

# CBCS SCHEME

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15EE72

## Seventh Semester B.E. Degree Examination, Dec.2019/Jan.2020 Power System Protection

Time: 3 hrs.

Max. Marks: 80

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

### Module-1

- 1 a. With schematic diagram, explain various zones of protection of a power system. (06 Marks)
- b. Explain the importance of automatic reclosing. (04 Marks)
- c. What are the advantages of static relays over electro mechanical relays? (06 Marks)

OR

- 2 a. The current rating of a relay is 5Amps, PSM = 1.5 CT ratio is 400/5. Fault current = 6000 Amps. Determine the operating time of the relay for a TMS = 0.4. The operating time at various PSM at TMS = 1 are given in the below table. (06 Marks)

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

- b. Draw the schematic diagram of numerical relay and explain the functions of various components. (06 Marks)
- c. With neat sketch, explain the working principle of reed relay. (04 Marks)

### Module-2

- 3 a. Explain different types of over current protective schemes. (08 Marks)
- b. Explain impedance relay characteristics in the R-X diagram. (04 Marks)
- c. What are the advantages of numerical over current relays over conventional over current relays? (04 Marks)

OR

- 4 a. Explain stepped time-distance characteristics of three distance relaying units used for I, II and III zone of protection. (06 Marks)
- b. Explain how reactance relay and MGO relay characteristics are realized using a sampling comparator. (06 Marks)
- c. With neat diagram, explain an over current protective scheme for a ring feeder. (04 Marks)

### Module-3

- 5 a. What are the important operating principles which are used in wire 'pilot' schemes? With schematic diagram, explain circulating current principle. (06 Marks)
- b. Explain the working principle of 'Buchholz' relay used for the protection of transformer. (05 Marks)
- c. With schematic diagram, explain balanced (opposed) voltage differential protection. (05 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

OR

- 6 a. With neat sketch, explain frame leakage protection scheme. (04 Marks)  
b. With schematic diagram, explain protection of stator against over heating in an alternator. (06 Marks)  
c. What is simple differential protection scheme? Explain its behavior during normal condition. (06 Marks)

**Module-4**

- 7 a. With neat sketches, explain the recovery rate theory of arc interruption in a circuit breaker. (06 Marks)  
b. What are the advantages and disadvantages of SF<sub>6</sub> circuit breaker? (06 Marks)  
c. Explain the phenomenon of current chopping in a circuit breaker. (04 Marks)

OR

- 8 a. With neat circuit diagram explain synthetic testing of a circuit breaker. (06 Marks)  
b. With neat sketch, explain the working principle of axial blast circuit breaker. (05 Marks)  
c. With schematic diagram, explain the working of 'HVDC' circuit breaker. (05 Marks)

**Module-5**

- 9 a. With neat diagrams, explain the phenomenon of lighting. (06 Marks)  
b. Describe the construction and working of the HRC cartridge fuse. (05 Marks)  
c. With neat sketch, explain the construction and working of 'Klydonograph'. (05 Marks)

OR

- 10 a. What are the various components of GIS? Briefly describe their functions. (07 Marks)  
b. With neat diagram, explain the working of expulsion type lighting arrester. (05 Marks)  
c. What is insulation coordination? Explain its volt time curve. (04 Marks)

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**Sceme and solutions EEE**

1 message

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**Dr. A.Manjunath** <manjuprinci@gmail.com>

To: pmanjunath p <pmanjunathvtu@gmail.com>

Sat, Jan 4, 2020 at 10:42 AM

Good Morning

the Scheme and solutions of following subjects are not having any modification and approved from my end

