GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
Department of Electrical and Electronics Engineering

Course Title: POWER GENERATION AND TRANSMISSION (GR20A2033)

Following documents are available in Course File.

S.No.	Points	Yes	No
1	Institute and Department Vision and Mission Statements	Y	
2	PEO & PO Mapping	Y	
3	Academic Calendar	Y	
4	Syllabus Copy	Y	
5	Course Outcomes	Y	
6	CO-PO Mapping	Y	
7	Course Schedule	Y	
8	Course Unit Schedule	Y	
9	Guidelines to Study Course and Teaching Strategic Plan	Y	
10	Lecture Notes (Soft Copy of Notes/PPT/Slides)	Y	
11	Tutorial/Assignment Sheets with Solution	Y	
12	Best, Average and Weak Answer Scripts for Each Sessional Exam.	Y	
13	Sessional Question Paper and Scheme of Evaluation (Internal and External)	Y	
14	Previous University Question Papers	Y	
15	Result Analysis	Y	
16	Feedback from Students	Y	
17	Course Exit Survey		N
18	CO Attainment for All Mids.	Y	
19	CO-Cognitive Level Mapping	Y	
20	Remedial Action plan.		N

Dr. V Vijaya Ramaraju
Professor
EEE Department

HOD,EEE

Vision of the Institute

To be among the best of the institutions for engineers and technologists with attitudes, skills and knowledge and to become an epicenter of creative solutions.

Mission of the Institute

To achieve and impart quality education with an emphasis on practical skills and social relevance.

Vision of the Department

To impart technical knowledge and skills required to succeed in life, career and help society to achieve self-sufficiency.

Mission of the Department

- To become an internationally leading department for higher learning.
- To build upon the culture and values of universal science and contemporary education.
- To be a center of research and education generating knowledge and technologies which lay groundwork in shaping the future in the fields of electrical and electronics engineering.
- To develop partnership with industrial, R&D and government agencies and actively participate in conferences, technical and community activities.

Program Educational Objectives (B.Tech-EEE)

This programme is meant to prepare our students to professionally thrive and to lead. During their progression:

PEO-1: Graduates will have a successful technical or professional career, including supportive and leadership roles on multidisciplinary teams.

PEO-2: Graduates will be able to acquire, use and develop skills as required for effective professional practices.

PEO-3: Graduates will be able to attain holistic education that is an essential prerequisite for being a responsible member of society.

PEO-4: Graduates will be engaged in life-long learning, to remain abreast in their profession and be leaders in our technologically vibrant society.

Program Outcomes (B.Tech-EEE)

a. Ability to apply knowledge of mathematics, science, and engineering.

b. Ability to design and conduct experiments, as well as to analyze and interpret data.

c. Ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

d. Ability to function on multi-disciplinary teams.

e. Ability to identify, formulates, and solves engineering problems.

f. Understanding of professional and ethical responsibility.

g. Ability to communicate effectively.

h. Broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

i. Recognition of the need for, and an ability to engage in life-long learning.

j. Knowledge of contemporary issues.

k. Ability to utilize experimental, statistical and computational methods and tools necessary for engineering practice.

l. Graduates will demonstrate an ability to design electrical and electronic circuits, power electronics, power systems; electrical machines analyze and interpret data and also an ability to design digital and analog systems and programming them.

Program Specific Outcomes(PSOs):

PSO-1: Graduates will interpret data and able to analyze digital and analog systems related to electrical and programming them.

PSO-2: Graduates will able to demonstrate, design and model electrical, electronic circuits, power electronics, power systems and electrical machines.

Program Educational Objectives (PEOs) - Program Outcomes (POs)
Relationship Matrix

	POs	a	b	c	d	e	f	g	h	i	j	k	l	pso1	pso2
PEOs	PEO 1: Graduates will have a successful technical or professional career, including supportive and leadership roles on multidisciplinary teams.	M	M	H		H			H	H		H	H	H	M
	PEO 2: Graduates will be able to acquire, use and develop skills as required for effective professional practices.	H		M	M	H	H	H			H		H	M	H
	PEO 3: Graduates will be able to attain holistic education that is an essential prerequisite for being a responsible member of society.	M	H	H		H	H	M	M	M	M	H	H	M	H
	PEO 4: Graduates will be engaged in life-long learning, to remain abreast in their profession and be leaders in our technologically vibrant society.		H		M	M	H	M	H	H		M	H	H	H

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090, India

GRIET/DAA/1H/G/22-23 09 May 2022

Academic Year 2022-23

II B.Tech. – First Semester

S. No.	EVENT	PERIOD	DURATION
1	Commencement of First Semester class work	10-10-2022	
2	I Spell of Instructions	10-10-2022 to 07-12-2022	9 Weeks
3	I Mid-term Examinations	08-12-2022 to 12-12-2022	3 Days
4	II Spell of Instructions	13-12-2022 to 07-02-2023	8 Weeks
5	II Mid-term Examinations	08-02-2023 to 10-02-2023	3 Days
6	Preparation/Break	11-02-2023 to 17-02-2023	1 Week
7	End Semester Examinations (Theory/ Practical) Regular/ Supplementary	20-02-2023 to 11-03-2023	3 Weeks
8	Commencement of Second Semester, AY 2022-23	13-03-2023	

II B.Tech. – Second Semester

S. No.	EVENT	PERIOD	DURATION
1	Commencement of II Semester class work	13-03-2023	
2	I Spell of Instructions	13-03-2023 to 29-04-2023	7 Weeks
3	Summer Vacation	01-05-2023 to 13-05-2023	2 Weeks
4	I Spell of Instructions Contd	15-05-2023 to 27-05-2023	2 Weeks
5	I Mid-term Examinations	29-05-2023 to 31-05-2023	3 Days
6	II Spell of Instructions	01-06-2023 to 31-07-2023	8 Weeks
7	II Mid-term Examinations	01-08-2023 to 03-08-2023	3 Days
8	Preparation	04-08-2023 to 10-08-2023	1 Week
9	End Semester Examinations (Theory/ Practical) Regular / Supplementary	11-08-2023 to 31-08-2023	3 Weeks
10	Commencement of III B.Tech First Semester, AY 2023-24	01-09-2023	

Dean Academic Affairs

Copy to Principal, All HoDs, CoE

Gokaraju Rangaraju Institute of Engineering and Technology

Department of Electrical and Electronics Engineering

2022 -23 I sem Subject allocation sheet

II YEAR(GR20)	Section-A	
Electrical Circuit Analysis	G Sandhya Rani	
Principles of Analog Electronics	P Ravikanth	
DC Machines and Transformers	Dr Phaneedra Babu B	
Electromagnetic Fields	Dr T Suresh Kumar	
Power Generation and Transmission	V Vijaya Rama Raju	
Java Programming for Engine	CSE Dept. Staff	
Constitution of India	D Karuna Kumar	
Value Ethics and Gender Culture	M Prashanth	
Principles of Analog Electronics Lab	U Vijaya Lakshmi/ M Prashanth	
DC Machines and Transformers Lab	V Vijaya Rama Raju / M Rekha	
III YEAR (GR20)	Section-A	
Power System Analysis	Dr J Sridevi	
Power Electronics	Dr Pakkiraiah B	
Microproces sors and Microcontrol lers	Dr D Raveedhra	
Electrical and Hybrid Vehicles (PE-1)	Dr D G Padhan	
Cloud Computing (NPTEL)	P Ravikanth	
Power Systems Lab	Dr J Sridevi / V Usha Rani/ U Vijaya Lakshmi	
Power Electronics Lab	Dr Pakkiraiah B/ G Sandhya Rani	
Microproces sors and Microcontrol lers Lab	Dr P Srividya Devi/ M N Sandhya Rani	
IV YEAR(GR18)	Section-A	Section-B
Power Systems – III	Dr P Srividya Devi	P Prashanth Kumar
Electronics Design	Dr D S N M Rao	Dr D S N M Rao
Electrical and Hybrid Vehicles (PE-III)	D Srinivasa Rao	D Srinivasa Rao
High Voltage Engineering (PE-IV)	A Vinay Kumar	A Vinay Kumar
Robotics	Anitha (Mech)	
Database Management Systems	D Swathi (CSE)	
Electronics Design Lab	P Ravikanth /Dr DSNM Rao	D Karuna Kumar/ V Usha Rani
Project work - (PhaseI)	A Vinay Kumar/ D Srinivasa Rao	M N Sandhya Rani / G Sandhya Rani
I/I BEE(GR20)	Theory	LAB

EEE (1) BEE	R Anil Kumar/ P Praveen Kumar / P Prashanth Kumar/ K Sudha
ECE (3) BEE	
IT (3) BEE	
CSBS (1) PEE	
Design Thinking	Dr D G Padhan
Mech II/I (GR20)	A
BEEE	M N Sandhya Rani

Dr Phaneendra Babu B
HOD,EEE

Gokaraju Rangaraju Institute of Engineering and Technology

Department of Electrical and Electronics Engineering

GRIET/PRIN/06/G/01/22-23 **Wef : 10th Oct 2022**

BTech - EEE - A **II Year - I Semester**

DAY/ HOUR	08:50 - 09:40	09:40 - 10:30	10:30 - 11:20	11:20 - 12:00	12:00 - 12:55	12:55 - 01:50	01:50 - 02:45
MONDAY	EMF		PAE	BREAK	PGT	VEGS	
TUESDAY	ECA		PGT		DCMT Lab/PAE Lab (A1/A2)		
WEDNESDAY	ECA	DCMT			PAE		EMF
THURSDAY	EMF	DCMT			DCMT Lab/PAE Lab (A2/A1)		
FRIDAY	PAE	ECA			EMF	PGT	
SATURDAY	CI		PGT		PAE	JPE	

ROOM NO	
Theory/Tutorial	4401
Lab	PAE Lab-4505 DCMT Lab-2106/07
Class Incharge:	D. Karuna Kumar

Subject Code	Subject Name	Faculty Code	Faculty Name
GR20A2023	Electrical Circuit Analysis	GSR	G. Sandhya Rani
GR20A2024	Principles of Analog Electronics	PRK	P. Ravikanth
GR20A2025	DC Machines and Transformers	Dr PBB	Dr B. Phaneendra Babu
GR20A2026	Electromagnetic Fields	Dr TSK	Dr. T. Suresh Kumar
GR20A2033	Power Generation and Transmission	VVRR	V. Vijayarama Raju
GR20A2028	Java Programming for Engineers	DP	D. Preethi
GR20A2029	Principles of Analog Electronics Lab	UVL/MP	U. Vijaya Lakshmi/ M. Prashanth
GR20A2030	DC Machines and Transformers Lab	VVRR/MRE	V. Vijayarama Raju/ M. Rekha
GR20A2003	Constitution of India (CI)	DKK	D. Karuna Kumar
GR20A2002	Value Ethics and Gender Culture	MP	M. Prashanth

Almanac	
1st Spell of Instructions	10/10/2022 to 07/12/2022
1st Mid-term Examinations	08/12/2022 to 12/12/2022
2nd Spell of Instructions	13/12/2022 to 07/02/2023
2nd Mid-term Examinations	08/02/2023 to 10/02/2023
Preparation	11/02/2023 to 17/02/2023
End Semester Examinations (Theory/ Practicals) Regular / Supplementary	20/02/2023 to 11/03/2023
Commencement of Second Semester, A.Y 2021-22	13/03/2023

Time Table Coordinator **HOD** **DAA**

Syllabus – POWER GENERATION AND TRANSMISSION

COURSECODE:GR20A2033 **LTPC**
II Year I Semester **3 0 0 3**

UNIT-I: GENERATION OF ELECTRIC POWER Conventional Sources (Qualitative): Hydro station, Steam Power Plant, Nuclear Power Plant and Gas Turbine Plant. Non-Conventional Sources (Qualitative): Ocean Energy, Tidal Energy, Wave Energy, wind Energy, Fuel Cells, and Solar Energy, Cogeneration and energy conservation and storage.

UNIT-II: ECONOMICS OF POWER GENERATION Introduction, definitions of connected load, maximum demand, demand factor, load factor, diversity factor, Load duration curve, number and size of generator units. Base load and peak load plants. Cost of electrical energy-fixed cost, running cost, Tariff on charge to customer.

UNIT-III: TRANSMISSION LINE PARAMETERS AND PERFORMANCE Line conductors, inductance and capacitance of single phase and three phase lines with symmetrical and unsymmetrical spacing, Composite conductors-transposition, bundled conductors, and effect of earth on capacitance. Representation of lines, short transmission lines, medium length lines, nominal T and PI- representations, long transmission lines. The equivalent circuit representation of a long Line, A, B, C, D constants, Ferranti Effect. Sending end and receiving end power circle diagrams.

UNIT-IV: MECHANICAL DESIGN OF OVERHEAD TRANSMISSION LINES AND CORONA Tension and sag calculations, Factors affecting Sag, Sag template, Stringing charts, Vibrations and vibration damper. Corona: Introduction, disruptive critical voltage, corona loss, Factors affecting corona loss and methods of reducing corona loss, Disadvantages of corona, interference between power and Communication lines.

UNIT-V: OVERHEAD LINE INSULATORS & INSULATED CABLES Introduction, types of insulators, Potential distribution over a string of suspension insulators, Methods of equalizing the potential, testing of insulators. Introduction, insulation, insulating materials, Under-Ground Cables: Types of Cables, grading of cables, insulation resistance of a cable, Capacitance of a single core and three core cables, Overhead lines versus underground cables, types of cables.

TEXT BOOKS:

1. A Text Book on Power Systems Engineering by Sony, Gupta, Bhatnagar and Chakrabarti, Dhanapatrai& Co.
2. C.L. Wadhwa Generation, Distribution and Utilization of Electrical Energy, Second Edition, New AgeInternational,2009
3. C.L.Wadhwa " Electrical Power systems:New age Publishers 7th Edition 2017

REFERENCE BOOKS:

1. H.Cotton& H. Barber-The Transmission and Distribution of Electrical Energy, Third Edition, ELBS,B.I.Pub.,1985
2. Power generation technologies by Paul Breeze, Third Edition, Elsevier Publishers 2019

S.No	Course Outcomes
1	Explain the basic concepts of Power Generation.
2	Calculate economics of power generation.
3	Recall various power system components, line models and its performance.
4	Outline the different concepts related to mechanical design of transmission lines and corona
5	Demonstrate on overhead lines insulator and cables

COURSE OUTCOME AND PROGRAM OUTCOME MAPPING

		P-Outcomes **C-Outcomes**	a	B	c	d	e	f	g	h	i	j	k	l
GR20A2033	**POWER GENERATION AND TRANSMISSIONs**	1.Explain the basic concepts of Power Generation.	H	H	M	M		H	H	H			H	M
		2.Calculate economics of power generation.		H	H	M	M	H	H	M	H	M	H	H
		3.Recall various power system components, line models and its performance.	H		H	M		H		M	H		H	H
		4.Outline the different concepts related to mechanical design of transmission lines and corona		H	H	M		H	M	M	H		H	H
		5.Demonstrate on overhead lines insulator and cables	H	H	H	M		H		M	H		H	H

Academic **Y**ear : **2022-23**

Semester : **I**

Name of the Program: **B.Tech-EEE** Year: **II** Section: **A**

Course/Subject: **POWER GENERATION AND TRANSMISSION** Course Code: **GR20A2033**

Name of the Faculty: **Dr.V VIJAYA RAMA RAJU** Designation :**PROFESSOR.**

Department: **ELECTRICAL AND ELECTRONICS ENGINEERING**

The Schedule for the whole Course / Subject is:

S. No.	Description	Total number of Periods
1	Unit-I: GENERATION OF ELECTRIC POWER	10
2	Unit-II: ECONOMICS OF POWER GENERATION	12
3	Unit-III: TRANSMISSION LINE PARAMETERS AND PERFORMANCE	14
4	Unit-IV: MECHANICAL DESIGN OF OVERHEAD TRANSMISSION LINES AND CORONA	12
5	Unit-V: OVERHEAD LINE INSULATORS & INSULATED CABLES	12

Total No. of Instructional periods available for the course: ……60……. Periods

SCHEDULE OF INSTRUCTIONS

UNIT PLAN

Academic **Y**ear : **2022-23**

Semester : **I** Unit No: **I**

Name of the Program: **B.Tech-EEE** Year: **II** Section: **A**

Course/Subject: **POWER GENERATION AND TRANSMISSION** Course Code: **GR20A2033**

Name of the Faculty: **Dr. V VIJAYA RAMA RAJU** Designation: **PROFESSOR.**

Department: **ELECTRICAL AND ELECTRONICS ENGINEERING**

S.NO	UNIT	NO: OF PERIODS	TOPIC/SUBTOPICS
1	I	2	Conventional Sources (Qualitative): Hydro station, Steam Power Plant
2	I	2	Nuclear Power Plant and Gas Turbine Plant.
3	I	2	Non-Conventional Sources (Qualitative): Ocean Energy, Tidal Energy
4	I	2	Wave Energy, wind Energy, Fuel Cells, and Solar Energy
5	I	2	Cogeneration and energy conservation and storage.

