



THERMAL ENGINEERING-I (ME403PC)

COURSE PLANNER

I. COURSE OVERVIEW:

This course provides an introduction to the most powerful engineering principles you will ever learn – Thermal Engineering- 1, the science of transferring energy from one place or form to another place or form. We will introduce the tools you need to analyze energy systems from solar panels, to engines, to insulated coffee mugs. More specifically, we will cover the topics of the working principle of SI and CI engines in detail including its performance, different types of compressors like Axial, centrifugal, Rotary compressors and also Gas turbines with performance evaluation.

COURSE PURPOSE:

Dynamic loads and undesired oscillations increase with higher speed of machines. At the same time, industrial safety standards require better vibration reduction. This book covers model generation, parameter identification, balancing of mechanisms, torsion and bending vibrations, vibration isolation, and the dynamic behavior of drives and machine frames as complex systems. Typical dynamic effects, such as the gyroscopic effect, damping and absorption, shocks, resonances of higher order, nonlinear and self-excited vibrations are explained using practical examples. These include manipulators, flywheels, gears, mechanisms, motors, rotors, hammers, block foundations, presses, high speed spindles, cranes, and belts. Various design features, which influence the dynamic behavior, are described.

II. PREREQUISITE(S):

The knowledge of following subjects is essential to understand the subject:

1. Physics
2. Knowledge of Differential equations.
3. Knowledge of principles of thermodynamics

III. COURSE OBJECTIVES:

The objectives of the course are to enable the student

- To understand the application of laws of Thermodynamics to analyze air standard cycles.
- To understand and evaluate the performance analysis of the major component and systems of IC engines, Reciprocating , Rotary , Dynamics and Axial flow compressors and Gas Turbines.

IV. COURSE OUTCOME:

Sl. No.	Description	Bloom's Taxonomy level
CO1	Able to understand the application of laws of Thermodynamics to analyze air standard cycles.	Knowledge,

		Comprehension, Analyze (Level1, Level2, Level 4)
CO2	Able to understand and evaluate the performance analysis of the major component systems of IC engines.	Knowledge, Comprehension, Analyze (Level1, Level2, Level 4)
CO3	Able to understand and evaluate the performance analysis of the major component and systems of Reciprocating compressors.	Knowledge, Comprehension, Analyze (Level1, Level2, Level 4)
CO4	Able to understand and evaluate the performance analysis of the major component and systems of Rotary , Dynamics and Axial flow compressors.	Knowledge, Comprehension, Analyze (Level1, Level2, Level 4)
CO5	Able to understand and evaluate the performance analysis of the major component and systems of Gas Turbines.	Knowledge, Comprehension, Analyze (Level1, Level2, Level 4)

V. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		Level	Proficiency assessed by
PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	2	Assignment / Exam
PO2	Problem analysis: Identify, formulate, review research literature, and analyze engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	3	Assignment / Exam
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3	Assignment / Exam
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	2	Assignment / Exams

PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	2	Assignment /Exams
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	2	-
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	2	-
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	3	-
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	2	Assignment /Exams
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	2	Assignment /Exams
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	3	-
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	1	Assignment /Exams

VI. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		Level	Proficiency assessed by
PSO1	The student will be able to apply the knowledge of Mathematics, Sciences and engineering fundamentals to formulate, analyze and provide solutions for the problems related to Mechanical engineering and communicate them effectively to the concerned.	2	Lectures, Assignments
PSO2	Design mechanical systems in various fields such as machine elements, thermal, manufacturing, industrial and interdisciplinary fields by using various engineering/technological	2	Lectures, Assignments

	tools to meet the mercurial needs of the industry and society at large.		
PSO3	The ability to grasp the latest development, methodologies of mechanical engineering and posses competent knowledge of design process, practical proficiencies, skills and knowledge of programme and developing ideas towards research.	3	Lectures, Assignments

VII. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes (COs)	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1.	3	2	3	2	--	--	--	3	--	2	--	2
CO2.	3	2	3	2	--	--	--	3	--	2	--	2
CO3.	3	2	3	2	--	--	--	3	--	2	--	2
CO4.	3	2	3	2	--	--	--	3	--	2	--	2
CO5. .	3	2	3	2	--	--	--	3	--	2	--	2
Average	3	2	3	2	--	--	--	3	--	2	--	2

PROGRAM SPECIFIC OUTCOMES:

Course Outcomes (COs)	Program Specific Outcomes (PSOs)		
	PSO1	PSO2	PSO3
CO1.	2	1	1
CO2.	2	1	1
CO3.	3	1	1
CO4.	2	1	1
CO5.	2	1	1
Average	2.16	1	1

VIII. SYLLABUS (JNTUH)

UNIT – I

I.C. Engines: Classification - Working principles of Four & Two stroke engine, SI & CI engines, Valve and Port Timing Diagrams, Air – Standard, air-fuel and actual cycles - Engine systems – Carburetor and Fuel Injection Systems for SI engines, Fuel injection systems for CI engines, Ignition, Cooling and Lubrication system, Fuel properties and Combustion Stoichiometry.

UNIT II

Normal Combustion and abnormal combustion in SI engines – Importance of flame speed and effect of engine variables – Abnormal combustion, pre-ignition and knocking in SI Engines – Fuel requirements and fuel rating, anti-knock additives – combustion chamber –

requirements, types of SI engines. Four stages of combustion in CI engines – Delay period and its importance – Effect of engine variables – Diesel Knock– Need for air movement, suction, compression and combustion induced turbulence in Diesel engine – open and divided combustion chambers and fuel injection– Diesel fuel requirements and fuel rating

UNIT III

Testing and Performance: Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and indicated power – Performance test – Heat balance sheet and chart Classification of compressors – Fans, blowers and compressors – positive displacement and dynamic types – reciprocating and rotary types.

