Department	EEE	Branch Code/Degree/Branch (mention all branches for which the subject is offered)	**07 – BE - EEE**			
Semester	07					
Subject Code	504022		**L**	**T**	**P**	**C**
Subject Title	**PROTECTION AND SWITCH GEAR**		3	0	0	3

Objectives:

- To educate the causes of abnormal operating conditions (faults, lightning and switching surges) of the apparatus and system.
- To introduce the characteristics and functions of relays and protection schemes.
- To impart knowledge on apparatus protection
- To introduce static and numerical relays
- To impart knowledge on functioning of circuit breakers

Unit 1	**PROTECTION SCHEMES**	Total Hrs	9

Principles and need for protective schemes – nature and causes of faults – types of faults – fault current calculation using symmetrical components – Methods of Neutral grounding – Zones of protection and essential qualities of protection – Protection schemes

Unit 2	**ELECTROMAGNETIC RELAYS**	Total Hrs	9

Operating principles of relays - the Universal relay – Torque equation – R-X diagram – Electromagnetic Relays – Overcurrent, Directional, Distance, Differential, Negative sequence and Under frequency relays.

Unit 3	**TRANSFORMER PROTECTION**	Total Hrs	9

Types of Faults, Over Current Protection, Percentage Differential Protection, Inrush Phenomenon, High Resistance Ground Faults in Transformers, Inter-turn Faults, Incipient Faults, Over-fluxing Phenomenon

Unit 4	**STATIC RELAYS AND NUMERICAL PROTECTION**	Total Hrs	9

Static relays – Phase, Amplitude Comparators – Synthesis of various relays using Static comparators – Introduction, block diagram of numerical relay, numerical over current protection, numerical transformer protection, numerical distance protection of transmission line

Unit 5	**CIRCUIT BREAKERS**	Total Hrs	9

Physics of arcing phenomenon and arc interruption - DC and AC circuit breaking – re-striking voltage and recovery voltage - rate of rise of recovery voltage - resistance switching - current chopping - interruption of capacitive current - Types of circuit breakers – air blast, air break, oil, SF6 and vacuum circuit breakers - D.C. circuit breaker, auto-reclosing - definitions & features.

		Total Hours	**45**

Text Book:

1. Badri Ram, B.H. Vishwakarma, ‘Power System Protection and Switchgear’, New Age International Pvt Ltd Publishers, Second Edition, 2011.
2. Y. G. Parithankar & S. R. Bhide, “Fundamentals of Power System Protection”, 2nd edition, PHI, 2010
3. B.Rabindranath and N.Chander, ‘Power System Protection and Switchgear’, New Age International (P) Ltd., First Edition 2011.

References:

1. Y.G.Paithankar and S.R.Bhide, ‘Fundamentals of power system protection’, Second Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2010.
2. C.L.Wadhwa, ‘Electrical Power Systems’, 6th Edition, New Age International (P) Ltd., 2010
3. Ravindra P.Singh, ‘Switchgear and Power System Protection’, PHI Learning Private Ltd., New Delhi, 2009

VISION AND MISSION OF THE INSTITUTE & DEPARTMENT

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	Vision	Mission	
	To emerge as a pioneer institute inculcating engineering education, skills, research, values and ethics.	**IM-1**	To achieve greater heights of excellence in technical knowledge and skill development through innovative teaching and learning practices.

Institute		**IM-2**	To develop the state of art infrastructure to meet the demands of technological revolution.
		IM-3	To improve and foster research in all dimensions for betterment of society.
		IM-4	To develop individual competencies to enhance innovation, employability and entrepreneurship among students.
		IM-5	To instill higher standards of discipline among students, inculcating ethical and moral values for societal harmony and peace.
Department	To emerge as pre-eminence program for quality Electrical and Electronics Engineering Graduates	**DM-1**	To enable quality infrastructure for advanced knowledge and skills towards learning under congenial environment for global placement, higher studies, research and entrepreneurship.
		DM-2	To stimulate the process of critical thinking and problem solving with special focus on research capabilities.
		DM-3	To enhance professional ethics, values and standards to meet the demands of society

Lession plan

S.No.	Unit	Topic to be covered	Hours Needed	Mode of Teaching (SM / PPT/PPT/Others)	Text/ Ref. Book	Page No.
1	1	Introduction	1	SM / PPT	T1	5
2		Importance of protective schemes for electrical apparatus and power system.	1	SM / PPT	T1	9
3		nature and causes of faults	1	SM / PPT	T1	21
4		types of faults	1	SM / PPT	T1	41
5		fault current calculation using symmetrical components	2	SM / PPT	T1	48
6		Methods of Neutral grounding	1	SM / PPT	T1	51
7		Zones of protection and essential qualities of protection	1	SM / PPT	T1	56
8		Protection schemes	1	SM / PPT	T1	61
9	2	Electromagnetic relays – operating principle	2	SM / PPT	T1	114
10		the Universal relay , Torque equation	1	SM / PPT	T1	121
11		R-X diagram	1	SM / PPT	T1	130

	12		Electromagnetic Relays	**2**	**SM / PPT**	**T1**	**141**
	13		Overcurrent, Directional, Distance, Differential	**2**	**SM / PPT**	**T1**	**152**
	14		Negative sequence and Under frequency relays.	**1**	**SM / PPT**	**T1**	**154**
	15	**3**	Types of Faults in Transformer	1	**SM / PPT**	**T1**	65
	16		Over Current Protection, Percentage Differential Protection	2	**SM / PPT**	**T1**	66
	17		High Resistance Ground Faults in Transformers	2	**SM / PPT**	**T1**	70
	18		Inter-turn Faults	1	**SM / PPT**	**T1**	72
	19		Inrush Phenomenon	2	**SM / PPT**	**T1**	89
	20		Over-fluxing Phenomenon	1	**SM / PPT**	**T1**	97
	21	**4**	Introduction of Static Relay	1	**SM / PPT**	**T1**	453
	22		Static relays – Phase, Amplitude Comparators	2	**SM / PPT**	**T1**	460
	23		Amplitude Comparators – Synthesis of various relays using Static comparators	2	**SM / PPT**	**T1**	491
	24		block diagram of numerical relay, numerical over current protection	1	**SM / PPT**	**T1**	525
	25		numerical transformer protection, numerical distance protection of transmission line	2	**SM / PPT**	**T1**	562
	26		***Fault- protection schemes for line/feeder**	1	**VIDEO**	--	--
	27	**5**	Physics of arcing phenomenon and arc interruption	1	**SM / PPT**	**T1**	156
	28		DC and AC circuit breaking	1	**SM / PPT**	**T1**	162
	29		re-striking voltage and recovery voltage	1	**SM / PPT**	**T1**	171
	30		rate of rise of recovery voltage	1	**SM / PPT**	**T1**	175
	31		resistance switching - current chopping - interruption of capacitive current	2	**SM / PPT**	**T1**	178
	32		Types of circuit breakers – air blast, air break, oil, SF6 and vacuum circuit breakers -	2	**SM / PPT**	**T1**	185

		D.C. circuit breaker, auto-reclosing - definitions & features.				
33		*** Testing & Rating of Lightining Arresters- Basic ideas of insulation co-ordination**	1	**SM / PPT**	**---**	Website
34		***Low voltage circuit breaker and maintenance of circuit breaker**	1	**SM / PPT**	**---**	Website

PSN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University)

Melathediyoor, Tirunelveli-627152

Department of Electrical and Electronics Engineering

QUESTION BANK

Degree/Branch: B.E / EEE
Semester: VII
Subject Code/Title: 504022 / Protection and Switch Gear
Regulation: 2018
Academic Year: 2021-2022

Prepared By: Miss.P.Muthu Lakshmi, Assistant Professor - EEE

Unit I - Protection Schemes
Principles and need for protective schemes–nature and causes of faults–types of faults–Methods of Grounding-Zones of protection and essential qualities of protection–Protection scheme
PART – A 2 MARKS

