K L UNIVERSITY
DEPARTMENT OF MECHANICAL ENGINEERING
2015-2019 BATCH Course Outcomes
Course Articulation Matrix

S NO	Course Code	Course Title	CO NO	Description of the Course Outcome	a	b	c	d	e	f	g	h	i	j	k
1	15EN1101	RUDIMENTS OF COMMUNICATION SKILLS	CO1	Remember speech sounds and apply stress and intonation rules to enhance pronunciation skills							2				
			CO2	Understand writing strategies and apply those by using the basic and advanced concepts of grammar							2				
			CO3	Understand the types of texts and tone of the author.							2				
			CO4	Understand the importance of interpersonal skills						2					
2	15MT1001	SINGLE VARIABLE CALCULUS AND MATRIX ALGEBRA	CO1	Model physical laws and relations mathematically as a first order differential equations, solve by an appropriate method and interpret the solution.	2										
			CO2	Model physical laws and relations mathematically as a second/higher order differential equations, solve by an appropriate method and interpret the solution.	2										
			CO3	Obtain the Fourier series expansions of periodic functions and use the series to solve differential equations.	2										
			CO4	Model physical problems mathematically as a system of linear equations and solve them by analytical and numerical methods. Also, determine the nature of Quadratic form using Eigen values	2										
			CO5	Verify the solution of problems through MATLAB.											2
3	15PH1001	ENGINEERING MATERIALS	CO1	Understands structure of crystalline solids, kinds of crystal imperfections and appreciates structure-property relationship in crystals.	1										
			CO2	Understands the role of electronic energy band structures of solids in governing various electrical and optical properties of materials.	1										
			CO3	Understands role of molecular vibrations in determining thermal properties of materials and deformation of materials in response to action of load, for identification of materials having specific engineering applications.	1										
			CO4	Understands spin and orbital motion of electrons in determining magnetic properties of materials and identifies their role in classification soft & hard magnetic materials having specific engineering applications.	1										
			CO5	Apply the knowledge on structure and properties of materials while executing related experiments and develop some inter disciplinary projects.		2									
4	15CS1001	C PROGRAMMING AND DATA STRUCTURES	CO1	Illustrate how problems are solved using computers and programming.	2				2						
			CO2	Interpret & Illustrate user defined C functions and different operations on list of data.	2				2						
			CO3	Implement Linear Data Structures and compare them.		2									
			CO4	Implement Binary Trees.		2									
			CO5	Apply the knowledge obtained by the course to solve real world problems.	2	2			2						
5	15GN1002	HUMAN VALUES	CO1	realize and understand the basic aspiration, harmony in the human being.						1				1	
			CO2	envisage the roadmap to fulfill the basic aspiration of human beings.						2				2	
			CO3	analyze the profession and his role in this existence.						2				2	

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6	15GN1004	INTRODUCTION TO ENGINEERING	CO1	Understand the basic principles of engineering design								1			
			CO2	Understand and analyze the possible career options in Engineering and develop strategic plan, career targets and mechanism to achieve the same.						3					
			CO3	Understand the aspects of critical thinking and problem solving in engineering								2			
			CO4	Apply to knowledge of critical thinking to frame real-world problems and provide basic solution approach to such problems from engineering perspective								2			
7	15ME1002	ENGINEERING GRAPHICS	CO1	Draft Orthographic views, projections of planes and , solidsmanually and by using CAD software Tool (AutoCAD)					2						
			CO2	Drafting Sectional views , Isometric views ,development of surfaces and perspectives views manually and by using AutoCAD					2						
			CO3	Project based workshop to prepare different models with the aid of workshop trades i.e., Carpentry, Tin smithy, House wiring and Fitting											2
8	15EN1202	INTER PERSONAL COMMUNICATION SKILLS	CO1	Understand the method of identifying the meaning of words and apply them in contexts.							2				
