DEPARTMENT OF MECHANICAL ENGINEERING

COURSE PLAN – PART I			
Name of the programme and specialization	**B.Tech., / ICE**		
Course Title	**ICPC13 - THERMODYNAMICS AND FLUID MECHANICS**		
Course Code	**ICPC13**	No. of Credits	**4**
Course Code of Pre-requisite subject(s)	-		
Session	**JAN. 2020**	Section (if, applicable)	**B**
Name of Faculty	**Mr. M. Sivakumar**	Department	**Mechanical**
Name of Course Coordinator(s) (if, applicable)	-		
E-mail	**sivam@nitt.edu**	Telephone No.	**96775-21121**
Course Type	[*] **Core course** [ ] **Elective course**		

Syllabus

Basic concepts of thermodynamics: Thermodynamic equilibrium, quasi-static process, zeroth law, work and heat interactions, first law for a cycle and a process, steady flow processes, second law statements, Carnot theorem, entropy principle. Properties of pure substances, phase equilibrium diagrams, Rankine cycle, reheat and regenerative cycle, properties of ideal gas, Stirling and Ericson cycles.

Heat engines: Otto, diesel and dual cycles, Brayton cycle with regeneration, inter cooling and reheat.

Fundamentals of Fluid mechanics: Classification of fluids and their physical properties, Fluid statics, manometers, pressure on submerged bodies. Ideal fluid - velocity field - stream line, streak line and path line, continuity equation - Rotational and irrotational flow, stream function and potential function, Euler's equations of motion, Bernoulli's equation and its application. Classification of open channel flows - measurement of discharge using rectangular and V-notches. Dimensional analysis – Buckingham Theorem and its applications. Laminar flow – Losses – Hagen-Poiseuille equation – Turbulent pipe flow – Friction.

Darcy Weisbach equation – Moody's diagram, minor losses – Boundary layer and its basic concepts.
Fluid machinery: Centrifugal pumps, Reciprocating pumps, Impulse turbine, Reaction turbine.

COURSE OBJECTIVES
1. To impart knowledge about the fundamentals of thermodynamic laws, concepts and principles. 2. To introduce the principles of various cycles and to apply the thermodynamic concepts in various applications. 3. To introduce the fundamental concepts of fluid mechanics, pressure distribution and dimensional analysis. 4. To comprehend the metering and transportation of fluids and fluid moving machinery performance.

COURSE OUTCOMES (CO)	
Course Outcomes	**Aligned Programme Outcomes (PO)**
On completion of this course, the students will be able to	
1. Apply the fundamental concepts of thermodynamics to the different types of processes	1,5,6,12
2. Comprehend thermodynamic cycles and their applications	1,5,6,7
3. Apply the knowledge of fluid mechanics in engineering applications using basic concepts and dimensional analysis	1,5,6,7,8,11
4. Select the proper metering equipment and fluid machinery for the engineering requirement	1,5,6,8,11,12

COURSE PLAN – PART II			
COURSE TEACHING AND LEARNING ACTIVITIES			
S.No.	**Week**	**Topic**	**Mode of Delivery**
1	1st Week	**Fundamentals of Fluid mechanics** Classification of fluids and their physical properties, Classification of flows	Chalk and Talk/ PPT
2	2nd Week	**Pressure and Fluid statics** Pressure, Manometers, Hydrostatic forces on submerged bodies, Buoyancy and stability	Chalk and Talk/ PPT
3	3rd Week	**Fluid Kinematics** Flow patterns – stream line, streak line and path line, Continuity equation – Rotational and irrotational flow, stream function and potential function	Chalk and Talk/ PPT
4	4th Week	**Conservation equations and Open channel flows** Euler's equations of motion, Bernoulli's equation and its application. Classification of open channel flows, measurement of discharge using rectangular and V – notches	Chalk and Talk/ PPT
5	5th Week	**Dimensional analysis** Buckingham Pi Theorem and its applications	Chalk and Talk/ PPT

