



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043, Telangana

TUTORIAL QUESTION BANK

ELECTRICAL SAFETY ENGINEERING

Regulations	:	IARE-R16
Academic Year	:	2019-2020
Semester	:	VII
Course Name	:	B TECH
Course Code	:	AEE807
Branch	:	EEE
Course Coordinator	:	Mr. A.Srikanth , Assistant professor, EEE
Team of Instructors	:	Mr. A.Srikanth , Assistant professor, EEE

COURSE OBJECTIVES:

The course should enable the students to:	
I	Understand the basic principles of electrical engineering and statutory requirements.
II	Distinguish electrical hazards and their importance in electrical safety systems.
III	Explain the electrical protective systems.
IV	Classify the hazardous zones to implement the electrical safety precautions.
V	Understand the electrical safety laws and their applications.

COURSE SYLLABUS :

UNIT-I	INTRODUCTION AND STATUTORY REQUIREMENTS
Introduction: Electrostatics, electro magnetism, stored energy, energy radiation and electromagnetic interference; Working principles of electrical equipment: Indian electricity act and rules, statutory requirements from electrical inspectorate, international standards on electrical safety, first aid-cardio pulmonary resuscitation(CPR).	
UNIT-II	ELECTRICAL HAZARDS AND SAFETY CODES
Primary and secondary hazards: Shocks, burns, scalds, falls; Human safety in the use of electricity: Energy leakage-clearances and insulation classes of insulation voltage; classifications excess energy current, surges over current and short circuit current; Heating effects of current electromagnetic forces, corona effect, static electricity; Definition, sources, hazardous conditions, control, electrical causes of fire and explosion ionization, spark and arc ignition; Energy national electrical safety codes, IS codes, lightning hazards, lightning arrestor installation; Specifications, earth resistance, earth pit maintenance.	

UNIT-III	ELECTRICAL PROTECTION SYSTEMS
Fuse, circuit breakers and overload relays: protection against over voltage and under voltage , safe limits of amperage, voltage safe distance from lines capacity and protection of conductor; Joints and connections, overload and short circuit protection, no load protection, earth fault protection. FRLS insulation and continuity test-system grounding equipment, grounding earth leakage circuit breaker (ELCB); Cable wires, maintenance of ground, ground fault circuit interrupter; Use of low voltage electrical guards , Personal protective equipment; Safety in handling hand held electrical appliances tools and medical equipment.	
UNIT-IV	CLASSIFICATION OF HAZARDOUS ZONES
Classification of hazardous zones: intrinsically safe and explosion proof electrical apparatus increase safe equipment and their selection for different zones; Temperature classification: grouping of gases; Use of barriers and isolators-equipment certifying agencies.	
UNIT-V	ELECTRICAL SAFETY LAW(S) APPLICATIONS
Electrical safety codes of practice and regulation, compliance, enforcement and engagement- electrical safety audits; Electrical safety engagement programs. NFPA 70E, ANSI codes	

Text Books:

1. Andrew N. Sloss, Dominic Symes, Chris Wright, “ARM Systems Developer’s Guides- Designing & Optimizing System Software”, Elsevier, 2008.

Reference Books

1. John Cadick, “Electrical Safety Handbook”, McGraw Hill, 3rd Edition, 2006.
2. W. Fordham Cooper, “Electrical Safety Engineering”, Butterworth and -Heinemann Ltd London, 3rd Edition, 1998.
3. Dr .Massim A.G .Mitolo, “Electrical Safety of Low Voltage Systems, McGraw Hill, 2009.

Web References:

1. www.nfpa.org/safety-information/for-consumers/causes/electrical

E-Text Book:

1. Indian Electricity Act and Rules Government of India, 2003.

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MODULE- I			
INTRODUCTION AND STATUTORY REQUIREMENTS			
S. No	QUESTIONS	Blooms Taxonomy Level	Course Learning Outcomes (CLOs)
1	Write briefly about Electrostatics and Electro Magnetism	Remember	AEE807.1
2	Explain Energy Radiation	Understand	AEE807.1
3	Explain Electromagnetic Interference	Understand	AEE807.2
4	Explain Working principles of electrical equipment	Understand	AEE807.2
5	Explain about Indian electricity act and rules	Remember	AEE807.1
6	Explain the international standards on electrical safety and first aids	Understand	AEE807.1
7	Explain cardio pulmonary resuscitation (CPR).	Understand	AEE807.3
8	Summarize the safety aspects in operation and maintenance of electrical plant and equipment.	Understand	AEE807.1
9	Explain the procedure of safety key system. Why is it necessary?	Understand	AEE807.2
10	Explain how field quality and safety can be ensured during erection.	Understand	AEE807.1
11	Discuss the salient aspects of safety management in operation and maintenance work.	Remember	AEE807.3
12	Explain the effects of electric and electromagnetic fields on men working at substations.	Understand	AEE807.3
13	What are all the effect of electrical injuries caused to Men and animals.	Understand	AEE807.2
14	What are all the safety measures to be followed while the electromagnetic fields on men working at energized HV lines and substations.	Understand	AEE807.3
MODULE- I I			
ELECTRICAL HAZARDS AND SEFETY CODES			
1	Explain Primary and secondary hazards	Understand	AEE807.4
2	Explain in detail about the hazards during the installation of electric plant.	Understand	AEE807.5
3	Explain the use of Unsafe conditions like Civil, Mechanical and electrical hazards likely to occur during installation of electric plant.	Remember	AEE807.4
4	Discuss the hazards associated with electric current and voltages.	Understand	AEE807.4
5	Explain how flash hazards and distances are calculated in electrical plant.	Understand	AEE807.5
6	Explain the surges over current and short circuit current	Understand	AEE807.6
7	Explain the classifications excess energy current	Understand	AEE807.6
8	Explain the insulation classes of insulation voltage	Understand	AEE807.4
9	Explain the Energy leakage-clearances	Remember	AEE807.5