			CO2	Understand and analyze different cultures and the importance of empathy in cross-cultural communication.						2					
			CO3	Understand and analyze seven techniques of reading and improve reading speed.							2				
			CO4	Understand and apply writing strategies in office/ formal communication							2				
9	15MT1203	MULTIVARIATE CALCULUS	CO1	Determine extreme values for functions of several variables	2										
			CO2	Determine area, volume through multiples integrals	2										
			CO3	Apply the concepts of vector calculus to calculate the gradient, directional derivative, arc length , areas of surfaces and volume of solids in practical problems	2										
			CO4	Obtain analytical and numerical solutions of Heat and wave equations	2										
			CO5	Verify the solution of problems through MATLAB											1
10	15CY1001	ENGINEERING CHEMISTRY	CO1	Examine water quality and select appropriate purification technique for intended problem		2	2								
			CO2	Predict potential complications from combining various chemicals or metals in an engineering setting		2	2								
			CO3	Discuss fundamental aspects of electrochemistry and materials science relevant to corrosion phenomena		2	2								
			CO4	Apply phase rule, polymers, conducting polymers and nano chemistry to engineering processes			2								
			CO5	An ability to analyze & generate experimental skills		2	2								
11	15ME1001	MECHANICS	CO1	Understand the concept of forces and apply the static equilibrium equations.	1				2						
			CO2	Analyze co-planar and non co-planar system of forces.	2				2						
			CO3	Apply the concept of centroid & centre of gravity to determine moment of inertia.	2				2						
			CO4	Analyze the rigid bodies under translation and rotation with and without considering forces.	2				2						
			CO5	Understand the engineering systems to prepare and demonstrate the models with the help of mechanics concept to solve the engineering problems.	1				2						

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12	15BT1001	BIOLOGY FOR ENGINEERS	CO1	Understand the basis of Life, Living organisms and human body systems								1		1	
			CO2	Understand the importance of Diet and Nutrition								1		1	
			CO3	Acquire the knowledge of beneficial and harmful Microorganisms and Biosensors								1		1	
13	15ME2207	GRAPHICS AND VISUALIZATION OF MECHANICAL COMPONENTS	CO1	Communicate information about various mechanical components visually							2				
			CO2	Sketch shaft coupling and pipe joints							2				
			CO3	Develop assembly and part drawings							2				
			CO4	Analyze and visualization of various mechanical joints and mechanisms.							2				
			CO5	Implement computer aided drafting and simulation											2
14	15GN1001	ECOLOGY AND ENVIRONMENT	CO1	Understand the importance of Environmental education and conservation of natural resources								1			
			CO2	Understand the importance of ecosystems and biodiversity.									1		
			CO3	Understand the knowledge on solid waste management,disaster management and EIA process										1	
15	15GN1003	MEASURMENTS	CO1	Understand and apply the fundamentals of a measurement system, characteristics, transducers and metrology using simulation and experimentation tools.	2	2									2
			CO2	Understand various electrical & computer parameters, and apply different measuring techniques on various electrical parameters using simulation and experimentation tools.	2	2									2
			CO3	Understand electronic & electro-physiological parameters, and apply measuring techniques on electronic parameters using simulation and experimentation tools.	2	2									2
			CO4	Understand and apply different measuring techniques on civil and mechanical parameters using simulation and experimentation tools.	2	2									2
16	15ME1003	THERMODYNAMICS	CO1	Understand the fundamentals of thermodynamic systems and processes	2										
			CO2	Apply laws of the thermodynamics and principle of entropy to engineering devices.	2										
			CO3	Analyze various air standard cycles and their performance.	2										
			CO4	Evaluate the performance of fuels and combustion to various engines.											1
