DEPARTMENT OF MECHANICAL ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Name of the programme and specialization	**THERMAL POWER ENGINEERING**		
Course Title	**DESIGN AND OPTIMISATION OF THERMAL ENERGY SYSTEMS**		
Course Code	**ME 641**	**No. of Credits**	**3**
Course Code of Pre-requisite subject(s)	**NIL**		
Session	**July/ 2018**	**Section (if, applicable)**	**---**
Name of Faculty	**Dr. V. MARIAPPAN**	**Department**	**MECHANICAL ENGINEERING**
Email	**vmari@nitt.edu**	**Telephone No.**	**0431-2503420, 9894471094**
Name of Course Coordinator(s) (if, applicable)			
E-mail		**Telephone No.**	
Course Type	☐ **Core course**	☑ **Elective course**	

Syllabus (approved in BoS)

Introduction to Energy System Design-Modeling of thermal equipment - heat exchangers, evaporators, condensers, turbomachines, distillation equipment. Absorber, generator, GAX. System simulation - Application of successive method and Newton Raphson Method to Energy Systems.

Regression analysis and Equation fitting, best fit - Least Square Regression, Exact fit - Lagrange interpolation.

Mathematical Representation for Optimization Problems in Energy Systems - Applications of various search methods to Energy Systems - Waste Heat Recovery System - design of energy recovery systems - Genetic Algorithm.

Thermoeconomic analysis - Exergy analysis - Estimation of cost of investment, cost of fuel, cost balance, cost of product - Thermoeconomic optimization.

COURSE OBJECTIVES

1. To describe energy system design and recall regression analysis and equation fitting
2. To design thermal equipment like heat exchangers, evaporators, condensers, turbomachines, distillation equipment, absorber, generator, GAX.
3. To apply the successive method and Newton Raphson method in energy systems
4. To construct mathematical representation for optimization problems in energy systems
5. To analyze the cost involved in energy system by present worth - annual cost method

COURSE OUTCOMES (CO)

Course Outcomes	Aligned Programme Outcomes (PO)
1. Describe energy system design and recall regression analysis and equation fitting	1, 2, 3, 5, 7, 10, 11, 12

2. Design thermal equipment like heat exchangers, evaporators, condensers, turbomachines, distillation equipment, absorber, generator, GAX.	1, 2, 3, 4, 5, 6, 10, 11, 12
3. Apply the successive method and Newton Raphson method in energy systems	1, 2, 5, 6, 7, 10, 11, 12
4. Construct mathematical representation for optimization problems in energy systems	1, 2, 5, 6, 7, 10, 11, 12
5. Analyze the cost involved in energy system by present worth - annual cost method	1,2, 6,8,10,11,12

COURSE PLAN – PART II

COURSE OVERVIEW

The main thrust of this course is to design and optimize systems based on inputs from simulation and experimental data on materials and on components that constitute the system. This couse will give a systematic approach is followed to obtain an optimal design, starting with conceptual design and proceeding through modeling, simulation, and design evaluation to choose a feasible design. A wide range of examples from many different applied areas, such as energy, environment, heating, cooling, manufacturing, aerospace, and transportation systems will be covered in this course to explain the various elements involved in modeling, simulation, and design.

COURSE TEACHING AND LEARNING ACTIVITIES

COURSE TEACHING AND LEARNING ACTIVITIES

Sl. No.	Week	Topic	Mode of Delivery
01	1st week	Introduction to Energy System Design-Modeling of thermal equipment.	Lecture C & T; PPT; VL
02	2nd week	Heat exchangers, evaporators	Lecture C & T; PPT
03	3rd week	Condensers, turbomachines, distillation equipment.	Lecture C & T; PPT
04	4th week	Absorber, generator, GAX.	Lecture C & T
05	5th week	System simulation - Application of successive method.	Lecture C & T
06	6th week	Newton Raphson Method to Energy Systems.	Lecture C & T; PPT
07		**Cycle Test - 1**	
08	7th week	Regression analysis and Equation fitting best fit.	Lecture C & T
09	8th week	Best fit - Least Square Regression	Lecture C & T; VL; Lab Visit
10	9th week	Mathematical Representation for Optimization Problems in Energy Systems.	Lecture C & T
12	10th week	Applications of various search methods to Energy Systems	Lecture C & T
13		**Cycle Test – 2**	
14	11th week	Waste Heat Recovery System - design of energy recovery systems	Lecture C & T; PPT

15	12th week	Genetic Algorithm	Lecture C & T
16	13th week	Thermoeconomic analysis	Lecture C & T; PPT

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

Sl. No.	Mode of Assessment	Week / Date	Duration	% Weightage
1.	Cycle Test - 1	After 6th week	60 Minutes	20
2.	Cycle Test – 2	After 12th week	60 Minutes	20
3.	Tutorials	Every week	50 Minutes	10
CPA	Compensation Assessment*			20
4.	Final Assessment *			50

***mandatory; refer to guidelines on page 4**

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

1. Feedback from the students during class committee meeting.
2. End semester feedback on Course Outcomes.

COURSE POLICY (preferred mode of correspondence with students, compensation assessment policy to be specified)

MODE OF CORRESPONDENCE (email/ phone etc)

All the communication to the class (schedule of assessment/ course material/ any other information regarding this course) will be through the class representative.

COMPENSATION ASSESSMENT POLICY

1. Attending all the assessments is MANDATORY for every student
2. If any student is not able to attend any one or both of the Continuous Assessments (Cycle Tests I & II due to genuine reasons, he/she is permitted to appear for one time Compensation Assessment (CPA) (This is not valid for students who have attendance lag.). At any case, CPA will not be considered as an improvement test.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- **At least 75% attendance in each course is mandatory.**
- **A maximum of 10% shall be allowed under On Duty (OD) category.**
- Students with **less than 65% of attendance** shall be prevented from writing the final assessment and **shall be awarded 'V' grade.**

ACADEMIC DISHONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and

award the punishment if the student is found guilty. The report shall be submitted to the Academic office. The above policy against academic dishonesty shall be applicable for all the programmes.
ADDITIONAL INFORMATION
The Course Coordinator is available for consultation at times those are displayed on the coordinator's office notice board. Queries may also be emailed to the Course Coordinator directly at **vmari@nitt.edu**
FOR APPROVAL
Course Faculty _____ (V. MARIAPPAN) **CC-Chairperson** _____ **HOD** _____

Guidelines:

a) The number of assessments for a course shall range from 4 to 6.

b) **Every course shall have a final assessment on the entire syllabus with at least 30% weightage.**

c) **One compensation assessment for absentees in assessments (other than final assessment) is mandatory. Only genuine cases of absence shall be considered.**

d) **The passing minimum shall be as per the regulations.**

e) **Attendance policy and the policy on academic dishonesty & plagiarism by students are uniform for all the courses.**

f) **Absolute grading policy shall be incorporated if the number of students per course is less than 10.**

g) Necessary care shall be taken to ensure that the course plan is reasonable and is objective.