Reciprocating Compressors: Principle of operation, work required, Isothermal efficiency volumetric efficiency and effect of clearance volume, staged compression, under cooling, saving of work, minimum work condition for staged compression

UNIT IV

Rotary Compressor (Positive displacement type): Roots Blower, vane sealed compressor, Lysholm compressor – mechanical details and principle of working – efficiency considerations.

Dynamic Compressors: Centrifugal compressors: Mechanical details and principle of operation – velocity and pressure variation. Energy transfer-impeller blade shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient – velocity diagrams – power.

Axial Flow Compressors: Mechanical details and principle of operation – velocity triangles and energy transfer per stage degree of reaction, work done factor - isentropic efficiency-pressure rise calculations – Polytropic efficiency.

UNIT – V

Gas Turbines: Simple Gas Turbine Plant – Ideal Cycle – Closed Cycle and Open Cycle for Gas Turbines, Constant Pressure Cycle, Constant Volume Cycle, Efficiency – Work Ratio and Optimum Pressure Ratio for Simple Gas Turbine Cycle. Parameters of Performance, Actual Cycle, Regeneration, Intercooling and Reheating – Closed and Semi-Closed Cycle

SUGGESTED BOOKS:

Text books:

1. I.C. Engines / V. Ganesan / Mc Graw Hill
2. Thermal Engineering / Mahesh M Rathore / Mc Graw Hill

Reference Books:

1. Applied Thermodynamics for Engineering Technologists / Eastop / Pearson
2. Fundamentals of Classical Thermodynamics / Vanwylen G.J., Sonntag R.E. / Wiley Eastern
3. Internal Combustion Engines Fundamentals – John B. Heywood – McGraw Hill Ed.

GATE SYLLABUS:

NA

IES SYLLABUS:

SI and CI Engines, Engine Systems and Components, Performance characteristics and testing of IC Engines; Fuels; Emissions and Emission Control. Vapour compression refrigeration,



Refrigerants and Working cycles, Compressors, Condensers, Evaporators and Expansion, Brayton cycles with regeneration and reheat, Fuels and their properties.

IX. COURSE PLAN:

Lecture No.	Unit No.	Topics to be covered	Link for PPT	Link for PDF	Link for Small Projects/ Numericals (if any)	Course learning outcomes	Teaching Methodology	Reference
1	I	I.C. Engines: Classification	https://classroom.google.com/c/Mjk4ODc4NjE1Mzc0/m/MzAwMzU1MDAwODk5/details	https://drive.google.com/file/d/1-GHtBqoC87Gn1raXDc5L9I17eDn6g3dC/view	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-IC-Engine	Understand	PPT, CHALK N BOARD, VIDEOS	I.C. Engines / V. Ganesh / Mc Graw Hill
2		Working principles of Four & Two stroke engine,	https://classroom.google.com/c/Mjk4ODc4NjE1Mzc0/m/MzAwMzU1MDAwODk5/details	https://drive.google.com/file/d/1-GHtBqoC87Gn1raXDc5L9I17eDn6g3dC/view	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-IC-Engine	Explain	PPT, CHALK N BOARD, VIDEOS	
3		Working principles of SI & CI engines	https://classroom.google.com/c/Mjk4ODc4NjE1Mzc0/m/MzAwMzU1MDAwODk5/details	https://drive.google.com/file/d/1-GHtBqoC87Gn1raXDc5L9I17eDn6g3dC/view	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-IC-Engine	Understand	PPT, CHALK N BOARD, VIDEOS	
4		Valve and Port Timing Diagrams	https://classroom.google.com/c/Mjk4ODc4NjE1Mzc0/m/MzAwMzU1MDAwODk5/details	https://drive.google.com/file/d/1-GHtBqoC87Gn1raXDc5L9I17eDn6g3dC/view	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-IC-Engine	Explain	PPT, CHALK N BOARD, VIDEOS	
5		Air – Standard, air-fuel and actual cycles	https://classroom.google.com/c/Mjk4ODc4NjE1Mzc0/m/MzAwMzU1MDAwODk5/details	https://drive.google.com/file/d/1-GHtBqoC87Gn1raXDc5L9I17eDn6g3dC/view	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-IC-Engine	Study	PPT, CHALK N BOARD, VIDEOS	
6		Engine systems- Carburetor	https://classroom.google.com/c/Mjk4ODc4NjE1Mzc0/m/MzAwMzU1MDAwODk5/details	https://drive.google.com/file/d/1-GHtBqoC87Gn1raXDc5L9I17eDn6g3dC/view	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-IC-Engine	Application	PPT, CHALK N BOARD, VIDEOS	
7		Fuel Injection Systems for SI engines	https://classroom.google.com/c/Mjk4ODc4NjE1Mzc0/m/MzAwMzU1MDAwODk5/details	https://drive.google.com/file/d/1-GHtBqoC87Gn1raXDc5L9I17eDn6g3dC/view	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-IC-Engine	Understand	PPT, CHALK N BOARD, VIDEOS	