No of Instructional Periods required to complete the lesson ....10.... periods

SCHEDULE OF INSTRUCTIONS

UNIT PLAN

Academic **Y**ear : **2022-23**

Semester : **I** Unit No: **II**

Name of the Program: **B.Tech-EEE** Year: **II** Section: **A**

Course/Subject: **POWER GENERATION AND TRANSMISSION** Course Code: **GR20A2033**

Name of the Faculty: **Dr. V VIJAYA RAMA RAJU** Designation: **PROFESSOR.**

Department: **ELECTRICAL AND ELECTRONICS ENGINEERING**

S.NO	UNIT	NO: OF PERIODS	TOPIC/SUBTOPICS
1	II	2	Introduction, definitions of connected load
2	II	2	maximum demand, demand factor, load factor, diversity factor
3	II	2	Load duration curve, number and size of generator units.
4	II	2	Base load and peak load plants.
5	II	2	Cost of electrical energy-fixed cost, running cost,
6	II	2	Tariff on charge to customer.

No of Instructional Periods required to complete the lesson ....12.... periods

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INSTITUTE OF ENGINEERING AND TECHNOLOGY
Department of Electrical and Electronics Engineering

SCHEDULE OF INSTRUCTIONS

UNIT PLAN

Academic **Y**ear : **2022-23**

Semester : **I** Unit No: **III**

Name of the Program: **B.Tech-EEE** Year: **II** Section: **A**

Course/Subject: **POWER GENERATION AND TRANSMISSION** Course Code: **GR20A2033**

Name of the Faculty: **Dr. V VIJAYA RAMA RAJU** Designation: **PROFESSOR.**

Department: **ELECTRICAL AND ELECTRONICS ENGINEERING**

S.NO	UNIT	NO: OF PERIODS	TOPIC/SUBTOPICS
1	III	2	Line conductors, inductance and capacitance of single phase with symmetrical and unsymmetrical spacing
2	III	2	Line conductors, inductance and capacitance of three phase lines with symmetrical spacing
3	III	2	Line conductors, inductance and capacitance of three phase lines with unsymmetrical spacing
4	III	2	Composite conductors-transposition, bundled conductors
5	III	2	effect of earth on capacitance, Representation of lines, short transmission lines
6	III	2	medium length lines, nominal T and PI-representations, long transmission lines, The equivalent circuit representation of a long Line, A, B, C, D constants
7	III	2	Ferranti Effect, sending end and receiving end power circle diagrams.

No of Instructional Periods required to complete the lesson ....14.... periods

SCHEDULE OF INSTRUCTIONS

UNIT PLAN

Academic **Y**ear : **2022-23**

Semester : **I** Unit No: **IV**

Name of the Program: **B.Tech-EEE** Year: **II** Section: **A**

Course/Subject: **POWER GENERATION AND TRANSMISSION** Course Code: **GR20A2033**

Name of the Faculty: **Dr. V VIJAYA RAMA RAJU** Designation: **PROFESSOR.**

Department: **ELECTRICAL AND ELECTRONICS ENGINEERING**

S.NO	UNIT	NO: OF PERIODS	TOPIC/SUBTOPICS
1	IV	2	Tension and sag calculations, Sag template
2	IV	2	Factors affecting Sag,
3	IV	2	Stringing charts, Vibrations and vibration damper.
4	IV	2	Corona: Introduction, disruptive critical voltage, corona loss
5	IV	2	Factors affecting corona loss and methods of reducing corona loss
6	IV	2	Disadvantages of corona, interference between power and Communication lines.

No of Instructional Periods required to complete the lesson ....12.... periods

SCHEDULE OF INSTRUCTIONS

UNIT PLAN

Academic **Y**ear : **2022-23**

Semester : **I** Unit No: **V**

Name of the Program: **B.Tech-EEE** Year: **II** Section: **A**

Course/Subject: **POWER GENERATION AND TRANSMISSION** Course Code: **GR20A2033**

Name of the Faculty: **Dr. V VIJAYA RAMA RAJU** Designation: **PROFESSOR.**

Department: **ELECTRICAL AND ELECTRONICS ENGINEERING**

S.NO	UNIT	NO: OF PERIODS	TOPIC/SUBTOPICS
1	V	2	Conventional Sources (Qualitative): Hydro station, Steam Power Plant
2	V	2	Nuclear Power Plant and Gas Turbine Plant.
3	V	2	Non-Conventional Sources (Qualitative): Ocean Energy, Tidal Energy
4	V	2	Wave Energy, wind Energy, Fuel Cells, and Solar Energy
5	V	2	Cogeneration and energy conservation and storage.
6	V	2	Overhead lines versus underground cables, types of cables.

No of Instructional Periods required to complete the lesson ....12.... periods

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
Department of Electrical and Electronics Engineering

LESSON PLAN

Academic **Y**ear : **2022-23**

Semester : **I**

Name of the Program: **B.Tech-EEE** Year: **II** Section: **A**

Course/Subject: **POWER GENERATION AND TRANSMISSION** Course Code: **GR20A2033**

Name of the Faculty: **Dr. V VIJAYA RAMA RAJU** Designation: **PROFESSOR.**

Department: **ELECTRICAL AND ELECTRONICS ENGINEERING**

S.NO	UNIT	NO: OF PERIODS	DATE	TOPIC/SUBTOPICS	CO No.
1	I	1	10-10-22	Hydro station	1
2	I	1	11-10-22	Steam Power Plant	1
3	I	2	14-10-22	Nuclear Power Plant	1
4	I	1	15-10-22	Gas Turbine Plant	1
5	I	1	17-10-22	Ocean Energy	1
6	I	1	18-10-22	Tidal Energy	1
7	I	2	21-10-22	Wave Energy, wind Energy, Fuel Cells	1
8	I	1	22-10-22	Solar Energy	1
9	I	1	25-10-22	Cogeneration and energy conservation and storage	1
10	II	2	28-10-22	Introduction, definitions of connected load	2
11	II	1	29-10-22	maximum demand, demand factor, load factor, diversity factor	2

12	II	1	31-10-22	Load duration curve	2
13	II	1	1-11-22	number and size of generator units.	2
14	II	2	4-11-22	Base load and peak load plants.	2
15	II	1	5-11-22	Cost of electrical energy-fixed cost, running cost	2
16	II	1	7-11-22	Tariff on charge to customer	2
17	III	2	11-11-22	Line conductors, inductance of single-phase lines symmetrical spacing	3
18	III	1	14-11-22	capacitance of single phase with symmetrical spacing	3
19	III	1	15-11-22	inductance of three phase lines with symmetrical spacing	3
20	III	2	18-11-22	capacitance of three phase lines with symmetrical spacing	3
21	III	1	19-11-22	Inductance of single-phase lines with unsymmetrical spacing	3
22	III	1	21-11-22	capacitance of single phase with unsymmetrical	3
23	III	1	22-11-22	inductance of three phase lines with unsymmetrical spacing	3
24	III	2	25-11-22	capacitance of three phase lines with unsymmetrical spacing	3
25	III	1	26-11-22	Composite conductors-transposition, bundled conductors	3

26	III	1	29-11-22	effect of earth on capacitance	3
27	III	2	2-12-22	Representation of lines, short transmission lines	3
28	III	1	3-12-22	medium length lines, nominal T and PI-representations	3
29	III	1	12-12-22	long transmission lines	3
30	III	1	13-12-22	The equivalent circuit representation of a long Line, A, B, C, D constants	3
31	III	2	16-12-22	Ferranti Effect	3
32	III	1	17-12-22	sending end and receiving end power circle diagrams.	3
33	IV	1	19-12-22	Tension and sag calculations	4
34	IV	1	20-12-22	Factors affecting Sag, Sag template	4
35	IV	2	23-12-22	Stringing charts	4
36	IV	1	26-12-22	Vibrations and vibration damper	4
37	IV	1	27-12-22	Corona: Introduction, disruptive critical voltage	4
38	IV	2	30-12-22	corona loss, Factors affecting corona loss	4
39	IV	1	2-1-23	methods of reducing corona loss	4
40	IV	1	3-1-23	Disadvantages of corona	4

41	IV	2	6-1-23	interference between power and Communication lines.	4
42	V	1	7-1-23	Introduction	5
43	V	1	16-7-23	types of insulators	5
44	V	1	17-1-23	Potential distribution over a string of suspension insulators	5
45	V	2	20-1-23	Methods of equalizing the potential	5
46	V	1	21-1-23	testing of insulators.	5
47	V	1	23-1-23	insulation, insulating materials	5
48	V	1	24-1-23	Introduction, types of cables.	5
49	V	2	27-1-23	Types of Cables	5
50	V	1	28-1-23	grading of cables	5
51	V	1	30-1-23	insulation resistance of a cable	5
52	V	2	3-2-23	Capacitance of a single core cable	5
53	V	1	6-2-23	Capacitance of a three core cables	5
54	V	1	7-2-23	Overhead lines versus underground cables	5

GUIDELINES TO STUDY THE COURSE/SUBJECT

Academic **Y**ear : **2022-23**

Semester : **I**

Name of the Program: **B.Tech-EEE** Year: **II** Section: **A**

Course/Subject: **POWER GENERATION AND TRANSMISSION** Course Code: **GR20A2033**

Name of the Faculty: **Dr. V VIJAYA RAMA RAJU** Designation: **PROFESSOR.**

Department: **ELECTRICAL AND ELECTRONICS ENGINEERING**

Course Design and Delivery System (CDD):

- The Course syllabus is written into number of learning objectives and outcomes.
- These learning objectives and outcomes will be achieved through lectures, assessments, assignments, seminars, presentations.
- Every student will be given an assessment plan, criteria for assessment, scheme of evaluation and grading method.
- The Learning Process will be carried out through assessments of Knowledge, Skills and Attitude by various methods and the students will be given guidance to refer to the text books, reference books.

The faculty be able to –

- Understand the principles of Learning
- Develop instructional objectives for a given topic
- Prepare course, unit and lesson plans
- Use appropriate teaching and learning aids like Slides and Paper Presentation.
- Plan and deliver lectures effectively.
- Provide the students of availability of the content in the textbooks and Internet.
- Provide feedback to students using various methods of Assessments and tools of Evaluation
- Act as a guide, advisor, counselor, facilitator, and motivator and not just as a teacher alone.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
Department of Electrical and Electronics Engineering

TEACHING STARTEGIC PLAN

Academic **Y**ear : **2022-23**

Semester : **I**

Name of the Program: **B.Tech-EEE** Year: **II** Section: **A**

Course/Subject: **POWER GENERATION AND TRANSMISSION** Course Code: **GR20A2033**

Name of the Faculty: **Dr. V VIJAYA RAMA RAJU** Designation: **PROFESSOR.**

Department: **ELECTRICAL AND ELECTRONICS ENGINEERING**

1. TARGET:

a) Percentage for pass: 100%

b) Percentage of class: 100%

2. COURSE PLAN & CONTENT DELIVERY

- PPT presentation of the Lectures
- Solving exercise programs
- Model questions

3. METHOD OF EVALUATION

1. Continuous Assessment Examinations (CAE-I, CAE-II)
2. Assignments
3. Quiz in Moodle
4. Class tests
5. Semester/End Examination

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
Department of Electrical and Electronics Engineering

ASSIGNMENT-I

Academic **Y**ear : **2022-23**

Semester : **I**

Name of the Program: **B.Tech-EEE** Year: **II** Section: **A**

Course/Subject: **POWER GENERATION AND TRANSMISSION** Course Code: **GR20A2033**

Name of the Faculty: **Dr. V VIJAYA RAMA RAJU** Designation: **PROFESSOR**

Department: **ELECTRICAL AND ELECTRONICS ENGINEERING**

This Assignment corresponds to Unit No. / Lesson ……**I**……

1) Which system carry water from intake to the turbines in power system?
2) How to raise the temperature in boiler?
3) Draw the block diagram of hydro power plant and describe in detail.
4) How power is extracted from tidal energy? Explain.
5) Draw the block diagram of steam power plant and describe in detail

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Department of Electrical and Electronics Engineering

ASSIGNMENT-II

Academic **Y**ear : **2022-23**

Semester : **I**

Name of the Program: **B.Tech-EEE** Year: **II** Section: **A**

Course/Subject: **POWER GENERATION AND TRANSMISSION** Course Code: **GR20A2033**

Name of the Faculty: **Dr. V VIJAYA RAMA RAJU** Designation: **PROFESSOR**

Department: **ELECTRICAL AND ELECTRONICS ENGINEERING**

This Assignment corresponds to Unit No. / Lesson ……**II**……

1. What is a peak load station?
2. What is the relationship between load, utilization and capacity factors?
3. How the cost of electrical energy is decided? Explain.
4. Installed capacities of generating station is 25MW and generated 200×106 units/annum. Calculate the cost per unit generated, if the annual fixed charges are Rs. 150/kW installed and running charges are 5 paise/kWh.
5. What are the different types of loads? Explain.

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Department of Electrical and Electronics Engineering

ASSIGNMENT-III

Academic **Y**ear : **2022-23**

Semester : **I**

Name of the Program: **B.Tech-EEE** Year: **II** Section: **A**

Course/Subject: **POWER GENERATION AND TRANSMISSION** Course Code: **GR20A2033**

Name of the Faculty: **Dr. V VIJAYA RAMA RAJU** Designation: **PROFESSOR**

Department: **ELECTRICAL AND ELECTRONICS ENGINEERING**

This Assignment corresponds to Unit No. / Lesson ……**III**……

1. A short 230 kV transmission line with a reactance of 18 Ω/phase supplies a load at 0.85 lagging power factor. For a line current of 1,000A the receiving- and sending-end voltages are to be maintained at 230kV. Calculate (a) rating of synchronous capacitor required, (b) the load current, (c) the load MVA. Power drawn by the synchronous capacitor may be neglected.
2. What is symmetrical spacing? Explain its advantages.
3. A single phase, two-wire transmission line, 10 km long, is made up of round conductors, each 0.5 cm in diameter, separated from each other by 30 cm. Calculate the equivalent diameter of a fictitious hollow, thin-walled conductor having the same inductance as the original one. What is the value of this inductance?
4. What is Ferranti effect in transmission lines? Explain.
5. A single circuit, three phase, 60-Hz transmission line consists of three conductors arranged as shown below. If the conductors are 5-km long solid cylindrical aluminum conductor with a diameter of 20 m, find the capacitive reactance of the line per kilometer per phase.