10	Write briefly about sources, hazardous conditions, control and electrical causes of fire	Understand	AEE807.5
11	Write briefly about explosion ionization, spark and arc ignition	Understand	AEE807.6
12	Explain the safety codes and IS codes for national electrical Energy	Remember	AEE807.4
13	Explain the lightning hazards	Understand	AEE807.5
14	Describe the operation of earth resistance megger.	Understand	AEE807.6
15	What is earth resistance, how it is measured? Explain its implication on the protection system	Understand	AEE807.6

MODULE- III

ELECTRICAL HAZARDS AND SAFETY CODES

1	What is the difference between isolator and circuit breaker and their significance with respect to construction and operation?	Understand	AEE807.7
2	Enumerate the difference between system grounding and equipment grounding.	Understand	AEE807.7
3	Discuss the advantages of neutral grounding.	Remember	AEE807.7
4	What are the functional requirements of an earthing system?	Understand	AEE807.8
5	Discuss the sequences of steps involved in the systematic installation of a typical electrical substation.	Understand	AEE807.7
6	List the objectives related to safe commissioning of electrical substation.	Remember	AEE807.9
7	Explain the neutral grounding of a generator through neutral grounding transformer.	Understand	AEE807.8
8	Explain the different types of neutral grounding of a system.	Understand	AEE807.8
9	Explain in detail about the general requirements for system grounding and procedure for laying earthing mat.	Understand	AEE807.8
10	Differentiate between system grounding and equipment grounding.	Remember	AEE807.9
11	Explain the Fuse, circuit breakers and overload relays	Understand	AEE807.9
12	Explain the protection against over voltage and under voltage	Understand	AEE807.7
13	Explain the protection of conductor	Understand	AEE807.8
14	Explain the overload and short circuit protection, no load protection and earth fault protection	Understand	AEE807.9
15	Discuss the FRLS insulation	Remember	AEE807.9
16	Discuss the earth leakage circuit breaker (ELCB)	Remember	AEE807.9
17	Safety in handling hand held electrical appliances tools and medical equipment	Understand	AEE807.8

MODULE- IV

CLASSIFICATION OF HAZARDOUS ZONES

1	Explain the Classification of hazardous zones	Understand	AEE807.10
2	What is meant by maintenance zone? What are the maintenance zones necessary in single bus bar substation and duplicate bus bar system?	Understand	AEE807.10
3	How can the workers be safeguarded from voltages induced in communication lines?	Understand	AEE807.10

4	Explain how different alarms, indications and communications help in managing safety.	Remember	AEE807.11
5	What is the six step safety method?	Remember	AEE807.11
6	Explain the construction and working principle of a digital insulation resistance megger.	Understand	AEE807.11
7	Discuss the explosion proof electrical apparatus increase safe equipment	Remember	AEE807.12
8	Explain the different zones for safe equipment	Understand	AEE807.12
9	Explain the grouping of gases	Understand	AEE807.12
10	Explain the	Understand	AEE807.11
11	Explain the equipment certifying agencies	Understand	AEE807.12
MODULE- V			
ELECTRICAL SAFETY LAW(S) APPLICATIONS			
1	Explain the Electrical safety codes of practice	Remember	AEE807.13
2	Explain the Electrical safety codes of regulation	Understand	AEE807.13
3	Explain the following : (i) Safety clearance. (ii) Creepage distance.	Understand	AEE807.14
4	List the objectives related to safecommissioning of electrical substation.	Remember	AEE807.14
5	Discuss the total quality management in a factory.	Understand	AEE807.15
6	Bring out the interface protocols between General safety, Industrial safety and TQM.	Understand	AEE807.15
7	State the preliminary preparations before commencing installation. What are the items to be described in the check list?	Understand	AEE807.13
8	Describe the theory of methods for measuring the earth resistance.	Understand	AEE807.14
9	Explain in detail about the safety documentation.	Understand	AEE807.14
10	Define the following : (a) six step safety method (b) Explain SCN (Safety Clearance notice) (c) Explain TQM (Total quality management).	Remember	AEE807.15
11	Explain in detail installation, commissioning and energizing of an electrical equipment	Understand	AEE807.15
12	Explain the functioning of 3 pin plug to 2 pin plug with respect to safety.	Understand	AEE807.15
13	Discuss the effects of electrical magnetic field due to electric High voltage lines.	Understand	AEE807.14
14	Explain the NFPA 70E, ANSI codes	Remember	AEE807.15

Prepared by:

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