOL OF ENGINEERING

PLOT NO. 1288, MAHATAPALLA, BAJAPUR, KHURDA, PIN-752060

Session: 2023-2024

Course Name: DIPLOMA

Branch Name: ELECTRICAL

Theory/Practical: Theory

Subject Name: Th.2: Switch Gear And Protective Devices

Section : A

Teacher Name: SUBHASISH MOHANTY

Semester : 6

Credit " External Evaluation(Marked) '80' Internal Evaluation(Marked) '20'

## Text Books:

Sl.No	Text Books
1	V. K. Mehta S Chand

## Reference books:

Sl.No	Reference books
1	Soni, Gupta and Bhatnagar

## Course Outcomes:

Sl.No	Course Outcomes
1	The basic principles of protection of alternator, transformer and feeders.
2	The basic principles of protection of alternator, transformer and feeders.
3	Fuse and Circuit breaker.
4	Fuse and Circuit breaker.
5	Protective Relay
6	Lighting Arrestor.
7	Calculation of symmetrical fault current.

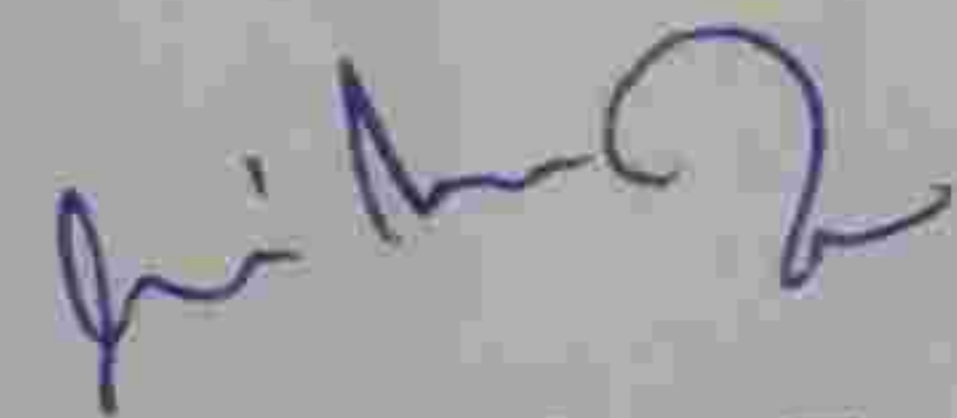
SL No.	Lecture No.	Module/Unit No.	Topic To Be Taught	Cos	Reference Material Links
1	1	INTRODUCTION TO SWITCHGEAR	Essential Features of switchgear, Switchgear Equipment	Cos 1	
2	2	INTRODUCTION TO SWITCHGEAR	Bus-Bar Arrangement	Cos 1	
3	3	INTRODUCTION TO SWITCHGEAR	Switchgear Accommodation	Cos 1	
4	4	INTRODUCTION TO SWITCHGEAR	Short Circuit	Cos 1	
5	5	INTRODUCTION TO SWITCHGEAR	Faults in a power system	Cos 1	
6	6	FAULT CALCULATION	Symmetrical faults on 3-phase system	Cos 1	
7	7	FAULT CALCULATION	Limitation of fault current	Cos 1	