6	6th Week	**Internal Flow** Boundary layer and its basic concepts, Laminar Flow–Pressure drop and head loss, Moody chart, Minor losses, Flow measurement devices	Chalk and Talk/ PPT
7	7th Week	**Fluid machinery** Impulse turbine, Reaction turbine, Centrifugal pumps, Reciprocating pumps	Chalk and Talk/ PPT
8	8th Week	**Fundamentals of Thermodynamics** System, Properties, Continuum, State, Equilibrium, Processes, Cycles, Zeroth law of Thermodynamics, Temperature and its measurement	Chalk and Talk/ PPT
9	9th Week	**Energy Transfer** Forms of Energy, Energy transfer by Heat and Work, First law for a closed and open system	Chalk and Talk/ PPT
10	10th Week	**Second law of Thermodynamics** Introduction, Heat Engines, Refrigerators, Heat Pumps, The Carnot principles, Concept of Entropy	Chalk and Talk/ PPT
11	11th Week	**Properties of pure substances** Pure substance, phase, phase change, property diagrams, property tables	Chalk and Talk/ PPT
12	12th Week	**Vapour power cycles** Carnot vapour cycle, Rankine cycle, Reheat and regenerative Rankine cycle	Chalk and Talk/ PPT
13	13th Week	**Gas power cycles** Basic considerations and assumptions, Stirling and Ericsson cycles, Otto, Diesel and Dual cycles	Chalk and Talk/ PPT
14	14th Week	**Gas power cycles** Brayton cycle with regeneration, inter cooling and reheat	Chalk and Talk/ PPT

COURSE ASSESSMENT METHODS

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Class Test-I	6th Week	1 hour*	20
2	Cycle Test – II	10th Week	1 hour*	20
3	Home work/Tutorial problems-Googleclassroom	-	-	10
4	MCQ test	11th Week	1 hour*	10
5	Final Assessment	14th Week	3 hours	40

(* Assessment time duration will be more than 1 hour for mode of test 1,2 and 4)

ESSENTIAL READINGS : Textbooks & Reference books:

1. Nag P.K., Engineering Thermodynamics, McGraw Hill Education, 5th Edition, 2013.
2. Cengel Y.A., Boles M.A., Thermodynamics, McGraw Hill Education, 8th Edition, 2015.
3. Bansal R.K, Fluid mechanics and Hydraulic Machines, Laxmi Publications, 9th Edition.
4. Cengel Y.A., Cimbala J.M., Fluid Mechanics, McGraw Hill Education, 3rd Edition, 2013

COURSE EXIT

- Feedback from the students during class committee meetings.
- Anonymous feedback through questionnaire and unknown formats.

COURSE POLICY (preferred mode of correspondence with students, policy on attendance, compensation assessment, academic honesty and plagiarism)

MODE OF CORRESPONDENCE (email/ phone)

All the students are advised to come to the class regularly. All the correspondence (schedule of classes/ schedule of assessment/ course material/any other information regarding this course) will be intimated in the Class only.

ASSESSMENTS:

- Attending all the assessments are MANDATORY for every student.
- If any student is not able to attend any of the continuous assessments (CAs: 1, 2 and 4 only) due to genuine reason, student is permitted to attend the compensation assessment (CPA) with % weightage equal to maximum of the CAs. However, maximum of the % weightage among the assessments for which the student was absent will be considered for computing marks for CA.
- At any case, CPA will not be considered as an improvement test.
- The minimum marks for passing this course and grading pattern will adhere to the regulations of the Institute.

ATTENDANCE

- 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 HONESTY & 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.

ADDITIONAL INFORMATION

- The faculty is available for consultation at times as per the intimation given by the faculty.
- Queries (if required) to the course teacher shall only be emailed to the email id specified by the teacher(sivam@nitt.edu)

FOR APPROVAL

Course Faculty _____ **CC-Chairperson** _____ **HOD** _____

(M. SIVAKUMAR)

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