PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Semester: Odd Semester: 2019 - 20

Course Code: EEE 218

Course Name: SWITCHGEAR AND PROTECTION

Program & Sem: B.Tech (EEE) & VII

Date: 28 December 2019

Time: 9.30 AM to 12.30 PM

Max Marks: 80

Weightage: 40%

Instructions:
(i) Read the all questions carefully and answer accordingly.

Part A [Memory Recall Questions]

Answer all the Questions. Each Question carries 4 marks (5Qx4M=20M)

1. Mention the effects of faults in a power system

(C.O.No.1) [Knowledge]

2. Fill in the blanks

a) The transient voltage which appears across the CB contacts at the instant of arc being extinguished is known as_____ (C.O.No.3) [Knowledge]

b) The power frequency rms voltage, which appears across the breaker contacts after the arc is finally extinguished and transient oscillations die out is known as _____ (C.O.No.3) [Knowledge]

c) When the CB contacts are open to address a fault and the arc is extinguished resulting in transient condition. The transmission line will act as inductance and capacitance_____ oscillatory circuit.

(C.O.No.2) [Knowledge]

d) In a CB operation RRRV stands for _____

(C.O.No.3) [Knowledge]

3. Match Section A with B from the following.

SECTION -A	SECTION-B
a)A high speed instantaneous relay is used for the primary protection of the transmission line and as a first zone of protection it covers only up to 90 % of the line to avoid	i) Under reach due to error in relay setting and CT mismatch errors.
b)Unprotected transmission line in the first zone of protection is covered by the second zone and this is to avoid	ii) Unnecessary excessive cost due to long pilot wires to connect respective pairs of CT secondaries through the relay for each phase.
c) Differential protection of a transmission line is not practically implemented to avoid	iii) fault on the boundary of the line
d) Adjacent Zones of protection are overlapped to avoid	iv) undesired tripping due to over reach which may occur due to transients during the fault .due to CT mismatch errors

(C.O.No.4) [Knowledge]

4. Explain the necessity and operation of ELCB.

(C.O.No.5) [Knowledge]

5. Describing the necessity of Earth Fault relay for protection of alternator, explain its operation.

(C.O.No.5) [Knowledge]

Part B [Thought Provoking Questions]

Answer all the Questions. Each Question carries 9 marks.   **(4Qx9M=36M)**

6. On occurrence of a fault the current starts increasing. The fault current should not reach the prospective peak which otherwise damage the system and to accomplish the same proper selection of the fuse is made. Explain how the properly selected fuse cuts off the fault current.

(C.O.No.2)[Comprehension]

7. Due to the rise of restriking voltage and associated current, heat energy is generated between the CB contacts during its operation under a fault. Explain how this energy is to be balanced so that arc is extinguished

(C.O.No.3) [Comprehension]

8. Explain the protection scheme that employs number of relays with operational characteristics, in which the measured quantity for its operation is proportional to the line length between the location of the relay and the point where the fault has occurred. Explain the operating characteristics of one such relay

(C.O.No.4) [Comprehension]

9. Single phasing in case of an Induction motor is to be avoided though it does not bring the machine to halt but leads to unintended malfunction. Briefly describe protection scheme to achieve this.

(C.O.No.5) [Comprehension]

Part C [Problem Solving Questions]

Answer all the Questions. Each Question carries 8 marks.   **(3Qx8M=24M)**

10. The current rating of an overcurrent relay is 5A. The relay has plug setting of 150% and TSM of 0.4.The CT ratio is 400/5. Determine the operating time of the relay for a fault current of 6000A. At TSM =1, operating time at various PSM are given in table below

PSM	2	4	5	8	10	20
Operating time in Seconds	10	5	4	3	2.8	2.4

(C.O.No.4) [Comprehension]

11. A generator is protected by restricted earth fault protection. The generator ratings are 13.2kV ,10MVA.The percentage of winding protected against phase to ground fault is 85%.The relay setting is such that it trips for 20% out of balance. Calculate the resistance to be added in the neutral to ground connection.   (C.O.No.5) [Comprehension]

12. A 11 kV/ 132 kV power transformer is connected in delta-star. The CTs on the low voltage side have turns ratio of 600/5.Find the suitable turns ratio for the CTs on high voltage side

(C.O.No.5) [Comprehension]

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO (% age of CO)	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels	Thought provoking type [Marks allotted] Bloom's Levels	Problem Solving type [Marks allotted]	Total Marks
			K	C	C	
1	CO 1	MODULE-1 Protection System and fuses	04			04
2	CO 2 CO 3	MODULE-1 Protection System and fuses MODULE-2 Circuit Brakers	04			04
3	CO 4	MODULE-3 Protective Relays	04			04
4	CO 5	MODULE-4 Unit Protection	04			04
5	CO 5	MODULE-4 Unit Protection	04			04
6	CO 2	MODULE-1 Protection system and fuses		09		09
7	CO 3	MODULE-2 Circuit Brakers		09		09
8	CO 4	MODULE-3 Protective Relays		09		09
9	CO 5	MODULE-4 Unit Protection		09		09
10	CO 4	MODULE-3 Protective Relays			08	08
11	CO 5	MODULE-4 Unit Protection			08	08
12	CO 5	MODULE-4 Unit Protection			08	08
	Total Marks		20	36	24	**80**