SL No.	Lecture No.	Module/Unit No.	Topic To Be Taught	Cos	Reference Material Links
8	8	FAULT CALCULATION	Percentage Reactance.	Cos 1	
9	9	FAULT CALCULATION	Percentage Reactance and base KVA	Cos 1	
10	10	FAULT CALCULATION	Short – circuit KVA	Cos 1	
11	11	FAULT CALCULATION	Reactor control of short circuit currents	Cos 1	
12	12	FAULT CALCULATION	Location of reactors	Cos 1	
13	13	FAULT CALCULATION	Steps for symmetrical Fault calculations	Cos 1	
14	14	FAULT CALCULATION	Solve numerical problems on symmetrical fault	Cos 1	
15	15	FUSES	Desirable characteristics of fuse element	Cos 3	
16	16	FUSES	Fuse Element materials	Cos 3	
17	17	FUSES	Types of Fuses and important terms used for fuses	Cos 3	
18	18	FUSES	Low and High voltage fuses	Cos 3	
19	19	FUSES	Current carrying capacity of fuse element	Cos 3	
20	20	FUSES	Difference Between a Fuse and Circuit Breaker	Cos 3	
21	21	CIRCUIT BREAKERS	Definition and principle of Circuit Breaker	Cos 4	
22	22	CIRCUIT BREAKERS	Arc phenomenon and principle of Arc Extinction , Methods of Arc Extinction	Cos 4	
23	23	CIRCUIT BREAKERS	Definitions of Arc voltage, Re-striking voltage and Recovery voltage	Cos 4	
24	24	CIRCUIT BREAKERS	Classification of circuit Breakers., Oil circuit Breaker and its classification	Cos 4	

SL No.	Lecture No.	Module/Unit No.	Topic To Be Taught	Cos	Reference Material Links
25	25	CIRCUIT BREAKERS	Plain brake oil circuit breaker , Arc control oil circuit breaker	Cos 4	
26	26	CIRCUIT BREAKERS	Low oil circuit breaker., Maintenance of oil circuit breaker	Cos 4	
27	27	CIRCUIT BREAKERS	Low oil circuit breaker. 4.10 Maintenance of oil circuit breaker	Cos 4	
28	28	CIRCUIT BREAKERS	Sulphur Hexa-fluoride (SF6) circuit breaker , Vacuum circuit breakers	Cos 4	
29	29	CIRCUIT BREAKERS	Switchgear component. , Problems of circuit interruption	Cos 4	
30	30	CIRCUIT BREAKERS	Resistance switching , Circuit Breaker Rating	Cos 4	
31	31	PROTECTIVE RELAYS	Definition of Protective Relay. , Fundamental requirement of protective relay	Cos 5	
32	32	PROTECTIVE RELAYS	Basic Relay operation	Cos 5	
33	33	PROTECTIVE RELAYS	Electromagnetic Attraction type , Induction type	Cos 5	
34	34	PROTECTIVE RELAYS	Pick-up current , Current setting	Cos 5	
35	35	PROTECTIVE RELAYS	Plug setting Multiplier., Time setting Multiplier	Cos 5	
36	36	PROTECTIVE RELAYS	Classification of functional relays , Induction type over current relay (Non-directiona	Cos 5	
37	37	PROTECTIVE RELAYS	Induction type directional power relay	Cos 5	
38	38	PROTECTIVE RELAYS	Induction type directional over current relay, Differential relay	Cos 5	
39	39	PROTECTION OF	Protection of	Cos 6	

SL No.	Lecture No.	Module/Unit No.	Topic To Be Taught	Cos	Reference Material Links
		ELECTRICAL POWER EQUIPMENT AND LINES	alternator , Differential protection of alternators		
40	40	PROTECTION OF ELECTRICAL POWER EQUIPMENT AND LINES	Balanced earth fault protection , Protection systems for transformer	Cos 6	
41	41	PROTECTION OF ELECTRICAL POWER EQUIPMENT AND LINES	Buchholz relay , Protection of Bus bar	Cos 6	
42	42	PROTECTION OF ELECTRICAL POWER EQUIPMENT AND LINES	Protection of Transmission line, Different pilot wire protection	Cos 6	
43	43	PROTECTION OF ELECTRICAL POWER EQUIPMENT AND LINES	Explain protection of feeder by over current and earth fault relay	Cos 6	
44	44	PROTECTION AGAINST OVER VOLTAGE AND LIGHTING	Voltage surge and causes of over voltage	Cos 6	
45	45	PROTECTION AGAINST OVER VOLTAGE AND LIGHTING	Internal cause of over voltage	Cos 6	
46	46	PROTECTION AGAINST OVER VOLTAGE AND LIGHTING	External cause of over voltage (lighting)	Cos 6	
47	47	PROTECTION AGAINST OVER VOLTAGE AND LIGHTING	Mechanism of lightning discharge	Cos 6	
48	48	PROTECTION AGAINST OVER VOLTAGE AND LIGHTING	Types of lightning strokes., Harmful effect of lightning	Cos 6	
49	49	PROTECTION AGAINST OVER VOLTAGE AND LIGHTING	Rod-gap lightning arrester. , Horn-gap arrester	Cos 6	