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Department of Electrical and Electronics Engineering

ASSIGNMENT-IV

Academic **Y**ear : **2022-23**

Semester : **I**

Name of the Program: **B.Tech-EEE** Year: **II** Section: **A**

Course/Subject: **POWER GENERATION AND TRANSMISSION** Course Code: **GR20A2033**

Name of the Faculty: **Dr. V VIJAYA RAMA RAJU** Designation: **PROFESSOR**

Department: **ELECTRICAL AND ELECTRONICS ENGINEERING**

This Assignment corresponds to Unit No. / Lesson ……**IV**……

1. Which factors influence corona loss? Explain
2. Explain the methods of reducing corona loss.
3. A 3-phase, 50 Hz, 132 kV transmission line consists of conductors of 1.17 cm diameter and spaced equilaterally at a distance of 3 metres. The line conductors have smooth surface with value for m = 0.96. The barometric pressure is 72 cm of Hg and temperature of 200C. Determine the fair and foul weather corona loss per km per phase
4. What are bundled conductors? Discuss the advantages of bundled conductors, when used for overhead lines
5. How the corona forms in power systems and write the advantages and disadvantages

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Department of Electrical and Electronics Engineering

ASSIGNMENT-V

Academic **Y**ear : **2022-23**

Semester : **I**

Name of the Program: **B.Tech-EEE** Year: **II** Section: **A**

Course/Subject: **POWER GENERATION AND TRANSMISSION** Course Code: **GR20A2033**

Name of the Faculty: **Dr. V VIJAYA RAMA RAJU** Designation: **PROFESSOR**

Department: **ELECTRICAL AND ELECTRONICS ENGINEERING**

This Assignment corresponds to Unit No. / Lesson ……**V**……

1. Why underground cables are used?
2. Discuss in detail about the grading of cables
3. Give the detailed classification of insulators.
4. A string of eight suspension insulators is to be fitted with a grading ring. If the pin to earth capacitances are all equal to C, find the values of line to pin capacitances that would give a uniform voltage distribution over the string
5. Determine the maximum working voltage of a single core lead sheathed cable having a conductor 1 cm dia and sheath of 5 cm dia inside. Two insulating materials with permittivities and maximum stresses 4, 2.5 and 60 kV/cm and 50 kV/cm respectively are used

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
Department of Electrical and Electronics Engineering

Academic Year: **2022-23**
Year:**II**
Semester:**I**

MID Exam – I (Descriptive)
Subject Name: Power Generation and Transmission
Subject Code: GR20A2033

Date:13/12/2022
Duration:**90 min**
Max Marks: **15**

Note: Answer any ALL questions. All questions carry equal marks.

Answer ALL questions. All questions carry equal marks

3 * 5 = 15 Marks

Q.No	Questions	Marks	CO	BL	PI
1.	**(a)** Classify water turbines and describe them with respect to their applications briefly.	**[2.5]**	**1**	**2**	**1.2.1** **13.1.1**
	(b) What are the functions of economizer and super heater in a thermal power plant?	**[2.5]**	**1**	**1**	**1.3.1** **13.1.1**
	OR				
2.	**(a)** With a simple block diagram explain the working of a nuclear power station.	**[2.5]**	**1**	**1**	**1.2.1** **13.1.1**
	(b) Explain with neat sketches the various methods of Tidal power generation. What are the limitations of each method?	**[2.5]**	**1**	**1**	**1.2.1** **13.1.1**
3.	**(a)** Derive the expression for capacitance of three phase transmission line with asymmetrical spacing	**[2.5]**	**3**	**4**	**1.4.1** **2.3.2** **13.1.1**
	(b) In a 3-phase transmission line the 3 conductors are place at the corners of a triangle of sides 2m, 3m and 2.5m. If the diameter of each conductor is 1.6cm and conductors are regularly transposed, calculate the inductance per phase per kilometer.	**[2.5]**	**3**	**3**	**1.1.1** **2.1.3** **2.2.2** **10.1.1**

					13.1.1 **13.2.2**
OR					
4.	**(a)** Derive the A, B, C and D constants for Nominal-Pie model.	**[2.5]**	**3**	**4**	**1.4.4** **2.3.2** **13.1.1**
	(b) A single-phase overhead transmission line is transmitting 1200kW power to factory at 11kV at 0.8 P. F lag. The line resistance and loop reactance of the line are 3ohm and 5ohm phase. Determine i) Source voltage ii) Percentage regulation iii) Efficiency.	**[2.5]**	**3**	**3**	**1.1.1** **2.1.3** **2.2.2** **2.4.1** **10.1.1** **13.1.1** **13.2.2**
5.	Prove that a transmission line conductor between two supports at equal heights takes the form of a catenary. Deduce expressions for (i) total length of conductor and (ii) tension at ends in terms of span length, horizontal tension, maximum sag and weight of the conductor per unit length.	**[5]**	**4**	**5**	**1.2.1** **3.2.2** **13.1.1**
OR					
6.	**(a)** Show how the effects of wind and ice loading are considered while determining the sag and stress of an overhead transmission line.	**[2.5]**	**4**	**5**	**1.2.1** **2.3.2**
	(b) An overhead transmission line has a span of 220meters, the conductor weighing 604 kg/km. calculate the maximum sag if the ultimate strength of the conductor is 5,758 kg. Assume a factor of safety =2.	**[2.5]**	**4**	**3**	**1.1.1** **2.1.3** **2.2.2** **10.1.1**

					13.1.1 13.2.2

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
Department of Electrical and Electronics Engineering

Academic Year: **2022-23**
Year:**II**
Semester:**I**

MID Exam – I (Objective)
Subject Name: Power Generation and Transmission
Subject Code: GR20A2033

Date: 13/12/2022
Duration: **10 min**
Max Marks:**5M**

Roll No:

Note: Answer ALL questions. All questions carry equal marks.

Answer all Objective Questions. All questions carry equal marks

Q.No	Questions	Option	CO	BL	PI
1	_____ generating stations are the best choice for meeting the peak demand. A) Hydro B) Thermal C) Nuclear D) Solar	[A]	1	1	13.1.1
2	In nuclear power plants, a moderator is a medium introduced into the fuel mass_____. A) control the reaction B) to slow the speed of fast-moving neutrons C) reduce the temperature D) remove the free moving electrons	[B]	1	2	1.3.1 13.1.1
3	A plant producing both, electrical power & process heat simultaneously is a_____ plant A) Combinatory B) Congenerical C) Cogeneration D) Conglomerate	[C]	1	1	13.1.1
4	Material used for making solar cell is _____. A) Magnesium B) Carbon C) Sodium D) Silicon	[D]	1	1	1.4.1 13.1.1
5	The presence of earth in case of overhead lines is _____ A) increases the capacitance B) increases the inductance C) decreases the capacitance D) decreases the inductance	[A]	3	3	1.2.1 13.1.1
6	Transmission lines are transposed to _____ A) reduce copper losses B) prevent interference with neighbouring telephone lines C) reduce skin effect D) prevent short circuits between the lines	[B]	3	2	1.3.1 13.1.1

7	Bundled conductors in EHV transmission system provide_____ A) increased inductance B) increased capacitance C) decreased inductance D) decreased capacitance	**[C]**	**3**	**2**	**1.3.1** **13.1.1**
8	In a short transmission line, voltage regulation is zero when the power factor angle of the load at the receiving end side equal to A) $tan^{-1}\left(\frac{X}{R}\right)$ B) $tan^{-1}\left(\frac{X}{Z}\right)$ C) $tan^{-1}\left(\frac{Z}{R}\right)$ D) $tan^{-1}\left(\frac{R}{X}\right)$	**[D]**	**3**	**4**	**1.1.1** **2.1.2** **13.1.1**
9	Effect of increase in temperature in overhead transmission line is to A) decrease the stress and increase length B) decrease the stress and length C) increase the stress and length D) increase length and decrease the stress	**[A]**	**4**	**2**	**1.1.2** **13.1.1**
10	Calculate the sag for a span of 200m if the ultimate tensile strength of the conductor is 6000 Kg. Allow a factor of safety of 2. The weight of the conductor is 900 Kg/Km. A) 1.0 m B) 1.5 m C) 2.0 m D) 2.5m	**[B]**	**4**	**3**	**1.1.2** **2.1.2** **13.1.1**

BL – Bloom's Taxonomy Levels
CO – Course Outcomes
PI – Performance Indicator Code3

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
Department of Electrical and Electronics Engineering

Academic Year: **2022-23**
Year:**II**
Semester:**I**

MID Exam – II (Descriptive)
Subject Name: Power Generation and Transmission
Subject Code: GR20A2033

Date: 08/02/2023
Duration:**90 min**
Max Marks: **15**

Note: Answer any ALL questions. All questions carry equal marks.

Answer ALL questions. All questions carry equal marks **3 * 5 = 15 Marks**					
Q.No	**Questions**	**Marks**	**CO**	**BL**	**PI**
1.	**(a)** Define and explain the following factors: i) demand factor ii) diversity factor iii) capacity factor and iv) utilization factor.	**[2]**	**2**	**1**	**13.1.1** **14.2.1**
	(b) The tariff in force is Rs. 150 per kVA of maximum demand and 8 paise per unit consumed. If the load factor is 30%, find the overall cost per unit at i) unity p.f. and ii) 0.7 p.f.	**[3]**	**2**	**4**	**1.1.1** **1.1.2** **1.4.1** **2.1.2** **2.1.3**
	OR				
2.	**(a) C**ompare load duration and integrated load duration curves.	**[2]**	**2**	**3**	**14.2.1**
	(b) A 60 MW power station has an annual peak load of 50 MW. The power station supplies loads having maximum demands of 20 MW, 17 MW, 10MW and 9MW. The annual load factor is 0.45. Find a) Average load b) Diversity factor c) Demand factor.	**[3]**	**2**	**4**	**1.1.1** **1.1.2** **1.4.1** **2.1.2** **2.1.3**
3.	**(a)** Explain how sag is determined for an overhead line conductor taking into account the effects of wind and ice loading.	**[2]**	**4**	**2**	**1.3.1** **2.4.1**
	(b) An overhead line has the following data: span length 160 meters, conductor diameter 0.95 cm, weight per unit length of the conductor 0.65 kg/meter. Ultimate stress 4,250 kg/cm^2, wind pressure 40 kg/cm^2 of projected area. Factor of safety 5. Calculate sag?	**[3]**	**4**	**4**	**1.1.1** **1.1.2** **1.4.1** **2.1.2**

					2.1.3
OR					
4.	**(a)** Discuss how the line voltage and the line spacing will effects the corona in the lines?	**[2]**	**4**	**2**	**2.4.1**
	(b) Explain how the atmospheric conditions will affect the critical disruptive voltage?	**[3]**	**4**	**2**	**1.4.1**
5.	**(a)** Explain why suspension insulators are preferred for high voltage transmission lines. What is a strain insulator and where it is used?	**[2]**	**5**	**2**	**13.1.4.**
	(b) Each conductor of a three-phase transmission line is suspended from a cross arm of a steel tower by a string of four suspension insulators. The voltage across the second unit is 15 kV and across the third is 20 kV. Find the voltage between the conductors and the string efficiency.	**[3]**	**5**	**4**	**1.1.1** **1.1.2** **1.4.1** **2.1.2** **2.1.3**
OR					
6.	**(a)** Derive the equation for calculating the insulation resistance of a single core cable	**[2]**	**5**	**5**	**13.1.4.**
	(b) A single core cable used on 33 KV,50 Hz has conductor diameter 10mm and inner diameter of sheath 25 mm. The relative permittivity of insulating material used is 3.5. Find i) Capacitance of the cable per Km ii) maximum and minimum electrostatic stress in the cable, and iii) Charging current per Km.	**[3]**	**5**	**4**	**1.1.1** **1.1.2** **1.4.1** **2.1.2** **2.1.3**

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
Department of Electrical and Electronics Engineering

Academic Year: **2022-23**
Year:**II**
Semester:**I**

MID Exam – II (Objective)
Subject Name: Power Generation and Transmission
Subject Code: GR20A2033

Date: 08/02/2023
Duration: **10 min**
Max Marks:**5M**

Roll No:

Note: Answer ALL questions. All questions carry equal marks.

Answer all Objective Questions. All questions carry equal marks					
Q.No	**Questions**	**Option**	**CO**	**BL**	**PI**
1	When the diversity factor of a plant increases_____ A) Plant cost increases B) Plant cost decreases C) Maximum demand is high D) Maximum demand is low	**[B]**	**2**	**3**	**1.4.1**
2	What is the average demand if the maximum demand of generation of power is 50 MW and the load factor of the plant is 60%? A) 20MW B) 30MW C) 40 MW D) 50 MW	**[B]**	**2**	**4**	**2.4.1**
3	A Power station has 4 consumers with their maximum demands as 40 MW, 20 MW, 30 MW, and 50 MW. The maximum demand of the station is 100 MW. The diversity factor of the plant is_____ A) 0.5 B) 0.2 C) 1.4 D) 0.35	**[C]**	**2**	**4**	**13.1.1**
4	Strining chart represents a graph of _____ A) Sag and tension Vs temperature B) Sag Vs frequency C) Sag Vs conductor size D) Tension Vs sag	**[A]**	**4**	**1**	**1.3.1**
5	Sag of the conductors of a transmission line is 2 m when the span is 200 m. If the height of the supporting tower is increased by 25% sag will _____ A) Increase by 25% B) Decrease by 25% C) Decrease by 12.5% D) Remain unchanged.	**[D]**	**4**	**4**	**1.4.1**

6	Corona loss doesn't depend on _____ A) Atmosphere B) Conductor size C) Line voltage D) Height of the conductor	**[D]**	**4**	**1**	**1.4.1**
7	Corona effect can be minimized by increasing _____ A) Length of the conductor B) Spacing between the conductors C) Diameter of conductors D) Both spacing between the conductor and diameter of the conductors.	**[D]**	**4**	**1**	**13.1.1**
8	Suspension type insulator are subjected to _____ A) Tensile stress B) Compressive stress C) Tensile and compressive stress D) Depends on its use.	**[A]**	**5**	**2**	**13.1.1**
9	Which type of insulator is used where there is dead end of the line or there is a corner or a sharp curve, for high voltage line? A) Pin type insulator B) Shackle insulator C) Strain insulator D) Stay insulator	**[C]**	**5**	**2**	**13.1.1**
10	The insulation of the cable decreases with A) The increase in length of the insulation B) The decrease in the length of the insulation C) The increase in number of cores D) The decrease in number of cores	**[A]**	**5**	**2**	**13.1.4.**

BL – Bloom's Taxonomy Levels
CO – Course Outcomes
PI – Performance Indicator Code3

Code No: 154BW **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year II Semester Examinations, April/May - 2023
POWER SYSTEM - I
(Electrical and Electronics Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a)	Which system carry water from intake to the turbines in power system?	[2]
b)	How to raise the temperature in boiler?	[3]
c)	What is a peak load station?	[2]
d)	What is the relationship between load, utilization and capacity factors?	[3]
e)	Why underground cables are used?	[2]
f)	What are the types of cables?	[3]
g)	What is a bundled conductor?	[2]
h)	What is symmetrical spacing? Explain its advantages.	[3]
i)	What is the purpose of substation?	[2]
j)	What are the objectives of distribution of power?	[3]