17EE52-Micro controller

✓ 15EE72-Power System Protection ✓


15EE73-High Voltage Engineering

15EE742-Utilization of Electric power

Dr.A.Manjunath

Chairman BOE, EEE

**" APPROVED "**



**Registrar (Evaluation)**

**Visvesvaraya Technological University**

**BELAGAVI - 590018**



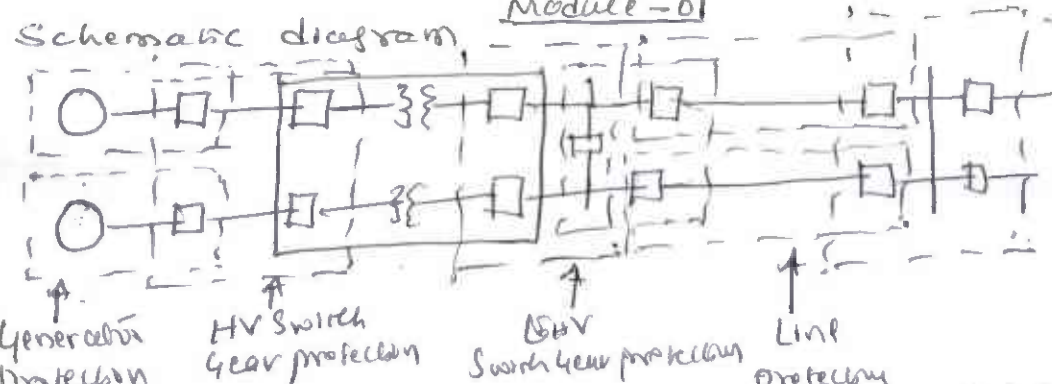
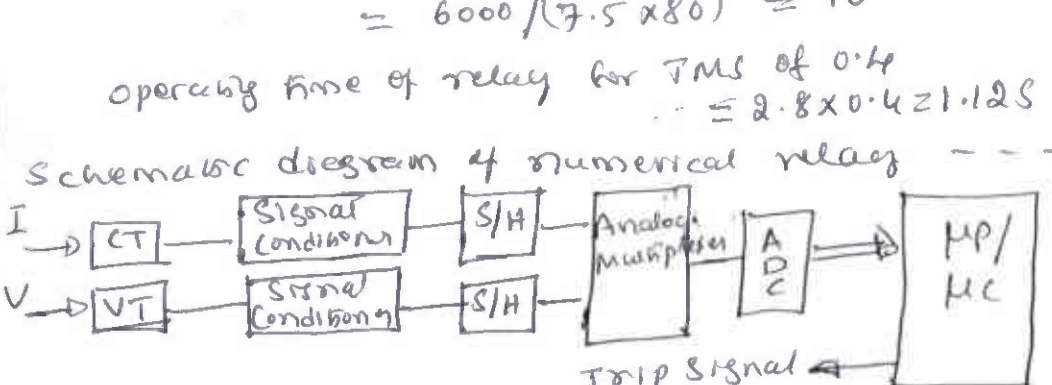
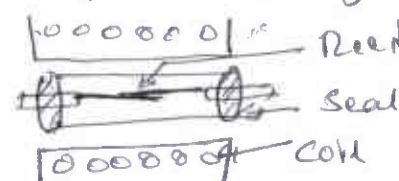
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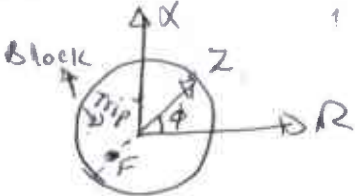
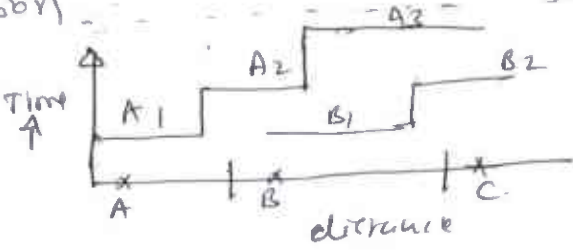

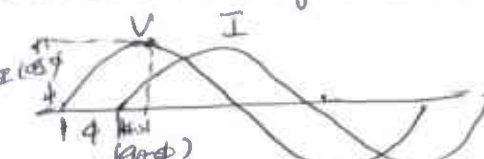
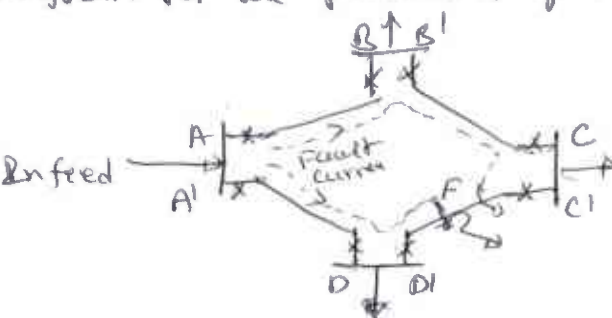
Scheme & Solution

