COURSE TITLE : PLANT UTILITIES AND MAINTENANCE
COURSE CODE : 6075
COURSE CATEGORY : E
PERIODS/ WEEK : 4
PERIODS/ SEMESTER : 60
CREDIT : 4

TIME SCHEDULE

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<tr>
<th>MODULE</th>
<th>TOPIC</th>
<th>PERIODS</th>
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<tr>
<td>1</td>
<td>Plant Utilities – Water&amp; Air</td>
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<td>2</td>
<td>Steam and steam generators</td>
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<td>Operational Maintenance of Chemical Plant equipments</td>
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<td>Plant location and lay out</td>
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<td>TOTAL</td>
<td>60</td>
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COURSE OUTCOMES :

<table>
<thead>
<tr>
<th>SL.NO</th>
<th>SUB</th>
<th>STUDENT WILL BE ABLE TO</th>
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<tbody>
<tr>
<td>1</td>
<td></td>
<td>1. Appreciate the requirement of different utilities for the process plant.</td>
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<td>2. Know the generation and its effective utilization of water, steam and air</td>
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<td>3. Understand different equipments used to run the process plant with different utilities.</td>
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<td>2</td>
<td>1</td>
<td>1. Acquire the knowledge for selection of different utilities.</td>
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<td>2</td>
<td>2. Understand the cleaning methods of Tubular equipments.</td>
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<td>3</td>
<td>3. Comprehend the start up and commissioning of chemical plant equipments</td>
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<tr>
<td>3</td>
<td>1</td>
<td>1. Understand the factor to be considered for the selection of chemical plant.</td>
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<td>2</td>
<td>2. Understand the chemical plant ventilation and lighting</td>
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SPECIFIC OUTCOME

MODULE-I

UTILITY AIR, WATER, AND STEAM

1.1.0 Understand utility Air and water

1.1.1 Name the air handling Equipments
1.1.2 Preparation methods of Instrument air
1.1.3 Discuss about heating and cooling of air

1.2.0 Comprehend Importance of water in chemical industries and water purification process

1.2.1 List the source of water
1.2.2 List the characteristics of water
1.2.3 Define hardness
1.2.4 Define temporary and permanent hardness
1.2.5 State the disadvantages of hard water
1.2.6 State the scale and sludge formation in boilers
1.2.7 List the disadvantages of scale formation
1.2.8 Define caustic embrittlement
1.2.9 Explain the following softening methods 1) lime soda process 2) zeolite process.
1.2.10 List advantages disadvantages cold and hot lime soda process
1.2.11 Explain the ion exchange process
1.2.12 Explain the method of municipal water treatment.
1.2.13 Describe the Production of cooling Water and chilled water
1.2.14 Explain the methods of distribution of cooling water
1.2.15 Describe preparation of Boiler Feed Water.

MODULE- II

Steam & Steam Generators
2.1.0 Understand the various properties of steam
2.1.1 Explain the formation of steam under constant pressure.
2.1.2 State the effect of pressure on temperature.
2.1.3 Distinguish the wet steam, dry steam and super heated steam.
2.1.4 Explain the properties of steam such as sensible heat, latent heat, total heat of steam, superheat and dryness fractions.

2.2.0 Understand the working of steam Generators
2.2.1 Define a boiler.
2.2.2 Explain the functions of a boiler.
2.2.3 Distinguish between fire tube boiler and water tube boiler.
2.2.4 Distinguish between low pressure boiler and high pressure boiler.
2.2.5 Describe with line diagram the construction and working of a Simple Vertical Boiler and Cochran boiler, Babcock and Wilcox boiler, la -Mont Boiler and Benson boiler.
2.2.6 Compare the smoke tube and water tube Boiler.
2.2.7 List the specification of a boiler.
2.2.8 State the function of boiler mountings such as stop valve, safety valve, water level indicator, pressure gauge and fusible plug etc. with line sketches.
2.2.9 Explain the functions of boiler accessories such as economizer, feed pump, super heater and air pre-heater etc. with simple sketch
2.2.10 Explain the developments such as draft, natural draft, induced draft, forced draft and balanced draft.