PART – B

(50 Marks)

2.a)	Draw the block diagram of hydro power plant and describe in detail.	
b)	How power is extracted from tidal energy? Explain.	[5+5]
	OR	
3.a)	Draw the block diagram of steam power plant and describe in detail.	
b)	What are the advantages and disadvantages of fuel cell? Explain.	[5+5]
4.a)	How the cost of electrical energy is decided? Explain.	
b)	Installed capacities of generating station is 25MW and generated 200×10^6 units/annum. Calculate the cost per unit generated, if the annual fixed charges are Rs. 150/kW installed and running charges are 5 paise/kWh.	[5+5]
	OR	
5.a)	What are the different types of loads? Explain.	
b)	A power station has a maximum demand of 40 MW with annual load factor is 60%. Determine the cost per kWh generated from the following data. Capital cost=Rs.80×10^5, annual cost of fuel and oil = Rs. 8×10^5, taxes, wages, and salaries = Rs. 5×10^5, and the rate of interest and depreciation is 12%.	[5+5]

6.a) What are the differences between over head and underground cables? Explain.
b) Which power lines are used for extra high voltages? Explain. [5+5]

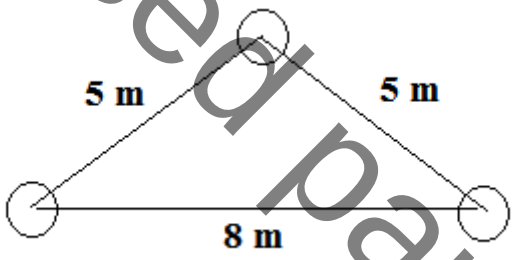
OR

7.a) Discuss in detail about the grading of cables.
b) Give the detailed classification of insulators. [5+5]

8.a) Which factors influence corona loss? Explain.
b) A single phase, two-wire transmission line, 10 km long, is made up of round conductors, each 0.5 cm in diameter, separated from each other by 30 cm. Calculate the equivalent diameter of a fictitious hollow, thin walled conductor having the same inductance as the original one. What is the value of this inductance? [5+5]

OR

9.a) Why there is interference between power and communication lines? Explain.
b) A single circuit, three phase, 60-Hz transmission line consists of three conductors arranged as shown below. If the conductors are 5-km long solid cylindrical aluminum conductor with a diameter of 20 m, find the capacitive reactance of the line per kilometer per phase. [4+6]



10.a) How DC distribution is done? Explain with neat sketch.
b) Explain the major differences and similarities of radial and ring main distributors in detail. [5+5]

OR

11.a) How bus bars are arranged in substations? Explain in detail.
b) What are the types of distribution systems? Explain each in detail. [5+5]

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Code No: 155CV **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, August - 2022
POWER SYSTEM – II
(Electrical and Electronics Engineering)

Time: 3 Hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
- - -

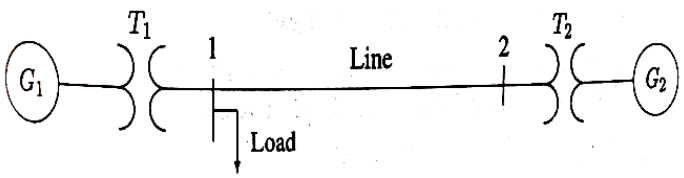
1.a) Deduce an expression for voltage regulation of a short transmission line, giving the phasor diagram.
b) A 3-phase, 50Hz, 150km line has a resistance, inductive reactance and capacitive shunt admittance of 0.1 ohm, 0.5 ohm and 3×10^{-6} mhos per km per phase. If the line delivers 50MW at 110kV and 0.8 p.f. lagging, determine the sending end voltage and current. Assume a Nominal-π circuit for the line. [7+8]

2.a) Explain the procedure how to draw the receiving end power circle diagram of a transmission line.
b) What is ferranti effect? Deduce a simple expression for the voltage rise of an unloaded transmission line. [8+7]

3.a) Describe the principle of on-load tap changing transformer? List out its merits and demerits.
b) A single circuit 3-phase, 220 kV line runs at no load. Voltage at the receiving end of the line is 205 kV. Find the sending end voltage, if the line has resistance of 20 ohm, reactance of 85 ohm and the total succeptance of 5.25×10^{-4} mho. The transmission line is to be represented by Π-model. [7+8]

4. Describe clearly what you mean by compensation of lines? Discuss different methods of compensation. [15]

5.a) What are the advantages of the per unit system for analysis of power system.
b) Draw an impedance diagram for the electric power system shown in figure showing all impedances in per unit on a 100 MVA base. Choose 20 kV as the voltage base for generator. The 3-phase power and line –line ratings are given below: [6+9]
G_1 : 90 MVA, 20 kV, X= 9%
T_1 : 80 MVA, 20/200 kV, X= 16%
T_2 : 90 MVA, 200/20 kV, X= 20%
G_2 : 90 MVA, 18kV, X= 9%
Line : 200 kV, X =120 ohms
Load: 200 kV, S = (48+j64) MVA



6.a) Explain the generation of traveling waves on a transmission line.

b) A 200 kV surge travels on a transmission line of 400 ohms surge impedance and reaches a junction where two branch lines of surge impedances of 500 ohms and 300 ohms respectively are connected with the transmission line. Find the surge voltage and current transmitted into each branch line. Also find the reflected voltage and current. [7+8]

7.a) Explain the construction, principle of operation and applications of valve type lightning arrester with diagram.

b) What are ground rods and counterpoises? Discuss clearly how these can be used to improve the grounding conditions. Give various arrangements of counterpoise. [7+8]

8.a) Describe the significance of positive, negative and zero sequence components.

b) A 30 MVA, 11 kV star connected generators has positive, negative and zero sequence reactance's of 30 %, 25 % and 10% respectively. A reactor with 6% reactance based on the rating of the generator is placed in the neutral to ground connection. A line to ground fault occurs at the terminals of the generator when it is operating at rated voltage. Determine the initial symmetrical line to ground rms fault current. Also find the line to line voltages. [6+9]

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Code No: 154BW **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year II Semester Examinations, August/September - 2021
POWER SYSTEM - I
(Electrical and Electronics Engineering)

Time: 3 Hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
- - -

1.a) Draw the schematic of gas turbine power plant and explain.
b) Explain in detail about energy conservation and storage. [8+7]

2.a) Give the advantages and disadvantages of hydroelectric plants.
b) Discuss in detail about the components of tidal power plant. [7+8]

3.a) A generating station has a maximum demand of 30 MW and has connected load of 60 MW. The annual generation of units is 30×10^7 kWh. Calculate the load factor and the demand factor.
b) Discuss in detail about the difference between load curve and load duration curve. [8+7]

4.a) An industry daily load is 200 kW for first 2 hr, 90 kW for next 8 hr, 140 kW for next 6 hr, and 6 kW for the remaining time. Calculate the electricity expenditure per year, if the tariff in force is Rs. 1,100/kW of maximum demand per annum plus Rs. 1.0/kWh.
b) Explain the significance of load factor and diversity factor. [8+7]

5.a) Explain different types of Insulators.
b) A string of eight suspension insulators is to be fitted with a grading ring. If the pin to earth capacitances are all equal to C, find the values of line to pin capacitances that would give a uniform voltage distribution over the string. [8+7]

6.a) Discuss about various types of cables.
b) Determine the maximum working voltage of a single core lead sheathed cable having a conductor 1 cm dia and sheath of 5 cm dia inside. Two insulating materials with permittivities and maximum stresses 4, 2.5 and 60 kV/cm and 50 kV/cm respectively are used. [8+7]

7.a) Explain the methods of reducing corona loss.
b) Derive the expression for the capacitance of three phase lines with symmetrical spacing. [7+8]

8.a) Give the detailed comparison between AC and DC distributions.
b) Discuss in detail about the selection of site for substation. [8+7]

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Code No: 155CV **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, January/February - 2023
POWER SYSTEM – II
(Electrical and Electronics Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a)	Give the formulas for transmission parameters of long lines.	[2]
b)	Give reasons for choosing π over T representation of lines.	[3]
c)	Give comparison between uncompensated and compensated lines.	[2]
d)	Explain about OLTC transformer as a voltage controller.	[3]
e)	What are the advantages of per unit system representation of system?	[2]
f)	Define reflection and refraction coefficients.	[3]
g)	Distinguish between surge diverters and rod gaps.	[2]
h)	What are volt-time curves? How are they useful?	[3]
i)	Give the classification of faults.	[2]
j)	What are symmetrical components? Explain.	[3]

PART – B

(50 Marks)

2. A long symmetrical line with A = D = 0.9 $\angle 1.5^0$ and B = 150 $\angle 65^0$ Ω has at the load end a transformer having a series impedance Z_T = 100 $\angle 67^0$ Ω. The load voltage and current are V_L and I_L. Obtain expressions for V_S and I_S in form of: [10]

$$\begin{bmatrix} V_S \\ I_S \end{bmatrix} = \begin{bmatrix} A' & B' \\ C' & D' \end{bmatrix} \begin{bmatrix} V_L \\ I_L \end{bmatrix}$$

OR

3.a) A 40 MVA generating station is connected to a three-phase line having $Z = 300 \angle 75^o\ \Omega$; $Y = 0.0025 \angle 90^o\ \mho$. There is a load of 10 MW at unity power factor at the mid-point of the line. Calculate the voltage and load at the distant end of the line. Use nominal-T circuit for the line.

b) What is Ferranti effect in transmission lines? Explain. [5+5]

4.a) Explain the transmission line voltage control using shunt and series Capacitance methods. Discuss their merits and demerits.

b) What is load compensation? Discuss its objectives in power system. [6+4]

OR

5. A short 230 kV transmission line with a reactance of 18 Ω/phase supplies a load at 0.85 lagging power factor. For a line current of 1,000A the receiving- and sending-end voltages are to be maintained at 230kV. Calculate (a) rating of synchronous capacitor required, (b) the load current, (c) the load MVA. Power drawn by the synchronous capacitor may be neglected. [10]

6. Draw the per unit impedance diagram on a common base for the system shown in below figure 1. All per unit impedances shown are with respect to their own base. Take the system base MVA same as generator MVA and system base KV as generator side voltage. [10]

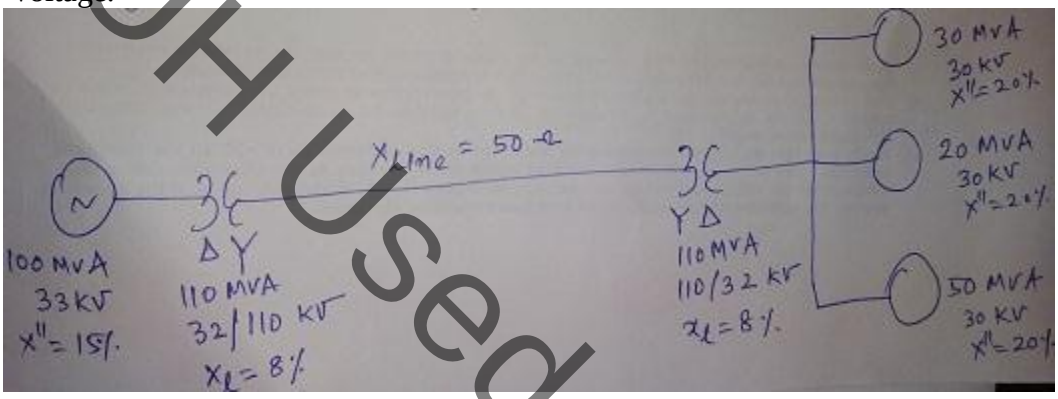

Figure 1

OR

7.a) A 500 kV, 2microsecond rectangular wave travels on a line having a surge impedance of 350 Ohm and approaches a termination with a capacitance C equal to 300 pF. Determine the magnitudes of the reflected and transmitted waves.

b) From fundamentals obtain the expressions for reflection and transmission co-efficient on a line terminated with load impedance equal to the surge impedance of the line. [5+5]

8.a) Briefly discuss about various causes of over-voltages in the power system network.

b) Explain the various methods of transmission line protection against over voltages due to lightning strokes. [5+5]

OR

9. Explain, with a neat sketch, the working principle and constructional details of expulsion type lightning arrester. [10]

10.a) The line currents in a three phase system are:

$$I_a = 72.1\angle 33.7^\circ,\ I_b = 82.46\angle 166^\circ,\ I_c = 63.24\angle -71.56^\circ$$

Calculate the symmetrical components of current.

b) An 11.2 kV bus-bar is fed from three synchronous generators as shown in figure 2 below. Calculate the fault current and MVA if 3-phase symmetrical fault occurs on the bus-bar. [5+5]

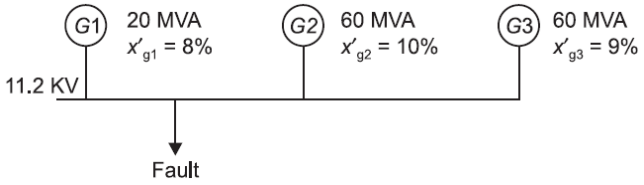

Figure 2

OR

11. A double line to ground fault occurs on phases b and c at point F in the system shown in figure 3 below. Find the fault current in phase c of G_1. Both the machines are rated 1.2MVA, 0.6kV with $X_1 = X_2 = 0.1$ p.u. and $X_0 = 0.05$ p.u. Transformers are 1.2 MVA each with leakage reactance of 0.05 p.u. Transmission line reactances are $X_{L1} = X_{L2} = 0.2$ p.u. and $X_{L0} = 0.4$ p.u. on the MVA base of the machines. [10]

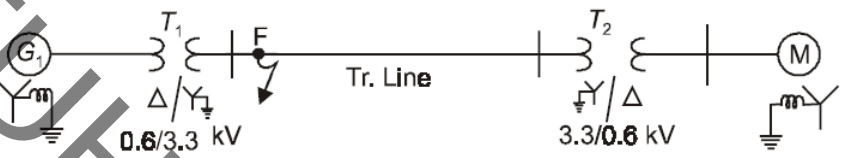

Figure 3

---ooOoo---

Code No: 155CV **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, March - 2021
POWER SYSTEM – II
(Electrical and Electronics Engineering)

Time: 3 Hours **Max. Marks: 75**

Answer any five questions.
All questions carry equal marks.
- - -

1.a) Explain clearly the 'Ferranti effect' with a phasor diagram.
b) A 3-phase 50 Hz transmission line has resistance, inductance and capacitance per phase of 10 ohm, 0.1 H and 0.9 μF respectively and delivers a load of 35 MW at 132 kV and 0.8 p.f. lag. Determine the efficiency and regulation of the line using (i) nominal-T, (ii) nominal-π. [6+9]

2.a) Derive the ABCD parameters of a nominal π represented medium length transmission line with neat phasor diagram.
b) Classify the transmission lines. [9+6]

3.a) How do you determine the capacity of the phase modifier if the net reactive power required to maintain certain voltages at the two ends is known? Explain.
b) What is the need of compensation in power system? Explain about Load ability characteristics of overhead lines. [7+8]

4.a) Explain the surge impedance loading with necessary expressions.
b) How voltage control can be achieved by using Off-load tap changing transformers? [8+7]

5.a) Discuss the advantages of p.u. system method over the absolute method of analysis.
b) Show that a travelling wave moves with a velocity of light on the overhead line and its speed is proportional to $1/\sqrt{\varepsilon_r}$ on a cable with dielectric material of permittivity ε_r. [7+8]