			CO5	Apply the theoretical concepts to conduct various experiments of thermodynamics practically and analyze the data.		2									
17	15ME2104	FLUID MECHANICS	CO1	Understand various properties of fluids and apply various laws for measuring pressure					2						
			CO2	Apply the laws to measure total pressure and center of pressure on surfaces and understand the concepts of Buoyancy and flotation					2						
			CO3	Apply continuity equation, stream function and velocity potential function for fluid flows and apply Bernoulli's equation to various fluid flow applications					2						
			CO4	Estimate the major and minor losses in flow through pipes and understand the concepts of dimensional analysis and boundary layers.					2						
			CO5	Apply the theoretical concepts to conduct various experiments of fluid flow practically and analyze the data.		2									

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18	15ME2106	STRENGTH OF MATERIALS	CO1	Analyze stresses in members with 1D axial loading or torsion		2									
			CO2	Analyze shear force and bending moment diagrams		2									
			CO3	Analyze deflections and stresses in beams					2						
			CO4	Design columns and pressure vessels					2						
			CO5	Apply the theoretical concepts to conduct various experiments of strength of materials practically and analyze the data		2									
19	15 EN 2103	PROFESSIONAL COMMUNICATION SKILLS	CO1	Apply the various strategies of presentation Skills.							2				
			CO2	Analyze the given topics and situations and applying the strategies of group discussion.							2				
			CO3	Analyze the basic concepts of critical and analytical reading skills.							2				
			CO4	Apply the strategies of sentence formation and sentence completion.							2				
20	15MT2104	PROBABILITY AND OPTIMIZATION TECHNIQUES	CO1	Demonstrate Probability, theorems of probability and their applications in discrete probability distributions to the real world problems.	2										
			CO2	Apply Continuous distributions to analyze various real-world situations and also Construct the linear and non-linear regression lines.	2										
			CO3	Determine the relationship between two variables for grouped and ungrouped data using correlation coefficient and also Formulate the given industrial problems as a linear programming problem and solve it by graphical method	2										
			CO4	Obtain the solutions of linear and non-linear programming problems using different methods	2										
			CO5	Verify the solution of the problems through MATLAB/Excel											1
21	15ES2002	SIGNAL ANALYSIS	CO1	Understand the representation, manipulation and operations of continous Time signals and Systems				2	2						
			CO2	Explore the continous Time signals in Fourier domain and illustration of sampling theorem				2	2						
			CO3	Understand the Laplace transforms and its applications in LTI Systems				2	2						
			CO4	Analyze Discrete time signals in Fourier and Z Transform domain				2	2						
			CO5	Apply and evaluate signals and systems concept to various applications under time domain and transform domain											3
22	15ME2105	MATERIALS SCIENCE AND METALLURGY	CO1	Identify and differentiate various types of materials. i.e. Metals, Alloys and understand various material testing methods.	2										
			CO2	Analyze the concept of cooling curves, equilibrium phase diagrams, and heat treatment techniques.	2										
			CO3	Identify the importance of composites, ceramics and strengthening mechanisms.		2									
			CO4	Identify various nano material, bio-material, smart material and powder metallurgy process and their applications.		2									
23	15ME2208	MANUFACTURING SCIENCE AND TECHNOLOGY	CO1	Understand the principles, applications, and limitations of Sand Casting.		2									
			CO2	Understand the principles, applications, and limitations of Special Casting , Forming, and Forging processes.			2								
			CO3	Understand the principles, applications, and limitations of joining processes and machining w.r.t turning, drilling			2								
			CO4	Understand the principle, applications, and limitations of machining w.r.t milling and grinding. Understand the principles of the design and use of jigs and fixtures.			2								
