

### Program Articulation Matrix

S#	Cat	Course	CO	CO Description	PO1	PO2	PO3	PO4	PO5	PO6	PO7
1	ESC	23MT5102 - CTEO	CO1	Understand the fundamental concepts of optimization, including types of problems, mathematical formulation, and programming implementation.	3	3					
2	ESC	23MT5102 - CTEO	CO2	Apply mathematical optimization techniques, both unconstrained and constrained, to solve engineering problems using programming languages like Matlab/Python/R.	3				3		
3	ESC	23MT5102 - CTEO	CO3	Analyze and solve multi-objective optimization problems, considering trade-offs and conflicting objectives, using appropriate algorithms and methodologies.	3				3		
4	ESC	23MT5102 - CTEO	CO4	Apply optimization techniques to solve application-specific problems in Machine Design and Thermal Engineering domains, demonstrating domain-specific knowledge and skills.	3				3		
5	PCC	23TE5102 - DTS	CO1	Apply the modelling concepts to the design of thermal systems		2					
6	PCC	23TE5102 - DTS	CO2	Analyze the design of thermal systems by considering its economic viability.			3	3			
7	PCC	23TE5102 - DTS	CO3	Analyze the problem formulation for optimization and its search methods and understanding Lagrange multiplier			3		3		
8	PCC	23TE5102 - DTS	CO4	Analyze the Geometric, linear and dynamic Programming and modelling of thermal equipment.					3		
9	PCC	23TE5102 - DTS	CO5	Analyze the design and Modeling of thermal systems.					3		

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10	PCC	23TE5102 - DTS	CO6	Analyze the models of thermal systems using tools.				3			
11	PCC	23TE5103 - ATD	CO1	Apply a review of the Joule-Thompson experiment, the Maxwell equations, the first and second laws of thermodynamics, irreversibility and availability, and energy analysis.	3				3		
12	PCC	23TE5103 - ATD	CO2	Apply thermodynamics entails grasping phase transitions, equilibrium types, multi-component and multi-phase systems, equations of state, chemical thermodynamics, combustion, and the Third Law.	3				3		
13	PCC	23TE5103 - ATD	CO3	Apply the knowledge of the kinetic theory of gases involves understanding molecular flux, the equation of state for an ideal gas, collisions with a moving wall, the principle of equipartition of energy, the classical theory of specific heat capacity, and transport phenomena related to intermolecular forces.	3				3		
14	PCC	23TE5103 - ATD	CO4	Applying fundamental knowledge of statistical thermodynamics involves understanding energy states and levels on macro and micro scales.	3				3		
15	PCC	23TE5103 - ATD	CO5	Analyze advanced thermodynamics and statistical mechanics involves a deep dive into the First and Second Laws.					3		
16	PCC	23TE5104 - CFD	CO1	Derive Governing equations of fluid flow and heat transfer and apply finite difference formulation to discretize the governing equations	3		3	3			

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17	PCC	23TE5104 - CFD	CO2	Analyze heat transfer characteristics in case of steady diffusion problems using finite volume discretization technique	3		3	3			
18	PCC	23TE5104 - CFD	CO3	Analyze fluid flow and heat transfer characteristics in case of steady advection diffusion	3		3	3			
19	PCC	23TE5104 - CFD	CO4	Formulate explicit and implicit algorithms to solve N-S Equations and to understand the turbulence modelling	3		3	3			
20	PCC	23TE5104 - CFD	CO5	Analyze various fluid flow and heat transfer characteristics using a simulation software (Ansys-Fluent)	3		3	3			2
21	PCC	23TE5205 - AHMT	CO1	Analyze 1D steady and unsteady state heat conduction in various heat transfer applications	2	2					
22	PCC	23TE5205 - AHMT	CO2	Analyze Multidimensional and transient heat conduction and heat transfer characteristics in various heat transfer applications	2	2					
23	PCC	23TE5205 - AHMT	CO3	Design heat exchangers by applying the basic heat transfer principles and analyze the radiation heat transfer characteristics	2	3					
24	PCC	23TE5205 - AHMT	CO4	Analyze the Diffusion and convective mass transfer in plate and pipes	2	2					
25	PCC	23TE5205 - AHMT	CO5	Analyze various the heat transfer characteristics in fins and heat exchangers using Ansys software		2	2	3			
26	PCC	23TE5206 - MTE	CO1	Apply scientific and engineering methods for the measurement of field and derived quantities	1						

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27	PCC	23TE5206 - MTE	CO2	Analyze principles of presentation, estimation and data analysis		2					
28	PCC	23TE5206 - MTE	CO3	Apply various experimental measurement techniques for the measurement of field quantities with probe and non-instructive techniques			1				
29	PCC	23TE5206 - MTE	CO4	Evaluate the measurement of derived quantities and analytical methods and design and conduct the experiments, as well as to organize, analyze and interpret data to produce meaningful conclusions and recommendations				3			
30	PCC	23TE5206 - MTE	CO5	Analyze the various measurement of the thermal engineering components					3		
31	PRI	23IE5149 - TP	CO1	Understand Literature Review and Problem Identification	1	2		2			
32	PRI	23IE5149 - TP	CO2	Understand Methodology and Implementation	1	2		2			
33	PRI	23IE5201 - ERD	CO1	Analyze existing research to identify a focused and answerable research question or develop a well-defined hypothesis	2	3					
34	PRI	23IE5201 - ERD	CO2	Evaluate different research designs based on their strengths and weaknesses in relation to the chosen research question and data needs.		3				2	3
35	PRI	23IE5201 - ERD	CO3	Apply appropriate data collection methods considering the chosen research design and data characteristics.	2					3	
36	PRI	23IE5201 - ERD	CO4	Analyze and interpret data using relevant data analysis methods to address the research question							3

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37	PRI	23IE6150 - DIS	CO1	Identify and articulate research problems within their field of study, demonstrating an understanding of current research gaps.	2				2		
38	PRI	23IE6150 - DIS	CO2	Design and execute research methodologies, employing relevant techniques for data collection, analysis, and interpretation.		2				2	
39	PRI	23IE6150 - DIS	CO3	Demonstrate advanced critical thinking skills, analyzing research findings within the context of existing literature to draw meaningful conclusions.		2			2		
40	PRI	23IE6250 - DIS	CO1	Demonstrate a comprehensive understanding of a chosen research topic and its significance in the broader field.	2					2	
41	PRI	23IE6250 - DIS	CO2	Apply appropriate research methodologies to address research questions		2			2		
42	PRI	23IE6250 - DIS	CO3	Analyze and interpret data effectively, drawing meaningful conclusions	2					2	
					2.4	2.3	2.7	2.8	2.8	2.2	2.7