SARDAR RAJA COLLEGES

SARDAR RAJA COLLEGE OF ENGINEERING, ALANGULAM.

DEPARTMENT OF MECHANICAL ENGINEERING

MICRO LESSON PLAN

SUBJECT : ME2351 - GAS DYNAMICS AND JET ROPULSION

CLASS : III Year / VI SEM

STAFF: Mr. K. MARIAPPAN, Asst.Prof,

DEPT. OF MECHANICAL ENGG.

ME 2351 - GAS DYNAMICS AND JET PROPULSION L T P C 3 1 0 4

UNIT I BASIC CONCEPTS AND ISENTROPIC FLOWS 6

Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts – Nozzle and Diffusers – Use of Gas tables.

UNIT II FLOW THROUGH DUCTS 9

Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties – Use of tables and charts – Generalised gas dynamics.

UNIT III NORMAL AND OBLIQUE SHOCKS 10

Governing equations – Variation of flow parameters across the normal and oblique shocks – Prandtl – Meyer relations – Use of table and charts – Applications.

UNIT IV JET PROPULSION 10

Theory of jet propulsion – Thrust equation – Thrust power and propulsive efficiency – Operation principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines.

UNIT V SPACE PROPULSION 10

Types of rocket engines – Propellants-feeding systems – Ignition and combustion – Theory of rocket propulsion – Performance study – Staging – Terminal and characteristic velocity – Applications – space flights.

TUTORIALS: 15 TOTAL: 60 PERIODS

TEXT BOOKS:

1. Anderson, J.D., Modern Compressible flow, McGraw Hill, 3rd Edition, 2003.

2. H. Cohen, G.E.C. Rogers and Saravanamutto, Gas Turbine Theory, Longman Group Ltd., 1980.

3. S.M. Yahya, fundamentals of Compressible Flow, New Age International (P) Limited, New Delhi, 1996.

REFERENCES:

1. P. Hill and C. Peterson, Mechanics and Thermodynamics of Propulsion, Addison – Wesley Publishing company, 1992.

2. N.J. Zucrow, Aircraft and Missile Propulsion, vol.1 & II, John Wiley, 1975.

3. N.J. Zucrow, Principles of Jet Propulsion and Gas Turbines, John Wiley, New York, 1970.

4. G.P. Sutton, Rocket Propulsion Elements, John wiley, 1986, New York.

5. A.H. Shapiro, Dynamics and Thermodynamics of Compressible fluid Flow, , John wiley, 1953, New York.

6. V. Ganesan, Gas Turbines, Tata McGraw Hill Publishing Co., New Delhi, 1999.

7. PR.S.L. Somasundaram, Gas Dynamics and Jet Propulsions, New Age International Publishers, 1996.

8. V. Babu, Fundamentals of Gas Dynamics, ANE Books India, 2008.

SUBJECT DESCRIPTION AND OBJECTIVES

CONTENT

This subject imparts knowledge to the students on compressible flow through ducts, jet propulsion and space propulsion.

SUBJECT OBJECTIVES

- To understand the basic difference between incompressible and compressible flow.
- To understand the phenomenon of shock waves and its effect on flow.
- To gain some basic knowledge about jet propulsion and Rocket Propulsion.

MICRO LESSON PLAN

Hours	LECTURE TOPICS	READING
	UNIT I - BASIC CONCEPTS AND ISENTROPIC FLOWS	
1	Energy and momentum equations of compressible fluid flows	T3
2	Stagnation states	T3
3	Problem solving	T3
4	Mach waves and Mach cone	T3
5	Effect of Mach number on compressibility	T3
6	Problem soving	T3
7	Isentropic flow through variable ducts	T3
8	Nozzle and Diffusers – Use of Gas tables.	T3
9	Problem soving	T3
	UNIT II - FLOW THROUGH DUCTS	
10-11	Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction	T3
12-14	Problem soving	T3
15-16	Flows through constant area ducts without heat transfer (Fanno flow)	T3
17	variation of flow properties	T3
18	Use of tables and charts – Generalised gas dynamics	T3
19-21	Problem soving	T3
	UNIT III - NORMAL AND OBLIQUE SHOCKS	
22-23	Governing equations – Variation of flow parameters across the normal shocks	T3
24-25	Problem soving	T3
25-26	Governing equations – Variation of flow parameters across the oblique shocks	T3
27-28	Problem soving	T3
29	Prandtl – Meyer relations	T3
30-31	Problem soving	T3
32	Use of table and charts – Applications	
33-34	Problem soving	T3
	UNIT IV - JET PROPULSION	
35	Theory of jet propulsion	T3
36	Thrust equation – Thrust power and propulsive efficiency	T3
37-38	Problem soving	T3
39	Operation principle, cycle analysis and use of stagnation state performance of ram jet engines.	T3
40-41	Problem soving	T3
42	Operation principle, cycle analysis and use of stagnation state performance of turbojet engines.(AV Class)	T3
43	Problem soving	T3

44	Operation principle, cycle analysis and use of stagnation state performance of turbofan engines.	T3
45	Problem soving	T3
46	Operation principle, cycle analysis and use of stagnation state performance of turbo prop engines. (AV Class)	
47	Problem soving	T3
UNIT V- SPACE PROPULSION		
48	Types of rocket engines	T3
49	Propellants-feeding systems	T3
50	Ignition and combustion	T3
51	Theory of rocket propulsion.(AV Class)	T3
52	Performance study	T3
53-54	Problem soving	T3
55	Staging – Terminal and characteristic velocity	T3
56-57	Problem soving	T3
58	Applications – space flights	T3
59-60	Problem soving	T3