SHRI SHANKARACHARYA TECHNICAL CAMPUS, BHILAI

(An Autonomous Institute affiliated to CSVTU, Bhilai)

SCHEME OF TEACHING AND EXAMINATION (EFFECTIVE FROM 2020-2021 BATCH)

M. Tech. (Thermal Engineering)

3rd Semester

S. No.	Board of Study	Subject Code	Subject	Periods per Week			Scheme of Examination			Total Marks	Credit L+(T+P)/2
							Theory / Practical				
				L	T	P	ESE	CT	TA		
1	Mech. Engg.	ME229301	Research Techniques and Basics of Report Writing	3	1	-	100	20	20	140	4
2	Mech. Engg	Elective-III		3	1	-	100	20	20	140	4
3	Mech. Engg.	ME229391	Preliminary Work on Dissertation	-	-	28	100	-	100	300	14
4	Mech. Engg	ME229392	Seminar based on Dissertation	-	-	4	-	-	20	20	2
Total				6	2	32	300	40	160	500	24

L- Lecture T- Tutorial

P- Practical, ESE- End Semester Exam

CT- Class Test TA- Teacher's Assessment

Table-III

PROFESSIONAL ELECTIVE III			
S.NO.	BOARD OF STUDY	SUBJECT CODE	SUBJECT
1	Mech. Engg.	ME229321	Cryogenics
2	Mech. Engg.	ME229322	Gas Turbines & Compressors
3	Mech. Engg.	ME229323	Exergy Analysis Of Thermal Systems

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M. Tech. (Thermal Engineering)

Subject Code ME229301	Research techniques & Basics of Report Writing	L = 2	T = 0	P = 0	Credits = 2
Evaluation Scheme	ESE	CT	TA	TOTAL	ESE Duration
	100	20	20	140	3 Hrs

Course Objective	Course Outcomes
1. To give an overview of the research methodology and explain the technique of defining a research problem 2. To explain various research designs and their characteristics. 3. To explain the details of sampling designs, measurement and scaling techniques and also different methods of data collections. 4. To explain several parametric tests of hypotheses and Chi-square test. To explain the art of interpretation and the art of writing research reports.	**Students will learn:** **CO1** How to clearly define a research problem **CO2** How to carry out Literature survey **CO3** About various techniques of data collection and analysis. **CO4** How to properly organise and write technical reports/Thesis.

Unit I **CO1**

Introduction to Research and Problem Definition Meaning, Objective and importance of research, Types of research, steps involved in research, defining research problem

Unit II **CO2**

Research Design Methods of research design, research process and steps involved, Literature Survey

Unit III **CO3**

Data Collection Classification of Data, Methods of Data Collection, Sampling, Sampling techniques procedure and methods, Ethical considerations in research

Unit IV **CO3**

Data Analysis and interpretation Data analysis, Statistical techniques and choosing an appropriate statistical technique, Hypothesis, Hypothesis testing, Data processing software (e.g. SPSS etc.), statistical inference, Interpretation of results

		October 2020	1.00	Applicable for AY 2020-2021 onwards
Chairman (AC)	Chairman (BoS)	Date of Release	Version	

Unit V **CO4**

Technical Writing and reporting of research Types of research report: Dissertation and Thesis, research paper, review article, short communication, conference presentation etc., Referencing and referencing styles, Research Journals, Indexing and citation of Journals, Intellectual property, Plagiarism.

Text Books:

S. No.	Title	Authors	Edition	Publisher
1	Research Methodology: Methods and Techniques	C.R. Kothari, Gaurav Garg	4 th Edition, 2018	New Age International
2	Research Methodology a step-by-step guide for beginners. (For the topic Reviewing the literature under module 2)	Ranjit Kumar	3 rd Edition, 2011	SAGE Publications Ltd

Reference Books:

S. No.	Title	Authors	Edition	Publisher
1	An introduction to Research Methodology	Garg B.L et al	2002	RBSA Publishers
2	An Introduction to Multivariate Statistical Analysis	Anderson T.W	3 rd Edition, 2003	Wiley
3	Proposal Writing	Coley S.M. Scheinberg, C.A	1991	A Sage Publications

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M. Tech. (Thermal Engineering)

Subject Code ME229321	Cryogenics	L = 2	T = 0	P = 0	Credits = 2
Evaluation Scheme	ESE	CT	TA	TOTAL	ESE Duration
	100	20	20	140	3 Hrs

