M.E Semester: 1 Mechanical Engineering (Thermal Engineering)
Subject Name: Fluid mechanics and Gas Dynamics

A. **Course Objective**

- To present a problem oriented in depth knowledge of Fluid Mechanics and Gas Dynamics
- To address the underlying concepts and methods behind Fluid Mechanics and Gas Dynamics

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	
METH103	Fluid Mechanics & Gas Dynamics	4	0	2	6	5	3	70	30	20	30	150

C. **Detailed Syllabus**

1. Review of fundamentals; types of flow; Generalized continuity equation; momentum and energy equations, Euler and Navier-Stokes equations, integration of the momentum equation; the generalized Bernoulli's equation; velocity of sound and its importance; physical difference between incompressible, subsonic and supersonic flows; three reference speeds; dimensionless velocity; concepts of static and stagnation parameters.

2. Two dimensional flow in rectangular and polar coordinates; stream function; irrotationality and the velocity potential function; vorticity and circulation; plane potential flow and the complex potential function; Sources, sinks, doublets and vortices; flow around corners; Rankine ovals; flow around circular cylinders with the without circulation; pressure distribution on the surface of these bodies

3. Aerofoils theory; Joukowski transformation; circular arc, symmetrical aerofoil theory; Joukowski aerofoils; Joukowski hypothesis; drag, and lift forces.

4. Flow in constant area duct; friction-governing equations; choking due to friction, performance of long ducts; isothermal flow in long ducts; Flow in constant area duct with heating and cooling; Normal shocks-Introductory remarks; governing equations; Rankine- Hugonout; Prandtl and other relations; weak shocks; thickness of shocks; normal shocks in ducts; performance of convergent-divergent nozzle with shocks; moving shock waves; shocks problems in one dimensional supersonics diffuser; supersonic pilot tube.

5. Dimensional analysis and similitude: Buckingham pie theorem; Van driest theorem; dimensional analysis; model study; compressible flow of viscous fluids.

D. **Lesson Planning**

Sr.No.	Date/Week	Unit No.	% Weightage	Topic No:
1	1^{st} ,2^{ed} ,3^{ed}	Unit 1	20 % .	1
2	4^{th} ,5^{th} ,6^{th}	Unit 2	20 %	2
3	7^{th} ,8^{th} ,9^{th}	Unit 3	20 %	3
4	19^{th} ,11^{th} ,12^{th}	Unit 4	20 %	4
5	13^{th} ,14^{th} ,15^{th}	Unit 5	20 %	5

E. **Instructional Method & Pedagogy**

9. At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
10. 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.
11. Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
12. 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.
13. 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.
14. Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.
15. The course includes a laboratory, where students have an opportunity to build an appreciation for the concept being taught in lectures.
16. Experiments shall be performed in the laboratory related to course contents.
17. List of Experiments:

1. To study calibration characteristics of Rotameter.
2. Study of flow passing through Shocks.
3. Performance and testing of orifice plate, nozzle and Venturimeter.
4. To study different types of Wind tunnel.
5. To study the effect of angle of attack on Lift and Drag force.
6. To study the loss of energy in wake region behind the aerofoil in the wind tunnel.
7. To study the loss of energy in wake region behind various models (car, jeep, bus etc.) in the wind tunnel.
8. To draw profile of NASA Aerofoils.

F. **Students Learning Outcomes**

- The student can identify different areas of Fluid Mechanics and Gas Dynamics.
- Can find the applications of all the areas in day to day life.

G. **Recommended Study Materials**

- **Text & Reference Books:**

1. Advanced Fluid Mechanics, Raudkiri & Callander Edward Ronald
2. Fundamentals of Mechanics, Currie McGraw Hill of Fluids
3. Fluid Mechanics, Landau & Lifshitz Addition Wesley
4. Fluid Mechanics, Som & Biswas Tata McGraw Hyde antic Machinery
5. Gas dynamics, Ali Campbell & lennings.
6. Gas dynamics, Radha Krishnan , PHI
7. Fundamentals of compressible flow, S.M. Yahya, New Age Pub
8. The Phenomena of Fluid, Brodkey Addition Wesley Motion
9. Foundation of Fluid, Yuan Prentice Hall Mechanics
10. Fundamentals of Compressible Fluid Dynamics,P.Balachandran,PHI,