Q.No	Questions	Course Outcome	BT Level	Competence
1	Show the need for protective schemes in power system?	CO1	BTL 1	Remember
2	Differentiate between a short circuit and an overload.	CO1	BTL 1	Remember
3	Summarize the role of protective relay in a modern power	CO1	BTL 5	Evaluate
4	Define switchgear.	CO1	BTL 1	Remember
5	What are the causes of faults in a power system?	CO1	BTL 1	Remember
6	Summarize the functions of isolating switch?	CO1	BTL 5	Evaluate
7	Explain surge absorber? Differentiate it from surge diverter?	CO1	BTL 4	Analyze
8	Identify the sources of fault power?	CO1	BTL 1	Remember
9	Identify the different types of faults occurring in power system?	CO1	BTL 1	Remember
10	Give the consequences of short circuit.	CO1	BTL 4	Analyze
11	Explain the importance of ground wire?	CO1	BTL 2	Understand
12	List the merits of resistance grounded system.	CO1	BTL 4	Analyze
13	Analyze how arcing ground avoided can be avoided?	CO1	BTL 2	Understand
14	What happen if earth wire is not provided in overhead	CO1	BTL 6	Create
15	Classify the different types of earthing.	CO1	BTL 2	Understand
16	What is the necessity for earthing?	CO1	BTL 3	Apply
17	What is primary protection?	CO1	BTL 6	Create
18	Define protection zone.	CO1	BTL 6	Create
19	Classify the different types of zones of protection.	CO1	BTL 1	Remember
20	Show the examples for unit and non unit system of protection.	CO1	BTL 2	Understand

PART – B				
1	What are the different types of faults? Discuss the consequence of faults on a power system (16)	CO1	BTL 4	Analyze
2	List the causes of faults in different equipment's in a sample system (16)	CO1	BTL 2	Understand

3	Explain in detail about the various methods of overvoltage protection of overhead transmission line. (16)	CO1	BTL 4	Analyze
4	Explain in detail about the need and different methods for neutral grounding with suitable diagram. (16)	CO1	BTL 3	Apply
5	(i) Explain different types of earthing the neutral point of the power system (8) (ii) Formulate an expression for the reactance of the Peterson coil in terms of capacitance of the protected line. (8)	CO1	BTL 4,6	Analyze Create
6	Describe in detail about the Peterson coil? List the protective functions performed by this device. (16)	CO1	BTL 1	Remember
7	A 132 kV, 3-phase, 50 Hz transmission line 200 km long consists of three conductors of effective diameter 20 mm arranged in a vertical plane with 4 m spacing and regularly transposed. Find the inductance and kVA rating of the arc suppression coil in the system (16)	CO1	BTL 3	Apply
8	(i) Explain the overlapping of protective zones with neat sketch. (8) (ii) Describe the different faults in power system. Which of these are more frequents? (8)	CO1	BTL 5,1	Remember Evaluate
9	(i) Describe the fundamental requirements of protective Relaying. (8) (ii) Differentiate between surge diverter and surge absorber. Also explain the characteristics of an ideal surge diverter. (8)	CO1	BTL 1,2	Remember Understand
10	(i) List the causes of short circuits due to failure of insulation on overhead conductors? (6) (ii) Briefly explain about resistance earthing and reactance earthing. (10)	CO1	BTL 1,4	Remember Analyze
11	A 230 kV, 3-phase, 50 Hz, 200 km transmission line has a capacitance to earth of 0.02 μF/km per phase. Calculate the inductance and kVA rating of the Peterson coil used for earthing the above system (16)	CO1	BTL 3	Apply
12	(i) Draw and explain protective zone diagram for a sample power system networks. (8) (ii)List the causes of faults in different equipment's in a sample system (8)	CO1	BTL 5,3	Evaluate Apply
13	Why protection scheme is required in power system with suitable example. (1 6)	CO1	BTL 4	Analyze
14	Explain different types of protection schemes with suitable diagrams. (16)	CO1	BTL 5	Evaluate

15	Why neutral grounding is provided and compare different types of neutral grounding (16)	CO1	BTL 4	Analyze
16	Determine the inductance of Peterson coil to be connected between the neutral and ground to neutralize the charging current of overhead line having the line to ground capacitance of 0.15μF. If the supply frequency is 50 HZ and the operating voltage is 132KV. Find the KVA rating of the coil. (16)	CO1	BTL 5	Evaluate

Unit II - Electromagnetic Relays

Operating principles of relays-the Universal relay–Torque equation–R-X diagram–Electromagnetic Relays–Over current, Directional, Distance, Differential, Negative sequence and Under frequency relays.

PART – A 2 MARKS

Q.No	Questions	Course Outcome	BT Level	Competence
1	List the basic requirements of protective relay	CO2	BTL 1	Remember
2	Summarize the functions of protective relays.	CO2	BTL 5	Evaluate
3	Show the different types of electromagnetic relays?	CO2	BTL 3	Apply
4	Identify the applications of attracted armature type	CO2	BTL 1	Remember
5	Define time setting multiplier in protective relays.	CO2	BTL 1	Remember
6	What is time graded relay	CO2	BTL 5	Evaluate
7	Discuss the effects of arc resistance?	CO2	BTL 2	Understand
8	Discuss R-X diagram?	CO2	BTL 2	Understand
9	Why shading ring is provided in and induction disc relay	CO2	BTL 2	Understand
10	What are the applications of over current relay?	CO2	BTL 1	Remember
11	In what way a distance relay is superior to over current protection for protection of transmission line. Justify	CO2	BTL 6	Create
12	List the different types of distance relay.	CO2	BTL 1	Remember
13	Show the merits of mho relay? And also draw its R-X Diagram.	CO2	BTL 3	Apply
14	Explain the principle of differential relay.	CO2	BTL 4	Analyze
15	What are the conditions under which the directional impedance relay will act?	CO2	BTL 1	Remember
16	Give the principle of negative sequence relay.	CO2	BTL 2	Understand
17	Mention the principle of operation of distance relay..	CO2	BTL 4	Analyze
18	Give the function of under frequency relay.	CO2	BTL 2	Understand
19	What are the applications of differential relay?	CO2	BTL 1	Remember
20	Show which type of relay is best suited for long distance very high voltage transmission lines.	CO2	BTL 3	Apply

PART – B

1	Develop the different inverse time characteristics of over current relays and mention how the characteristics can be achieved in practice for an EM relay? (16)	CO2	BTL 6	Create

2	Explain the general working of a relay and derive the fundamental torque equation. (16)	CO2	BTL 4	Analyze
3	Discuss the construction details and principle of operation of induction type directional over current relay. (16)	CO2	BTL 2	Understand
4	Discuss the construction and principle of operation of non-directional induction-disc relay. (16)	CO2	BTL 2	Understand
5	Determine plug setting multiplier of a 5 ampere,3 second over current relay having a current setting of 125% and a time setting multiplier of 0.6 connected to supply circuit through a 400/5 current transformer when the circuit carries a fault current of 4000Athrough a 400/5 current transformer when the circuit carries a fault current of 4000A . (16)	CO2	BTL 2	Understand
6	Describe the operating principle, constructional features and area of applications of directional relay. How do you implement directional feature in the over current relay. (16)	CO2	BTL 1	Remember
7	(i) Explain the construction details and principle of operation o f directional induction cup relay. (8) (ii) Explain with the help of neat diagram the construction and working of induction type directional power relay. (8)	CO2	BTL 4,4	Analyze
8	Show the MHO relay characteristic on the R-X diagram. Discuss the range setting of various distance relays placed on a particular location (16)	CO2	BTL 3	Apply
9	Show in what way distance protection is superior to over current protection for the protection of transmission line. (16)	CO2	BTL 3	Apply
10	Explain the principle of working of distance relays. Describe with neat sketches the following types of relay (i) Impedance relay (ii) Reactance relay (iii) Mho relay Indicate the difference on RX diagrams and show where each type is suitable. (16)	CO2	BTL 5	Evaluate
11	Describe the operating principles and characteristic of impedance, admittance and mho relays. (16)	CO2	BTL 1	Remember
12	Describe the principle of percentage biased differentia relay with necessary diagrams. Also discuss its applications. (16)	CO2	BTL 1	Remember
13	Explain with suitable diagram the principle of working of transley relay. (16)	CO2	BTL 3	Apply
14	(i) With neat sketch explain negative sequence relay (7) (ii) Explain clearly about current balance differential	CO2		

	relays. (6)		BTL 4,4	Analyze
15	With neat diagram explain the various types of electromagnetic relays. (16)	CO2	BTL 4	Analyze
16	Describe the construction and principle of operation of non directional induction type over current relay. (16)	CO2	BTL 5	Evaluate
17	Explain impedance relay with suitable R-X diagrams (16)	CO2	BTL 5	Evaluate
18	Derive the torque equation of mho relay from universal torque equation. (16)	CO2	BTL 4	Analyze

Unit III - Apparatus Protection

Current transformers and Potential transformers and their applications in protection schemes-Protection of transformer, generator, motor, bus bars and transmission line.

