

## Operation and Maintenance of Electrical Grid System & Transformers

Domain Name	Code	Type of course	T-P-P	Pre-requisite
Operation and Maintenance of Electrical Grid System & Transformers	EGCU2090	Theory + Practice + Project	6-14-4	Nil

### 1. Track Total Credits:

Theory + Practice + Project: [6+14+4] (24)

### 2. Domain objectives :

A] To create technically trained manpower readily available for recruitment to the power/energy Companies & Transformer Manufacturing firms in Electrical Sector.

B] Develop digital prototypes of the products and validate them and innovate for design efficiency

### 3. Domain Outcomes :

A] Product: Manufacturing of commercially used distribution transformer

B] Project Report: Report on different Operation and maintenance procedures carried out on transmission and distribution system including Transformer Manufacturing & Testing Process

### 4. Domain Structure : The Domain will consist of following components and these components will be reflected in the grade sheet.

- a. CUEG 2090: Introduction, Power Scenario, Power Quality & Faulty clearance, [1-1-0]
- b. CUEG 2091: Switchyard & substation Networks, [1-2-0]
- c. CUEG 2092: Protection scheme & Switchgear, [1-2-0]
- d. CUEG 2093: Cable system & Testing, [1-2-0]
- e. CUEG 2094: Power Markets, [1-0-0]
- f. CUEG 2095: Grid Safety, [0-2-0]
- g. CUEG 2096: Transformer Manufacturing, [1-5-0]
- h. CUEG 2097: Project, [0-0-4]

The Domain will be delivered through case studies, assignments and product development

Product Development Stack :

1. Distribution Transformer ( Full product)
2. Smart Energy Meter ( Modular Platform design and electric power train design , BIW)

## 5. Session Plan for the Entire Domain:

### Course 1: Generation, Transmission & Distribution scenario in India

[Interactive + Modelling], [1-1-0], [20 Hrs]

- 1.1 Types of generation: Conventional and Non-conventional,
- 1.2 Thermal Power Plant, Hydro Power Plant,
- 1.3 Gas Power Plant, Nuclear Power Plant,
- 1.4 Co-generation Various sources Non-conventional Energy Sources.
- 1.5 Role of computers in distribution system planning-Load modelling
- 1.6 characteristics: definition of basic terms and loss factor
- 1.7 Classification of loads and their characteristics.
- 1.8 Distribution Feeders and Substations: Design consideration of Distribution feeders: Radial and loop types of primary feeders, voltage levels, and feeder-loading.

#### Video Links

- 1.2.1 [https://www.youtube.com/watch?v=lh5\\_7sHyLU4](https://www.youtube.com/watch?v=lh5_7sHyLU4)
- 1.2.2 Hydro Power
- 1.3.1 Gas Power Plant
- 1.3.2 Nuclear Power Plant
- 1.3.3 1.4.1 Co-Generation

#### Practice

1. Load Modeling
2. Substation Modeling

### Course 2: Switchyard/Substation Types

[Lab Practice in Own Distribution Network, Modelling], [1-2-0], [20 Hrs]

- 2.1 Single line diagram/equipments [Equipments-transformer, CB, fuse etc.]
- 2.2 Relays, Relaying schemes and auxiliaries Wiring Diagram
- 2.3 Layout of Sub-Station(33/11KV S/S, 220/33KV S/S)
- 2.4 Indoor and outdoor busbars — bus-bar mountings and their clearances.
- 2.5 Designing Electrical Transmission Tower Types and Design

## **Video Links**

2.3.1 Substation layout

2.5.1 Transmission Tower Design

## **Practice**

1. Design 33/11 KV substation

2. Single Line layout of substation

## **Course 3: System Protection & Auxiliaries**

[Field Visit+ Lab Practice in Own Distribution Network] [1-2-0] [20 Hrs]

3.1 CT & PTs, Local & Back-up Protection. Protection Schemes,

3.2 New Generation Relays, Different types of indoor and outdoor CB, Breaker Maintenance,

3.3 Lightning Arrestors/Surge Arrestors, Isolators And Insulators,

3.4 Grounding system, Auxiliary System in Switchyard/Substation

## **Video Links**

3.1.1 CT, PT, Relay

3.2.1 Distance Protection

3.4.1 Grounding/Earthing

## **Practice**

1. Design Over current Protection for sub-station Feeder.

2. Measuring Earth Insulation Resistance

## **Course 4: Cables in Electrical System**

[Visit to Standard Testing Lab, Workshop Practice], [1-2-0], [20 Hrs]

4.1 Modern trends in Underground Cabling Basic Concepts,

4.2 Materials Used in Cables, Conductors,

4.3 Testing and Commissioning of cables,

## **Video Links**

4.1.1 Under Ground Cable

4.3.1 Cable Laying

## **Practice**

1. IR Test of Cable

2. Cable Jointing

## **Course 5: Power System Market, Markets For Electrical Energy, Energy Conservation**

[Interactive], [1-0-0] [3 Hrs]

- 5.1 Electricity Business
- 5.2 Electricity Market Models
- 5.3 Power Transfer, Inter & Intra State
- 5.4 Energy Efficiency in Grid
- 5.5 Energy conservation measures

### **Video Links**

- 5.1 Power Market Fundamental
- 5.2 Power Exchange
- 5.5 Energy Conservation

### **Practice**

1. Developing Market Model for electricity trading

### **Course 6: GRID Safety Norms, Electrical Accidents and prevention, Electricity Costing & Audit,**

[Field Survey], [0-2-0], [5 Hrs]

- 6.1 Safety Requirement, Hazards, Electrical Accidents and prevention, First Aid
- 6.2 Safety : Safety Philosophy, Safety Procedures, GRID Safety Norms, Procedures for issuing L.C.P. and cancellation, Maintenance of Safety records.
- 6.3 First Aid : Places of Potential Hazards, Electric Shock Treatment, Artificial Respiration, Handling Emergency Conditions, Treatment of Wounds, Injuries & Burns.
- 6.4 Fire Fighting: Causes of Fire, Fire Extinction, Classification of Fires, Fire Fighting, Equipment: their operation – maintenance & refilling, Fire prevention.
- 6.5 Energy Audit.

### **Video Link**

- 6.1.1 General Grid Safety
- 6.2.2 Industrial Safety
- 6.3.1 Electrical Shock First Aid
- 6.4.1 Fire Extinguisher

### **Practice**

Hazard Analysis & Mitigation

### **Course 7: Principles of transformer**

[DS Tools, Workshop Practice], [1-5-0], [20 Hrs]

- 7.1 Inner & Outer Part of Transformer,
- 7.2 Manufacturing of Transformer,
- 7.3 Transformer Test,
- 7.4 Conditions leading to faults in Transformer,
- 7.5 Maintenance of transformer

**Practice**

- 1. Transformer Manufacturing
- 2. Transformer Testing
- 3. Fault Finding & Corrective action

**6. List of Projects/products to be done in domain: [200 Hrs]**

- 1. Substation layout & Placement of equipment.
- 2. Protection System of 33/11/0.4 KV substation.
- 3. O & M of distribution substation.
- 4. Energy Audit
- 5. Safety Practice.
- 6. Transformer Manufacturing & Testing.

EVALUATION: As per Central QA system policy