			1Mzc0/m/MzAwMDAwODk5/details	GHtBqoC87Gn1raXDc5L9Il7eDn6g3dC/view	ideas/latest-projects-based-on-IC-Engine		VIDEOS	
8		Fuel injection systems for CI engines	https://classroom.google.com/c/Mzk4ODc4NjE1Mzc0/m/MzAwMDAwODk5/details	https://drive.google.com/file/d/1raXDc5L9Il7eDn6g3dC/view	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-IC-Engine	Understand	PPT, CHALK N BOARD, VIDEOS	
9		Ignition, Cooling Systems	https://classroom.google.com/c/Mzk4ODc4NjE1Mzc0/m/MzAwMDAwODk5/details	https://drive.google.com/file/d/1ccoFwhulPetVknYwDjRoQhrCMFVZ0m8/view	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-IC-Engine	Understand	PPT, CHALK N BOARD, VIDEOS	
10		Lubrication system	https://classroom.google.com/c/Mzk4ODc4NjE1Mzc0/m/MzAwMDAwODk5/details	https://drive.google.com/file/d/1ccoFwhulPetVknYwDjRoQhrCMFVZ0m8/view	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-IC-Engine	Application	PPT, CHALK N BOARD, VIDEOS	
11		Fuel properties	https://classroom.google.com/c/Mzk4ODc4NjE1Mzc0/m/MzAwMDAwODk5/details	https://drive.google.com/file/d/1ccoFwhulPetVknYwDjRoQhrCMFVZ0m8/view	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-IC-Engine	Study	PPT, CHALK N BOARD, VIDEOS	
12		Combustion Stoichiometry	https://classroom.google.com/c/Mzk4ODc4NjE1Mzc0/m/MzAwMDAwODk5/details	https://drive.google.com/file/d/1ccoFwhulPetVknYwDjRoQhrCMFVZ0m8/view	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-IC-Engine	Explain	PPT, CHALK N BOARD, VIDEOS	
13	II	Normal Combustion and abnormal combustion in SI engines	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://worldwidescience.org/topics/inter-nal+combustion+engine.html	Explain	PPT, CHALK N BOARD, VIDEOS	Thermal Engineering / Mahesh M Rathore / McGraw Hill
14		Importance of flame speed and effect of engine variables	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://worldwidescience.org/topics/inter-nal+combustion+engine.html	Study	PPT, CHALK N BOARD, VIDEOS	

15	Abnormal combustion, pre-ignition and knocking in SI Engines	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://worldwidescienc e.org/topicpages/i/internal+combustion+engine.html	Explain	PPT, CHALK N BOARD, VIDEOS
16	Fuel requirements, and fuel rating, anti-knock additives	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://worldwidescienc e.org/topicpages/i/internal+combustion+engine.html	Understand	PPT, CHALK N BOARD, VIDEOS
17	combustion chamber – requirements, types of SI engines.	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://worldwidescienc e.org/topicpages/i/internal+combustion+engine.html	Explain	PPT, CHALK N BOARD, VIDEOS
18	Four stages of combustion in CI engines	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://worldwidescienc e.org/topicpages/i/internal+combustion+engine.html	Study	PPT, CHALK N BOARD, VIDEOS
19	Delay period and its importance	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://worldwidescienc e.org/topicpages/i/internal+combustion+engine.html	Explain	PPT, CHALK N BOARD, VIDEOS
20	Effect of engine variables	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://worldwidescienc e.org/topicpages/i/internal+combustion+engine.html	Explain	PPT, CHALK N BOARD, VIDEOS
21	Diesel Knock– Need for air movement, suction,	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://worldwidescienc e.org/topicpages/i/internal+combustion+engine.html	Understand	PPT, CHALK N BOARD, VIDEOS
22	compression and combustion induced turbulence in Diesel engine	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://worldwidescienc e.org/topicpages/i/internal+combustion+engine.html	Application	PPT, CHALK N BOARD, VIDEOS

					.html			
23		open and divided combustion chambers and fuel injection	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://worldwidescience.org/topics/internal-combustion+engine.html	Explain	PPT, CHALK BOARD, VIDEOS	
24		Diesel fuel requirements and fuel rating	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://worldwidescience.org/topics/internal-combustion+engine.html	Study	PPT, CHALK BOARD, VIDEOS	
25	III	Testing and Performance: Parameters of performance	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://www.engineeringenotes.com/mechanical-engineering/ic-engine/testing-of-internal-combustion-ic-engine-thermal-engineering/51709	Explain	PPT, CHALK BOARD, VIDEOS	
26		measurement of cylinder pressure, fuel consumption	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://www.engineeringenotes.com/mechanical-engineering/ic-engine/testing-of-internal-combustion-ic-engine-thermal-engineering/51709	Application	PPT, CHALK BOARD, VIDEOS	
27		air intake, exhaust gas composition, Brake power	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://www.engineeringenotes.com/mechanical-engineering/ic-engine/testing-of-internal-combustion-ic-engine-thermal-engineering/51709	Application	PPT, CHALK BOARD, VIDEOS	
							Applied Thermodynamics for Engineering Technologists / Eastop / Pearson	

					internal-combustion-ic-engine-thermal-engineering/51709		
28	Determination of frictional losses and indicated power	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all		https://www.engineeringenotes.com/mechanical-engineering/ic-engine/testing-of-internal-combustion-ic-engine-thermal-engineering/51709	Understand	PPT, CHALK N BOARD, VIDEOS
29	Performance test	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all		https://www.engineeringenotes.com/mechanical-engineering/ic-engine/testing-of-internal-combustion-ic-engine-thermal-engineering/51709	Explain	PPT, CHALK N BOARD, VIDEOS
30	Heat balance sheet and chart	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all		https://www.engineeringenotes.com/mechanical-engineering/ic-engine/testing-of-internal-combustion-ic-engine-thermal-engineering/51709	Study	PPT, CHALK N BOARD, VIDEOS