PART – A 2 MARKS

Q.No	Questions	Course Outcome	BT Level	Competence
1	Justify, Why secondary of transformer should not be opened?	CO3	BTL 6	Create
2	For a 132KV system, the reactance and capacitance up to the location of circuit breaker is 3Ω and 0.015μf respectively the frequency of oscillation?	CO3	BTL 1	Remember
3	Mention the difference between CTs used for protection	CO3	BTL 4	Analyze
4	Define the term burden on CT.	CO3	BTL 1	Remember
5	List the application of potential transformer.	CO3	BTL 1	Remember
6	Discuss the short comings of differential protection scheme as applied to power transformer.	CO3	BTL 2	Understand
7	Define the term pilot with reference to power line	CO3	BTL 1	Remember
8	Show the applications of Buchholz's relay.	CO3	BTL 3	Apply
9	Identify the problems arising in differential protection in power transformer and how are they overcome?	CO3	BTL 1	Remember
10	Explain current grading of relays?	CO3	BTL 5	Evaluate
11	Explain over fluxing protection of a transformer?	CO3	BTL 4	Analyze
12	List the common faults that occur in a generator	CO3	BTL 1	Remember
13	Discuss the causes of over speed and how alternators are protected from it?	CO3	BTL 2	Understand
14	Discuss the type of relay is best suited for generation	CO3	BTL 2	Understand
15	What are the protection methods used for transmission line?	CO3	BTL 3	Apply
16	Explain the secondary of CT should not be open.	CO3	BTL 4	Analyze
17	Discuss the type of relays are used to protect transmission	CO3	BTL 2	Understand
18	Compose the common methods used for line protection?	CO3	BTL 6	Create

19	Classify the types of bus bar protection.	CO3	BTL 3	Apply
20	Explain time-graded system protection?	CO3	BTL 5	Evaluate
	PART - B			
1	(i) Compare CT & PT. What are the applications of CT & PT. (8) (ii) An 11 kV, 200MVA alternator is provided with differential protection. The % of winding to be protected against phase to ground fault is 85 %.The relay is set to operate when there is 20% out of balance current. Determine the value of the resistance to be placed in the neutral to ground connection. (8)	CO3	BTL 5	Evaluate
2	A 3 phase transformer having line voltage ratio of 0.4 kV/11 kV is connected in star delta and protective transformer on 400 v side have a current ratio of 500/5.what must be the ratio of the protective transformer on the 11kV side? (16)	CO3	BTL 2	Understand
3	Classify different protection schemes normally used for protection of a power transformer from internal faults? Discuss one of them in brief. (16)	CO3	BTL 4	Analyze
4	(i) Explain the Merz-price circulation current scheme of protection used for power transformer. (8) (ii) A three phase transformer of 220/11000 line volts is connected in star/delta. The protective transformers on 220V side have a current ratio of 600/5. Calculate the current transformer ratio on 11000V side. (8)	CO3	BTL 4,3	Analyze Apply
5	A 3 phase transformer having line voltage ratio of 440 V / 11 kV is connected in star – delta. The protection transformer on the LV side has a ratio of 500 / 5. Estimate the ratio of the protection transformer connected on HV side? (16)	CO3	BTL 2	Understand
6	(i) Describe the differential protective scheme of transformer. (8) (ii) Show the protective scheme employed for the bus bar. (8)	CO3	BTL 1,3	Remember Apply
7	(i) Describe clearly about Buchholz relay for the protection of incipient faults in transformers (8) (ii) A star connected, 3 phase, 10 MVA, 6.6KV alternator has a per phase reactance of 10%. It is protected by Merz- price circulating current principle which is set to operate for fault currents not less than 175A. Calculate the value of earthing resistance to be provided in order to ensure that only 10% of the alternator winding remains unprotected. (8)	CO3	BTL 1,4	Remember Analyze
8	Discuss the principle of percentage biased differential protection with necessary diagrams. Also discuss its applications (16)	CO3	BTL 2	Understand

9	Describe the differential pilot wire method of protection of feeder (16)	CO3	BTL 3	Apply
10	A star connected 3-phase,20MVA,11KV Alternator has a per phase reactance of 0.75 ohms/phase .It is protected by Merz price circulating current principle which is to operate for fault currents not less than 175A. Formulate the value of earthing resistance to be provided in order to ensure only 10% of the alternator winding remains unprotected (16)	CO3	BTL 6	Create
11	Describe the types of protective schemes employed for the protection of field winding and loss excitation of alternator. (16)	CO3	BTL 1	Remember
12	Describe the types of protective schemes employed for the protection of Busbar. (16)	CO3	BTL 1	Remember
13	Explain the types of protective schemes employed for the protection of Transmission line. (16)	CO3	BTL 4	Analyze
14	Show the different types of feeder and the protective schemes employed for the protection of feeder (16)	CO3	BTL 3	Apply
15	Give a brief account on the protection of generator using differential and biased differential protection scheme. (16)	CO3	BTL 4	Analyze
16	Give a brief account on the faults and protection of transformer. (16)	CO3	BTL 4	Analyze
17	A star connected 3 phase, 12 MVA, 11 KV alternator has a phase reactance of 10%. It is protected by Merz- price circulating current scheme which is set to operate for fault current not less than 200A. Calculate the value of earthing resistance to be provided in order to ensure that only 15% of the alternator winding remains unprotected. (16)	CO3	BTL 5	Evaluate
18	A 500 KVA, 6.6 KV star connected alternators has a synchronous reactance of 1.0Ω per phase and negligible resistance. The different relay operates if the out of balance current through it exceeds 30% of the normal full load current of the alternator. The star point of the alternator is earthed through a resistance of 5Ω. What percent of the stator winding is left unprotected? Show that the effect of the alternator reactance can be neglected. (16)	CO3	BTL 5	Evaluate
Unit IV - Static Relays and Numerical Protection				

Static relays–Phase, Amplitude Comparators–Synthesis of various relays using Static comparators–Block diagram of Numerical relays–Over current protection, transformer differential protection, distant protection of transmission lines.

PART – A 2 MARKS

Q.No	Questions	Course Outcome	BT Level	Competence
1	What are the basic circuits used in static relays?	CO4	BTL-6	Create
2	Give the advantages of static relays	CO4	BTL-2	Understand
3	Compose the problems arising in differential protection in power transformer and how are they overcome?	CO4	BTL-6	Apply
4	Show the Duality between Amplitude and Phase Comparators	CO4	BTL-1	Remember
5	Explain Comparator and its type	CO4	BTL-1	Remember
6	Explain the function of Synthesis of Mho Relay Using Static Phase Comparator	CO4	BTL-1	Remember
7	Define static relay	CO4	BTL-4	Analyze
8	Explain the function of Synthesis of Simple Impedance Relay using Amplitude Comparator	CO4	BTL-5	Evaluate
9	Define Amplitude Comparator and Phase Comparator	CO4	BTL-2	Understand
10	Distinguish the Synthesis of Various Distance Relays Comparators	CO4	BTL-3	Apply
11	List out the general characteristics of numerical protection.	CO4	BTL-1	Remember
12	Define the Over Current Protection	CO4	BTL-4	Analyze
13	Give the Different over current protection relays	CO4	BTL-4	Analyze
14	Define the definite time over-current relay	CO4	BTL-3	Apply
15	Define the Inverse Time Over-current Relay	CO4	BTL-1	Remember
16	Define the Instantaneous OC Relay	CO4	BTL-2	Understand
17	Compose the advantages of over current relays over electromagnetic types	CO4	BTL-2	Understand
18	Explain the Phase Comparators and write its type	CO4	BTL-5	Evaluate
19	Illustrate with neat Block diagram of Numerical Transformer Differential Protection	CO4	BTL-3	Apply
20	List the different methods of Numerical distant protection of transmission lines	CO4	BTL-1	Remember
	PART - B			
1	Describe the construction, working principle and operation of static over current relay. (16)	CO4	BTL-1	Remember
2	i) Define the Duality Between Amplitude and Phase Comparators. (8) ii) Define the type of Amplitude and Phase Comparators (8)	CO4	BTL-4	Analyze