6.a) Describe about Attenuation of travelling waves.
b) State the advantages of p. u system. [8+7]

7.a) What is volt-time curves? What is their significance in power system studies?
b) What are ground rods and counterpoises? Explain clearly how these can be used to improve the grounding conditions. Give various arrangements of counterpoise. [6+9]

8.a) Obtain the symmetrical components of the following set of unbalanced currents $I_a = 1.6 \angle 250^0$, $I_b = = 1.0 \angle 180^0$ and $I_c = 0.9 \angle 132^0$. Also find out the neutral current.
b) Derive an expression for the fault current for a double line to ground fault as an unloaded generator and draw its equivalent circuit. [7+8]

---ooOoo---

Code No: 154BW **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year II Semester Examinations, November/December - 2020
POWER SYSTEM - I
(Electrical and Electronics Engineering)

Time: 2 Hours **Max. Marks: 75**

Answer any Five Questions
All Questions Carry Equal Marks
- - -

1.a) Explain the function of feed water heater and air pre-heater.
b) Explain the working of fuel cell and their applications. [8+7]

2. What is the function of a condenser in a steam power plant? Describe with a neat sketch any one type of condenser commonly used in power plants. [15]

3. The capital cost of a hydro-power station of 50 MW capacity is Rs 1,000 per kW. The annual depreciation charges are 10% of the capital cost. A royalty of Re 1 per kW per year and Re 0·01 per kWh generated is to be paid for using the river water for generation of power. The maximum demand on the power station is 40 MW and annual load factor is 60%. Annual cost of salaries, maintenance charges etc. is Rs 7,00,000. If 20% of this expense is also chargeable as fixed charges, calculate the generation cost in two part form. [15]

4. Define and explain the importance of the following terms in generation:
a) Connected load b) demand factor c) average load. [5+5+5]

5. In a string of 3 units, the capacitance between each link to pin to earth is 11% of the capacitance of one unit. Calculate the voltage across each unit and string efficiency when the voltage across the string is 33kV. [15]

6. Explain different types of Insulators used in overhead lines. [15]

7.a) What are bundled conductors? Discuss the advantages of bundled conductors, when used for overhead lines
b) How the corona forms in power systems and write the advantages and disadvantages. [8+7]

8. Explain the radial distribution system with neat diagram and list out its merits and demerits. [15]

---ooOoo---

Gokaraju Rangaraju Institute of Engineering & Technology

II B.Tech I Sem (EEE) Result Analysis

Academic Year: 2022-23 Total No. of Students Registered: 69

Course	Total No. of Students appeared	Total No. of Students Passed	No. of Students Failed	Count of Students with Grade Point					
				GP (10)	GP (9)	GP (8)	GP (7)	GP (6)	GP (5)
VEGC	69	67	02	20	33	09	03	01	01
CI	69	67	02	14	22	19	09	02	01
ECA	69	50	19	00	03	04	14	17	12
PAE	69	66	03	01	14	24	13	10	04
DCMT	69	57	12	00	00	06	15	20	16
EMF	69	57	12	00	02	11	19	18	07
JPE	69	66	03	00	05	23	22	11	05
PAE Lab	69	65	04	16	09	15	13	07	05
DCMT Lab	69	60	09	06	09	08	08	18	11
PGT	69	65	04	00	02	15	30	13	05

Arrears Position – II year / I Semester

No.of students	All Pass	One Arrear	Two Arrears	Three Arrears	More than three arrears	Overall % of pass
69	46	07	07	04	05	66.67%

Performance overall Class Three Toppers

ROLL NO.	NAME	SGPA
21241A0257	Siripuram Manisree	8.93
22245A0202	Divya Namani	8.50
21241A0245	Palleti Sri Padma Latha Reddy	8.40

Class coordinator **HOD, EEE**

II B.Tech - I Sem (EEE)

SECTION	Courses	VEGC	CI	ECA	PAE	DCMT	EMF	JPE	PAE LAB	DCMT LAB	PGT
	Course codes	GR20A2002	GR20A2003	GR20A2023	GR20A2024	GR20A2025	GR20A2026	GR20A2028	GR20A2029	GR20A2030	GR20A2033
A	TOTAL	69	69	69	69	69	69	69	69	69	69
	PASS	67	67	50	66	57	57	66	65	60	65
	PASS(%)	97.1	97.10	72.46	95.65	82.60	82.60	95.65	94.20	86.95	94.20
	FACULTY NAME	M. Prashanth	D. Karuna Kumar	G Sandhya Rani	P Ravi Kanth	Dr B Phaneendra Babu	Dr T Suresh Kumar	D. Preethi	U. Vijaya Lakshmi/ M. Prashanth	V. Vijayarama Raju/ M. Rekha	V. Vijayarama Raju
	FACULTY ID	1279	760	888	1178	1563	1494		692/1279	361/933	361

Class coordinator **HOD, EEE**

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Summation of Teacher's Appraisal by Students

Name of the Instructor	V. Vijayarama Raju
Faculty ID	361
Branch	EEE
Class and Semester	II-A SEM I
Academic Year	2022-23
Subject Title	Power Generation and Transmission
Total No. of Responses/class strength	67/69

Average rating on a scale of 4 for the responses considered:

S.No.	Questions	Average
1	How does the teacher explain the subject?	2.81
2	Knowledge and Preparation of teacher	3.58
3	The language and communication skills of the teacher is	3.22
4	Overall, how were the online classes conducted?	3.04
5	Rate your teacher's ability in interaction and clarifying the doubts	3.06
6	Rate your teacher's commitment in completing the syllabus	3.25
7	Rate your teacher's punctuality, usage of Audio, Visuals in online classes	3.31
8	Usage of teaching aids, real time examples and applications	3.06
9	Study material, PPTs, Conducting activities like quiz, etc.,	2.85
10	What is your overall opinion about the teacher ?	3.04
		3.12

Net Feedback on a Scale of 1 to 4 3.12

Remarks by HOD:

Remarks by Principal:

Remarks by Director:

Gokaraju Rangaraju Institute of Engineering and Technology

(Autonomous)

Bachupally, Kukatpally, Hyderabad – 500 090

Direct Internal CO Attainments

Academic Year	2022-23	Department	Electrical and Electronics Engineering	Name of the Programme	B.Tech		
Year - Semester	II-I	Course Name :	POWER GENERATION AND TRANSMISSION	Course Code	GR20A2033	Section	A

	Mid -I												Mid -II												Assignment Marks					Assessment
	Q.No 1(a)	Q.No 1(b)	Q.No 2(a)	Q.No 2(b)	Q.No 3(a)	Q.No 3(b)	Q.No 4(a)	Q.No 4(b)	Q.No 5	Q.No 6(a)	Q.No 6(b)	Objective Marks	Q.No 1(a)	Q.No 1(b)	Q.No 2(a)	Q.No 2(b)	Q.No 3(a)	Q.No 3(b)	Q.No 4(a)	Q.No 4(b)	Q.No 5(a)	Q.No 5(b)	Q.No 6(a)	Q.No 6(b)	Objective Marks	I	II	III	IV	V	Marks
Enter CO Number → 1,2,3,4,5,6,7	1	1	1	1	3	3	3	3	4	4	4	1,3,4	2	2	2	2	4	4	4	4	5	5	5	5	2,4,5	1,2	2,3	3,4	4,5	1,2,3,4,5	1,2,3,4,5
Marks →	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	5	2.5	2.5	5	2	3	2	3	2	3	2	3	2	3	2	3	5	5	5	5	5	5	5
S.No/Roll No.	*Note :* Enter Marks Between Two Green rows. *Another Note :* Additional Columns if Required should be inserted after column H and appropriately rename the Q. Nos. For Calculations consult Departments CO-PO Incharge																													
21241A0201	1	2								2		3					1		1	2	1				1	5	5	5	5	5	5
21241A0202		2				1						1							1	2					3	5	5	5	5	5	5
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if your class strength is > 60 then *insert rows above the green row(last record)* , Similarly *delete the empty rows above green row* if the class strenght is < 60)																																				
Total number of students appeared for the examination (NST)	69	69	69	69	69	69	69	69	69	69	69	69		69	69	69	69	69	69	69	69	69	69	69	69	69	69		69	69	69	69	69	69
Total number of students attempted the question (NSA)	53	52	16	8	4	8	15	10	36	13	7	67		35	17	15	19	7	6	55	45	34	18	2	1	63		69	69	69	69	69	69
Attempt % (TAP) = (NSA/NST)*100	76.81	75.36	23.19	11.59	5.80	11.59	21.74	14.49	52.17	18.84	10.14	97.10		50.72	24.64	21.74	27.54	10.14	8.70	79.71	65.22	49.28	26.09	2.90	1.45	91.30		100.00	100.00	100.00	100.00	100.00	100.00
Total number of Students who got more than 60% marks (NSM)	53	52	16	7	4	8	15	10	26	13	7	21		34	15	14	18	7	6	55	45	34	16	2	1	27		69	69	69	69	69	69
Attainment % (TMP) = (NSM/NSA)*100	100.00	100.00	100.00	87.50	100.00	100.00	100.00	100.00	72.22	100.00	100.00	31.34		97.14	88.24	93.33	94.74	100.00	100.00	100.00	100.00	100.00	88.89	100.00	100.00	42.86		100.00	100.00	100.00	100.00	100.00	100.00
Score(S)	3	3	3	3	3	3	3	3	3	3	3	1		3	3	3	3	3	3	3	3	3	3	3	3	1		3	3	3	3	3	3
Note : CO attainment is considered to be zero if the attempt % is less than 30%																																				
CO Validation	1	1	1	1	3	3	3	3	4	4	4	1,3,4		2	2	2	2	4	4	4	4	5	5	5	5	2,4,5		1,2	2,3	3,4	4,5	1,2,3,4,5	1,2,3,4,5
Course Outcome	CO1	CO1	CO1	CO1	CO3	CO3	CO3	CO3	CO4	CO4	CO4	O1,CO3,CO		CO2	CO2	CO2	CO2	CO4	CO4	CO4	CO4	CO5	CO5	CO5	CO5	O2,CO4,CO		CO1,CO2	CO2,CO3	CO3,CO4	CO4,CO5	O2,CO3,CO	CO1,CO2,CO3,CO4,CO5
Marks (Y)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	5	2.5	2.5	5		2	3	2	3	2	3	2	3	2	3	2	3	5		5	5	5	5	5	5
No. of COs Shared (Z)	1	1	1	1	1	1	1	1	1	1	1	3		1	1	1	1	1	1	1	1	1	1	1	1	3		2	2	2	2	5	5
Y/Z	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	5	2.5	2.5	1.66667		2	3	2	3	2	3	2	3	2	3	2	3	1.66667		2.5	2.5	2.5	2.5	1	1
S*Y/Z	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	15	7.5	7.5	1.66667		6	9	6	9	6	9	6	9	6	9	6	9	1.66667		7.5	7.5	7.5	7.5	3	3
CO1	1	1	1	1	0	0	0	0	0	0	0	1		0	0	0	0	0	0	0	0	0	0	0	0	0		1	0	0	0	1	1
CO2	0	0	0	0	0	0	0	0	0	0	0	0		1	1	1	1	0	0	0	0	0	0	0	0	1		1	1	0	0	1	1
CO3	0	0	0	0	1	1	1	1	0	0	0	1		0	0	0	0	0	0	0	0	0	0	0	0	0		0	1	1	0	1	1
CO4	0	0	0	0	0	0	0	0	1	1	1	1		0	0	0	0	1	1	1	1	0	0	0	0	1		0	0	1	1	1	1
CO5	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	1	1	1	1	1		0	0	0	1	1	1

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Indirect CO Attainments

Academic Year	2022-23	Department	Electrical and Electronics Engineering	Name of the Programme	B.Tech
Year - Semester	II-I	Course Name :	POWER GENERATION AND TRANSMISSION	Course Code	GR20A2033

Section	A

Course Outcomes survey on Scale 1 (Low) to 5 (High)

Enter Course Outcomes →	1. Explain the basic concepts of Power Generation	2. Calculate economics of power generation.	3. Recall various power system components, line models and its performance.	4. Outline the different concepts related to mechanical design of transmission lines and corona	5.Demonstrate on overhead lines insulator and cables
CO Number → 1,2,3,4,5,6,7	1	2	3	4	5
Marks →	5	5	5	5	5
S.No/Roll No.	Note : Enter Marks Between Two Green rows.				
21241A0201	3	3	3	3	5
21241A0202	1	1	1	1	4
21241A0203	5	5	5	5	5
21241A0204	5	4	4	4	4
21241A0205	5	5	5	5	5
21241A0206	5	4	2	2	2
21241A0207	5	4	4	4	4
21241A0208	5	4	4	4	4
21241A0209	5	5	5	5	5
21241A0210	5	5	5	5	5
21241A0211	5	5	5	5	5
21241A0212	5	5	5	5	5
21241A0213	5	5	5	5	5
21241A0214	5	2	3	2	3
21241A0215	5	5	5	2	3
21241A0216	5	5	5	2	2
21241A0217	5	5	5	2	5
21241A0218	5	5	5	2	5
21241A0219	2	5	5	2	5
21241A0220	5	5	3	2	5
21241A0221	2	2	5	2	5
21241A0222	5	5	5	5	2
21241A0223	2	5	5	5	2
21241A0224	5	5	3	5	1
21241A0225	2	5	5	5	1
21241A0226	2	5	3	5	1
21241A0227	2	5	5	5	1
21241A0228	5	5	5	5	5
21241A0229	5	5	5	5	5
21241A0230	5	5	5	5	5
21241A0231	2	5	5	5	5
21241A0232	5	5	5	5	5
21241A0233	5	5	5	5	5
21241A0234	4	4	4	4	3
21241A0235	4	4	4	4	3
21241A0236	4	4	4	4	3
21241A0237	4	4	4	4	3
21241A0238	4	4	4	4	3
21241A0239	4	4	4	4	3
21241A0240	4	4	4	4	3
21241A0241	4	4	4	4	3
21241A0242	4	4	4	4	3
21241A0243	4	4	4	4	3
21241A0244	4	4	4	4	3
21241A0245	4	4	4	4	3
21241A0246	4	4	4	4	1
21241A0247	4	4	4	4	5
21241A0248	4	4	4	4	4
21241A0249	4	4	4	4	4

21241A0250	4	4	4	4	4
21241A0251	3	2	1	3	4
21241A0252	3	2	1	3	2
21241A0253	3	2	1	3	4
21241A0254	3	2	1	1	2
21241A0255	3	2	2	1	2
21241A0256	3	2	2	1	2
21241A0257	2	2	2	1	2
21241A0258	3	3	3	3	3
21241A0259	1	1	1	1	1
21241A0260	5	5	5	5	5
21241A0261	3	3	3	3	5
21241A0262	1	1	1	1	4
21241A0263	5	5	5	5	5
22245A0201	5	4	4	4	4
22245A0202	5	5	5	5	5
22245A0203	5	4	2	2	2
22245A0204	5	4	4	4	4
22245A0205	5	4	4	4	4
22245A0206	3	2	1	1	2
if your class strength is > 60 then *insert rows above the green row(Last Record)* , Similarly *delete the empty rows above green row* if the class strenght is < 60)					
Total number of students appeared for the examination (NST)	69	69	69	69	69
Total number of students attempted the question (NSA)	69	69	69	69	69
Attempt % (TAP) = (NSA/NST)*100	100.00	100.00	100.00	100.00	100.00
Total number of Students who got more than 60% marks (NSM)	58	56	56	51	52
Attainment % (TMP) = (NSM/NSA)*100	84.06	81.16	81.16	73.91	75.36
Score(S)	3	3	3	3	3

CO attainment is considered zero if the attempt % is less than 30%

Indirect CO (COIn)	CO1	CO2	CO3	CO4	CO5
	3	3	3	3	3

!! Caution !! For CO Values < 2.1 should be justified with Remidial Action Report.