31		Classification of compressors – Fans, blowers and compressors	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-Air-Compressor	Explain	PPT, CHALK BOARD, VIDEOS	Thermal Engineering / Mahesh M Rathore / Mc Graw Hill
32		positive displacement and dynamic types	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-Air-Compressor	Understand	PPT, CHALK BOARD, VIDEOS	
33		reciprocating and rotary types	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-Air-Compressor	Explain	PPT, CHALK BOARD, VIDEOS	
34		Reciprocating Compressors: Principle of operation	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-Air-Compressor	Study	PPT, CHALK BOARD, VIDEOS	
35		work required, Isothermal efficiency volumetric efficiency and effect of clearance volume	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-Air-Compressor	Explain	PPT, CHALK BOARD, VIDEOS	
36		staged compression, under cooling, saving of work, minimum work condition for staged compression	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-Air-Compressor	Explain	PPT, CHALK BOARD, VIDEOS	
37	IV	Rotary Compressor (Positive displacement type): Roots Blower, vane sealed	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-Air-Compressor	Understand	PPT, CHALK BOARD, VIDEOS	

		compressor Lysholm compressor			Compressor		ogists / Eastop / Pearson
38		mechanical details and principle of working – efficiency considerations	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-Air-Compressor	Application	PPT, CHALK N BOARD, VIDEOS
39		Dynamic Compressors: Centrifugal compressors: Mechanical details	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-Air-Compressor	Explain	PPT, CHALK N BOARD, VIDEOS
40		principle of operation and velocity and pressure variation.	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-Air-Compressor	Study	PPT, CHALK N BOARD, VIDEOS
41		Energy transfer- impeller blade shape-losses, slip factor, power input factor,	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-Air-Compressor	Explain	PPT, CHALK N BOARD, VIDEOS
42		pressure coefficient and adiabatic coefficient velocity diagrams – power.	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-Air-Compressor	Application	PPT, CHALK N BOARD, VIDEOS
43		Axial Flow Compressors: Mechanical details and principle of operation	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-Air-Compressor	Application	PPT, CHALK N BOARD, VIDEOS

44		velocity triangles	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-Air-Compressor	Understand	PPT, CHALK N BOARD, VIDEOS	
45		energy transfer per stage degree of reaction	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-Air-Compressor	Explain	PPT, CHALK N BOARD, VIDEOS	
46		work done factor	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-Air-Compressor	Explain	PPT, CHALK N BOARD, VIDEOS	
47		isentropic efficiency-pressure rise calculations	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-Air-Compressor	Understand	PPT, CHALK N BOARD, VIDEOS	
48		Polytropic efficiency.	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://www.skyfilabs.com/project-ideas/latest-projects-based-on-Air-Compressor	Application	PPT, CHALK N BOARD, VIDEOS	
49	V	Gas Turbines: Simple Gas Turbine Plant	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://worldwidescience.org/topicpages/g/gas+turbines+project.html	Explain	PPT, CHALK N BOARD, VIDEOS	Gas Turbines / V. Ganesan / Mc Graw Hill
50		Ideal Cycle – Closed Cycle and Open Cycle for Gas Turbines	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://worldwidescience.org/topicpages/g/gas+turbines+project.html	Study	PPT, CHALK N BOARD, VIDEOS	
51		Constant Pressure Cycle,	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://worldwidescience.org/topicpages/g/gas+turbines+project.html	Explain	PPT, CHALK N BOARD,	

		E1Mzc0/t/all	Dc4NjE1Mzc0/t/all	es/g/gas+turbines+project.html		VIDEOS
52	Constant Volume Cycle, Efficiency	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://worldwidescience.org/topicpages/g/gas+turbines+project.html	Application	PPT, CHALK BOARD, VIDEOS
53	Work Ratio and Optimum Pressure Ratio for Simple Gas Turbine Cycle	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://worldwidescience.org/topicpages/g/gas+turbines+project.html	Understand	PPT, CHALK BOARD, VIDEOS
54	Parameters of Performance,	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://worldwidescience.org/topicpages/g/gas+turbines+project.html	Understand	PPT, CHALK BOARD, VIDEOS
55	Actual Cycle, Regeneration	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://worldwidescience.org/topicpages/g/gas+turbines+project.html	Explain	PPT, CHALK BOARD, VIDEOS
56	Intercooling and Reheating	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://worldwidescience.org/topicpages/g/gas+turbines+project.html	Study	PPT, CHALK BOARD, VIDEOS
57	Closed and Semi-Closed Cycle	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://worldwidescience.org/topicpages/g/gas+turbines+project.html	Explain	PPT, CHALK BOARD, VIDEOS
58	REVISION	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://classroom.google.com/u/1/w/Mjk4ODc4NjE1Mzc0/t/all	https://worldwidescience.org/topicpages/g/gas+turbines+project.html	Understand	PPT, CHALK BOARD, VIDEOS

TEXT BOOKS:

1. I.C. Engines / V. Ganesan / Mc Graw Hill
2. Thermal Engineering / Mahesh M Rathore / Mc Graw Hill

X. QUESTION BANK: (JNTUH)

DESCRIPTIVE QUESTIONS:

UNIT-I

Short Answer Questions-

S.No	Question	Blooms	Course outcomes
1	Explain in detail about fuel air cycle of CI engine	L1	C01
2	Compare Air standard cycle and actual cycles. Explain what are the reasons for deviation and why?	L1	C01
3	what are different losses incurred in C I Engine in order to understand actual cycle? Explain the salient points.	L1	C01
4	How does the variation of specific heats and dissociation exhaust gases influence the cycle performance?	L1	C01
5	Define mean effective pressure and explain its significance and measurement in an I.C. Engine.	L1	C01