			CO5	Gain hands on experience in converting a given raw material into desired shape and size by applying suitable primary and /or secondary manufacturing processes		2									

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24	15ME2209	KINEMATICS AND DYNAMICS OF MACHINES	CO1	Identify, select and analyze kinematically suitable mechanisms for required motion of machinery											2
			CO2	Develop velocity and acceleration diagrams and analyze the data		2									
			CO3	Develop cam profiles and Analyze gears and gear trains kinematically											2
			CO4	Analyze mechanisms dynamically					2						
			CO5	Apply the theoretical concepts to design mechanisms by using the simulation software and analyzing the data		2									
25	15ME2210	APPLIED THERMODYNAMICS	CO1	Understand the properties of Pure substances and analyze the Rankine cycle efficiency	2		2								
			CO2	Apply the principles of nozzle and understand the working of Condensers	2		2								
			CO3	Understand fundamentals of I.C engines and combustion	2		2								
			CO4	Apply the principles of Refrigeration and Psychrometry to refrigeration and air conditioning units	2		2								
			CO5	Able to do design a power plant , air conditioning unit and a refrigeration plant			2								
26	15 EE 2202	BASIC ELECTRICAL & ELECTRONICS ENGINEERING	CO1	Understand basics of DC circuit analysis, fundamentals of AC and introduction three phase circuits	1										
			CO2	Understand construction & working principle of DC Machines	1										
			CO3	Understand construction & working principle of Transformer, three phase and single phase induction motor.	1										
			CO4	Understand number systems and their conversions, characteristics of PN junction diode	1										
			CO5	Conduct an experiment to analyze the performance of various electrical and electronic devices and draw their char characteristics.	2										
27	15ME3111	FINITE ELEMENT METHOD	CO1	Analyse and evaluate 1D problems and plane trusses using FEM					2						
			CO2	Analyse and evaluate 2D problems using FEM					2						
			CO3	Analyse and evaluate axisymmetric solids subjected to axisymmetric loading using FEM											3
			CO4	Analyze and evaluate solids subjected to dynamic loads											3
			CO5	Apply the theoretical concepts to conduct various interpretation by using Analysis software's		2									
28	15ME3112	DESIGN OF MACHINE ELEMENTS	CO1	Design of machine elements for simple and combined static stresses, fatigue strength			2								
			CO2	Design shaft and couplings under static and dynamic loads, Flywheel			2								
			CO3	Design of Power screws, bolted and welded joints and springs.					3						
			CO4	Design of bolted and welded joints and springs					3						
			CO5	Apply the theoretical concepts to conduct various experiments on design of machine elements practically and analyze the data.		2									

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29	15ME3113	ADVANCED MANUFACTURING TECHNOLOGY	CO1	Implement various modern and advanced manufacturing techniques and processes		2									
			CO2	Analyze the parameters related to economics of machining		2									
			CO3	Understand NC, DNC and CNC systems											3
			CO4	Identify various techniques for processing of MEMS											3
			CO5	Apply the theoretical concepts to conduct various experiments on Unconventional machines		2									
30	15ME3114	TURBO MACHINES	CO1	Design of rotor systems		2									
			CO2	Design of compressor and fan blades		2			2						
			CO3	Design of pumps		2			2						
			CO4	Design of turbines		2			2						
			CO5	Apply the theoretical concepts to conduct various experiments practically and analyze the data.		2									
31	15ME3115	FEEDBACK AND CONTROL SYSTEMS	CO1	Acquire ability to analyze, evaluate and simulate time response of a Mechatronic system		2									
			CO2	Understand Quantizing theory and Data acquisition systems			2								
			CO3	Understand the role of PLCs and microcontrollers in the design of control systems for mechatronic systems to achieve desired performance characteristics			2								
			CO4	Acquire ability to analyze, evaluate and improve system performance using the control strategies viz. P, PD, PI, PID etc.			2								
			CO5	Modelling of mechanical, hydraulic/ pneumatic and thermal systems using NI LabVIEW Software		2									