Course Objective	Course Outcomes
1. To get the knowledge on the properties of both matter and fluid for better design of the process equipment in cryogenics application 2. To understand the gas liquefaction and refrigeration system 3. Instrumentation in cryogenic system is essential for measuring properties at low temperature 4. Safety in cryogenics is highly important for handling liquids or cryogens environment.	**After learning the course the students will get:** **CO1.** The knowledge on the properties of both matter and fluid for better design of the process equipment in cryogenics application. **CO2.** Understanding the gas liquefaction and refrigeration system **CO3.** Instrumentation in cryogenic system is essential for measuring properties at low temperature **CO4.** Safety in cryogenics is highly important for handling liquids or cryogens environment.

Unit I **CO1**

Introduction to Cryogenic Systems: Historical development, Present areas involving cryogenic engineering, Low Temperature Properties of Engineering Materials: Mechanical properties-Thermal properties - Electric and magnetic properties-Properties of cryogenic fluids.

Unit II **CO2**

Gas Liquefaction Systems: Joule Thompson effect; Adiabatic expansion; Simple Linde-Hampson, Precooled Linde Hampson system; Liquid dual pressure system; Cascaded system; Claude system, Kapitza system, Collins helium liquefaction system.

Unit III **CO1**

Critical Component of Liquefaction System: Effect of heat exchanger; Effectiveness of system performance, Effect of compressor and expander efficiency on system performance; effect of heat transfer to the system.

Unit IV **CO3**

Cryogenic Storage & Transfer System: Cryogenic fluid storage vessels, Insulation, Cryogenic transfer system.

Measurement System of Low Temperature: Temperature measurement, Flow rate measurement, Liquid level measurement.

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Unit V **CO4**

Applications of cryogenic systems Super conductive devices such as bearings, motors, cryotrons, magnets, D.C. transformers, tunnel diodes, space technology, space simulation, cryogenics in biology and medicine, food preservation and industrial applications, nuclear propulsions ,chemical propulsions

Cryogenic Hazards: Physical hazards, Chemical hazards, Physiological hazards, combustion hazards, oxygen hazards, accidents in cryogenic plants & prevention

Text Books:

S. No.	Title	Authors	Edition	Publisher
1	Cryogenic Systems	Barron Randall F	__	Oxford University Press
2	A Text Book of Cryogenics	Valery V Kostiouk	__	Discovery Publishing House

Reference Books:

S. No.	Title	Authors	Edition	Publisher
1	Cryogenic Technology and Applications	A R Jha	__	
2	Thermodynamic Properties of Cryogenic Fluids	R T Jacobsen	__	Plenum Publishing Corpn

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M. Tech. (Thermal Engineering)

Subject Code ME229322	GAS TURBINES & COMPRESSORS	L = 2	T = 0	P = 0	Credits = 2
Evaluation Scheme	ESE	CT	TA	TOTAL	ESE Duration
	100	20	20	140	3 Hrs

Course Objective	Course Outcomes
1. To introduce thermal and mechanical aspects of Gas Turbines. 2. To make students acquainted to thermal and mechanical aspects of Centrifugal compressors. 3. To make students acquainted to thermal and mechanical aspects of Axial Flow Compressors. 4. To make students acquainted to thermal and mechanical aspects of Turbines 5. To make students acquainted to thermal and mechanical aspects Gas Turbine Power Plants	After the completion of course Students will get knowledge of: **CO1** Thermal and mechanical aspects Gas Turbines **CO2** Thermal and mechanical aspects Centrifugal Compressors **CO3** Thermal and mechanical aspects Axial Flow Compressors **CO4** Thermal and mechanical aspects Turbines **CO5** Thermal and mechanical aspects Gas turbine power plants

Unit I **CO1**

Gas Turbines: Development, Classification and field applications of gas turbines, Ideal and actual cycles; multi-stage compression; Reheating, Regeneration, Combined and Cogeneration, Energy transfer between fluid and rotor; Axis symmetric flow in compressors and turbines.

Unit II **CO2**

Centrifugal Compressor: Principles of operation; Compressor losses; Adiabatic efficiency; Slip factor; Pressure coefficient; Power unit; Design consideration for impeller and diffusion systems; Performance characteristics.

