

**M.E Semester: 2 Mechanical Engineering (Thermal Engineering)  
Subject Name: Cogeneration & Waste Heat Recovery Systems**

**A. Course Objective**

- To present a problem oriented in depth knowledge of Cogeneration & Waste Heat Recovery Systems
- To address the underlying concepts and methods behind Cogeneration & Waste Heat Recovery Systems

**B. Teaching / Examination Scheme**

SUBJECT		Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
		L	T	P	Total		THEORY		IE	CIA	PR. / VIVO	
CODE	NAME	Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
METH205-B	Cogeneration & Waste Heat Recovery Systems	3	0	0	3	3	3	70	30	20	0	120

**C. Detailed Syllabus**

1. COGENERATION: Introduction - Principles of Thermodynamics - Combined Cycles-Topping -Bottoming - Organic Rankin Cycles - Advantages of Cogeneration Technology.
2. APPLICATION & TECHNO ECONOMICS OF COGENERATION: Cogeneration Application in various industries like Cement, Sugar Mill, Paper Mill etc. Sizing of waste heat boilers - Performance calculations, Part load characteristics selection of Cogeneration Technologies – Financial considerations - Operating and Investments - Costs of Cogeneration.
3. WASTE HEAT RECOVERY: Introduction - Principles of Thermodynamics and Second Law - sources of Waste Heat recovery - Diesel engines and Power Plant etc.
4. WASTE HEAT RECOVERY SYSTEMS, APPLICATIONS & TECHNO ECONOMICS: Recuperators - Regenerators - economizers - Plate Heat Exchangers - Waste Heat Boilers-Classification, Location, Service Conditions, Design Considerations, Unfired combined Cycle - supplementary fired combined cycle - fired combined cycle applications in Industries - fluidised bed heat exchangers - heat pipe exchangers - heat pumps -thermic fluid heaters selection of waste heat recovery technologies - financial considerations - operations and investment costs of waste heat recovery.
5. ENVIRONMENTAL CONSIDERATIONS: Environmental considerations for cogeneration and waste heat recovery - Pollution.

**D. Lesson Planning**

Sr.No.	Date/Week	Unit No.	% Weightage	Topic No:
1	1 <sup>st</sup> , 2 <sup>ed</sup> , 3 <sup>ed</sup>	Unit 1	20 % .	1
2	4 <sup>th</sup> , 5 <sup>th</sup> , 6 <sup>th</sup>	Unit 2	20 %	2
3	7 <sup>th</sup> , 8 <sup>th</sup> , 9 <sup>th</sup>	Unit 3	20 %	3
4	10 <sup>th</sup> , 11 <sup>th</sup> , 12 <sup>th</sup>	Unit 4	20 %	4
5	13 <sup>th</sup> , 14 <sup>th</sup> , 15 <sup>th</sup>	Unit 5	20 %	5

**E. Instructional Method & Pedagogy**

1. At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
2. Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal weightage should be given to all topics while teaching and conduction of all examinations.
3. Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.

4. One/Two internal exams may be conducted and total/average/best of the same may be converted to equivalent of 30 marks as a part of internal theory evaluation.
5. Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.
6. Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.

**F. Students Learning Outcomes**

- The student can identify different areas of Cogeneration & Waste Heat Recovery Systems.
- Can find the applications of all the areas in day to day life.

**G. Recommended Study Materials**

• **Text & Reference Books:**

1. Charles H. Butler, Cogeneration, McGraw Hill Book Co., 1984.
2. Horlock JH, Cogeneration - Heat and Power, Thermodynamics and Economics, Oxford, 1987.
3. Institute of Fuel, London, Waste Heat Recovery, Chapman & Hall Publishers, London, 1963.
4. Sengupta Subrata, Lee SS EDS, Waste Heat Utilization and Management, Hemisphere, Washington, 1983.
5. De Nevers, Noel., Air Pollution Control Engineering, McGrawHill, New York, 1995.

• **Websites:**

1. <http://www.sicom.nl>
2. <http://www.jenbacher.com>
3. <http://www.cogen.com>
4. <http://www.energypubs.com>