K =Knowledge Level   C = Comprehension Level

C.O WISE MARKS DISTRIBUTION:

CO 01: 04 MARKS, **CO 02:** 10 MARKS, **CO 03:** 12 MARKS, **CO 04**:21 MARKS **CO 05**:33 MARKS

MODULE WISE DISTRIBUTION:

MODULE-1: 14 MARKS (17.5%); MODULE-2: 12 MARKS (15.00%)

MODULE-3: 21 MARKS (26.25%); MODULE-4: 33 MARKS (41.25%)

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

I hereby certify that all the questions are set as per the above guidelines.

Faculty Signature:

Reviewer Commend:

Format of Answer Scheme

SCHOOL OF ENGINEERING

SOLUTION

Semester : Odd Semester: 2019 - 20

Course Code: EEE 218

Course Name: Switchgear and Protection

Program & Sem: Electrical and Electronics Engineering

Date: 28 Dec 2019

Time: 9.30am to 12.30pm

Max Marks: 80

Weightage: 40 %

Part A   (5Q x 4M = 20Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	Equipment damage, hazards, voltage reduction in healthy feeders loss of load, supply unbalance ,loss of stability,	4M	8mins
2	a) Restriking voltage b) Recovery voltage c) series d) Rate of Rise of Restriking Voltage voltage	4X1M=4M	8mins
3	a→iv ; b→i ; c → ii; d → iii	4X1M=4M	8mins
4	ELCB Diagram and Operation	2X2M=4M	8mins
5	Earth fault relay diagram and explanation	2X2M=4M	8mins

Part B   (4Q x 9M = 36 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
6	- Realization: cut off characteristic of fuse - Diagram - Explanation	1M+2M + 6M =9M	20 mins
7	-Realization: Energy Balance theorem -Graph -Explanation	2M+ 2M+5M=9M	20 mins
8	- Realization: Distance relay - Diagram - Explanation of mho or impedance relay	2M+ 3M+4M=9M	20 mins
9	-Realization: protection against single phasing -Diagram -Explanation	1M+4M+4M=9M	20 mins

Q No	Solution	Scheme of Marking	Max. Time required for each Question
10	- PSM=10 corresponding time = 2.8 Sec - Actual Time =1.12 Sec	4X2M = 8M	20 mins
11	I= 437.38A ;Io =87.47 A Line to neutral voltage = 7621 V R= 13.068 Ω	4X2M = 8M	20 mins
12	Ip =5 A ; Line current =5 / $\sqrt{3}$ A Secondary line current = 50 A CT ratio =17.32:1	4X2M = 8M	20 mins

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST – 2

Sem & AY: Odd Sem 2019-20

Course Code: EEE 218

Course Name: SWITCHGEAR AND PROTECTION

Program & Sem: B.Tech. (EEE) & VII Sem

Date: 19.11.2019

Time: 1.00 PM to 2.00 PM

Max Marks: 40

Weightage: 20%

Instructions:
(i) Read the questions carefully and answer.
(ii) Question paper consists of 3 parts.
(iii) Scientific and Non-programmable calculators are permitted.

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries six marks. **(3Qx6M=18M)**

1. Briefly explain the construction and working of cross jet explosion pot type circuit breaker. (C.O.NO.3)[Knowledge]
2. Briefly explain the operation of air break circuit breaker. (C.O.NO.3)[Knowledge]
3. What are the essential qualities of a relay? Explain. (C.O.NO.4)[Knowledge]

Part B [Thought Provoking Questions]

Answer both the Questions. Each question carries six marks. **(2Qx6M=12M)**

4. When a fault occurs internally in an equipment, it is necessary to instantaneously clear the same, which otherwise damage the equipment. Explain the protection scheme employed, which is based on the fact that any internal fault in an electrical equipment would cause the current entering it, to be different from current leaving it.
(C.O.NO.4)[Comprehension]
5. The current rating of an overcurrent relay is 5A. The relay has plug setting of 150% and TSM of 0.4.The CT ratio is 400/5. Determine the operating time of the relay for a fault current of 6000A. At TSM=1, operating time at various PSM are given in table below.

PSM	2	4	5	8	10	20
Operating time in Seconds	10	5	4	3	2.8	2.4

(C.O.NO.4)[Comprehension]

Part C [Problem Solving Questions]

Answer the Question. The question carry ten marks. **(1Qx10M=10M)**

6. The schematic depicted in Fig.1 shows the part of a typical power system. If for the discrimination, the time grading margin between the relays is 0.6 seconds, calculate the time of operation of relay-1 and TSM of Relay-2. The TSM of relay-1 is 0.3.The characteristics of the relay is given in table below.