3	Discuss the Synthesis of Various Distance Relays Using Static Comparators (16)	CO4	BTL-6	Create
4	Explain with neat block diagram of the function of Synthesis of Mho Relay Using Static Phase Comparator (16)	CO4	BTL-1	Remember
5	Explain with neat block diagram of the function of Synthesis of Reactance Relay Using Cosine-type Phase Comparator (16)	CO4	BTL-3	Apply
6	Distinguish briefly about the Phase Comparators and write its Types (16)	CO4	BTL-4	Analyze
7	i) Compare static relay with electromagnetic relays. (8) ii) Explain the advantages of Numerical relays. (8)	CO4	BTL-4	Analyze
8	Compose the problems arising in differential protection in power transformer and how are they overcome? (16)	CO4	BTL-2	Understand
9	Explain with neat block diagram of the function of Synthesis of Simple Impedance Relay Using Amplitude Comparator (16)	CO4	BTL-1	Remember
10	Discuss the various semiconductor devices used in the static relay.(16)	CO4	BTL-2	Understand
11	Illustrate with neat Block diagram of Numerical Transformer Differential Protection (16)	CO4	BTL-2	Understand
12	Discuss with Neat Block diagram of different methods of Numerical Distance Protection of Transmission Line.(16)	CO4	BTL-1	Remember
13	Define the Over Current Protection and Explain its types Briefly (16)	CO4	BTL-3	Apply
14	Define i) definite time over-current relay (8) ii) Inverse Time Over-current Relay (8)	CO4	BTL-5	Evaluate
15	Explain with neat block diagram the operation of static relay and list the advantages and disadvantages (16)	CO4	BTL-4	Analyze
16	Assess the factors cause spill current on external fault in case of transformer Differential protection? (16)	CO4	BTL-5	Evaluate
17	Discuss the coincidence principle used in phase comparators. (16)	CO4	BTL-4	Analyze
18	Derive the characteristics equation for the phase comparator and amplitude comparator. (16)	CO4	BTL-5	Evaluate

Unit V - Circuit Breakers

Physics of arcing phenomenon and arc interruption-DC and AC circuit breaking–re-striking voltage and recovery voltage-rate of rise of recovery voltage-resistance switching-current chopping-interruption of capacitive current-Types of circuit breakers–air blast, air break, oil,SF6, MCBs, MCCBs and vacuum circuit breakers–comparison of different circuit breakers–Rating and selection of Circuit breakers.

PART – A 2 MARKS

Q.No	Questions	Course Outcome	BT Level	Competence

1	What is meant by MCB?	CO5	BTL-1	Remember
2	Differentiate A.C. and D.C. circuit breaking	CO5	BTL-2	Understand
3	Discuss the arc phenomenon in a circuit breaker.	CO5	BTL-6	Apply
4	State the slepian theory for arc interruption.	CO5	BTL-1	Remember
5	Define the term “rate of rise of recovery voltage”.	CO5	BTL-1	Remember
6	Explain recovery voltage?	CO5	BTL-1	Remember
7	Explain resistance switching	CO5	BTL-4	Analyze
8	Explain current chopping	CO5	BTL-5	Evaluate
9	What are the factors responsible for the increase of arc resistance?	CO5	BTL-2	Understand
10	Discuss the different methods of arc extinction	CO5	BTL-3	Apply
11	Define restriking voltage.	CO5	BTL-4	Analyze
12	Assess the problems encountered in the interruption of capacitive currents	CO5	BTL-3	Apply
13	Explain the ratings of a circuit breaker	CO5	BTL-4	Analyze
14	Define symmetrical breaking capacity	CO5	BTL-3	Apply
15	Show the making capacity of a circuit breaker	CO5	BTL-1	Remember
16	Classify the circuit breakers	CO5	BTL-2	Understand
17	A circuit breaker is rated as 1500 A, 1000 MVA, 3 second, 3 phase oil circuit breaker. Find rated making current.	CO5	BTL-6	Create
18	Give the advantage of SF6 circuit breaker over Air blast circuit breaker	CO5	BTL-5	Evaluate
19	Compose Peterson coil? What protective functions are performed by this device?	CO5	BTL-2	Understand
20	Illustrate the disadvantages of an Air blast circuit breaker	CO5	BTL-1	Remember
	PART - B			
1	Define the principle of arc extinction. What are the methods of arc extinction? Describe them in detail. (16)	CO5	BTL-1	Remember
2	i) Explain the arc interruption methods used in circuit breakers (8) ii) Explain Resistance switching for arc extinction in circuit breakers (8)	CO5	BTL-4	Analyze
3	Give the reason of using SF6 circuit breaker. (16)	CO5	BTL-6	Create
4	i) Explain how arc initiated and sustained when the circuit breaker contacts break (8) ii) Explain in detail the various methods of arc extinction in circuit breaker (8)	CO5	BTL-3	Apply

5	i) Show an expression for Restriking voltage and rate of rise of restriking voltage (RRRV) in a C.B. (8) ii) Illustrate the current chopping? Explain how can the effect of current chopping be minimized? (8)	CO5	BTL-3	Apply
6	Describe the construction and principle of operation of AIR Blast circuit breaker. (16)	CO5	BTL-4	Analyze
7	i) With neat sketch explain resistance switching. (8) ii) Explain current chopping with suitable diagrams. (8)	CO5	BTL-4	Analyze
8	Discuss with neat sketch, the construction and working of minimum oil circuit breaker. Also gives its merits and demerits. (16)	CO5	BTL-2	Understand
9	Describe the constructional details of SF6 circuit breaker and its operation. Give its advantages and disadvantages (16)	CO5	BTL-1	Remember
10	A 50 Hz, 11 KV, 3 phase alternator with earthed neutral has a reactance of 5 ohms per phase and is connected to bus bar through a CB. The distributed capacitance up to CB between phase and neutral is 0.01µf.determine (i) peak restriking voltage across the contacts of the breaker. (ii) Frequency of oscillation. (iii) The average rate of rise of re striking voltage up to the first peak. (16)	CO5	BTL-1	Remember
11	Describe the principle constructional features of all types of air blast CB. Give its advantages and disadvantages. (16)	CO5	BTL-2	Understand
12	Explain the construction, working principle, operation and application of Vaccum circuit breakers. (16)	CO5	BTL-1	Remember
13	Explain rupturing capacity, making capacity and short time rating and rated current of the circuit breaker. (16)	CO5	BTL-2	Understand
14	Explain working principle and construction of MCB and MCCB (16)	CO5	BTL-5	Evaluate
15	i) Solve the RRRV of 132 kV circuit breaker with neutral earthed circuit breaker data as: broken current is symmetrical, restriking voltage has frequency of 20 kHz, and power factor is 0.15. Assume fault is also earthed. (8) ii) Illustrate the selection of circuit breakers for different ranges of system voltages (8)	CO5	BTL-5	Evaluate

16	A generator connected through 5 cycle CB to a transformer is rated 8000KVA with the reactance of X''_d=10 % , X''_d=16% and X_d=100%. It is operating at no load and rated voltage when 3 phase short circuit occurs between breaker and transformer. Find i) Sustained short circuit in circuit breaker ii) The initial symmetrical r.m.s current in breaker iii) Maximum possible D.C component of short circuit in breaker iv) The momentary current rating of breaker v) Current to be interrupted by breaker vi) The interrupting KVA (16)	CO5	BTL-5	Evaluate
17	Compare the different types of circuit Breaker used for power system protection (16)	CO5	BTL 4	Analyze
18	What are the different methods of testing of circuit breaker? Describe the method which is more suitable for testing the large capacity circuit breakers. Also discuss the merits and demerits of the method. (16)	CO5	BTL 4	Analyze

PSN College of Engineering and Technology
An Autonomous Institution, Affiliated to Anna University
Approved by AICTE, Accredited by NAAC with A+ Grade
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Multiple Choice Question Bank

Branch: B.E	Regulation: 2018	Year / Semester: IV/7
Course Code: 504218	Course Name: POWER ELECTRONICS APPLICATIONS IN POWER SYSTEM	

UNIT – 1 –PROTECTION SCHEMES

1. The factor which influences the acr de ionisation dominantly _____
a) line voltage
b) magnitude of transient fault current
c) speed of reclosure
d) all of the mentioned

Answer: a

2. A three phase transformer having a line voltage ratio of 400/33000 V is connected in the star-delta. The CTs on the 400V side have a CT ratio of 1000/5. What must be the ratio of CTs on the 33000 side?
a) 7/5
b) 5/7
c) 3/5
d) 5/2

