

DEPARTMENT OF MECHANICAL ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Name of the programme and specialization	B.Tech / Mechanical Engineering		
Course Title	TURBOMACHINES		
Course Code	MEPC21	No. of Credits	3
Course Code of Pre-requisite subject(s)	MEPC18 – FLUID MECHANICS		
Session	July 2018	Section (if, applicable)	A
Name of Faculty	Dr. S Vedharaj	Department	Mechanical Engineering
Email	vedha@nitt.edu	Telephone No.	
Name of Course Coordinator(s) (if, applicable)			
E-mail		Telephone No.	
Course Type	<input checked="" type="checkbox"/> Core course <input type="checkbox"/> Elective course		
Syllabus (approved in BoS)			
<p>Introduction - Classification - Dimensional analysis - Specific speed - Basic laws and equations. Hydraulic turbines; Pelton, Francis, and Kaplan turbines - Turbine efficiencies - Cavitation in turbines.</p> <p>Centrifugal pumps; theory, components, and characteristics - Cavitation - Axial flow pumps - Pump system matching.</p> <p>Centrifugal and axial flow compressors; slip, surging and chocking.</p> <p>Steam turbines; basic cycle, impulse and reaction turbines - Gas turbine; basic cycle and multi-staging - Power and efficiency calculations.</p> <p>Reference Books:</p> <ol style="list-style-type: none"> 1. Dixon, S.L., Fluid Mechanics and Thermodynamics of Turbomachines, 5th ed., Butterworth-Heinemann, 2005. 2. Sayers, A.T., Hydraulic and Compressible Flow Turbomachines, CBLs, 2003. 3. Ganesan, V., Gas Turbines, 2nd ed., Tata McGraw-Hill, 2003. 4. Lakshminarayana, B., Fluid Dynamics and Heat Transfer of Turbomachinery, Wiley-Interscience, 1995. 			
COURSE OBJECTIVES			
<ul style="list-style-type: none"> ➤ Provide students with opportunities to apply basic flow equations ➤ How to compare and chose machines for various operations 			

COURSE OUTCOMES (CO)	
Course Outcomes	Aligned Programme Outcomes (PO)
At the end of the course student will	
1. Explain basic concepts of turbomachines and visualize dimensional analysis.	1,2,5,10,11,12
2. Describe the working of Pelton, Francis and Kaplan along their performance parameters.	1,2,5,10,11,12
3. Discuss the operation of centrifugal pumps, centrifugal and axial compressors.	1,2,5,10,11,12
4. Associate the effect of cavitation in turbines and pumps.	1,2,3,5,6,10,11,12
5. Express the basic cycles and calculations involved in the operation of steam and gas turbines	1,2,3,5,6,10,11,12

COURSE PLAN – PART II

COURSE OVERVIEW			
This course familiarizes the students with the governing principles and preliminary design of various turbomachines such as Pelton wheel turbine, Francis turbine, Kaplan turbine, Steam turbines, Gas turbines, Centrifugal Pump/Compressor, Axial Flow Pumps/Compressor, Fan and blowers.			
COURSE TEACHING AND LEARNING ACTIVITIES			
S.No.	Week/Contact Hours	Topic	Mode of Delivery
1.	1 st Week	Introduction and classification of turbomachinery, Energy transfer equations, Euler's equation of turbomachinery	Chalk and Talk
2.	2 nd Week	Dimensional Analysis and Specific speed in turbomachines, Problems	Chalk and Talk
3.	3 rd Week	Introduction to hydraulic turbines, Different efficiencies and velocity triangles for Pelton wheel and Francis turbines, Problems	Chalk and Talk
4.	4 th Week	Introduction about axial flow turbines - Kaplan turbines, Problems	Chalk and Talk
5.	5 th Week	Governing of impulse and reaction turbines, Cavitation in turbines.	Chalk and Talk
6.	6 th Week	Roto-dynamic pumps – Centrifugal pump theory of operation, components and pump characteristics, Problems	Chalk and Talk

7.	7 th Week	Matching of Pump and system characteristics, Cavitation, Net positive suction head, Priming. Axial flow pumps, Problems	Chalk and Talk
8.	8 th Week	Centrifugal Compressors: Stage velocity triangles, slip factor, power input factor, stage efficiency and surging, Problems	Chalk and Talk
9.	9 th Week	Axial flow Compressors: pressure ratio, loading coefficient, efficiencies and stalling. Problems.	Chalk and Talk
10.	10 th Week	Steam Turbines: Classification, Single stage impulse turbine, blade and stage efficiency, Problems.	Chalk and Talk
11.	11 th Week	Need and methods of compounding, Multistage impulse turbine, Problems	Chalk and Talk
12.	12 th Week	Reaction turbine – Parsons turbine, reaction staging, Problems	Chalk and Talk
13.	13 th Week	Gas Turbines: Basic cycle, Power and efficiency calculations. Problems.	Chalk and Talk
14.	14 th Week	Multi-staging in gas turbines, Problems	Chalk and Talk
15.	15 th Week	Revision	Chalk and Talk

COURSE ASSESSMENT METHODS

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1.	Cycle test 1	8th Week	90 minutes	15%
2.	Cycle test 2	16th Week	90 minutes	15%
3.	Quiz (Multiple Choice Questions)	14th Week	15 minutes	10%
4.	Assignments	12th Week		10%
CPA	Compensation test	Before end semester	90 minutes	15%
5.	End Semster	12 – 22 Nov 2018	180 minutes	50%

COURSE EXIT SURVEY

- Students feedback in the class after every 4 weeks and also through class committee meetings.
- Feedback from students on the course outcomes shall be obtained at the end of the course.

COURSE POLICY

MODE OF CORRESPONDENCE (email/ phone etc)

- All the communication (schedule of assessment/ course material/any other information regarding this course) will be intimated through the class representative.
- The Faculty is available for consultation after contact hours with prior appointment through email: vedha@nitt.edu

COMPENSATION ASSESSMENT POLICY

- Attending all the assessments (1, 2, 3, 4, 5) are mandatory for every student. Flexibility is given to the students to fix the date for each mode of evaluation convenient to majority of the students.
- If any student fails to attend the cycle test 1 and 2 due to genuine reason like medical emergency, the student may be permitted to appear for the compensation assessment (CPA) on submission of appropriate documents as proof. (Not valid for students having attendance lag).
- Students not having 75 % minimum attendance at the end of the semester and also didn't attend cycle test 1 and 2 will be awarded 'V' Grade and have to REDO the course.
- In any case, compensation assessment (CPA) is not considered as an improvement test.
- The minimum marks for passing this course and grading pattern will adhere to the regulations of the institute.

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

- All the students are expected to attend all the contact hours. Students should maintain 75% minimum physical attendance by the end of the course to attend the end semester examination.
- Absence due to medical reason and institutional activities will be considered when the student falls below 75% of physical attendance and it should be supported by a letter (in professional letterhead) from the concerned authorities. Any preparatory works in view of institution activities should not be taken up in class contact hours.
- Students not having 75% minimum attendance at the end of the semester will be awarded 'V' Grade and have to REDO the course.

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.

FOR APPROVAL



Dr. S. Vedharaj (AP/ME)
Course Faculty



CC-Chairperson



HOD (ME)

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. Details of compensation assessment to be specified by faculty.**
- 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.