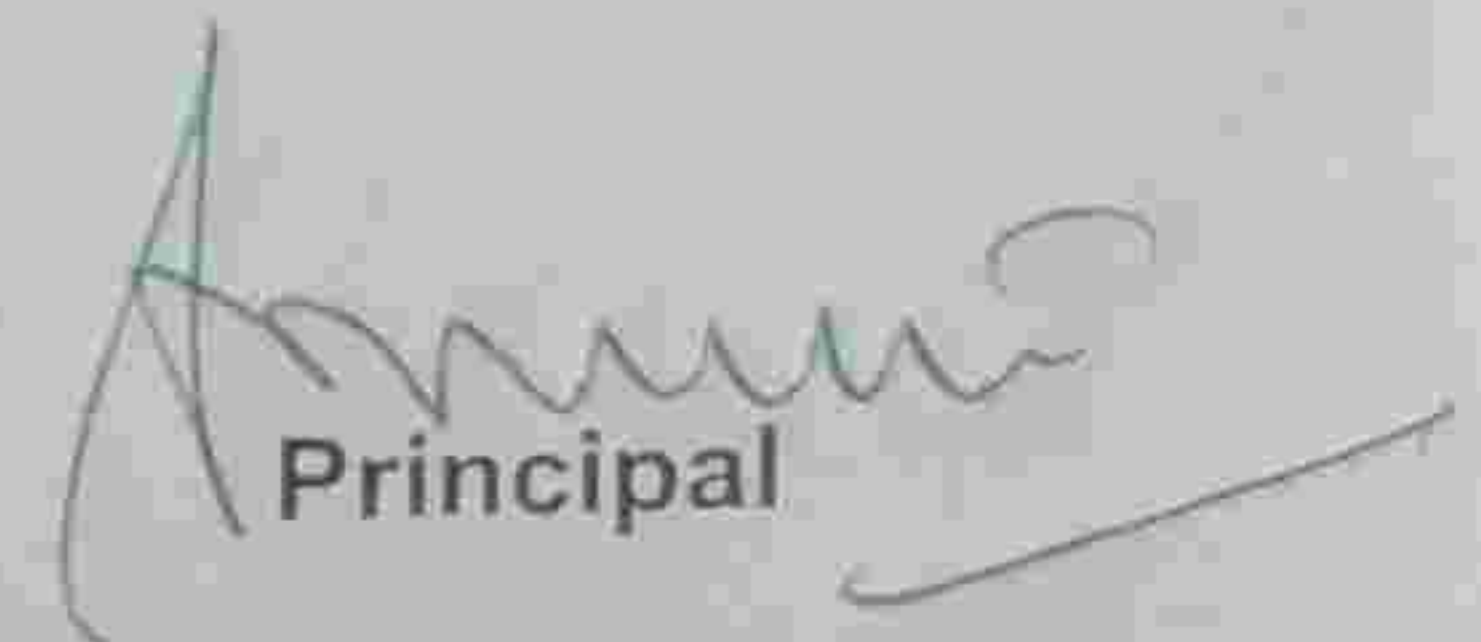
SL No.	Lecture No.	Module/Unit No.	Topic To Be Taught	Cos	Reference Material Links
50	50	PROTECTION AGAINST OVER VOLTAGE AND LIGHTING	Valve type arrester	Cos 6	
51	51	PROTECTION AGAINST OVER VOLTAGE AND LIGHTING	Surge Absorber	Cos 6	
52	52	STATIC RELAY:	Advantage of static relay	Cos 6	
53	53	STATIC RELAY:	Advantage of static relay	Cos 6	
54	54	STATIC RELAY:	Advantage of static relay	Cos 6	
55	55	STATIC RELAY:	Principle of IDMT relay	Cos 6	