32	15 ME 3216	DESIGN OF TRANSMISSION ELEMENTS	CO1	Design and select suitable bearings for applications			2		3						
			CO2	Design brakes and clutches for given conditions			2		3						
			CO3	Design gears and belt and chain drives for power transmission			2		3						
			CO4	Design of IC engine components - piston, connecting rod and crankshaft.			2		3						
			CO5	Apply the theoretical concepts to conduct various Simulations by using the simulation tool and analyze the data		2									
33	15 ME 3217	PRODUCTION AND OPERATIONS MANAGEMENT	CO1	Apply techniques to improve productivity and quality in production system			2								3
			CO2	Apply the principles of layout design, line balancing, Forecasting	2	2									
			CO3	Apply the principles of Aggregates planning, Inventory management in operations management											3
			CO4	Inspection & Quality control			2								
			CO5	Apply the theoretical concepts to conduct various experiments practically and analyze the data.		2									

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34	15 ME 3218	HEAT TRANSFER	CO1	Understanding basic principles of conduction, radiation, and convection heat transfer.					2						
			CO2	Extend the basic principle of conservation of energy to systems which involve conduction, radiation, and heat transfer.					2						
			CO3	To identify, formulate and solve engineering problems involving conduction convection and radiation heat transfer.											2
			CO4	To identify, formulate and solve engineering problems involving conduction convection and radiation heat transfer into a mathematical model, selecting an appropriate solution technique and evaluating the significance of results.											2
			CO5	Apply the theoretical concepts to conduct various experiments of heat transfer practically and analyze the data. b 2		2									
35	15 ME 3251	AUTOMOBILE ENGINEERING	CO1	Understand cooling and lubrication systems	2										
			CO2	Understand chassis and emission of automobiles	2										
			CO3	Know the transmission and suspension systems			2								
			CO4	Analyze the performance of transmission and suspension systems					3						
36	15 ME 4155	AUTOMOBILE ENGINE DESIGN	CO1	Understand and design of engine from first principle	2										
			CO2	Design and Analyze cooling, lubrication and engine component systems			3								
			CO3	Design engine components			2								
			CO4	Understand engine testing equipments			2								
37	15 ME 4156	AUTOMOTIVE TRANSMISSION	CO1	Understand functionality of clutches and gear box			2								
			CO2	Principle of working of drive line systems			2								
			CO3	Understand transmission of fluid flywheel and torque convertor			2								
			CO4	Principle of working of automatic transmission systems			2								
38	15 ME 4157	AUTOTRONICS & SAFETY	CO1	Understand working principles of different batteries and ignition system			2								
			CO2	Understand working principles of ignition system			2								
			CO3	Understand auto wiring electrical systems			2								
			CO4	Understand safety concept and safety equipments			2								
39	15 ME4158	ALTERNATIVE ENERGY SOURCES FOR AUTOMOBILES	CO1	Application of solar photo voltaic cells	2										
			CO2	Understand Hydrogen energy			2								
			CO3	Know the design considerations of electric automobiles			2								
			CO4	Understand principles of working of electric automobiles			2								

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40	15 ME 3252	INDUSTRIAL AUTOMATION & CONTROLS	CO1	Understanding Industrial automation and control			2								
			CO2	Understand working principles of different sensors			2								
			CO3	Understand working principles of prime movers			2								
			CO4	Know the working of PLCs			2								
41	15 ME 4159	ROBOTIC MODELING ANALYSIS AND CONTROL	CO1	Analysis of manipulator kinematics		3									
			CO2	Understanding manipulator statics			2								
			CO3	Understanding manipulator dynamics			2								
			CO4	Understand programming languages			2								
42	15 ME 4160	MODELING AND ANALYSIS OF DYNAMIC PHYSICAL SYSTEMS	CO1	Analysis and Synthesis of systems		3									
			CO2	Understanding system response-Time domain			2								
			CO3	Understanding system response-Frequency domain			2								
