

Hall Ticket No

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Question Paper Code: AEE014



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER

B.Tech VII Semester End Examinations, November - 2019

Regulations: R16

POWER SYSTEM PROTECTION

(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 70

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

UNIT – I

1. a) Explain the terms Recovery voltage, restriking voltage and RRRV. Derive an expression for the restriking voltage in terms of system capacitance and inductance [7M]
b) A circuit breaker is rated at 1500 A, 2000 MVA, 33 kV, 3 sec, 3-phase oil circuit breaker. Determine (i) the rated normal current (ii) breaking current (iii) making current (iv) short time rating current [7M]
2. a) What are the major duties that a circuit breaker is required to perform? Explain them clearly? [7M]
b) Describe construction, operating principle and application of vacuum circuit breaker. For what voltage range is it recommended? [7M]

UNIT – II

3. a) Describe the operating principle, constructional features and area of applications of reverse power or directional relay. [7M]
b) Determine the time of operation 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 4000 A. [7M]
4. a) Explain with the help of neat diagram the construction and working of Induction type directional power relay. [7M]
b) A relay is connected to 200/5 ratio current transformer with current setting of 120%. Calculate the Plug Setting Multiplier when circuit carries a fault current of 2000A. [7M]

UNIT – III

5. a) What are the advantages of the following equipment in a substation [7M]
a) bus bars b) Insulators c) circuit breakers d) isolating switches.

- b) What are the different bus-bar arrangements possible in a substation? Discuss them briefly with application areas? [7M]
6. a) What are the Comparisons of Gas Insulated Substation over Air Insulated. [7M]
b) Write short notes on the following (i) Necessity of bus-bar protection? [7M]
(ii) bus bar arrangement (iii) differential protection of bus bar

UNIT – IV

7. a) Describe the protection scheme for internal faults in a three phase delta/star connected power transformer. Draw a neat sketch and explain clearly why the CTs are to be connected in a particular fashion only. [7M]
b) Write short notes on the following (i) Generator faults (ii) protection of alternator [7M]
(iii) over-load protection of alternator (iv) self balanced protection
8. a) Describe the protection scheme for internal faults in a three phase delta/star connected power transformer. Draw a neat sketch and explain clearly why the CTs are to be connected in a particular fashion only. [7M]
b) What protective devices other than differential protection are used for the protection of a large transformer? Briefly describe them . [7M]

UNIT – V

9. a) Write short notes on the following surge diverters [7M]
a) Expulsion type diverter
b) Multigap type diverter
b) Explain How do ground wires protect the overhead lines against direct lightening strokes? [7M]
10. a) Explain the term over voltage factor, protective ratio, protective angle, protective zone and coupling factor? [7M]
Write short notes on the following
b) (i) Causes of over voltages [7M]
(ii) Lightening phenomenon



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COURSE OBJECTIVES:

The course should enable the students to:

| | |
|-----|---------------------------------------------------------------------------------------------|
| I | Understand types of various circuit breakers. |
| II | Classify relays into various types such as of electromagnetic, static and numerical relays. |
| III | Evaluate the performance of protection schemes of generator and transformer. |
| IV | Analyze the performance of feeder and bus-bar protection. |
| V | Discuss the protection schemes against over voltages. |

COURSE OUTCOMES (COs):

| | |
|------|--------------------------------------------------------------------------------------------------------|
| CO 1 | Understand the working of various types of circuit breakers and protective equipments of power systems |
| CO 2 | Understand the working of various protective relays. |
| CO 3 | Discuss about various components of substation and understand protection of feeders and bus bars. |
| CO 4 | Understand the various faults and protection methods for the Generators and Transformers. |
| CO 5 | Understand the various protection schemes of power system against over voltages. |