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Direct External CO Attainment

Academic Year	2022-23		Department	Electrical and Electronics Engineering		Name of the Programme	B.Tech		Section	A
Year - Semester	II-I		Course Name :	POWER GENERATION AND TRANSMISSION		Course Code	POWER GENERATION A			

	Q.No 1 (a) Marks	Q.No 2A Marks	Q.No 2B Marks	Q.No 3A Marks	Q.No 4A Marks	Q.No 4B Marks	Q.No 5A Marks	Q.No 5B Marks	Q.No6A Marks	Q.No 6B Marks	Q.No7A Marks	Q.No 7B Marks	Q.No8A Marks	Q.No 8B Marks	Q.No 9A Marks	Q.No 9B Marks	Q.No 10A Marks	Q.No 10B Marks	Q.No 11A Marks
Enter CO Number → 1,2,3,4,5	1,2,3,4,5	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5
Marks →	20	5	5	10	5	5	5	5	5	5	5	5	5	5	5	5	5	5	10
S.No/Roll No.	***Note :*** Enter Marks Between Two Green rows. ***Another Note :*** Additional Columns if Required should be inserted after column H and appropriately rename the Q. Nos. For Calculations consult Departments CO-PO Incharge																		
1	0				2	0	0	2											
2	0			2	2	1													
3	19	3	4		3	1					2	3	3	1					6
4	12			9		3							4	3					5
5	19	3	3		3	3						2					3	3	
6	20	3	3		3	3					0	3	1		4	2			7
7	9					0		0						0		0			
8	20			9	4	3					3	3	4	3					7
9	19			8	3	3					2	3	2	3					6
10	18	3	3				2	3	2	2			3	3					
11	10			7	2	2						2	3				2		
12	16			8			3	0			2	3	3		4	3	3	3	6
13	18			8	3	3							3	2			2	2	7
14	19			8	4	3					0	3	3	3		2			6
15	20			9	3	2			2				2						6
16	19			8			3	3			3	3	4	2					6
17	18			8	3	3					3		3		3				6
18	18			8			3	2			3		4	3					7
19	16	2	3		3	2							2	2					5
20	6	3		2								3	2						4
21	19			8	3	3			2	0		2	3	3					6
22	20			8	3	3			4	3			4	3					7
23	18			8	3	4			2				3	3					6
24	20			8			3	1				3	4		3				7
25	18			5	2	2	2		2			2	3	1			3	3	6
26	19			8	3	3					2	3	3	3					7
27	17			8	4	3			3			3	3						6
28	20			9	4	4			4	3			4	3			3	4	
29	19			7	3	3					2	3	3	3					6
30	15			7	0	0			0	0					4	4			5
31	20			7			3	2	3	2			3	2					5
32	17			6	3	3					3	3	3	3					6
33	15			7	3	3			2	2			2	2					4
34	16			3			2	0			1	0	2	0					5
35	19			6	3	3					3	3		2					4
36	19			7	4	3						3			4		3		
37	17			7	3	3						3	2	2					5
38	15			7	3				2				3				3	3	6
39	20			7			3	6	3	3			3	3					6
40	20			6	4	3			4	2			3	3	3	4			6
41	15			8			3	0	4	2			4	2			4	3	
42	18			6	3	3			3	2			3	3					6
43	15			4	3	2					3	3	3	2					4
44	20			8	4	3			3	3			4	3					6
45	14			5			2	0			2	3	2		4	2			7
46	20			8	3	3			3	0			2						5
47	18	3	3	8	3	3						2	4	3					5
48	19			7	3	4					3	3	4	3			3	3	4
49	20	3	4		3	4					3	2	4	3					7
50	20			7	3	4			3	1			4	4			4	2	

51	17	3	3		3	4						3			2	0			6
52	19			6	4	3			3	2		2	3	2	3	2	3	3	
53	16			6			3	2			2	4	3	3					6
54	9	2	2	6	3		2					1	3				3		3
55	15			7	3	3							2	0					6
56	20			8	4	3			3	3	3	2	4	3					5
57	20			6	3	2						3	3	3					4
58	14			3	3	2							2		1				4
59	16			8	2	4			3	1			4	3			3	2	
60	14		2	5				3				3			3	1			4
61	20			8	3	3			3	3			4	4			3	3	7
62	19			9			4		3				4	2					7
63	20			7	2	4			4	3			3	3			3	3	
64	20			8	4	4					2	3	3	4			4	4	
65	15			7	3	3							4						6
66	19			6	3	3			3	2			3	4					6
67	18			6	4	4					3	3	4	4					5
68	17			7	3	4					2	3	3	3	3	4			4
69	19			8			3	0					3	4			3	3	

if your class strength is > 60 then *insert rows above the green row* , Similarly *delete the empty rows above green row* if the class strenght is < 60)

Total number of students appeared for the examination (NST)	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69
Total number of students	69	10	10	60	52	52	16	15	26	20	23	36	60	48	13	11	18	15	54
Attempt % (TAP) =	100.00	14.49	14.49	86.96	75.36	75.36	23.19	21.74	37.68	28.99	33.33	52.17	86.96	69.57	18.84	15.94	26.09	21.74	78.26
Total number of Students who got more than 60% marks (NSM)	63	8	8	52	45	40	10	4	18	7	11	26	48	32	11	4	16	12	34
Attainment % (TMP) =	91.30	80.00	80.00	86.67	86.54	76.92	62.50	26.67	69.23	35.00	47.83	72.22	80.00	66.67	84.62	36.36	88.89	80.00	62.96
Score(S)	3	3	3	3	3	3	3	0	3	1	1	3	3	3	3	1	3	3	3

CO attainment is considered zero if the attempt % is less than 30%

CO Validation	**1,2,3,4,5**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**4**	**4**	**4**	**4**	**5**	**5**	**5**
Course Outcome	**O2,CO3,CO**	**CO1**	**CO1**	**CO1**	**CO2**	**CO2**	**CO2**	**CO2**	**CO3**	**CO3**	**CO3**	**CO3**	**CO4**	**CO4**	**CO4**	**CO4**	**CO5**	**CO5**	**CO5**
Marks (Y)	**20**	**5**	**5**	**10**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**10**
No. of COs Shared (Z)	**5**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Y/Z	**4**	**5**	**5**	**10**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**10**
S*Y/Z	**12**	**15**	**15**	**30**	**15**	**15**	**15**	**0**	**15**	**5**	**5**	**15**	**15**	**15**	**15**	**5**	**15**	**15**	**30**

CO1	**1**	**1**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
CO2	**1**	**0**	**0**	**0**	**1**	**1**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
CO3	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
CO4	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**1**	**1**	**0**	**0**	**0**
CO5	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**1**

Weighted Average for	CO1	CO2	CO3	CO4	CO5
Attainment relevance	3.00	2.38	2.17	2.58	3.00

!! Caution !! For CO Values < 2.1 should be justified with Remidial Action Report.

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Summary Sheet CO Attainments

Academic Year:	2022-23
Course/Subject:	POWER GENERATION AND TRANSMISSIC
Department:	Electrical and Electronics Engineering
Section	A

Name of the Program:	B.Tech
Course Code:	GR20A2033
Year - Semester :	II-I

Attainment/CO	CO1	CO2	CO3	CO4	CO5
Attainment for Direct Internal CO (Mid I & II, Assignments, Tutorials, Assessments, etc.)	2.79	2.82	2.82	2.78	2.79
Attainment for Direct External CO (End Semester Exam)	3.00	2.38	2.17	2.58	3.00
Direct CO (0.3*Internal + 0.7*External)	2.94	2.51	2.36	2.64	2.94
Indirect CO	3.00	3.00	3.00	3.00	3.00
Final CO (COFn) = (0.9 x Direct CO + 0.1 x Indirect CO)	**2.94**	**2.56**	**2.43**	**2.68**	**2.94**

CO	Course Outcome	Remedial Action for COs Less than 70% (2.10)
CO1	**1. Explainthe basic concepts of Power Generation.**	
CO2	**2. Calculate economics of power generation.**	
CO3	**3. Recall various power system components,**	
CO4	**4. Outline the different concepts related to**	
CO5	**5.Demonstrate on overhead lines insulator**	

ID No.	Name of the Faculty	Department	Signature
361	V. Vijaya Rama Raju	EEE	

HOD **DAA**

Copy to: IQAC

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Direct Internal CO Attainments

Academic Year	2022-23
Year - Semester	II-I

Department	Electrical and Electronics Engineering
Course Name :	POWER GENERATION AND TRANSMISSION

Name of the Programme	B.Tech
Course Code	GR20A2033

P-Outcomes / C-Outcomes	A	B	C	D	E	F	G	H	I	J	K	L	PSO1	PSO2
1	H				H	M		H	M	M	H	H	M	H
2	H	H	H		H		M	M	M	H	H	H	M	H
3	H	H	H		H		M			M	H	H	M	H
4	H	M	H	M	H			M		M	H	H	M	H
5	H	M	H	M	H	M				H	H	H	M	H

Enter H,M, L values of CO-PO Mapping Matrix in blue shaded rows 12 - 18 for seven CO s automatically PO Attainments are Calculated

←

Convert above mappings to scale 1-3

P-Outcomes / C-Outcomes	A	B	C	D	E	F	G	H	I	J	K	L	PSO1	PSO2
CO1	3				3	2		3	2	2	3	3	2	3
CO2	3	3	3		3		2	2	2	3	3	3	2	3
CO3	3	3	3		3		2			2	3	3	2	3
CO4	3	2	3	2	3			2		2	3	3	2	3
CO5	3	2	3	2	3	2				3	3	3	2	3
Expected Attainment	3.00	2.50	3.00	2.00	3.00	2.00	2.00	2.33	2.00	2.40	3.00	3.00	2.00	3.00

Fill the below table with obtained attainments in mids, external and Tutorial/Attendence

	CO1	CO2	CO3	CO4	CO5
Final Cos CoF	2.94	2.56	2.43	2.68	2.94

	Attained PO A	Attained PO B	Attained PO C	Attained PO D	Attained PO E	Attained PO F	Attained PO G	Attained PO H	Attained PO I	Attained PO J	Attained PO K	Attained PO L	Attained PSO 1	Attained PSO 2
CO1	2.94				2.94	1.96		2.94	1.96	1.96	2.94	2.94	1.96	2.94
CO2	2.56	2.56	2.56		2.56		1.71	1.71	1.71	2.56	2.56	2.56	1.71	2.56
CO3	2.43	2.43	2.43		2.43		1.62			1.62	2.43	2.43	1.62	2.43
CO4	2.68	1.79	2.68	1.79	2.68			1.79		1.79	2.68	2.68	1.79	2.68
CO5	2.94	1.96	2.94	1.96	2.94	1.96				2.94	2.94	2.94	1.96	2.94
Attained	2.71	2.18	2.65	1.87	2.71	1.96	1.66	2.15	1.83	2.17	2.71	2.71	1.81	2.71

Note : If Average Attainment of a PO is #Div/0! Relace the corresponding PO with blank.

	A	B	C	D	E	F	G	H	I	J	K	L	PSO1	PSO2
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 11	PO 12
Expected	3.00	2.50	3.00	2.00	3.00	2.00	2.00	2.33	2.00	2.40	3.00	3.00	2.00	3.00
Attained	2.71	2.18	2.65	1.87	2.71	1.96	1.66	2.15	1.83	2.17	2.71	2.71	1.81	2.71
	90.34	87.33	88.39	93.71	90.34	98.14	83.08	91.93	91.71	90.57	90.34	90.34	90.34	90.34

Note : PO is Satisfied if attained PO > 70, U indicates PO Unsatisfied

Faculty Co-Ordinator **HOD**

Cognitive Level Mapping

POWER GENERATION AND TRANSMISSION

Co's	Cognitive level learning					
	1	2	3	4	5	6
1		X				
2			X			
3				X		
4	X					
5				X		

Cognitive Learning Levels

1-REMEMBER

2-UNDERSTAND

3-APPLY

4-ANALYSE

5-EVALUATE

6-CREATE

CODE: GR20A2033 | GR 20 | SET - 2

II B.Tech I Semester Regular Examinations, February/March 2023

POWER GENERATION AND TRANSMISSION

(Electrical and Electronics Engineering)

Time: 3 hours | Max Marks: 70

Instructions:

1. Question paper comprises of **Part-A** and **Part-B**
2. **Part-A** (for 20 marks) must be answered at one place in the answer book.
3. **Part-B** (for 50 marks) consists of **five questions with internal choice,** answer all questions.
4. **CO** means Course Outcomes. **BL** means Blooms Taxonomy Levels.

PART – A

(Answer ALL questions. All questions carry equal marks)

10 * 2 = 20 Marks

1. a.	What are the functions of an economizer?	[2]	CO1	BL1
b.	What is the importance of reflector in nuclear reactor?	[2]	CO1	BL2
c.	Define load factor and demand factor.	[2]	CO2	BL1
d.	Define diversity factor and plant capacity factor.	[2]	CO2	BL1
e.	What are the advantages of bundled conductors in transmission lines?	[2]	CO3	BL1
f.	What is the need for transposition of transmission lines?	[2]	CO3	BL1
g.	Explain how does stranded and bundled conductors reduce corona loss.	[2]	CO4	BL2
h.	Discuss why the Ferranti effect is observed on a lightly loaded line?	[2]	CO4	BL2
i.	Why the capacitance of the cable is very high than the capacitance of the overhead lines?	[2]	CO5	BL1
j.	What are the advantages of cables compared to overhead transmission lines?	[2]	CO5	BL2

PART – B

(Answer ALL questions. All questions carry equal marks)

5 * 10 = 50 Marks

2.	(a) Discuss about the nuclear waste disposal mechanism in a nuclear power plant.	[10]	CO1	BL2
	(b) Explain the functions of cooling tower and condenser with respect to a Thermal power station.			