Long Answer Questions-

S.No	Question	Blooms	Course outcomes
1	How does the valve timing diagram influence the volumetric efficiency of I C Engine? Discuss the salient features.	L1	C01
2	Draw the schematic diagram of simple carburetor and explain its working principle and also discuss how to achieve rich mixture during peak loads and ideal conditions.	L1	C01
3	How does the valve timing diagram influence the volumetric efficiency of I C Engine? Discuss the salient features.	L2	C01
4	In an ideal diesel cycle the temperatures at the beginning and end of compression are 27°C and 600°C respectively. The temperatures at the beginning and end of expansion are 1900°C and 850°C respectively. Calculate compression ratio, cut off ratio and ideal efficiency of the cycle.	L2	C01
5	Derive the equation for thermal efficiency and m.e.p. for Otto cycle and compare the values with diesel cycle.	L1,L3	C01
6	What are the important requirements of fuel injection system in a C.I Engine? Explain with suitable diagram.	L1,L3	C01
7	Draw the diagram of fuel pump used for C I Engine and explain the important functions of the components.	L1,L3	C01
8	A fiat car working on Otto cycle has initial pressure and temperature of 1 bar and 25°C and pressure at the end of compression is 10 bar. Calculate the percentage clearance and thermal efficiency of the cycle. Also calculate the mean effective pressure if the maximum pressure of the cycle is limited to 20 bar.	L4	C01

9	In what respect working of an actual engine differ from theoretical cycle.	L1	C01
10	How does dry sump lubrication system is different from wet sump lubrication system?	L2,L1	C01
11	In what respect working of an actual engine differ from theoretical cycle.	L2,L1	C01
12	With the help of a neat diagram, explain the working of fuel injection system	L2,L1	C01
13	Compare and contrast the valve timing diagram and port timing diagram.	L2,L1	C01
14	What are different methods are adopted in cooling of an I.C. Engine? Explain in detail	L2,L1	C01
15	Why lubrication system is required in an I.C. Engine and explains one method with the diagram.	L2,L1	C01

UNIT-2

Short Answer Questions-

S.No	Question	Blooms	Course outcomes
1	What is pre-ignition? Discuss its ill effects on performance.	L2,L1	C02
2	What is meant by knocking? Explain the effects of knocking in SI engines	L2	C02
3	What is meant by diesel knock and how to control it? Explain with the help of examples	L1	C02
4	Explain what is meant by knocking in SI engines and what are anti knock additives and their significance.	L2	C02
5	What are the factors which will affect the delay period in CI engines? Explain.	L1	C02

Long Answer Questions-

S.No	Question	Blooms	Course outcomes
1	a) With the help of neat diagram, explain the method of swirl generation by helical inlet port in CI engines. b) With the help of P- θ diagram, explain four stages of combustion in CI engine.	L1,L3	C02
2	a) Explain the mechanism of ignition advance mechanism and optimum spark timing in SI engines? b) Give a schematic sketch of electrical ignition system of a modern automobile engine and explain in detail.	L1,L3	C02
3	What is ignition lag in S.I. Engine combustion? Explain the influence of different operating parameters on ignition lag.	L1,L3	C02
4	a) Name few additives, which can minimize the knocking in S.I. Engine and What are detrimental effects on cylinder by adding additives in S.I. Engine. b) What are the requirements for better combustion chamber of	L3	C02

	S I Engine? Explain them.		
5	Explain with the help of p- θ diagram, different stages of combustion in SI engines.	L1,L3	C02
6	a) Draw the p- θ diagram of the C.I. Engine combustion and explain different stages of combustion process. b) Explain the advantages and limitations of direct injection type combustion chambers over indirect injection type combustion chambers of C.I. Engine.	L1,L3	C02
7	Explain the influence of different operating parameters on ignition delay during combustion process in C.I. Engine.	L3	C02
8	Describe the phenomenon of knocking in C.I. Engine and how it is different from S.I. Engine detonation.	L3	C02
9	What are the different shapes of nozzles and different combustion chambers of CI engines and explain them with diagrams in detail.	L1,L3	C02
10	Explain different shapes of combustion chambers which are mostly used with the help of line diagram and explain them in detail.	L2	C02
11	What are the different methods used in CI engines to create turbulence in the mixture? Explain its effect on power output and thermal efficiency of the engine	L2	C02

UNIT-3

Short Answer Questions-

S.No	Question	Blooms	Course outcomes
1	Explain Fan, Blower, Compressor	L2,L1	C03
2	What is the principle of reciprocating compressor	L1,L1	C03
3	What are different types of compressors	L1	C03
4	What is Heat balance sheet	L1	C03
5	What is meant by Brake power and Indicated power	L1	C03

Long Answer Questions-

S.No	Question	Blooms	Course outcomes
1	A two stroke diesel engine was motored when meter reading was 1.5 kW. Then the test on the engine was carried with following results: Brake torque = 120 N-m, RPM = 600; fuel used = 2.5 kg, CV of fuel = 41 kJ/kg; cooling water used = 820 kg. Rise in cooling water temperature is 1000 C. Exhaust gas temp = 3500C; Room temp = 250C; A:F = 32:1; Calculate BP, IP, Mechanical and indicated thermal efficiencies and heat balances on percentage basis.	L1,L3	C03
2	a) Derive the equation for volumetric efficiency and discuss the effect of clearance on volumetric efficiency.	L3	C03