Answer: a

3. A three phase transformer having a line voltage ratio of 400/33000 V is connected in the star-delta. The CTs on the 400V side have a CT ratio of 1000/5. What will be the current through the pilot wire?
a) 5√3 A
b) 5/√3 A
c) 5 A
d) 1/5 A

Answer: a

4. The neutral of the three phase 20 MVA, 11kV alternator is earthed through a resistance of 5 ohms, the relay is set to operate when there is an out of balance current of 1.5 A. The CTs have a ratio of 100/5. What percentage of the winding is protected against L-G faults?
a) 76.4
b) 77.8
c) 73
d) None of the mentioned

Answer: d

5. The neutral of the three phase 20 MVA, 11kV alternator is earthed through a resistance of 5 ohms, the relay is set to operate when there is an out of balance current of 1.5 A. The CTs have a ratio of 100/5. What percentage of the winding is protected against earth faults?
a) 76.4
b) 77.8
c) 73
d) None of the mentioned

Answer: a

6. The neutral of the three phase 20 MVA, 11kV alternator is earthed through a resistance of 5 ohms, the relay is set to operate when there is an out of balance current of 1.5 A. The CTs have a ratio of 100/5. What percentage of the winding is protected against L-G faults?
a) 76.4
b) 23.6
c) 73
d) None of the mentioned

Answer: b

7. The neutral of the three phase 20 MVA, 11kV alternator is earthed through a resistance of 5 ohms, the relay is set to operate when there is an out of balance current of 1.5 A. The CTs have a ratio of 100/5. What should be the minimum value of the earthing resistance to protect 90% of winding?
a) 2.12 Ω
b) 1.12 Ω
c) 4.24 Ω
d) 3.24 Ω

Answer: a

8. While a transformer is energised, the differentially connected relay will
a) mal operate
b) not mal operate
c) mal operate for lagging loads
d) never mal operate

Answer: a

9. If a transformer is provided with differentially connected relay. To prevent the mal operation of the relay, the relay relay operating coil is biased with _____
a) 3rd harmonic
b) 2nd harmonic
c) 7th harmonic
d) 5th harmonic

Answer: d

10. If a transformer is provided with differentially connected relay. To prevent the mal operation of the relay, the relay restraining coil is biased with _____
a) 3rd harmonic
b) 2nd harmonic
c) 7th harmonic
d) 5th harmonic

Answer: b.
11. The frequency of the carrier in the case of carrier-current-pilot scheme is in the range of _____
a) 50 kHz-500 kHz
b) 1 kHz-10 kHz
c) 25 kHz-50 kHz
d) 15 kHz-25kHz

Answer: a
12. A protection system engineer is planning to provide the complete protection, he can achieve this by _____
a) three phase fault relays and two earth fault relays
b) two phase fault relays and three earth fault relays
c) a two phase fault relays and three earth fault relays
d) a two phase fault relays and two earth fault relays

Answer: a

13. The given figure shows protection system scheme for one phase of generator. A high resistance fault occurs near the neutral end with the current distribution as marked. The slope of the relay is 10% and pick-up current of 0.15A.
The CT ratio is 500/5.
Will the relay operate under given circumstances?
a) True
b) False

Answer: b

14. We need the biasing of differential relay biased to avoid mal operation when used for transformer protection due to _____
a) mismatch of CT
b) saturation of
c) difference in connection of both sides of CT
d) current setting mismatch

Answer: a

15.If the specified fault setting for a winding is mentioned as 20%, then what can be inferred about it?
a) If a terminal fault has its current limited to the full load rating, then 20% of winding from neutral end will be unprotected
b) If a terminal fault has its current limited to the full load rating, then 80% of winding from neutral end will carry current
c) If a terminal fault has its voltage limited to the full load rating, then 20% of winding from neutral end will be unprotected
d) Any of the mentioned

Answer: a
16. A longitudinal differential protection on stator can detect inter-turn on the stator.
a) True
b) False

Answer: b

17. Bias is used in the relay protection to _____
a) provide balanced sharing of current
b) reduce current level
c) deivert the current
d) none of the mentioned

Answer: a

18. Unbalancing of an alternator may occur due to _____
a) single phase fault
b) unbalanced loading
c) line breaking
d) all of the mentioned

Answer: d
19. A single phase distributor of 1 km long has resistance and reactance per conductor of 0.1Ω and 0.15 Ω respectively. If the far end voltage Vb=200V and current is at 100A at 0.8 lag. At the midpoint a current of 100A is tapped at a pf of 0.6 pf with ref to voltage Vm at mid point. The voltage magnitude at M is _____
a) 218V
b) 200V
c) 232V

d) 220V

Answer: a

20. A single phase distributor of 1 km long has resistance and reactance per conductor of 0.1Ω and 0.15 Ω respectively. If the far end voltage Vb=200V and current is at 100A at 0.8 lag. At the midpoint a current of 100A is tapped at a pf of 0.6 pf with ref to voltage Vm at mid point. The voltage magnitude at M is _____

a) 218V
b) 200V
c) 232V
d) 220V

Answer: a

21. A single phase motor is connected to 400V, 50Hz supply. The motor draws a current of 31.7A at a power factor 0.7 lag. The capacitance required in parallel with motor to raise the power factor of 0.9 lag (in micro farads) is _____

a) 94.62
b) 282.81
c) 108.24
d) 46.87

Answer: a

22. A single phase motor is connected to 400V, 50Hz supply. The motor draws a current of 31.7A at a power factor 0.7 lag. The additional reactive power (in VAR) to be supplied by the capacitor bank will be _____

a) 4756
b) 4873
c) 4299
d) 9055.3

Answer: a

23. A 275 kV TL has following line constants A=0.85∟5o, B=200∟75o. The active power received if the voltage to be maintained is 275kV will be _____

a) 117.63
b) 220
c) 120
d) 115.25

Answer: a

24. A 275 kV TL has following line constants A=0.85∟5o, B=200∟75o. The active power angle such that the voltage to be maintained at the other end will be 275 kV _____

a) 22
b) 16
c) 18
d) 24

Answer: a

25. A power system has a maximum load of 15 MW. Annual load factor is 50%. The reserve capacity of plant is _____ if the plant capacity factor is 40%.
a) 3.75 MW
b) 4.75 MW
c) 18.75 MW
d) 5.75 MW

Answer: a
26. A 100 MVA synchronous generator operates on full load at a frequency of 50 Hz. The load is suddenly reduced to 50 MW. Due to time lag in governor system, the steam valve begins to close after 0.4s. The change in the frequency (H=5 kW-s/KVA) is _____
a) 1
b) 0.5
c) -1.5
d) 0.8

Answer: a
27. A 50 Hz four pole turbo-generator rated 100 MVA, 11 kV has an inertia constant of 8 MJ/MVA. If the mechanical input is suddenly raised to 80 MW for an electrical load of 50MW, then the rotor acceleration is _____
a) 337.5
b) 3.375
c) 457.5
d) 4.57

Answer: a
28. A single phase TL has copper conductor of 0.775 cm2 cross section through which 200 kW at UPF at 330 V is to be maintained. If the efficiency of transmission line is 90%, then the minimum length of TL is _____(in km and take specific resistance to be 1.785 μΩ/cm).
a) 13.6 km
b) 14 km
c) 136 km
d) 16.4 km

Answer: a
29. An isolated generator connected to a turbine with its continuous maximum power of 20 MW, 50 Hz. Generator connected with two loads of 8 MW, each operate at 50 Hz.. Generator has 5% droop characteristic. If an additional load of 6 MW is added then frequency will be _____
a) 50.25
b) 40.75
c) 49.75
d) 48.75

Answer: a
30. An isolated generator connected to a turbine with its continuous maximum power of 20 MW, 50 Hz. Generator connected with two loads of 8 MW, each operate at 50 Hz.. Generator has 5% droop characteristic. If an additional load of 6 MW is added then the change in the frequency will be _____
a) 0.25
b) 0.75
c) 0.5

d) 1

Answer: a

UNIT – 2 –ELECTROMAGNETIC RELAYS

1. If short TL is delivering a lagging power factor load, sending end p.f. would be _____
a) $(V_r\cos\Phi_r+IR)/Vs$
b) $(V_r\cos\Phi_r+IR\sin\Phi_r)/Vs$
c) $(V_r\sin\Phi_r+IR)/V_s$
d) $(V_s\sin\Phi r+IR\cos\Phi r)/V_s$