OR

3.	Explain the operation of thermal power plant with a neat diagram.	[10]	CO1	BL2

4.	(a) Briefly explain the fixed cost, semi-fixed cost and running cost.	[10]	CO2	BL2
	(b) A generating station supplied the following loads: 175MW, 100MW, 80MW, 50MW and 4 MW. The station has a maximum demand of 225MW. The annual load factor of the station is 45%, Calculate (i) the number of units supplied annually (ii) the diversity factor and (iii) the demand factor.			BL5
	OR			
5.	(a) Explain the influence of load factor on the cost of generation?	[10]	CO2	BL2
	(b) Calculate annual bill of a consumer whose maximum demand is 100KW, p.f=0.8 lagging and load factor=60%. The tariff used is Rs.75/KVA of maximum demand plus 15 paise per KWh consumed.			BL5
6.	(a) Draw the phasor diagram for finding sending end voltage and current of the medium transmission line with nominal– T model? How do you find them in terms of ABCD parameters?	[10]	CO3	BL3
	(b) Derive the expression for voltage regulation in medium length transmission lines.			
	OR			
7.	(a) Derive expressions for ABCD constants for lossless long transmission line. Assume distributed parameters for the line.	[10]	CO3	BL3
	(b) Discuss the effect of earth on capacitance of transmission lines.			BL4
8.	(a) Derive the sag expression for a transmission line at equal level supports.	[10]	CO4	BL3
	(b) An overhead transmission line has a span of 220m, the conductor weighing 804 kg/km. Calculate the maximum sag if the ultimate tensile strength of the conductor is 5,758 kg. Assume safety factor 2.			BL5
	OR			
9.	(a) Derive the expression for corona inception voltage and list what are the conditions to occur corona power loss.	[10]	CO4	BL3
	(b) A three phase, 220 kV, 50 Hz transmission line consists of 1.2 cm radius of conductor spaced 2 m a part as an equilateral triangle configuration. Calculate disruptive critical voltage between the lines. Irregularity factor = 0.96, temperature= 25°, barometric pressure = 72.2 cm of Hg. Dielectric strength of air = 21.1 KV (rms)/cm. Also calculate corona power loss.			BL5

10.	**(a)** Discuss about the strain type and shackle type of insulators with neat diagrams?	[10]	CO5	BL3
	(b) Explain the applications of string insulators in over head lines.			BL2

OR

11.	Explain in detail about the pin type insulator with neat diagram and discuss it's advantages, disadvantages?	[10]	CO5	BL2

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Code: GR20A2033 **GR20** **Set 2**

II B. Tech. I Semester Regular Examinations, February/ March 2023

Power Generation and Transmission

(Electrical and Electronics Engineering)

Time: 3 Hours **Max Marks: 70**

1.

a. What are the functions of an economizer?

Ans: Function of economizers in steam power plants is to capture the waste heat from boiler flue gases and transfer it to the boiler feedwater. This raises the temperature of the boiler feedwater, lowering the needed energy input, in turn reducing the firing rates needed for the rated boiler output.

b. What is the importance of reflector in nuclear reactor?

Ans: Reflector's function is to scatter neutrons that leak from the core, thereby returning some of them back into the core.

c. Define load factor and demand factor.

Ans: Load factor is defined as the ratio of average load to the maximum demand for a given period.

The demand factor of an electric power station is defined as the ratio of maximum demand on the power station to its connected load.

d. Define diversity factor and plant capacity factor.

Ans: Diversity Factor is defined as the ratio of sum of individual maximum demand to the maximum demand on the plant.

Capacity Factor is defined as the actual electrical energy generated by the plant to the maximum energy that could be generated.

e. What are the advantages of bundled conductors in transmission lines?

Ans: Advantages of Bundled conductors:

- reduces the possibility of the corona discharge.
- improve transmission efficiency.
- helps in improving the power factor.
- higher maximum power transfer ability.
- lesser loss due to reactance drop.

f. What is the need of transposition of transmission lines?

Ans: The transposing is necessary as there is capacitance between conductors, as well as between conductors and ground. This is typically not symmetrical across phases. By transposing, the overall capacitance for the whole line is approximately balanced. Transposing also reduce effects to communication circuits.

g. Explain how does stranded and bundled conductors reduce corona loss.

Ans: Conductor bundling increases the effective radius of the lines conductor and also reduces the electric field strength near the conductors. Therefore increasing the number of conductors in a bundle reduces the effects of corona discharge.

h. Discuss why the Ferranti effect is observed on a lightly loaded line?

Ans: The "Ferranti Effect" occurs when a transmission line is lightly loaded or has no load at all. The receiving end voltage of the transmission line will be higher than the sending end voltage. This high voltage phenomenon occurs because the reactive power generated by the shunt Line capacitance is greater than the reactive power absorbed by the series line inductance.

i. Why the capacitance of the cable is very high than the capacitance of the overhead lines?

Ans: The capacitance of a cable is very high than that of an overhead line of the same length due to the following reasons.

- The distance between the conductor is very small.
- The distance between the core and earth sheath of the overhead line is very small.
- The permittivity of the cable insulation is usually 3 to 5 times greater than that of the insulation around the conductors of overhead line.

j. What are the advantages of cables compared to overhead transmission lines?

Ans:

- They have reduced visual impact due to being below the ground.
- These lines have reduced EMFs (Electric and Magnetic Fields) and hence eliminates potential health issues.
- Safer from lightning.
- It creates no obstructions.
- It has lesser transmission losses.

2. (a) Discuss about the nuclear waste disposal mechanism in a nuclear power plant.

Ans: Wastes from atomic energy installations are radioactive, create a radioactive hazard and require strong control to ensure that radioactivity is not released into the atmosphere to avoid atmospheric pollution. The wastes produced in the nuclear power plant may be in the form of liquid, gas, or solid and each is treated in a different manner. The waste should either be buried in a deep trench or disposed of in the sea quite away from the seashore.

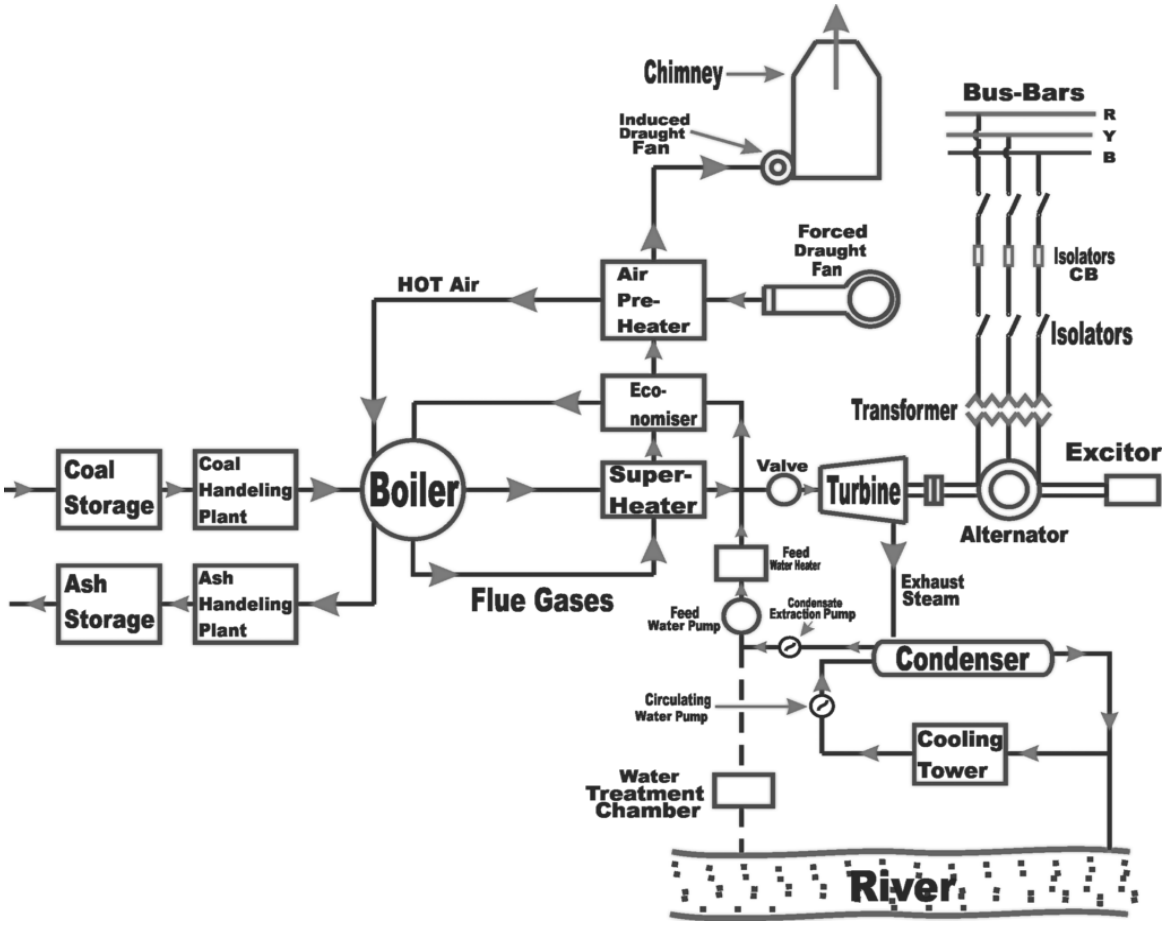
(b) Explain the functions of the cooling tower and condenser with respect to a thermal power plant.

Ans: Function of condenser: The condenser condenses the steam from the exhaust of the turbine into the liquid to allow it to be pumped. It provides the lowest economic heat rejection temperature for steam. It is used to introduce make-up water.

The function of the cooling tower: The function of the cooling tower is to reduce the temperature of the water coming from the condenser.

3. Explain the operation of a thermal power plant with a neat diagram.

Ans:



According to the thermal power plant diagram, the generation of power in the thermal power plant involves the following steps.

Coal and ash circuit

The coal is transported from coal supplying authorities to the coal storage yard of the generating plant. From there the coal is delivered to the pulverized coal plants with the help of a conveyor. After removing unwanted substances from the coal, it is pulverized in coal dust. Pulverization

makes the coal more efficient for burning. After the combustion of the coal, the ash is collected at the ash handling plant. Then the ash is finally collected in the ash storage yard.

Air and flue gas circuit

The systems involved in this circuit are the Air filter, Air Preheater, Dust Collector, Chimney. The air from the atmosphere is sent to Air Preheater. After that, with the help air filter series dust from the air is removed. The chimney will serve as a system to dispose of waste (exhaust gas). As the flue gas flow diagram of the thermal power plant shows, after the combustion process, the flue gas which has a sufficient quantity of heat is made to pass boiler tubes, dust collectors, economizers, and Preheater before passing out through a chimney. The water and air get preheated by passing the flue gas around the economizer and Preheater. All these things will happen before going to the boiler.

Feedwater and steam circuit

The system involves the following boiler feed pump, boiler, turbine, and feedwater heaters. The steam which was produced is passed through the superheater and then to the steam turbine. The steam turbine is coupled to the condenser where the steams exits. In the condenser, the steam is condensed. Then the condensate is heated through a high-pressure and low-pressure heater. In the economizer, the steam is further heated. There would a loss of water and steam while passing through different components, to compensate for those losses feed water is supplied.

Cooling water circuit

The cooling circuit consists of the cooling water pump, condenser, and cooling tower. A massive amount of water is needed for condensing steam in the condenser. A large supply of water can be from lakes or nearby rivers. If the enormous amount of water supply is not available means, the water coming out from the condenser can be cooled and reused.

4. (a) Briefly explain fixed cost, semi-fixed cost, and running cost.

Ans: The total cost of power (electrical energy) generation comprises the following charges: (i) Fixed cost, (ii) Semi-fixed cost, (iii) Running or operating cost.

Fixed Cost: It is independent of the maximum demand, the plant capacity, and the energy generated. It includes Annual charges of the central organization management, Salary of the employees, and Interest in the land costs.

Semi-Fixed Cost: these charges are independent of the energy (kWh) generated but depend upon the maximum demand. Higher the max demand, the greater the semi-fixed costs. This cost includes Interest and depreciation on the capital costs of the land, the buildings, and the costs of the equipment needed for the generation, transmission, and distribution of the electricity. Semi-fixed charges will also include the salaries of the management and other staff since these depend upon the size (and cost) of installation which again depends on the max demand.

Running Or Operating Cost: these charges mainly depend upon the energy (in units or kWh) generated by the plant. This cost includes the cost of fuel, the cost of maintenance and repairs, and the salaries of the operating staff.

Total annual cost = Fixed cost + Semi-fixed cost + Running cost = A + B(kW) + C(kWh)

where, A = annual fixed cost, B = a constant which when divided by maximum demand (kW) gives annual semi-fixed cost, and C = a constant which when multiplied by the annual kWh output gives annual running cost.

(b) A generating station supplied the following loads: 175MW, 100MW, 80MW, 50MW, and 4MW. The station has a maximum demand of 225MW. The annual load factor of the station is 45%, Calculate (i) the number of units supplied annually (ii) the diversity factor, and (iii) the demand factor.

Ans:

Units generated/annum = Average load (in kW) × Hours in a year

= Max. demand (in kW) × L.F. × 8760

= 225000 x 0.45 x 8760 = 88,69,50,000 kWh

Diversity factor = Sum of individual max. demands/ Max. demand on power station

= (175+100+80+50+4)/225 = 1.8178

Demand factor = Max. demand/ Connected load = 225 / (175+100+80+50+4) = 225/409 = 0.55

5. (a) Explain the influence of the load factor on the cost of generation.

Ans: The ratio of the average load to the maximum demand during a given period is known as the load factor. The load factor may be the daily load factor, monthly load factor, or annual load factor if the time considered is a day or month, or year. The load factor is always less than 1 because the average load is smaller than the maximum demand. The load factor plays a key role in determining the overall cost per unit generated. The higher the load factor of the power station, the lesser will be the cost per unit generated.

(b) Calculate the annual bill of a consumer whose maximum demand is 100kW, p.f.=0.8 lagging and load factor= 60%. The tariff used is Rs. 75/kVA of maximum demand plus 15 paise per kWh consumed.

Ans: Units consumed/year = Max. demand × L.F. × Hours in a year = (100) × (0·6) × (8760) kWh

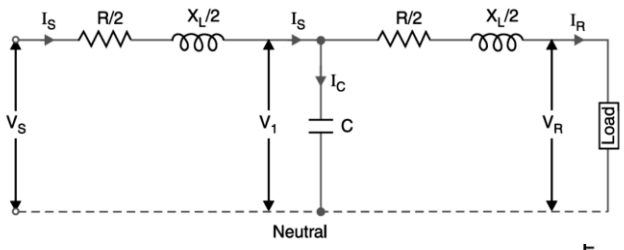
= $5{\cdot}256 \times 10^5$ kWh

Max. demand in kVA = 100/p.f. = 100/0·8 = 125

Annual bill = Max. demand charges + Energy charges = Rs 75 × 125 + Rs $0{\cdot}15 \times 5{\cdot}256 \times 10^5$

= Rs 9375 + Rs 78,840 = Rs 88,215

6. (a) Draw the phasor diagram for finding sending end voltage and current of the medium transmission line with a nominal – T model. How do you find them in terms of ABCD parameters?



Ans: The phasor diagram for the circuit is shown in Fig. Taking the receiving end voltage V_R as the reference phasor, we have,

Receiving end voltage, $V_R = V_R + j\,0$

Load current, $I_R = I_R (\cos \varphi_R - j \sin \varphi_R)$

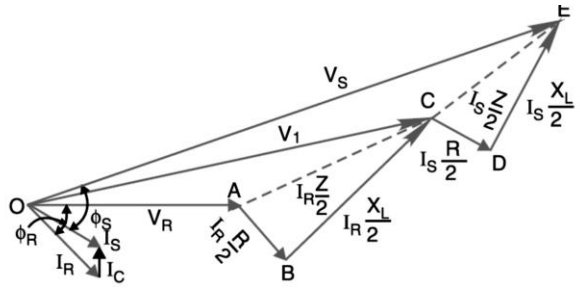
Voltage across C, $V_1 = V_R + I_R Z / 2$

$= V_R + I_R (\cos \varphi_R - j \sin \varphi_R)\,(R/2 + j\,X_L/2)$

Capacitive current, $I_C = j\,\omega\,C\,V_1 = j\,2\,\pi\,f\,C\,V_1$

Sending end current, $I_S = I_R + I_C$

Sending end voltage, $V_S = V_1 + I_S Z/2 = V_1 + I_S(R/2 + j\,X_L/2)$

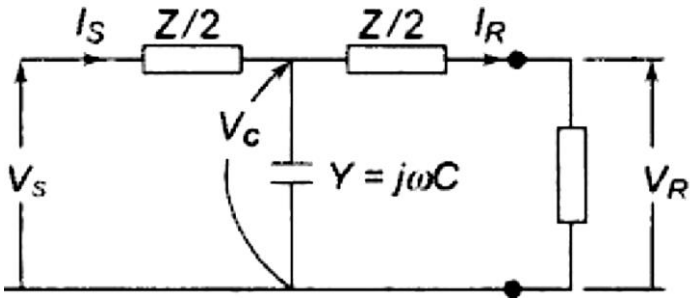


$$V_C = V_R + I_R(Z/2)$$

$$I_S = I_R + V_C Y$$

$$= I_R + YV_R + I_R(Z/2)Y$$

$$V_S = V_C + I_S(Z/2)$$



$$V_S = V_R + I_R(Z/2) + (Z/2)\left[I_R\left(1+\frac{ZY}{2}\right) + YV_R\right]$$

$$= V_R\left(1+\frac{ZY}{2}\right) + I_R\,Z\left(1+\frac{YZ}{4}\right)$$

$$\begin{bmatrix} V_S \\ I_S \end{bmatrix} = \begin{bmatrix} \left(1+\frac{1}{2}ZY\right) & Z\left(1+\frac{1}{4}YZ\right) \\ Y & \left(1+\frac{1}{2}YZ\right) \end{bmatrix} \begin{bmatrix} V_R \\ I_R \end{bmatrix}$$

(b) Derive the expression for voltage regulation in medium-length transmission lines.