	b) A single stage air compressor is required to deal with 30 m ³ of free air per hr at 1 bar. The delivery pressure at 450 RPM is 6.5 bar. Calculate clearance ratio, the IMEP, BP if the mechanical efficiency is 0.8, isothermal efficiency is 0.76 and volumetric efficiency is 0.75.		
3	Following data refers to a four stroke gas engine run for 1hr. RPM = 16,000; Missed cycles = 600; Net brake load = 1.6 kN; Brake circumference = 4 m; mep = 8 bar; Gas consumption = 22KL; CV of gas = 20 KJ/L; d = 25 cm; L = 40 cm; CR = 6.5; Calculate BP, IP, brake thermal fuel consumption, brake thermal efficiency.	L2,L3	C03
4	Explain the methods of measurement of frictional power. b) A 4 cylinder, 2 stroke petrol engine develops 40KW at 40RPS. The m.e.p. on each piston is 8 bar and the mechanical efficiency is 80%. Calculate the diameter and stroke of each cylinder if stroke to bore ratio is 1.5. Calculate BSFC if brake thermal efficiency is 24%. CV of fuel is 44 MJ/Kg.	L3	C03
5	a) Explain the methods of measurement of indicated power. b) A four cylinder engine running at 20RPS gave 19KW of brake power. The average torque when one cylinder was cut off was 103 N-m. Calculate Indicated thermal efficiency if CV = 42,000 KJ/Kg and engine uses 0.34 Kg of petrol per Kwhr of brake power.	L3	C03
6	a) Derive an equation for the work done in single stage reciprocating compressor neglecting the clearance volume. b) Air at 1 bar and 27°C is taken into single stage single acting reciprocating air compressor with law of $pV^{1.1} = \text{constant}$ to a final pressure of 7 bar and compressor takes 1 m ³ /min. Calculate the indicated power and isothermal efficiency. Also calculate the cylinder dimensions and power of the motor required to drive compressor. Speed of compressor is 5 rps. Stroke to bore ratio 1.5:1, mechanical efficiency = 85%, transmission efficiency = 90%	L3	C03
7	a) What is the effect of multistage compression on volumetric efficiency of reciprocating compressor? b) In single stage single acting air compressor of 30 cm diameter, 40 cm stroke makes 100RPM. It takes air at 1 bar and 20°C to a pressure of 5 bar. Calculate mean effective pressure and power required to drive it when compression is isothermal and adiabatic.	L3	C03
8	a) Derive the equation for volumetric efficiency and discuss the effect of clearance on volumetric efficiency. b) A single stage air compressor is required to deal with 30 m ³ of free air per hr at 1 bar. The delivery pressure at 450 RPM is 6.5 bar. Calculate clearance ratio, the IMEP, BP if the mechanical efficiency is 0.8, isothermal efficiency is 0.76 and	L3	C03

	volumetric efficiency is 0.75.		
9	<p>a) What is the condition for maximum efficiency in multistage compression.</p> <p>b) A single stage double acting air compressor running at 5RPS delivers air at 7 bar from 1 bar and 270C. The amount of free air delivered is 0.15 m³/s. If the clearance volume is 5% of swept volume and index of expansion/compression is 1.3. Calculate the volumetric efficiency, indicated power and cylinder dimensions if L/D ratio as 1.2.</p>	L3	C03
10	<p>a) Show that in a reciprocating compressor with perfect inter cooling, the work required in LP compressor is same as that of work required in HP compressor.</p> <p>b) A single stage reciprocating air compressor compresses 10 kg/min of air from 100 Kpa, 170C to 600 Kpa according to the law $pV^{1.25} = \text{constant}$. If the diameter of the cylinder is 0.3 m and the average piston speed is 150 m/min at 100 rpm, determine the power required to drive the compressor.</p>	L2	C03

UNIT-4

Short Answer Questions-

S.No	Question	Blooms	Course outcomes
1	Explain the effect of Pre-whirl in rotary compressors.	L2	C04
2	What are blade shape losses	L1	C04
3	What is meant by Pressure coefficient and adiabatic coefficient	L2	C04
4	What is meant by degree of reaction	L1	C04
5	What is polytropic efficiency of an axial flow compressor	L2	C04

Long Answer Questions-

S.No	Question	Blooms	Course outcomes
1	<p>a) Derive the equation for polytropic efficiency for a multi stage rotary compression.</p> <p>b) Derive the equation for energy transfer between fluid and rotor of rotary compressor.</p>	L2	C04
2	Give the analysis of centrifugal compressors with the help of velocity diagrams.	L2	C04
3	<p>a) Explain the working details of steady flow rotary compressors and p – v curves of the same.</p> <p>b) Derive the equation for the thermodynamics cycle work done for a rotary compressor.</p>	L2	C04
4	a) Draw a Centrifugal compressor in side view and end view	L1,L2	C04