PSM	4	5.33	5.7	6.4	8.33	10.66	12.45
Operating time in Seconds	6.1	3.8	3.4	3.0	1.8	0.8	0.5
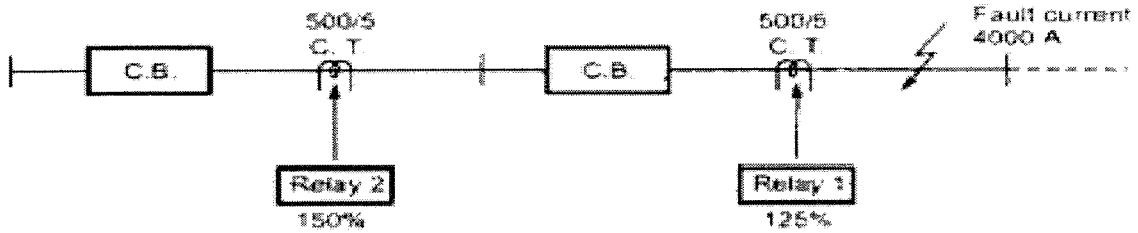
Fig.1

(C.O.NO.4)[Application]

SCHOOL OF ENGINEERING

GAIN MORE KNOWLEDGE REACH GREATER HEIGHTS

Semester: VII

Course Code: EEE 218

Course Name: Switchgear and Protection

Date: 18-11-2019

Time: 1.00 pm to 2.00 pm

Max Marks: 40

Weightage: 20%

Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels			Thought provoking type [Marks allotted] Bloom's Levels		Problem Solving type [Marks allotted]	Total Marks
			K			C		A	
PART-A	C.O. 3&4	Module 2 (Last half) & Module 3(3/4th)	6M	6M	6M				(3X6 M) 18M
PART B	C.O. 4	Module 3(3/4th)				6M	6M		(2X6M) 12M
PART C	C.O.4	Module 3(3/4th)						10M	(1X10M) 10M
	Total Marks								40M

K =Knowledge Level C = Comprehension Level, A = Application Level

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Annexure- II: Format of Answer Scheme for Test-2

SCHOOL OF ENGINEERING

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

SOLUTION

Semester: VII

Course Code: EEE 218

Course Name: Switchgear and Protection

Date: 18-11-2019

Time: 1.00 pm to 2.00 pm

Max Marks: 40

Weightage: 20%

Part A		(3 x 6 = 18Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	- Schematic diagram of construction - working of cross jet explosion pot type circuit breaker	2M+4M	9 mins
2	- Schematic diagram of air break circuit breaker - operation	2M+4M	9 mins
3	Explanation of any three essential qualities of relay	3x2M	9 mins

Part B		(2x 6M =12M)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
4	- Realization of the question asked as: Differential Relay. - Explanation	1 M 5M	9 mins
5	- PSM=10 corresponding time = 2.8 Sec - Actual Time =1.12 Sec	3M 3M	9 mins

Q No	Solution	Scheme of Marking	Max. Time required for each Question
6	Relay-1 - Fault current in relay coil =40A - PSM=6.4 corresponding time = 3 Sec - Actual Time =0.9 Sec Relay-2 - Fault current in relay coil =40A - PSM=5.33 corresponding time = 1.8 Sec - Actual Time =3.8 Sec -TSM= 0.4	5M 5M	15 mins

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SCHOOL OF ENGINEERING

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Program & Sem:B.Tech (EEE) & VII

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Instructions:
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Part A [Memory Recall Questions]

Answer all the Questions. Each Question carries 4 marks   **(5Qx4M=20M)**

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(C.O.No.1) [Knowledge]

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(C.O.No.4) [Knowledge]

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(C.O.No.5) [Knowledge]

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Part B [Thought Provoking Questions]

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Part C [Problem Solving Questions]

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SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

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2	CO 2 CO 3	MODULE-1 Protection System and fuses MODULE-2 Circuit Brakers	04			04
3	CO 4	MODULE-3 Protective Relays	04			04
4	CO 5	MODULE-4 Unit Protection	04			04
5	CO 5	MODULE-4 Unit Protection	04			04
6	CO 2	MODULE-1 Protection system and fuses		09		09
7	CO 3	MODULE-2 Circuit Brakers		09		09
8	CO 4	MODULE-3 Protective Relays		09		09
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Reviewer Commend:

Format of Answer Scheme

SCHOOL OF ENGINEERING

SOLUTION

Semester : Odd Semester: 2019 - 20

Course Code: EEE 218

Course Name: Switchgear and Protection

Program & Sem: Electrical and Electronics Engineering

Date: 28 Dec 2019

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Part A (5Q x 4M = 20Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
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2	a) Restriking voltage b) Recovery voltage c) series d) Rate of Rise of Restriking Voltage voltage	4X1M=4M	8mins
3	a→iv ; b→i ; c → ii; d → iii	4X1M=4M	8mins
4	ELCB Diagram and Operation	2X2M=4M	8mins
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Part B (4Q x 9M = 36 Marks)

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Q No	Solution	Scheme of Marking	Max. Time required for each Question
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11	I= 437.38A ;Io =87.47 A Line to neutral voltage = 7621 V R= 13.068 Ω	4X2M = 8M	20 mins
12	Ip =5 A ; Line current =5 / √ 3 A Secondary line current = 50 A CT ratio =17.32:1	4X2M = 8M	20 mins