COURSE LEARNING OUTCOMES (CLOs):

| CLO Code | CLO's | At the end of the course, the student will have the ability to: | PO's Mapped | Strength of Mapping |
|-----------|--------|---------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------------------|
| AEE014.01 | CLO 1 | Understand various types of faults in Power system. | PO1, PO3 | 2 |
| AEE014.02 | CLO 2 | Apply the knowledge on different Protective Equipments of Power Systems. | PO2, PO3 | 2 |
| AEE014.03 | CLO 3 | Understand concept of recovery and restriking voltages. | PO1, PO3 | 3 |
| AEE014.04 | CLO 4 | Understand working of various protective systems. | PO1, PO3 | 3 |
| AEE014.05 | CLO 5 | Compare the different type of circuit breakers performance based on which selection of circuit breaker can be made for a given application. | PO2, PO3 | 2 |
| AEE014.06 | CLO 6 | Discuss the construction and working of Fuse and circuit breakers. | PO2, PO3 | 2 |
| AEE014.07 | CLO 7 | Explain working of protective relays. | PO2, PO3 | 2 |
| AEE014.08 | CLO 8 | Understand the concept of DMT, IDMT type relays. | PO1, PO2 | 3 |
| AEE014.09 | CLO 9 | Understand layout of Substations. | PO2, PO3 | 2 |
| AEE014.10 | CLO 10 | Understand layout of Substations, neutral earthing, testing of CB, CT and PT. | PO1, PO2 | 3 |
| AEE014.11 | CLO 11 | Remember the faults and protection for the Feeders and Bus-Bars. | PO2, PO3 | 2 |

| CLO Code | CLO's | At the end of the course, the student will have the ability to: | PO's Mapped | Strength of Mapping |
|-----------------|--------------|----------------------------------------------------------------------------------|--------------------|----------------------------|
| AEE014.12 | CLO 12 | Understand and justify a suitable protection system for a specified application. | PO1, PO2 | 3 |
| AEE014.13 | CLO 13 | Understand the faults and protection for the Generators and Transformers. | PO1, PO2 | 2 |
| AEE014.14 | CLO 14 | Understand Rotor, Stator Faults, inter turn faults and their protection. | PO2, PO3 | 3 |
| AEE014.15 | CLO 15 | Understand the protection of power system against over voltages. | PO1, PO2 | 2 |

MAPPING OF SEMESTER END EXAMINATION - COURSE OUTCOMES

| SEE Question No | | Course Learning Outcomes | | Course Outcomes | Blooms Taxonomy Level |
|------------------------|---|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------------------------------|
| 1 | a | AEE014.01 | Understand various types of faults in Power system | CO 1 | Understand |
| | b | AEE014.02 | Apply the knowledge on different Protective Equipments of Power Systems. | CO 1 | Understand |
| 2 | a | AEE014.03 | Understand concept of recovery and restriking voltages | CO 1 | Understand |
| | b | AEE014.05 | Compare the different type of circuit breakers performance based on which selection of circuit breaker can be made for a given application. | CO 1 | Understand |
| 3 | a | AEE014.07 | Explain working of protective relays. | CO 2 | Understand |
| | b | AEE014.08 | Understand the concept of DMT, IDMT type relays. | CO 2 | Remember |
| 4 | a | AEE014.07 | Explain working of protective relays. | CO 2 | Understand |
| | b | AEE014.08 | Understand the concept of DMT, IDMT type relays. | CO 2 | Understand |
| 5 | a | AEE014.09 | Understand layout of Substations. | CO 3 | Understand |
| | b | AEE014.11 | Remember the faults and protection for the Feeders and Bus-Bars. | CO 3 | Understand |
| 6 | a | AEE014.09 | Understand layout of Substations. | CO 3 | Understand |
| | b | AEE014.11 | Remember the faults and protection for the Feeders and Bus-Bars. | CO 3 | Understand |
| 7 | a | AEE014.13 | Understand the faults and protection for the Generators and Transformers. | CO 4 | Understand |
| | b | AEE014.14 | Understand Rotor, Stator Faults, inter turn faults and their protection. | CO 4 | Understand |
| 8 | a | AEE014.13 | Understand the faults and protection for the Generators and Transformers. | CO 4 | Understand |
| | b | AEE014.13 | Understand the faults and protection for the Generators and Transformers. | CO 4 | Understand |
| 9 | a | AEE014.15 | Understand the protection of power system against over voltages. | CO 5 | Remember |
| | b | AEE014.15 | Understand the protection of power system against over voltages. | CO 5 | Understand |
| 10 | a | AEE014.15 | Understand the protection of power system against over voltages. | CO 5 | Remember |
| | b | AEE014.15 | Understand the protection of power system against over voltages. | CO 5 | Understand |

Signature of Course Coordinator

HOD, EEE