Unit III **CO3**

Axial Flow Compressors: Elementary theory; Vortex theory; Degree of reaction; Simple design; Elementary air foil theory; Isolated air foil and cascade theory; 3D flow; Stages; stage efficiency and overall efficiency; Performance characteristics.

Unit IV **CO4**

Turbines: Axial flow and radial flow turbines; Impulse and reaction turbines; Fundamental relations and velocity triangles; Elementary vortex theory; Limiting factors in turbine design application of Air foil theory to the study of

flow through turbine blades; Aerodynamic and thermodynamic design considerations; Blade materials; Blade attachments and blade cooling.

Unit V **CO5**

Gas Turbine Power Plants: Fuel feed systems; Combustion systems-design considerations and flame stabilization; regenerator types and design; Gas turbine power; Plant performance and matching; Applications

Text Books:

S. No.	Title	Authors	Edition	Publisher
1	Steam and Gas Turbine	R Yadav	__	Standard Publishers
2	Process Centrifugal Compressors : Basics, Function, Operation, Design, Application	Klaus H Ldtke	__	

Reference Books:

S. No.	Title	Authors	Edition	Publisher
1	Gas Turbine Engineering Handbook	Boyce Meherwan P	__	Gulf Profe
2	Compressor Performance, Aerodynamics for the User	Theodore Gresh	__	

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SCHEME OF TEACHING AND EXAMINATION (EFFECTIVE FROM 2020-2021 BATCH)

M. Tech. (Thermal Engineering)

Subject Code ME229322	EXERGY ANALYSIS OF THERMAL SYSTEMS	L = 2	T = 0	P = 0	Credits = 2
Evaluation Scheme	ESE	CT	TA	TOTAL	ESE Duration
	100	20	20	140	3 Hrs

Course Objective	Course Outcomes
1. **To give an overview** of exergy analysis of thermal components 2. **To make students learn about** computation of exergy analysis of different processes for power and refrigeration cycles 3. **To make students able to c**alculate exergy-economics costing of thermal components	After successful completion of the course, the student will be able to: **CO1** Acquire an overview of exergy analysis of thermal components **CO2** Able to compute exergy analysis of different processes and power and refrigeration cycles **CO3** Calculate exergy-economics costing of thermal components

Unit I **CO1**

Exergy Destruction: Lost available work referred to heat engine cycle, refrigeration cycle, heat pump cycle, non flow and steady flow processes, Mechanism of exergy destruction, modified Gouy-Stodola theorem, concept of effective temperature.

Unit II **CO1**

Exergy Analysis of Simple Processes: Mixing and separation process of fluids of different temperature, heat transfer across a temperature difference, expansion and compression process, combustion process

Unit III **CO2**

Exergy Analysis of Power Plant Cycles: Maximum power subject to size constraint with fixed heat input and its application to Brayton cycle Steam turbine power plants: External and internal irreversibility, superheater, reheater, vacuum condenser, regenerative feed water heating, combined feed water heating and reheating Gas turbine power plant: External and internal irreversibility, regeneration, reheater, and intercooler, combined steam and gas turbine power plant

Unit IV **CO2**

Exergy analysis of Refrigeration cycle: Joule-Thomson Expansion, Work-Producing Expansion, Brayton Cycle, Optimal Intermediate Cooling, Exergy analysis of Air-conditioning applications: Mixtures of air and water vapour, total flow exergy of humid air & liquid water, Evaporative cooling process and other aspects

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Unit V **CO3**

Exergy-economic Analysis: Fundamental of exergy-economics, exergy costing of different thermal components: steam or gas turbine, boiler, cogeneration system

Text Books:

S. No.	Title	Authors	Edition	Publisher
1	Advanced Engineering Thermodynamics	Adrian Bejan	__	John Wiley & Sons, Inc
2	The Exergy Method of Thermal Plant Analysis	T J Kotas	__	Krieger Publishing Company
3	Thermal Design and Optimization	Adrian Bejan, George Tsatsaronis, Michael Moran	__	John Wiley & Sons, Inc

Reference Books:

S. No.	Title	Authors	Edition	Publisher
1	Advance Thermodynamics for Engineers	Winterbore D E	__	Arnold Publication
2	Advanced Thermodynamics for Engineers	Kenneth Wark	__	McGraw Hill Publishing Co. Ltd
3	Fundamentals of Engineering Thermodynamics	Michel J Moran, Howard N Shapiro	__	John Wiley & Sons, Inc