MODULE – III

Operational Maintenance of Chemical Plant equipments
3.1.0 Understand the principles of maintenance management
3.1.1 List the need for maintenance.
3.1.2 List the three types of maintenance.
3.1.3 Prepare a sample maintenance schedule for any equipment.
3.1.4 Describe the cost factors in maintenance.
3.1.5 List the main elements in a maintenance records.
3.1.6 List the tree types of equipment replacement.
3.2.0 Comprehend maintenance of Chemical Plant equipments

3.2.1 List the methods of cleaning tubular equipments.
3.2.2 State why cleaning of tubular equipment is essential.
3.2.3 Explain method and procedures of chemical cleaning of tubular equipment.
3.2.4 Describe the mechanical methods of cleaning tubular equipments.
3.2.5 List the method for cleaning towers and columns.
3.2.6 Explain the common causes of troubles and remedial action in the following equipments: Centrifugal pumps, Reciprocating compressor, Filter press, Agitator.
3.2.7 Explain the decoking methods of furnace tubes.

3.3.0 Know start up and commissioning of some plant equipments

3.3.1 Describe the procedure for starting of centrifugal pumps.
3.3.2 List the precautions to be taken before starting the reciprocating pump.
3.3.3 List the precautions to be taken before starting of the reciprocating compressor.
3.3.4 Explain various steps to be taken for the start up and commissioning of the heater.
3.3.5 Explain various steps to be taken for start up and commissioning of a distillation column.
3.3.6 Select various steps to be taken for start up and commissioning of the Absorption columns.

3.4.0 Understand chemical plant inspection

3.4.1 Explain the precautions to be taken before opening and entry in the vessels for cleaning.
3.4.2 List the types of inspections.
3.4.3 Explain conventional monitoring methods.
3.4.4 List the standard testing methods of a high pressure vessels before and after fabrication.
3.4.5 List the non-destructive testing methods.
3.4.6 Describe the ultrasonic test for pressure vessel.
3.4.7 Describe the radiographic test for pressure vessel.

MODULE – IV

Plant Location and Layout.

4.1.0 Know the basic principles in location and layout of a chemical plant.

4.1.1 List the points to be considered in the location of a big chemical plant.
4.1.2 Identify the role of raw materials, transportation and power supply in the location of a Chemical plant.
4.1.3 Explain the community factors in the location of a chemical plant.
4.1.4 State the waste disposal and water supply in the location of a chemical plant.
4.1.5 Explain the factors to be considered in the preparations of a plant lay out.
4.1.6 Draw a plant lay out for a chemical plant.
4.1.7 List the safety factors involved in plant layout.
4.1.8 Locate a canteen, ETP, Boiler house, in a typical layout and justify the location.
4.1.9 List the methods of preparing a plant layout and explain any one method.
4.1.10 Explain master plot plan and unit plot plan.
4.1.11 Draw a typical master plot plan of a plant you know.
4.1.12 Explain the guide lines for preparing a master plot plan and unit plot plan.
4.1.13 Illustrate the scale model method of preparing plot plans.
4.1.14 Draw sketches of different types of chemical plant buildings.
4.1.15 Differentiate between housed and Un housed plants.
4.1.16 Explain the advantages of multi storied construction over single storied construction.
4.1.17 Explain chemical plant roofs and floorings.
4.1.18 Describe the methods of providing artificial and natural ventilation and lighting.

COURSE CONTENT

MODULE I
UTILITY- AIR AND WATER

MODULE II
PROPERTIES OF STEAM & BOILERS

MODULE III
OPERATIONAL MAINTENANCE OF CHEMICAL PLANT EQUIPMENT

MODULE IV
PLANT LOCATION AND LAY-OUT

REFERENCE
Prof. BENCHAMIN - General Engineering
BADGER & JULIOUS T BANCHERO - Introduction to Chemical Engg.