	<p>showing all critical components and give salient working details.</p> <p>b) Briefly explain the effect of each impeller vane on the performance of centrifugal compressor.</p>		
5	<p>A single sided centrifugal compressor is to deliver 15 Kg/sec of air when operating at a stagnation pressure ratio of 4:1 and a speed of 200 RPS. The inlet stagnation conditions may be taken as 1 bar and 288K. Assuming a slip factor of 0.9, a power input factor of 1.04 and an overall isentropic efficiency of 0.8, estimate the overall diameter of the impeller.</p>	L3	C04
6	<p>Write short notes on the following</p> <p>a) Fan, Blower, Compressor – Compare and Contrast.</p> <p>b) Exhaust blow down and its effects.</p> <p>c) Vane sealed compressor working details.</p>	L1	C04
7	<p>a) Draw the velocity triangles and give the analysis of axial flow compressors.</p> <p>b) Explain the significance of Degree of Reaction in axial flow compressors.</p>	L2	C04
8	<p>An axial compressor has a mean diameter of 60m and runs at 15,000 RPM. If the actual temperature rise and pressure ratio developed are 300C and 1.3 respectively, calculate the power required to drive the compressor while delivering 57 Kg/Sec of air. Assuming mechanical efficiency of 86% and initial temperature of 350C, calculate the stage efficiency and the degree of reaction if the temperature at the rotor exit is 550C</p>	L3	C04
9	<p>a) Draw the velocity triangles for the axial flow air compressor and discuss the method to calculate the power requirement.</p> <p>b) An axial flow compressor with compression ratio as 5, draws air at 20oC delivers it at 50oC. Assuming 50% degree of reaction, find the velocity of flow if the blade velocity is 100 m/s. Also find the number of stages if work factor = 0.85, $\alpha = 10^\circ$, $\beta = 40^\circ$ and $C_p = 1.005 \text{ kJ/kg K}$.</p>	L3	C04
10	<p>Describe the operation and mechanical details of axial flow compressors with detailed advantages and applications?</p>	L1,L2	C04
11	<p>a) Describe the working principle of axial flow air compressor with suitable diagram and velocity triangles.</p> <p>b) The following data refers to an axial flow air compressor: turning angle = 30°; increment velocity $I = 100 \text{ m/s}$; degree of reaction = 0.5 speed = 36000 rpm; mean blade diameter = 140 mm; inlet pressure and temperature 2 bar and 57oC respectively. Find the other angles, pressure rise, the amount of air handled and power if the blade height is 20 mm and $\beta_1 = 60^\circ$.</p>	L1,L2,L3	C04

UNIT-5

Short Answer Questions-

S.No	Question	Blooms	Course outcomes
1	Give the basic concepts of gas turbine unit on block diagram, PV diagram and TS diagram	L1	C05
2	What are advantages of closed cycle gas turbine over the open cycle?	L1	C05
3	What are uses of using Reheater in gas turbine unit?	L1	C05
4	What are uses of using Intercooler in gas turbine unit?	L1	C05
5	What are uses of using Regeneration in gas turbine unit?	L1	C05

Long Answer Questions-

S.No	Question	Blooms	Course outcomes
1	In a simple gas turbine plant air enters the compressor at 1 bar and 27°C and leaves at 6 bar. It is then heated in the combustion chamber to 700°C then enters in the turbine and expands to 1 bar. The isentropic efficiency of compressor and turbine are 80% and 85% respectively and combustion efficiency is 98%. The pressure drop in the combustion chamber is 0.1 bar. Determine, (i) Thermal efficiency (ii) Work ratio (iii) Specific fuel consumption (iv) Air fuel ratio	L1,L3	C05
2	Explain the method INTER COOLING employed to increase the specific output and thermal efficiency of Gas Turbine plant? Draw the T-S diagram for the same	L3	C05
3	Exhaust steam having a dryness fraction of 0.82 enters a surface condenser where the vacuum is 690 mm of Hg and is condensed to water at 34.8°C. The temperature of the hot well is 31.6°C. The circulating water enters the condenser at 14°C and leaves at 34°C. The barometric pressure is 756 mm of Hg. Calculate, the mass of circulating water required per kg of steam.	L3	C05
4	What are the sources of air leakages into a condenser? Explain the affects of air leakage on the performance of a condenser	L2	C05
5	What is the effect of thermal efficiency of open cycle Gas Turbine with the following operating variables (i)Pressure ratio ii)Turbine inlet temperature iii)Compressor inlet temperature iv)Efficiency of the turbine v)Efficiency of compressor	L2	C05

OBJECTIVE QUESTIONS:

Including JNTUH:

UNIT – 1

1. The reference fuels for knock rating of spark ignition engines would include

A. iso-octane and alpha-methyl naphthalene

B. normal octane and aniline

C. iso-octane and normal hexane

D. normal heptane and iso-octane

Answer : D

2. The diesel engines are also known as _____ engines.

3. In a four stroke cycle, the minimum temperature inside the engine cylinder occurs at the

A. beginning of suction stroke

B. end of suction stroke

C. beginning of exhaust stroke

D. end of exhaust stroke

Answer: A

3. In hit and miss governing, the fuel supply is cut-off completely during one or more number of cycles. (Yes/ no)

4. The thermal efficiency of a standard Otto cycle for a compression ratio of 5.5 will be

A. 25%

B. 50%

C. 70%

D. 100%

Answer: B

5. The exhaust valve in a four stroke cycle petrol engine

A. opens at 50° before bottom dead centre and closes at 15° after top dead centre

B. opens at bottom dead centre and closes at top dead centre

C. opens at 50° after bottom dead centre and closes at 15° before top dead centre

D. may open and close anywhere

Answer: A

UNIT-2

1. For the same capacity engines, the compression ratio of diesel engine

A. is lower than the compression ratio of SI engine

B. is higher than the compression ratio of SI engine

C. is same as the compression ratio of SI engine

D. cannot say

Answer: B

2. Rate of burning in the compression ignition engine can be controlled by

A. rate of injection of fuel

B. rate of air taken into carburetor

C. Both a and b

Answer: A

3. In a spark ignition engine combustion which is initiated between the spark plug electrodes spreads across the combustible mixture. (True/ False)

4. The process of autoignition has nothing to do towards engine knock. . (True/ False)

5. Auto ignition refers to initiation of combustion without the necessity of a flame. (True/ False)

UNIT-3

1. For which of the following engines a prony brake is used to measure brake power?

a. Single cylinder engine

b. Low speed engine

c. Low power engine

d. Variable speed engine

2. _____ is the basic requirement of a good combustion chamber.

3. _____ is the method of governing used in petrol engine.