Answer: a
2. If all the sequence voltages at the fault point in a power system are equal, then fault is _____
a) LLG fault
b) LG fault
c) Three phase to ground fault
d) Line to Line fault

Answer: a
3. The inertia constant of two groups of machines which do not swing together are 4 and 20 MJ/MVA, the equivalent inertia constant of the system is _____
a) 2.85
b) 14
c) 6
d) 12

Answer: a
4. Who invented electrical relay?
a) Grueblerowen
b) Joseph Henry
c) Philip Vaughan
d) Robert Abalakov

Answer: b
5. What is the full form of MCB?
a) Miniature contact breaker
b) Mini circuit breaker
c) Miniature circuit breaker
d) Mini contact breaker

Answer: c
6. Which electrical relay contact tip material has the highest electrical conductivity?
a) Silver
b) Alloy of silver and copper
c) Alloy of silver and tungsten

d) Alloy of silver and Nickel

Answer: a
7. Which type of relay can be used to automatically switch between transmitter and receiver configuration from a same antenna setup?
a) Mercury relay
b) Latching relay
c) Force-guided contacts relay
d) Coaxial relay

Answer: d
8. Solid state relays face high arching problems.
a) True
b) False

Answer: b
9. Solid state relays have only one moving part which helps in switching between “ON” and “OFF” position.
a) True
b) False

Answer: b
10. Which type of snubber network is required at the output terminal of the solid state relays to protect the semiconductor from transient spikes and unwanted noises?
a) RC (Resistor capacitor) type
b) RL (Resistor inductor) type
c) RLC (Resistor inductor capacitor) type
d) LC (Inductor capacitor) type

Answer: a
11. Which type of solid state relay turns “ON” when a minimum operating control voltage is applied and the load voltage nearly reaches zero?
a) Instant ON Relays
b) Zero-Switching Relays
c) Peak Switching Relays
d) Analog Switching Relays

Answer: b
12. Who developed the first Solid state relay?
a) Grueblerowen
b) Walcraft engineers
c) Crydom engineers
d) Robert Conrad
Answer: c
13. Which is an example of relay?
a) KSD9700
b) XMPA06B2131
c) SLB700A/06VA
d) 792XDXM4L-24A
A good electrical relay contact tip should have higher arc resistance.
a) True

b) False

Answer: a

14. Relay and contactors perform different physical operation.
a) True
b) False

Answer: b
15. Electro mechanical relay's (EMR) needs to be manually turned "ON" and "OFF".
a) True
b) False

Answer: a
16. Which type of relay contains a glass tube which contains an inert gas which is used to protect the contacts from corrosion?
a) Polarised relay
b) Solid-state relay
c) Contactor
d) Reed relay

Answer: d
17. Which electrical relay contact tip material has the highest thermal conductivity?
a) Silver
b) Alloy of silver and copper
c) Alloy of silver and tungsten
d) Alloy of silver and Nickel

Answer: a
18. What is the purpose of back up protection?

a. To increase the speed
b. To increase the reach
c. To leave no blind spot
d. To guard against failure of primary

ANSWER: d.
19. What is the actuating quantity for the relays?

a. Magnitude
b. Frequency
c. Phase angle
d. All of these

ANSWER: d.
20. Protective relays can be designed to respond to _____

a. Light intensity, impedance
b. Temperature, resistance, reactance
c. Voltage and current

d. All of these

ANSWER: d.
21. In the above figure, the relay circuit is divided into three parts. What does the first part consist of?

a. Primary winding of a current CT which is connected in series with the line to be protected.
b. Secondary of the CT and the operating coil.
c. Tripping circuit.
d. All of these.

ANSWER: a.
22. What does the third part consist of?

a. Primary winding of a current CT which is connected in series with the line to be protected.
b. Secondary of the CT and the operating coil.
c. Tripping circuit.
d. All of these.

ANSWER: c
23. Which component ensures the safety of the line from damage?

a. Relay
b. Circuit breaker
c. Bus bar
d. Current transformer

ANSWER: a
24. The tripping circuit is_____

a. AC
b. DC
c. Either AC or DC
d. None of these

ANSWER: c
25. Plug setting of a electromagnetic relay can be altered by varying

a. Number of ampere turns
b. Air gap of magnetic path
c. Adjustable back stop
d. None of these

ANSWER: a
26.The most efficient torque producing actuating structure for the induction type relays is

a. Shaded pole structure
b. Watt hour meter structure
c. Induction cup structure
d. Single induction loop structure

ANSWER: c
27. What do protective relays provide?

a. Provide additional safety to the circuit breaker in its operation.
b. Close the contacts when the actuating quantity attains a certain predetermined value.
c. Limit the arcing current during the circuit breaker operation.
d. Earth or ground any stray voltage.

ANSWER: b
28. An apparatus used for switching, controlling and protecting the electrical circuits and equipments.
b. It detects the faults only.
c. It corrects the faults only.
d. All of the above.

ANSWER: d
29. What is the primary principle of a fuse?

a. Open the circuit.
b. Protect the appliance.
c. Protect the line.
d. Prevent excess current from flowing into the line.

ANSWER: d
30. When does the circuit breaker operate in the line?

a. When power is to be supplied.
b. When the line is to be tested.
c. Whenever the fault occurs in the line.
d. Whenever the switch and the relay has to be operated.

ANSWER: c

UNIT – 3 –TRANSFORMER PROTECTION

1. Satisfactory parallel operation of transformers needs _____
a) 5 conditions
b) many conditions
c) 10 conditions
d) 7 conditions

Answer: b
2. Voltmeter connected across two similar terminals of parallel operated transformers should give _____
a) 0 reading
b) maximum reading
c) sum of individual reading
d) division of individual readings

Answer: a
3. Transformers are subjected to transients because _____
a) open-circuit currents

b) short-circuit currents
c) inrush currents
d) both OC and SC currents

Answer: d
4. Any transformer needs to be protected from _____
a) transformer faults
b) faults occurring on the transformer connected systems
c) faults within and on system
d) other faults

Answer: c
5. How many types of faults can occur in a system?
a) 2
b) 3
c) 5
d) Many

Answer: b
6. Ferroresonanace can be added in _____
a) faults due to system
b) faults in the transformer
c) manual faults
d) other faults

Answer: a
7. System-short circuits may occur due to _____
a) Line to line contacts
b) Line to neutral contacts if neutral is not earthed
c) Line to neutral contacts if neutral is earthed
d) LL and LG faults

Answer: d
8. Mechanical stress produced in the circuit _____
a) directly proportional to the square of the voltage
b) inversely proportional to the square of the voltage
c) directly proportional to the square of the currents
d) inversely proportional to the square of the currents

Answer: c
9. High voltage, high frequency surges can occur in the system due to _____
a) atmospheric disturbances
b) line faults
c) manual faults
d) line to neutral faults

Answer: a
10. Surge impedance can be calculated as _____
a) L/C
b) C/L

c) √(L/C)
d) √(C/L)

Answer: c
11. Surge protection can't be implemented by the addition of rod gaps.
a) True
b) False

Answer: b
12. Satisfactory parallel operation of transformers needs _____
a) 5 conditions
b) many conditions
c) 10 conditions
d) 7 conditions

Answer: b
13.Voltmeter connected across two similar terminals of parallel operated transformers should give _____
a) 0 reading
b) maximum reading
c) sum of individual reading
d) division of individual readings

Answer: a
14. Transformers are subjected to transients because _____
a) open-circuit currents
b) short-circuit currents
c) inrush currents
d) both OC and SC currents

Answer: d
15. Any transformer needs to be protected from _____
a) transformer faults
b) faults occurring on the transformer connected systems
c) faults within and on system
d) other faults

Answer: c
16. How many types of faults can occur in a system?
a) 2
b) 3
c) 5
d) Many

Answer: b
17. Ferroresonanace can be added in _____
a) faults due to system
b) faults in the transformer
c) manual faults
d) other faults

Answer: a
18. System-short circuits may occur due to _____
a) Line to line contacts
b) Line to neutral contacts if neutral is not earthed
c) Line to neutral contacts if neutral is earthed
d) LL and LG faults

Answer: d
19. Mechanical stress produced in the circuit _____
a) directly proportional to the square of the voltage
b) inversely proportional to the square of the voltage
c) directly proportional to the square of the currents
d) inversely proportional to the square of the currents

Answer: c

20. High voltage, high frequency surges can occur in the system due to _____
a) atmospheric disturbances
b) line faults
c) manual faults
d) line to neutral faults