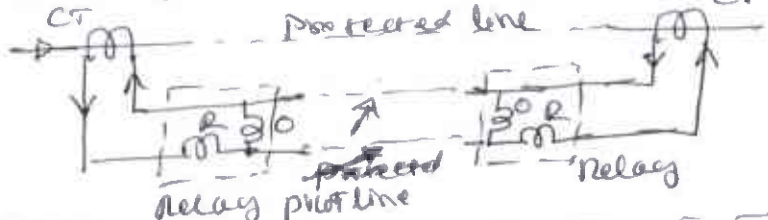
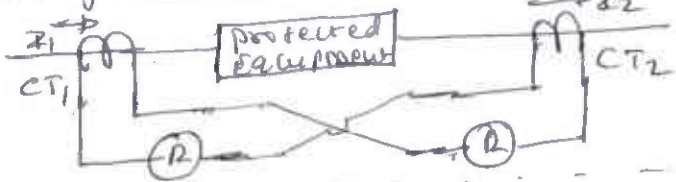
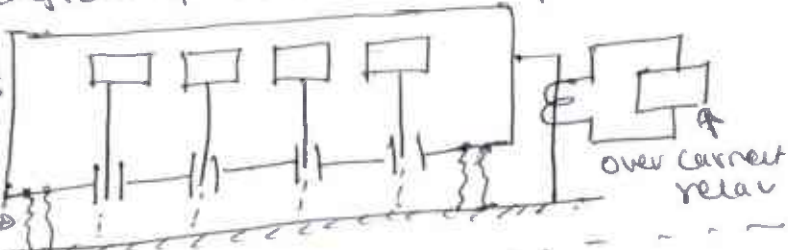
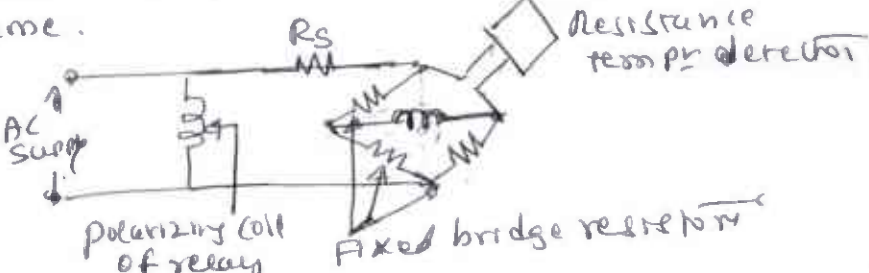
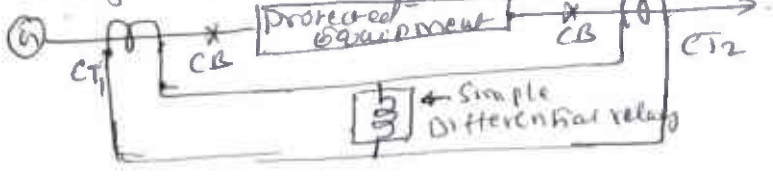
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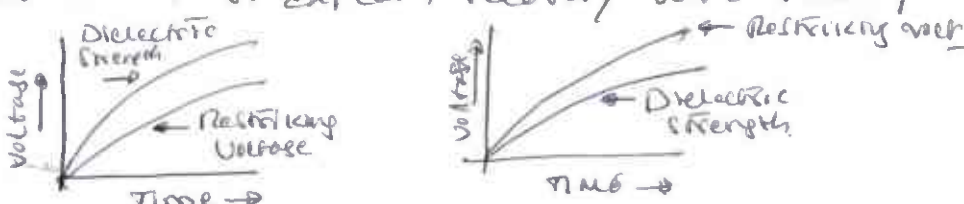
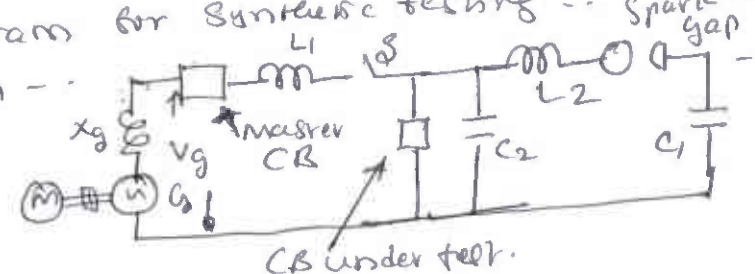
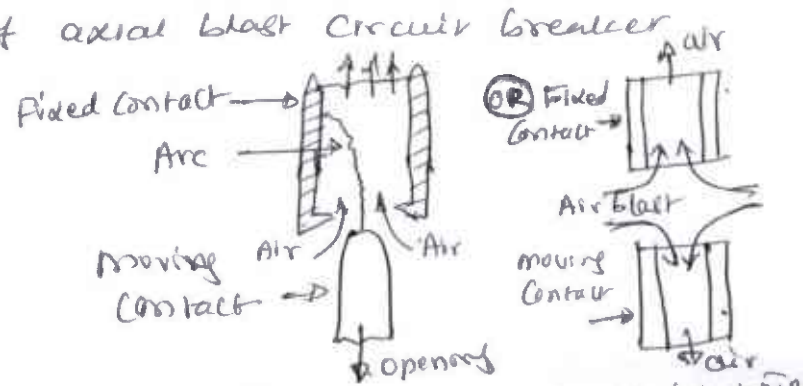
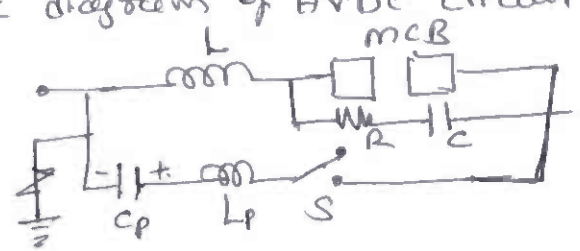
Subject Title: POWER SYSTEM PROTECTION