Subject Teacher



HOD



Principal



# CAPITAL SCHOOL OF ENGINEERING

PLOT NO. 1288, MAHATAPALLA, BAJAPUR, KHURDA, PIN-752060

Session: 2023-2024

Course Name: DIPLOMA

Theory/Practical: Theory

Section : A

Semester : 6

Branch Name: ELECTRICAL

Subject Name: Th.3 : Control System Engineering

Teacher Name: GOPAL CH MARTHA

Credit " External Evaluation(Marked) '80' Internal Evaluation(Marked) '20'

## Text Books:

Sl.No	Text Books
1	Control system Engineering I. J. Nagarath, M. Gopal WEN

## Reference books:

Sl.No	Reference books
1	Control system Engineering I. J. Nagarath, M. Gopal WEN
2	Control Systems S P Eugene Xavier, J Joseph Cyril Babu S Chand


## Course Outcomes:

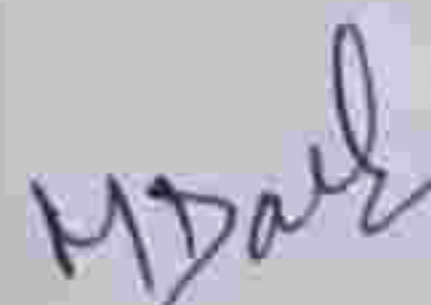
Sl.No	Course Outcomes
1	Acquire knowledge about Mathematical modeling, Block diagram algebra, signal flow graphs and control system components
2	Ability to deal with time response analysis of various systems.
3	Finding out steady state error and error constants
4	Acquire knowledge about the analysis of stability in Root locus technique
5	Learning about frequency response analysis of control system.
6	To use Bode plot and Nyquist plot for judgments about stability of a system.

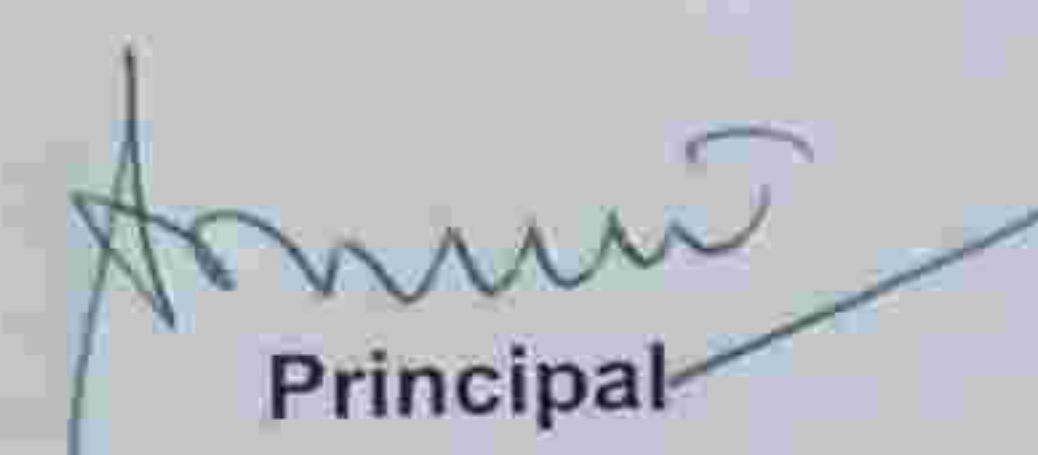
SL No.	Lecture No.	Module/Unit No.	Topic To Be Taught	Cos	Reference Material Links
1	1	1	Classification of Control system	Cos --Select--	
2	2	1	Open loop system & Closed loop system and its comparison	Cos --Select--	
3	3	1	Effects of Feed back	Cos --Select--	
4	4	1	Standard test Signals(Step, Ramp, Parabolic, Impulse Functions) Servomechanism	Cos 1	
5	5	2	Transfer Function & Impulse response, 2.2. Properties, Advantages &	Cos 2	