4. _____ is used to check the state of charge of a battery

5. The positive displacement compressor is.....

- A. Roots blower compressor
- B. Centrifugal compressor
- C. Axial flow compressor
- D. Vane blower compressor

Answer: A & D

6. If the flow of air through the compressor is perpendicular to its axis, then it is a.....

- A. Reciprocating compressor
- B. Centrifugal compressor
- C. Axial flow compressor
- D. Turbo compressor

Answer : B

UNIT-4

1. Rotary compressor is best suited for.....

- A. Large quantity of air at high pressure
- B. Small quantity of air at high pressure
- C. Small quantity of air at low pressure
- D. Large quantity of air at low pressure

Answer: D

2. The volume of air delivered by the compressor is called.....

- A. Free air delivery
- B. Compressor capacity
- C. Swept volume
- D. None of The above

Answer: B

3. The most efficient method of compressing air is to compress it.....

- A. Isothermal
- B. Adiabatically
- C. Isentropically
- D. Isochronically

Answer:

4. Maximum work is done in compressing air when the compression is.....

- A. Improves volumetric efficiency for the given pressure ratio
- B. Isothermal
- C. Adiabatic
- D. Polytropic
- E. Any of the above

Answer: B

5. The intercooling in multistage compressors is done.....

- A. To cool the air during compression
- B. To cool the air at delivery
- C. To enable compression in two stages
- D. To minimise the work of compression

Answer: D

UNIT-5

1. Thermal efficiency of closed cycle gas turbine plant increases by

(a) Reheating (b) intercooling (c) Regenerator (d) all of the above.

2. With the increase in pressure ratio thermal efficiency of a simple gas turbine plant with fixed turbine inlet temperature

- (a) Decreases (b) increases (c) first increases and then decreases (d) first decreases and then increases.
3. The thermal efficiency of a gas turbine cycle with ideal regenerative heat exchanger is
(a) Equal to work ratio (b) is less than work ratio
(c) Is more than work ratio (d) un-predictable
4. In a two stage gas turbine plant reheating after first stage
(a) Decreases thermal efficiency (b) increases thermal efficiency
(c) does not effect thermal efficiency (d) none of the above.
5. In a two stage gas turbine plant, reheating after first stage
(a) increases work ratio (b) decreases work ratio
(c) does not affect work ratio (d) none of the above.
6. In a two stage gas turbine plant, with inter-cooling and reheating
(a) both work ratio and thermal efficiency improve
(b) work ratio improves but thermal efficiency decreases
(c) thermal efficiency improves but work ratio decreases
(d) both work ratio and thermal efficiency decrease

IES:

1. In the centrifugal compressor the work input is equal to sum of: (a) pressure head, relative head and dynamic head (b) dynamic head, centrifugal head and relative head (c) pressure head, centrifugal head and dynamic head (d) pressure head, centrifugal head and relative head
- 2 For a centrifugal compressor with radial vanes, slip factor is the ratio of : (a) isentropic work to Euler work (b) whirl velocity to the blade velocity at the impeller exit (c) stagnation pressure to static pressure (d) isentropic temperature rise to actual temperature rise
3. The specific speed of a centrifugal compressor is generally: (a) less than that of reciprocating compressor (b) independent of compressor type, but depends only on size of compressor (c) higher than that of axial compressor (d) more than specific speed of reciprocating compressor but less than axial compressor.
- 4 In a centrifugal compressor, the highest Mach number leading to shock wave in the fluid flow occurs at: (a) diffuser inlet radius (b) diffuser outlet radius (c) impeller inlet radius (d) impeller outlet radius.
5. In a centrifugal compressor, an increase in speed at a given pressure ratio causes: (a) increase in flow and increase in efficiency (b) increase in flow and decrease in efficiency (c) decrease in flow and increase in efficiency (d) decrease in flow and decrease in efficiency
6. In an axial flow compressor, the ratio of pressure rise in the rotor blades to the pressure rise in the compressor in one stage is known as: (a) pressure coefficient (b) work factor (c) degree of reaction (d) slip factor

XI. NPTEL WEB VIDEOS:

https://www.youtube.com/watch?v=zTt8cfH_qT8&list=PLwdnzlV3ogoXhmMQIulzPQkbH6XG4JYoh&index=3

<https://www.youtube.com/watch?v=zzHR2S9Kvc&list=PLwdnzlV3ogoXhmMQIulzPQkbH6XG4JYoh&index=6>



<https://www.youtube.com/watch?v=zzHR2S9Kvc&list=PLwdnzlV3ogoXhmMQIulzPQkbH6XG4JYoh&index=6>

<https://www.youtube.com/watch?v=SbLV883BGtQ&list=PLwdnzlV3ogoXhmMQIulzPQkbH6XG4JYoh&index=31>

<https://www.youtube.com/watch?v=H392ZcZwKe4&list=PLwdnzlV3ogoXhmMQIulzPQkbH6XG4JYoh&index=35>

XII. WEBSITES:

www.ntpc.com.

www.bhel.com.

www.vtpc.com.

XIII. EXPERT DETAILS:

V. GANESHAN

MATHUR & SHARMA

XIV. JOURNALS:

1. Power Engineering by Taylor and Francis Group
2. Energy Journal by Elsevier

XV. LIST OF TOPICS FOR STUDENT SEMINARS:

1. Difference between S.I and C.I Engine
2. Detonation and knocking
3. Four strokes of S.I engine
4. Brake and Indicated power
5. Types of compressor
6. Improvements in Gas turbine unit

XVI. CASE STUDIES / SMALL PROJECTS:

1. Assembly and disassembly of an I.C engine
2. Numerical analysis of an single stage axial compressor