Subject Code: 15EE72

Question Number	Solution	Marks Allocated
1 a)	<p>Schematic diagram, <u>Module-01</u></p>  <p>Generation Protection    HV Switch Gear protection    HV Switch gear protection    Line protection</p>	02
	<p>Explanation on zones of protection</p>	04
b)	<p>Explanation on Automatic reclosing</p>	04
c)	<p>Six advantages of Static relay's</p>	06
2 a)	<p>Solution: <math>CT \text{ ratio} = 400/5 = 80</math></p> <p>Relay current setting = <math>1.5 \times 5 = 7.5 \text{ A}</math></p>	01
	<p><math>PSM = \frac{\text{Primary Current}}{\text{Relay current setting} \times CT \text{ ratio}}</math></p>	01
	<p><math>= \frac{6000}{(7.5 \times 80)} = 10</math></p>	02
	<p>operating time of relay for TMS of 0.4</p>	01
	<p><math>= 2.8 \times 0.4 = 1.12 \text{ S}</math></p>	01
b)	<p>Schematic diagram of numerical relay</p>	02
		04
	<p>Explanation</p>	04
c)	<p>Schematic diagram of Reed relay</p>	01
	<p>"APPROVED"</p>	
		
	<p>Working principle of Reed relay</p>	03

Question Number	Solution	Marks Allocated
3	<p style="text-align: center;"><u>Module 2</u></p> <p>a) Explanation of time-graded system ----- 03                      Explanation of current-graded system ----- 03                      Explanation of combination of time &amp; current grading ----- 02</p> <p>b) R-x diagram of impedance relay ----- 01</p> <div style="text-align: center;">  </div> <p>Explanation ----- 03</p> <p>c) Four advantages of numerical over current relay ----- 04</p>	
4	<p>a) Stepped time-distance characteristics ----- 01                      Explanation ----- 05</p> <div style="text-align: center;">  </div> <p>b) Realization of reactance relay ----- 03</p> <div style="text-align: center;">  <math display="block">\frac{V \sin \phi}{I_{DC}} &lt; K_1 \text{ or } X &lt; K_1</math> </div> <p>Realization of MHO relay ----- 03</p> <div style="text-align: center;">  <math display="block">\frac{Z \cos \phi}{V_{DC}} &gt; K_1 \text{ or } M &lt; K_1</math> </div>	
	<p>c) Diagram for the protection of ring feeder ----- 01</p> <div style="text-align: center;">  </div> <p>Explanation ----- 03</p>	

Question Number	Solution	Marks Allocated
	module 3	
5 a)	Circular current principle and balanced voltage principle Schematic Diagram	01 02
	 <p>Explanation</p>	03 05
b)	Explanation on working principle of Buchholz relay	05
c)	Schematic diagram of balanced (opposed) volt differential protection	01
	 <p>Explanation</p>	04
6 a)	Schematic diagram of frame leakage protection	01
	 <p>Explanation</p>	03
b)	Schematic diagram of stator overheating relaying scheme.	02
	 <p>Explanation</p>	04.
c)	The differential protection scheme employing simple differential relay	01
	 <p>Explanation</p>	01 04

Question Number	Solution	Marks Allocated
<p>Q 7 a)</p>	<p style="text-align: center;">Module 4<sub>1</sub></p> <p>Sketches to explain recovery rate theory</p>  <p>a) Arc Extinguishes</p> <p>Explanation</p>	<p>02</p> <p>04</p> <p>06</p> <p>04</p>
<p>Q 8 a)</p>	<p>Circuit diagram for Synthetic testing</p>  <p>Explanation</p> <p>b) Sketch of axial blast circuit breaker</p>  <p>Explanation</p>	<p>02</p> <p>04</p> <p>02</p> <p>03</p>
<p>c)</p>	<p>Schematic diagram of HVDC circuit breaker</p>  <p>Explanation</p>	<p>01</p> <p>04</p>

Question Number	Solution	Marks Allocated
module 5		
9 a)	<p>Diagrams to Explain lightning phenomenon</p>	02
EXPLANATION		
b)	<p>Diagram of HRC fuse</p>	04
CONSTRUCTION		
WORKING		
c)	<p>Sketch of Klydonograph</p>	01
CONSTRUCTION		
WORKING		
10 a)	<p>List of components of GIS Brief explanation of their function</p>	05
b)	<p>Diagram of Expulsion type lightning arrester</p>	02
WORKING		
c)	<p>Definition: It is the correlation of the insulation of electrical equipment and lines with the characteristics of protective devices.</p> <p>Volt-time curve</p>	01
EXPLANATION		

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