SL No.	Lecture No.	Module/Unit No.	Topic To Be Taught	Cos	Reference Material Links
			with: . Unit step respons, Unit impulse response.		
26	26	5	Time response specification.	Cos 5	
27	27	5	Derivation of expression for rise time, peak time, peak overshoot, settling time and steady state error.	Cos 5	
28	28	5	Steady state error and error constants.	Cos 5	
29	29	5	Types of control system.[ Steady state errors in Type-0, Type-1, Type-2 system]	Cos 5	
30	30	5	Effect of adding poles and zero to transfer function. 5 . 7 Response with P, PI, PD and PID controller.	Cos 5	
31	31	6	ANALYSIS OF STABILITY BY ROOT LOCUS TECHNIQUE.	Cos 6	
32	32	6	Root locus concept.	Cos 6	
33	33	6	Construction of root loci	Cos 6	
34	34	6	Rules for construction of the root locus.	Cos 6	
35	35	6	Effect of adding poles and zeros to $G(s)$ and $H(s)$ .	Cos 6	
36	36	6	Numeric about root locus	Cos 6	
37	37	6	Numeric about root locus	Cos 6	
38	38	7	Root locus concept.	Cos 6	
39	39	7	Fundamental about FREQUENCY RESPONSE ANALYSIS.	Cos 6	
40	40	7	Correlation between time response and frequency response.	Cos 6	

SL No.	Lecture No.	Module/Unit No.	Topic To Be Taught	Cos	Reference Material Links
41	41	7	Polar plots.	Cos 6	
42	42	7	Bode plots.	Cos 6	
43	43	7	Procedure for Polar plots.	Cos 6	
44	44	7	Procedure for Bode plots	Cos 6	
45	45	7	All pass and minimum phase system	Cos 6	
46	46	7	Computation of Gain margin and phase margin.	Cos 6	
47	47	7	Log magnitude versus phase plot	Cos 6	
48	48	7	Closed loop frequency response.	Cos 6	
49	49	7	Numeric about polar plot	Cos 6	
50	50	7	Numeric about bode plot	Cos 6	
51	51	8	Fundamental about NYQUIST PLOT	Cos 6	
52	52	8	Principle of argument.	Cos 6	
53	53	8	Nyquist stability criterion	Cos 6	
54	54	8	Nyquist stability criterion applied to inverse polar plot.	Cos 6	
55	55	8	Effect of addition of poles and zeros to $G(S)H(S)$ on the shape of Nyquist plot.	Cos 6	
56	56	8	Assessment of relative stability.	Cos 6	
57	57	8	Constant M and N circle	Cos 6	
58	58	8	Constant M and N circle	Cos 6	
59	59	8	Numeric about Nyquist stability	Cos 6	
60	60	8	Numeric about Nyquist stability	Cos 6	

  
Subject Teacher

  
HOD

  
Principal





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Session: 2023-2024

Course Name: DIPLOMA  
Theory/Practical: Theory  
Section : A  
Semester : 6

Branch Name: ELECTRICAL  
Subject Name: Th.4: Renewable Energy  
Teacher Name: ARATI PRIYADARSINI SAHOO

Credit " External Evaluation(Marked) '80' Internal Evaluation(Marked) '20'

## Text Books:

Sl.No	Text Books
1	D.P.Kothari, K.C Singal

## Reference books:

Sl.No	Reference books
1	B.H.Khan


## Course Outcomes:


Sl.No	Course Outcomes
1	Power production from pollution free forces
2	Solar energy conversion is noiseless and cheap
3	environment friendly resources
4	Production of power form nature at free of cost
5	Production of power form nature at free of cost