Answer: a
21. Surge impedance can be calculated as _____
a) L/C
b) C/L
c) √(L/C)
d) √(C/L)

Answer: c
22.Surge protection can’t be implemented by the addition of rod gaps.
a) True
b) False

Answer: b
23. In how many types transformers can be used with relay protection system?
a) 5
b) 10
c) 2
d) Many

Answer: c
24. Ingress of air into the oil tank can be avoided by using _____
a) relays
b) plastic coatings
c) metal coatings
d) fuses

Answer: a

25. When tripping of the transformer from the main circuit is required?
a) Local overheating
b) Short-circuited core laminations
c) Core-bolt insulation failure
d) Puncture of bushings

Answer: d
26. Transformers used generally don't belong to type "construct and forget."
a) True
b) False

Answer: b
27. Which of the following is the reason relating to the maintenance while operation?
a) To obtain the maximum practicable operating efficiency
b) To obtain optimum life
c) To minimise the risk of premature and unexpected failure
d) Maximum efficiency, life, minimum temperature

Answer: d
28. Stored oil should be checked continuously for _____
a) impurities in the oil
b) oil levels
c) oil moisture content
d) oil reactions

Answer: c
29. Dissolved gas contents are need to be observed because _____
a) dissolved oxygen
b) dissolved gases from outside air
c) dissolved gases from arcs occurring in the transformer
d) all dissolved gases

Answer: c
30. How many places of arcing can possible?
a) 4 places
b) 5 places
c) 8 places
d) 2 places

Answer: a

1.A single phasing relay can be used with

a) 1ϕ motor
b) 2^{r} ϕ motor
c) 3 ϕ motor
d) All of these

Ans: (c)

2. A relay is used to
a) Break the fault current
b) Sense the fault
c) Sense the fault and direct to trip the circuit breaker
d) All of these

Ans: (c)

3. In impedance relay, current element torque should be
a) Equal to voltage element torque
b) Greater than voltage element torque
c) Less than voltage element torque
d) None of these

Ans: (a)

4. Over current fault is most likely in
a) Transformer
b) Overhead line equipment
c) Alternator
d) Motors

Ans: (b)

5. Plug setting of a relay can be changed by changing
a) Air gap
b) Back up stop
c) Number of ampere turns
d) All of these

Ans: (c)

6. Distance relays are generally
a) Impedance type
b) MHO type
c) Reactance type
d) All of these

Ans: (b)

7. Buchholz relay is used to protect against

a) Inter-turn fault
b) External faults
c) Rotor faults
d) Every internal faults

Ans: (d)

8. Instantaneous relay should operate within
a) 0.0001 sec
b) 0.001 sec
c) 0.01 sec
d) 0.1 sec

Ans: (c)

9. MHO relay is inherently a
a) Directional type
b) Non-directional type
c) Unidirectional type
d) None of these

Ans: (a)

10. Basic relay connection requirement is that the relay must operate for
a) Load
b) Internal faults
c) Both (a) and (b)
d) None of these

Ans: (b)

11. An impedance relay is used for

a) Earth faults
b) Interphase faults
c) Both (a) and (b)
d) None of these

Ans: (c)

12. Relay gets its operating energy from
a) Transformer
b) Alternator
c) Overhead lines
d) C.T., P.T.

Ans: (d)

13. Good relay should possess

a) Speed & reliability
b) Aped & sensitivity
c) Adequateness & selectivity
d) All of these

Ans: (d)

14. Earthing transformer is used to
a) Improve neutral wire's current capacity
b) Avoid overheating of transformer
c) Provide artificial earthing
d) Avoid harmonics

Ans: (c)

15. Percentage differential protection is used to prevent against
a) Inter-turn faults
b) Heavy Loads
c) External Faults
d) Magnetizing current

Ans: (d)

16. Back up protection is needed for
a) Over voltage
b) Short circuits
c) Over current
d) All of these

Ans: (b)

17. An instantaneous relay is
a) Permanent moving magnet
b) Induction cup
c) Shaded pole
d) Moving coil

Ans: (a)

18. Relays for transmission line protection are
a) In three zones
b) In two zones
c) Independent of zone
d) None of these

Ans: (a)

19. Induction cup relays responds to
a) Current
b) Power

c) Voltage
d) Impedance

Ans: (d)

20. Split-phase relay responds to
a) Over load faults
b) Over voltage
c) Inter turn faults
d) All of these

Ans: (c)

21. Time classification of relays includes

a) Instantaneous relays
b) Definite time lag
c) Inverse time lag
d) All of these

Ans: (d)

22. Directional relays responds to
a) Power
b) Voltage
c) Current
d) Reactance

Ans: (a)

23. Single phase preventers are used for
a) Transmission lines
b) Transformers
c) Motors
d) Underground cables

Ans: (c)

24. In carrier current protection, wave trap is used is for trapping
a) High frequency waves entering in generating units
b) Power frequency waves
c) Both (a) and (b)
d) None of these

Ans: (a)

25. Operating current in relay is
a) A.c. only
b) D.c. only
c) Both (a) and (b)

d) None of these

Ans: (c)

26. For phase fault on long line, which relay is used?
a) MHO relays
b) Reactance relays
c) Impedance relays
d) All of these

Ans: (c)

27. For motor protection, which relay is used?
a) Thermocouple type relays
b) Bimetallic relays
c) Electronic relays
d) All of these

Ans: (d)

28. For protection against synchronizing power surges, which relay is used?
a) Split-phase relays
b) Impedance relays
c) Reactance relays
d) MHO relays

Ans: (d)

29. Pilot wire protection is for
a) Overhead lines
b) Transformer
c) Motors
d) Cables

Ans: (a)

30. Under voltage relays are used for
a) Motors
b) Alternators
c) Bus bars
d) All of these

Ans: (d)

1. Plug setting of a relay can be altered by varying

a) Air gap of magnetic path
b) Number of ampere-turns
c) Adjustable back up stop
d) None of these

Ans: (b)

2. If the operation of a relay does not involve any change in air gap, then the ratio of rest to pick up is usually
a) Low
b) Medium
c) High
d) Independent of the change in air gap

Ans: (c)

3. Drop out to cutoff ratio for most relays is of the order of
a) 0.2 to 0.3
b) 0.3 to 0.4
c) 0.4 to 0.6
d) 0.6 to 1.0

Ans: (d)

4. Basic quantity measured in a distance relay is
a) Impedance
b) Current difference
c) Voltage difference
d) None of these

Ans: (a)

5. Which of following are the desirable qualities of protective relays?
a) Stability, reliability
b) Speed sensitivity
c) Selectivity, adequacy
d) None of these

Ans: (d)

6. Protective relays are devices which detect abnormal conditions in electrical circuit by measuring
a) Current during abnormal condition
b) Voltage during abnormal condition
c) Both (a) and (b) simultaneously
d) Constantly the electrical quantities which differ during normal and abnormal conditions

Ans: (d)

7. Resistance offered by series reactor is usually

a) Low
b) High
c) Medium
d) Very high

Ans: (a)

8. Time interval from instant of contact separation to time of arc extinction is called
a) Arcing time
b) Opening time
c) Closing time
d) None of these

Ans: (b)

9. A distance relay measures

a) Current difference
b) Voltage difference
c) Impedance difference
d) Distance between two CT's

Ans: (c)

10. Maximum short circuit current occurs due to
a) Line-to-line fault
b) Line-to-line circuit
c) Dead short circuit
d) Both (a) and (b) occurring simultaneously

Ans: (d)

11. Various power system faults in increasing order of severity are

a) LG,LL,LLG,LLLG
b) LLLG,LLG,LG,LL
c) LLG,LLLG,LL,LG
d) LL,LG,LLLG,LLG

Ans: (a)

12. Which of following are used to reduce short circuit fault currents
a) Reactors
b) Resistors
c) Capacitors
d) Parallel combination of all these

Ans: (a)

13. Which of the following type of reactors are popularly used in power systems?

a) Compensation reactors
b) Current limiting reactors
c) Suppression or Peterson reactors
d) All of these

Ans: (d)

14. Oil immersed type reactor has the advantage of
a) Higher safety against flashover
b) Smaller size with large thermal capacity
c) Limiting the fault voltage
d) Both (a) and (b) above

Ans: (a)

15. Shunt reactors are connected with transmission lines for
a) Limiting fault current
b) Absorbing reactive power
c) Absorbing high voltage surges
d) Limiting fault current

