NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF ENERGY AND ENVIRONMENT

COURSE PLAN – PART I			
Name of the programme and specialization	**M.Tech Energy Engineering**		
Course Title	**COMPUTATIONAL FLUID DYNAMICS**		
Course Code	**EN 604**	**No. of Credits**	**3**
Course Code of Pre-requisite subject(s)	**Nil**		
Session	**January 2019**	**Section (if, applicable)**	**NA**
Name of Faculty	**M.Vivekanandan**	**Department**	**Energy and Environment**
Official Email	vivek@trycae.com	**Telephone No.**	
Name of Course Coordinator(s) (if, applicable)	**Ramesh R**		
Official E-mail		**Telephone No.**	
Course Type (please tick appropriately)	✓ **Core course**	☐ **Elective course**	

Syllabus (approved in BoS)

Governing Equations of Fluid Flow, Finite Difference, Finite Volume, Finite Element Methods, Laplace Equation, Diffusion Equation or Wave Equation

Application of Finite Volume Method to Fluid Flow problems - Pressure Correction Techniques Gauss Siedel - Gauss Jordan.Introduction to Multi grid Methods - Boundary Conditions

Structured and Unstructured Mesh- Introduction to CAD systems and Different Standards used for DATA Exchange. Governing Equations for Turbulent Flow, Rotating Machinery, Combusting Flow, Multiphase Flow.

Simple Internal Flows: T-Junction, Driven Cavity, Manifold, Valves, External Flows: Flow Over Ahmed Body, Car-Reacting Flow in a Gas Burner, Multiphase Flow in an Air Lift Reactor.

COURSE OBJECTIVES

To introduce students to applied computational fluid dynamics and to teach them how to solve a fluid flow
Equip the students with the Computational Fluid Dynamics
Enable the students to formulate the design problems into CFD/FEA.

MAPPING OF COs with POs	
Course Outcomes	**Programme Outcomes (PO)** (Enter Numbers only)
1. Describe various flow features in terms of appropriate fluid mechanics principles.	**PO1, PO2, PO3, PO4, PO12**
2. Solve complex fluid mechanics Equations using various discretisation techniques available like FEM, FVM, and FDM.	
3. Analyse a flow field to determine various quantities of interest, such as flow rates, heat fluxes, pressure drops, losses etc.	
4. Simplify a real fluid-flow system into a simplified model problem, to select the proper governing equations for the physics involved in the system, to solve for the flow, to investigate the fluid-flow behaviour, and to understand the results.	
5. Recognize the type of fluid flow that is occurring in a particular physical system and to use the appropriate model equations to investigate the flow and will be able to communicate the results of this detailed fluid-flow study in a written format.	

COURSE PLAN – PART II

COURSE OVERVIEW

This course will provide core knowledge of the fundamentals of CFD, and an introduction to the methods and analysis techniques used in CFD. It also provides an introduction to the use of commercial CFD codes to analyse flow and heat transfer in problems of practical engineering interest. The emphasis of the course is on the use of CFD as a virtual fluid laboratory. By studying a variety of flow situations students will develop a better intuition of fluid mechanics more quickly than is possible with traditional analytical approaches.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1.	1	Governing Equations of Fluid Flow, Finite Difference, Finite Volume	Lecture / PPT
2	2	Finite Element Methods	Lecture / PPT
3	3	Laplace Equation, Diffusion Equation or Wave Equation	Lecture / PPT
4	4	Application of Finite Volume Method to Fluid Flow problems	Lecture / PPT

5	5	Pressure Correction Techniques Gauss Siedel - Gauss Jordan	Lecture / PPT
6	6	Introduction to Multi grid Methods - Boundary Conditions	Lecture / PPT
7	7	Structured and Unstructured Mesh	Lecture / PPT
8	8	Introduction to CAD systems and Different Standards used for DATA Exchange	Lecture / PPT
9	9	Governing Equations for Turbulent Flow, Rotating Machinery	Lecture / PPT
10	10	Governing Equations for Combusting Flow, Multiphase Flow	Lecture / PPT
11	11	Simple Internal Flows: T-Junction, Driven Cavity	Lecture / PPT
12	12	Simple Internal Flows Manifold, Valves	Lecture / PPT
13	13	External Flows: Flow Over Ahmed Body, Car-Reacting Flow in a Gas Burner	Lecture / PPT
14	14	Multiphase Flow in an Air Lift Reactor.	Lecture / PPT

COURSE ASSESSMENT METHODS (shall range from 4 to 6)				
S.No.	**Mode of Assessment**	**Week/Date**	**Duration**	**% Weightage**
1	Cycle Test 1	Feb Second week	45 min	15
2	Cycle Test 2	March last week	45 min	15
3	Assignment	March first week		10
4	Case Study	April Second week		10
CPA	Compensation Assessment*	April first week		15
5	Seminar	Regular Intervals(3nos)		10
6	Final Assessment *	May first week		40

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

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

Feedback is obtained by the institute through MIS

COURSE POLICY (including compensation assessment to be specified)

Students are encouraged to communicate through mail address vivek@trycae.com

COMPENSATION ASSESSMENT

Compensation assessment will be conducted only for students who miss the CYCLE TEST-I/II on valid/genuine grounds of medical or other emergencies.

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, IF ANY

FOR APPROVAL

Course Faculty M. Vinek **CC- Chairperson** N.A.A.R. **HOD** N.A.A.R.

Guidelines

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

b) Every theory 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.

B.Tech. Admitted in				P.G.
2018	2017	2016	2015	
35% or (Class average/2) whichever is greater.		(Peak/3) or (Class Average/2) whichever is lower		40%

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.