SL No.	Lecture No.	Module/Unit No.	Topic To Be Taught	Cos	Reference Material Links
1	1	Introduction to Renewable energy	Environmental consequences of fossil fuel use	Cos 1	
2	2	Introduction to Renewable energy	Importance of renewable sources of energy. , Sustainable Design and development.	Cos 1	
3	3	Introduction to Renewable energy	Types of RE sources. , Limitations of RE sources.	Cos 1	
4	4	Introduction to Renewable energy	Present Indian and international energy scenario of conventional and RE sources	Cos 1	
5	5	Solar Energy	Solar photovoltaic system-Operating principle	Cos 2	

SL No.	Lecture No.	Module/Unit No.	Topic To Be Taught	Cos	Reference Material Links
6	6	Solar Energy	Photovoltaic cell concepts	Cos 2	
7	7	Solar Energy	Cell, module, array, Series and parallel connections. Maximum power point	Cos 2	
8	8	Solar Energy	Classification of energy Sources	Cos 2	
9	9	Solar Energy	Extra-terrestrial and terrestrial Radiation	Cos 2	
10	10	Solar Energy	Azimuth angle, Zenith angle	Cos 2	
11	11	Solar Energy	Hour angle, Irradiance, Solar constant	Cos 2	
12	12	Solar Energy	Solar collectors, Types and performance characteristics	Cos 2	
13	13	Solar Energy	Applications: Photovoltaic - battery charger, domestic lighting	Cos 2	
14	14	Solar Energy	street lighting, water pumping	Cos 2	
15	15	Wind Energy	Introduction to Wind energy	Cos 3	
16	16	Wind Energy	Wind energy conversion	Cos 3	
17	17	Wind Energy	Types of wind turbines	Cos 3	
18	18	Wind Energy	Aerodynamics of wind rotors	Cos 3	
19	19	Wind Energy	Wind turbine control systems; conversion to electrical power	Cos 3	
20	20	Wind Energy	Induction and synchronous generators	Cos 3	
21	21	Wind Energy	Grid connected and self excited induction generator operation	Cos 3	
22	22	Wind Energy	Constant voltage and constant frequency generation with power electronic control	Cos 3	
23	23	Wind Energy	Single and double	Cos 3	

SL No.	Lecture No.	Module/Unit No.	Topic To Be Taught	Cos	Reference Material Links
			output systems		
24	24	Wind Energy	Characteristics of wind power plant	Cos 3	
25	25	Biomass Power	Energy from Biomass	Cos 4	
26	26	Biomass Power	Biomass as Renewable Energy Source	Cos 4	
27	27	Biomass Power	Types of Biomass Fuels - Solid, Liquid and Gas	Cos 4	
28	28	Biomass Power	Combustion and fermentation	Cos 4	
29	29	Biomass Power	Anaerobic digestion	Cos 4	
30	30	Biomass Power	Types of biogas digester	Cos 4	
31	31	Biomass Power	Wood gassifier	Cos 4	
32	32	Biomass Power	Pyrolysis	Cos 4	
33	33	Biomass Power	Applications: Bio gas	Cos 4	
34	34	Biomass Power	Bio diesel	Cos 4	
35	35	Other Energy Sources	Tidal Energy	Cos 5	
36	36	Other Energy Sources	Energy from the tides, Barrage	Cos 5	
37	37	Other Energy Sources	Non Barrage Tidal power system	Cos 5	
38	38	Other Energy Sources	Ocean Thermal Energy Conversion (OTEC)	Cos 5	
39	39	Other Energy Sources	Geothermal Energy – Classification	Cos 5	
40	40	Other Energy Sources	Hybrid Energy Systems	Cos 5	
41	41	Other Energy Sources	Need for Hybrid Systems	Cos 5	
42	42	Other Energy Sources	Diesel-PV, Wind-PV, Microhydel-PV	Cos 5	
43	43	Other Energy Sources	Microhydel-PV	Cos 5	
44	44	Other Energy Sources	Electric and hybrid electric vehicles	Cos 5	

  
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