Ans: (b)

16. Which of the following method of protection is used to achieve earth fault operation?
a) Core balance method
b) Relay connected with neutral to ground
c) Frame leakage method
d) None of these

Ans: (a)

17. Minimum faults occur in which of the following power system equipment?
a) Transformer
b) Switch gear
c) CT, PT
d) Alternator

Ans: (d)

18. Large internal faults below oil level are protected by
a) Mho and ohm relays
b) Horn gap and temperature relay
c) Merz Price percentage differential relay
d) Earth fault and positive sequence relay

Ans: (b)

19. Interruption due to fault and maintenance is minimum in
a) Main and transfer bus arrangement
b) Single bus arrangement

c) Sectionalized single bus arrangement
d) Double bus, double breaker arrangement

Ans: (d)

20. When a line-to-line fault occurs, the short circuit current of an alternator depends upon its
a) Subtransient reactance
b) Transient reactance
c) Synchronous reactance
d) Short circuit reactance

Ans: (c)

21. For an arc length of 1 metres carrying fault current of I amperes, the arc resistance in ohms is

a) $(2.9\times10^{3}$])/$I^{1.4}$
b) $(2.9\times10^{4}$])/$I^{1.4}$
c) $(2.9\times10^{4}$])/I^{2}
d) $(2.9\times10^{4}$])/I

Ans: (a)

22. Which of the following are the requirements of protection of power station building against direct strokes?
a) Interception alone
b) Interception, conduction and dissipation
c) Interception and conduction
d) Conduction and dissipation

Ans: (b)

23. Generator internal fault protection is usually based the principle of
a) Differential protection
b) Cross-differential protection
c) Negative sequence protection
d) All of these

Ans: (a)

24. A relay is said to be high speed relay if it operation time is
a) 1 to 2 cycles
b) 3 to 5 cycles
c) 2 to 3 cycles
d) 5 to 7 cycles

Ans: (a)

25. The phase comparison relay has merit that
a) Its operation does not depend upon the direction of power flow
b) Correct relay action can be obtained by using series capacitors on the line

c) It can operate even for low value of fault current
d) None of these

Ans: (c)

26. Maximum demand of consumer is 2kW and his daily energy consumption is 20 units. His load factor will be
a) 10%
b) 25%
c) 41.6%
d) None of above

Ans: (c)

27. The advantage of grounding a power system is that
a) Earth fault current can be used to operate relays
b) “Arcing ground” phenomenon is avoided
c) It provides symmetry to the line impedances
d) Both (a) and (b)above

Ans: (c)

28. Advantage of hydro-electric power station is
a) Low operating cost
b) Free from pollution problems
c) No fuel transportation problems
d) All of the above.

Ans: (d)

29. Pilot wire protection is basically used for the protection of
a) Transmission lines
b) Alternators
c) Switch gears
d) Transformers

Ans: (d)

30. A sodium graphite reactor uses
a) Sodium as moderator and graphite as coolant
b) Sodium as coolant and graphite as moderator
c) A mixture of sodium and graphite as coolant
d) A mixture of sodium and graphite as moderator.

Ans: (b)

Question Paper Code:

Reg. No: | | | | | | | |

PSN COLLEGE OF ENGINEERING AND TECHNOLOGY (Autonomous)

B.E DEGREE END SEMESTER EXAMINATIONS, NOV 2022

B. E. – Electrical and Electronics Engineering
Semester – 07
Course Code & Course Title
504022 & Protection and Switchgear
Regulation–2018

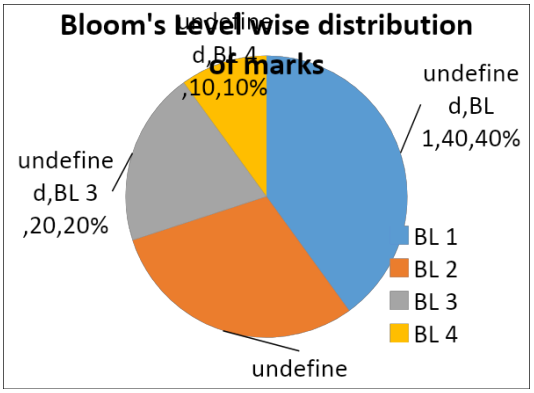
Time: 3 Hours | Answer ALL Questions | Max. Marks 100

Course Outcomes (COs):
CO1: Study the fundamentals of protection.
CO2: Analyse about various types of relays
CO3: Attain the knowledge on Transformer protection
CO4: Know about numerical protection
CO5: Understand the operation of different circuit breakers.

BL – *Bloom's Level (1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating)*; **CO** – *Course Outcome*;

Qn. No.	PART A (10 x 2 = 20 marks)	Marks	CO	BL
1	What is meant by relay?	2	1	1
2	Define circuit breaker	2	1	1
3	What is the function of differential relay?	2	2	2
4	Define electromagnetic relay	2	2	4
5	List out the causes of bus zone faults.	2	3	2
6	Define incipient faults	2	3	2
7	What is Comparator? List out its type.	2	4	1
8	What is meant by static relay?	2	4	2
9	What is meant by MCB?	2	5	1
10	What are the ratings of a circuit breaker?	2	5	1
Qn. No.	**PART B (5 x 16 = 80 marks)**	**Marks**	**CO**	**BL**
11(a)	Discuss the nature and causes of fault .Also, briefly explain about protection of power system equipments.	16	1	5
	OR			
11(b)	Explain the essential qualities of protective relaying	16	1	1
12(a)	Explain about working and operating principle of electromagnetic relay	16	2	2
	OR			
12(b)	Explain about protection against over voltage due to lightning.	16	2	2

13(a)	Discuss the construction details and principle of operation of induction type directional over current relay.	16	3	1
	OR			
13(b)	Discuss the construction and operating principle of over current relay with directional scheme.	16	3	2
14(a)	Discuss about Synthesis of Various Distance Relays using Static Comparators. Also, discuss various semiconductor devices used in the static relay.	16	4	2
	OR			
14(b)	Compare the different types of circuit Breaker used for power system protection.	16	4	3
15(a)	Explain the construction, working principle, operation and application of Vacuum circuit breakers.	16	5	2
	OR			
15(b)	Describe the constructional features of all types of air blast Circuit breaker. Give their advantages and disadvantages.	16	5	2



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Time: 3 Hours | Answer ALL Questions | Max. Marks 100

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BL – *Bloom's Level (1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating)*; **CO** – *Course Outcome*;

Qn. No.	PART A (10 x 2 = 20 marks)	Marks	CO	BL
1	List out the types of electromagnetic relays	2	1	1
2	Compare Fuses with Circuit breaker.	2	1	1
3	What is differential relay?	2	2	2
4	Define the term protected zone.	2	2	4
5	List out various faults in Transformers.	2	3	2
6	List out different types of faults	2	3	2
7	List out the general characteristics of numerical protection	2	4	1
8	What is meant by numeric relay?	2	4	2
9	Classify the types of circuit breaker.	2	5	1
10	Justify Why SF6 gas is preferred in circuit breakers.	2	5	1
Qn. No.	**PART B (5 x 16 = 80 marks)**	**Marks**	**CO**	**BL**
11(a)	Explain the working principle of Current transformer and Potential transformer. Also compare their working principles...	16	1	5
	OR			
11(b)	Explain the essential qualities of differential relays and distant relays.	16	1	1
12(a)	Describe in detail about differential protective schemes of transformer.	16	2	2
	OR			
12(b)	Explain about protection against over voltage due to surges and over voltages.	16	2	2
13(a)	Discuss various protective devices used for the protection of large transformer in detail.	16	3	1
	OR			
13(b)	Explain in detail about the operation of Merz – price differential relay	16	3	2
14(a)	Compare the different types of circuit Breaker used for power system protection.	16	4	2
	OR			
14(b)	A generator connected through 5 cycle CB to a transformer is rated 8000KVA with the reactance of X''_d=10 % , X''_d=16% and X_d=100%. It is operating at no load and rated voltage when 3 phase short circuit occurs between breaker and transformer. Find i) Maximum possible D.C component of short circuit in breaker ii) The momentary current rating of breaker and iii) Current to be interrupted by breaker	16	4	3

15(a)	Explain the construction, operating principles and merits of SF6 Circuit breaker.	16	5	2
	OR			
15(b)	Explain the construction, operation and application of Air blast circuit – breaker.	16	5	2