Savitribai Phule Pune University, Pune 2012 Course
(Elective III)
STEAM ENGINEERING & ENERGY CONSERVATION

Pre-requisite: Thermodynamics, Heat Transfer, Fluid mechanics
Lectures: 4 Hrs/week

In semester exam: 30 Marks
End Semester Exam: 70 Marks
Oral/Pract Exam: NA

Course Objectives:

1. To acquaint and make students to understand the fundamentals of steam system in process heating with special emphasis on the steam and condensate loop and its design.

2. To develop an ability amongst the students to design a steam system , assess it's performance and improve its contribution to energy conservation.

Course Outcomes :

1. Students will be able to understand the use of steam as an effective process heating medium.
2. Students will be able to apply this knowledge in the design ,development and analysis of steam system for applications in process industry.
3. Students will be able to apply this knowledge for energy conservation in steam system.

Unit I. Steam Basics. (8 Hrs.)

Introduction, What is steam, formation of steam at constant pressure/ temperature, T-v, P-v, T-s and h-s diagram Steam pressure/temperature relationship, Steam pressure volume relationship, super heated steam, steam as a carrier of heat for process heating, steam distribution pressures, steam quality, heat transfer, flash steam. Properties of steam Use of steam table/Mollier Chart.
Heat Exchangers: uses, types and selection.

Unit II. Steam generation (8 Hrs.)

Boilers- Water tube and Fire tube boilers. Boiler Water Treatment - need, types / methodology , Blow-down Boiler mountings and accessories, Fuels and combustion, Boiler efficiency (direct and indirect method), factors affecting boiler efficiency, Boiler manufacturing. IBR considerations, types of burners.

Unit III. Accessories and Steam distribution (8 Hrs.)

Piping accessories. Valves (types, selection and characteristics) moisture separators, strainers etc.
Steam Distribution.
Line sizing, good engineering practices in piping design, water hammer, air venting, insulation etc.

Unit IV. Measurements and controls (8 Hrs.)

Control Basics ,Control valves and desuperheating
Pressure and Temperature controls.
Need, Methods and advantages of Pressure and Temperature Controls.
Flow Measurement.
Need, Types of Flow meters, applications, advantages and disadvantages.

Unit V. Condensate Management (8 Hrs.)

Trapping and Trap Monitoring.
Types of traps, Principles, operation, applications, need of trap monitoring and methods.
Flash steam and Condensate recovery.
Flash steam recovery, Condensate Management, Steam operated pumps, Flash vessels, Stalling etc.

Unit VI. Energy Conservation and Steam Applications (8 Hrs.)

Steam engineering and energy conservation, Steam Audit, introduction to co-generation.
Applications of steam in Process industries like Paper, Textile, Dairy and Hospitality.
Performance matrix of steam systems.

Four sessions of In plant Training . (8 hrs.)

1. Boiler Manufacturing, mounting and accessories.
2. Steam piping accessories, traps, flash vessels, steam operated pumps etc.
3. Control valves and desuperheaters.
4. Flow meters (manufacturing, testing)

Assignments:

1. Study of Insulating Effect of air on heat transfer rate in heat exchanger.
2. Study of stages in boiler fabrication.
3. Application based comparative study of steam traps.
4. Study of condensate recovery system.
5. Study of manufacture and testing of Pressure reducing valves and Pressure reducing stations, control valves and desuperheater.
6. Study of manufacture and testing of flow meters.
7. Report on visit to a process industry.

References:

1. Boiler Operations by M.P. Murgai and W.M Baber (New International, 1990)
2. Efficient Use of Steam Vol1 and Vol 2 by Oliver Lyle. (Her Majesty Stationery Office (1947)
3. Steam Trapping and Air Venting by L.G.Northcroft (Hutchinson And Company (Publishers) Ltd.)
4. Valve Handbook by Philip Skousen (Mcgraw Hill Companies)
5. Boilers for Power and Process by Rayprolu.(Crc Press-Taylor & Francis Group)
6. Boiler Operation Engineering by P. Chattopadhyay, (Tata McGrawhill Company)