Ans: Voltage regulation of transmission line is defined as the ratio of difference between sending and receiving end voltage to receiving end voltage of a transmission line between conditions of no load and full load. It is also expressed in percentage.

$$\%\, Voltage\ Regulation = \frac{V_S - V_R}{V_R} \times 100$$

Where, Vs is the sending end voltage per phase and VR is the receiving end voltage per phase.

$$V_s = \sqrt{(V_R cos\theta_R + IR)^2 + (V_R sin\theta_R + IX_L)^2}$$

XL is the reactance per phase.

R is the resistance per phase.

cosθR is the receiving end power factor.

Effect of load power factor on regulation of transmission line:

For lagging load

$$\%\, Voltage\ Regulation\ = \frac{IRcos\theta_R + IX_L sin\theta_R}{V_R} \times 100$$

For leading load

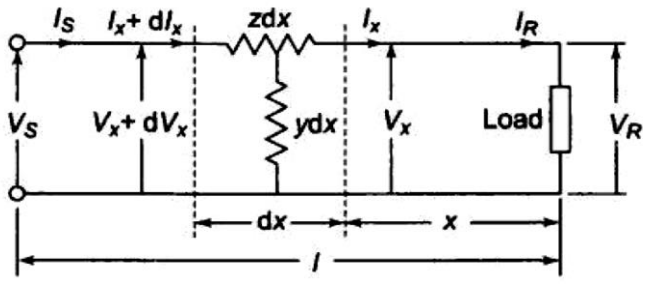
$$\%\, Voltage\ Regulation\ = \frac{IRcos\theta_R - IX_L sin\theta_R}{V_R} \times 100$$

Power factor is lagging or unity, and then VR is increased and goes to be positive.

Power factor is leading, and then VR is decreased and goes to be negative.

7. (a) Derive the expressions for ABCD constants for the lossless long transmission line. Assume distributed parameters for the line.

Ans: For lines over 250 km, the fact that the parameters of a line are not lumped but distributed uniformly throughout its length, must be considered.



The figure shows one phase and the neutral return (of zero impedance) of a transmission line. Let dx be an elemental section of the line at a distance x from the receiving end having a series impedance z dx and a shunt admittance y dr. The rise in voltage to neutral over the elemental section in the direction of increasing x is dv. We can write the following differential relationships across the elemental section:

$$dV_x = I_x\, z\, dx \qquad or \qquad \frac{dV_x}{dx} = z\, I_x$$

$$dI_x = V_x\, y\, dx \qquad or \qquad \frac{dI_x}{dx} = y\, V_x$$

It may be noticed that the kind of connection (e.g. T or) assumed for the elemental section, does not affect these first order differential relations. Differentiating Eq. with respect to x, we obtain

$$\frac{d^2V_x}{dx^2} = \frac{dI_x}{dx}\, z$$

Substituting the value of $\frac{dI_x}{dx}$ from Eq. we get $\frac{d^2V_x}{dx^2} = yz\, V_x$

This is a linear differential equation whose general solution can be written as follows:

$$V_x = C_1 e^{\gamma x} + C_2 e^{-\gamma x}$$

Where $\gamma = \sqrt{yz}$ and C_1, and C_2 are arbitrary constants to be evaluated.

Differentiating Eq. with respect to x, $\frac{dV_x}{dx} = C_1\gamma e^{\gamma x} - C_2\gamma e^{-\gamma x} = zI_x$

$$I_x = \frac{C_1}{Z_C} e^{\gamma x} - \frac{C_2}{Z_C} e^{-\gamma x}$$

Where $Z_C = \sqrt{\frac{z}{y}}$

The constants C1, and C2 may be evaluated by using the end conditions, i.e. when x = 0, $V_x = V_R$ and $I_x = I_R$. Substituting these values in Eqs gives

$$V_R = C_1 + C_2;\ I_R = \frac{1}{Z_C}(C_1 - C_2)$$

which upon solving yield

$$C_1 = \frac{V_R + Z_C I_R}{2};\ C_2 = \frac{V_R - Z_C I_R}{2}$$

With C1, and C2 as determined above, Eqs yield the solution for Vx, and Ix, as

$$V_x = \left(\frac{V_R + Z_C I_R}{2}\right) e^{\gamma x} + \left(\frac{V_R - Z_C I_R}{2}\right) e^{-\gamma x}$$

$$I_x = \left(\frac{\frac{V_R}{Z_C} + I_R}{2}\right) e^{\gamma x} - \left(\frac{\frac{V_R}{Z_C} - I_R}{2}\right) e^{-\gamma x}$$

Here Z_C, is called the characteristic impedance of the line and γ is called the propagation constant.

Knowing VR, IR and the parameters of the line, using Eq. complex number rms values of Vx, and Ix, at any distance x along the line can be easily found out.

A more convenient form of expression for voltage and current is obtained by introducing hyperbolic functions. Rearranging Eq. we get

$$V_x = V_R\left(\frac{e^{\gamma x}+e^{-\gamma x}}{2}\right) + Z_C I_R\left(\frac{e^{\gamma x}-e^{-\gamma x}}{2}\right)$$

$$I_x = V_R\frac{1}{Z_C}\left(\frac{e^{\gamma x}-e^{-\gamma x}}{2}\right) + I_R\left(\frac{e^{\gamma x}+e^{-\gamma x}}{2}\right)$$

These can be rewritten after introducing hyperbolic functions, as

$$V_x = V_R Cosh\,\gamma x + Z_C I_R Sinh\,\gamma x$$

$$I_x = I_R Cosh\,\gamma x + \frac{1}{Z_C} V_R Sinh\,\gamma x$$

When x = l , $V_x = V_s$, $I_x = I_s$

$$\begin{bmatrix} V_s \\ I_s \end{bmatrix} = \begin{bmatrix} Cosh\,\gamma l & Z_C Sinh\,\gamma l \\ \frac{1}{Z_C} Sinh\,\gamma l & Cosh\,\gamma l \end{bmatrix} \begin{bmatrix} V_R \\ I_R \end{bmatrix}$$

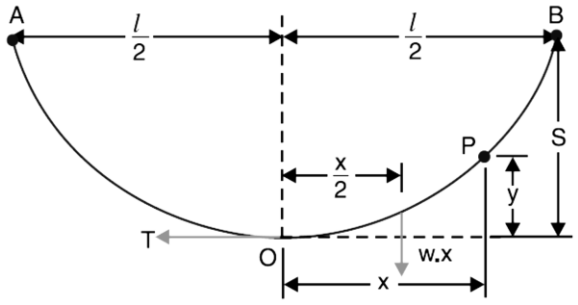
Here A = D = $Cosh\,\gamma l; B = Z_C Sinh\,\gamma l$ *and* $C = \frac{1}{Z_C} Sinh\,\gamma l$

(b) Discuss the effect of the earth on the capacitance of transmission lines.

Ans: Capacitance between the phase conductors is not only dependent on conductor spacing, the radius of the conductor, and the height of the conductor from the ground rather it is also influenced by the earth. The effect of the earth on the capacitance of the system is to increase it. However, normally the distance of separation between the conductors is much smaller than the height of the conductor from the ground, and for all practical purposes the effect of earth online capacitance can be neglected.

8. (a)Derive the sag expression for a transmission line at equal level supports.

Ans: Consider a conductor between two equal level supports A and B with O as the lowest point as shown in Fig. It can be proved that lowest point will be at the mid-span.



Let

l = Length of span

w = Weight per unit length of conductor

T = Tension in the conductor.

Consider a point P on the conductor. Taking the lowest point O as the origin, let the co-ordinates of point P be x and y. Assuming that the curvature is so small that curved length is equal to its horizontal projection (i.e., OP = x), the two forces acting on the portion OP of the conductor are:

(i) The weight wx of conductor acting at a distance x/2 from O.

(ii) The tension T acting at O.

Equating the moments of above two forces about point O, we get, $Ty = wx \times \frac{x}{2}$

or $y = \frac{Wx^2}{2T}$

The maximum dip (sag) is represented by the value of y at either of the supports A and B.

At support A, x = l/2 and y = S

∴ Sag, $S = \frac{W(l/2)^2}{2T} = \frac{Wl^2}{8T}$

(b) An overhead transmission line has a span of 220m, the conductor weighing 804 kg/km. calculate the maximum sag if the ultimate tensile strength of the conductor is 5758kg. Assume safety factor 2.

Ans: Transmission line span length = 220m

Ultimate tensile strength of the conductor = 5758kg

Weight of the conductor (W) = 804 kg/km = 804/1000 = 0.804 kg/m

Working tension, T = Ultimate tensile strength/ safety factor = 5758/2 =2879 kg

∴ Sag, $S = \frac{Wl^2}{8T} = \frac{0.804 \times 220^2}{8 \times 2879}\ 1.69m$

9. (a) Derive the expression for corona inception voltage and list what are the conditions to occur corona power loss.

Ans: Consider two conductors of radii r cm and spaced d cm apart. If V is the phase-neutral potential,

then potential gradient at the conductor surface is given by:

$$g = \frac{V}{r\ log_e \frac{d}{r}}\ volts/cm$$

In order that corona is formed, the value of g must be made equal to the breakdown strength of air. The breakdown strength of air at 76 cm pressure and temperature of 25ºC is 30 kV/cm (max) or 21·2 kV/cm (r.m.s.) and is denoted by go. If Vc is the phase-neutral potential required under these conditions, then,

$$g_o = \frac{V_c}{r\ log_e \frac{d}{r}}$$

where g_o = breakdown strength of air at 76 cm of mercury and 25ºC

= 30 kV/cm (max) or 21·2 kV/cm (r.m.s.)

∴ Critical disruptive voltage,

$$V_c = g_o r \, log_e \frac{d}{r}$$

The above expression for disruptive voltage is under standard conditions i.e., at 76 cm of Hg and 25ºC.

(b) A three phase 220kV 50Hz transmission line consists of 1.2cm radius of conductor spaced 2m apart as an equilateral triangle configuration. Calculate disruptive critical voltage between the lines. Irregularity factor = 0.96, temperature = 25^0, barometric pressure =72.2 cm of Hg. Dielectric strength of air = 21.1kV(rms)/cm. Also calculate corona power loss.

Ans:

$$\delta = \frac{3.92b}{273 + t} = \frac{3.92 \times 72.2}{273 + 25} = 0.9497$$

Critical disruptive voltage per phase is

$V_c = m_o g_o \delta r \, log_e \frac{d}{r} \, kV = 0.96 \times 21.2 \times 0.9497 \times 1.2 \times log_e \frac{200}{1.2} = 118.69 \, kV =$

Supply voltage per phase, $V = 220/V = \frac{220}{\sqrt{3}} = 127kV$

Corona loss is given by:

$$P = \frac{242.2}{\delta}(f + 25)\sqrt{\frac{r}{d}}(V - V_C)^2 \times 10^{-5} \frac{\frac{kW}{km}}{phase}$$

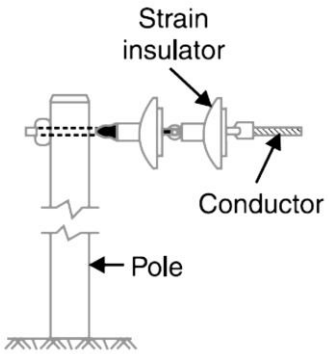
$$P = \frac{242.2}{0.9497}(50 + 25)\sqrt{\frac{1.2}{200}}(127 - 118.69)^2 \times 10^{-5} = 1{,}02{,}312 \times 10^{-5} \frac{\frac{kW}{km}}{Phase}$$

Total corona loss per km for three phases = 3 x $1{,}02{,}312 \times 10^{-5}$ = 3.06936 kW/km

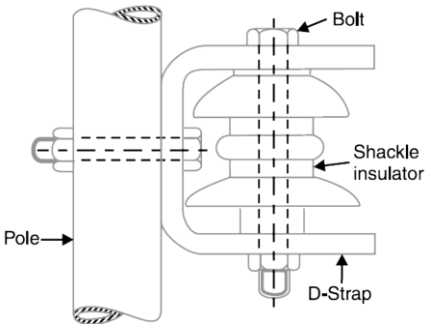
10. (a) Discuss about the strain type and shackle type of insulators with a neat diagram.

Ans:

Strain insulators: When there is a dead end of the line or there is corner or sharp curve, the line is subjected to greater tension. In order to relieve the line of excessive tension, strain insulators are used. For low voltage lines (< 11 kV), shackle insulators are used as strain insulators. However, for high voltage transmission lines, strain insulator consists of an assembly of suspension insulators as shown in Fig. The discs of strain insulators are used in the vertical plane. When the tension in lines is exceedingly high, as at long river spans, two or more strings are used in parallel.



Shackle insulators: In early days, the shackle insulators were used as strain insulators. But now a days, they are frequently used for low voltage distribution lines. Such insulators can be used either in a horizontal position or in a vertical position. They can be directly fixed to the pole with a bolt or to the cross arm. Fig. shows a shackle insulator fixed to the pole. The conductor in the groove is fixed with a soft binding wire.



(b) Explain the applications of string insulators in overhead lines

Ans: The cost of pin type insulator increases rapidly as the working voltage is increased. Therefore, this type of insulator is not economical beyond 33 kV. For high voltages (>33 kV), it is a usual practice to use suspension type insulators. They consist of a number of porcelain discs connected in series by metal links in the form of a string. The conductor is suspended at the bottom end of this string while the other end of the string is secured to the cross-arm of the tower. Each unit or disc is designed for low voltage, say 11 kV. The number of discs in series would obviously depend upon the working voltage. For instance, if the working voltage is 66 kV, then six discs in series will be provided on the string.

11. Explain in detail about the pin type insulator with a neat diagram and discuss its's advantages, disadvantages.

Ans: The cut section of a pin type insulator is shown in Fig. As the name suggests, the pin type insulator is secured to the cross-arm on the pole. There is a groove on the upper end of the insulator for housing the conductor. The conductor passes through this groove and is bound by the annealed wire of the same material as the conductor. Pin type insulators are used for transmission and distribution of electric power at voltages upto 33 kV. Beyond operating voltage of 33 kV, the pin type insulators become too bulky and hence uneconomical.