			CO4	Carried out computer analysis and simulation		2									
43	15 ME 4161	THEORY AND DESIGN OF CONTROL SYSTEMS	CO1	Understand time response design and Digital control			2								
			CO2	Study different plots like Bode plot, polar plot, Nyquist plot etc.			2								
			CO3	Understand Modern control systems			2								
			CO4	Understand Linear control systems			2								
44	15 ME 4162	SMART MATERIALS FOR MECHATRONIC APPLICATIONS	CO1	Understand applications of smart materials			2								
			CO2	Design of smart actuation and control systems		2									
			CO3	Application of piezoelectric actuators			2								
			CO4	Know the future applications of smart materials			2								
45	15 ME 3253	FRACTURE MECHANICS	CO1	Understand Crack growth and fracture mechanics			2								
			CO2	Development of stress field equations in fracture mechanics	2										
			CO3	Know the various methods for evaluating stress intensity factors			2								
			CO4	Understand how to perform fracture toughness testing		2									
46	15 ME 4163	MECHANICAL VIBRATIONS	CO1	Understand and analyze free and forced vibrations		2									
			CO2	Understand Torsional vibrations		2									
			CO3	Understand principle modes of vibrations	2										
			CO4	Understand Mutli-Degree of freedom systems			2								

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47	15 ME 4164	PRODUCT DESIGN	CO1	Understand design models and product life cycle			2								
			CO2	Understand concept to Design for Manufacturing			2								
			CO3	Understand concept to Design for Assembly			2								
			CO4	Understand concept to Design for environment and design for sustainability			2								
48	15 ME 4165	FLEXIBLE MANUFACTURING SYSTEMS	CO1	Understand Group Technology Techniques			2								
			CO2	Understand CAPP techniques			2								
			CO3	Understand FMS			2								
			CO4	Understand AGV and ASRS systems			2								
49	15 ME 4166	REVERSE ENGINEERING AND RAPID PROTOTYPING	CO1	Analyze the need of reverse engineering	2										
			CO2	Understand working principles of RP techniques			2								
			CO3	Understand Rapid tooling and RP case studies			2								
			CO4	Understand applications of RP techniques			2								
50	15 ME 4167	CONDITION MONITORING AND FAULT DIAGNOSIS	CO1	Understand types of maintenance			2								
			CO2	Understand Equipment downtime and breakdown analysis			2								
			CO3	Perform Equipment health monitoring			2								
			CO4	Perform and analyze vibration characteristics			2								
51	15 ME 4168	EXPERIMENTAL STRESS ANALYSIS	CO1	Understand three-dimensional stress strain relations			2								
			CO2	Understand Brittle coatings			2								
			CO3	Understand moiré methods			2								
			CO4	Understand photo elasticity			2								
52	15 ME 4169	ADVANCED MECHANISMS DESIGN	CO1	Kinematic analysis of mechanisms			2								
			CO2	Perform path curvature theory			2								
			CO3	Synthesis of mechanisms			2								
			CO4	Understand spatial mechanism and robotics			2								

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53	15 ME 4170	COMPUTATIONAL FLUID DYNAMICS	CO1	Understand numerical methods	2										
			CO2	Apply time integration methods			2								
			CO3	Understand numerical grid generation and mapping			2								
			CO4	Apply Navier Stokes Equations			2								
54	15 ME 4171	REFRIGERATION & AIR-CONDITIONING	CO1	Understand working principle of air refrigeration system			2								
			CO2	Understand vapour compression and absorption systems			2								
			CO3	Understand working of steam jet refrigeration system			2								
			CO4	Perform Air-conditioning load calulations		2									
55	15 ME 30B4	ROBOTICS	CO1	Analyze existing robotic systems with respect to their anatomy, type, performance specifications, end effectors etc.		2									
			CO2	Suggest a robotic system design with respect to the suitable sensors, actuators for an intended application and simulate its performance			2								
			CO3	Analyze robot manipulator performance with respect to digital control architecture comprising of PLC's / Microcontroller for an application		2									
			CO4	Understand different programming languages			2								
56	15 ME 30B5	MECHATRONICS	CO1	Identify appropriate sensors, actuator, microcontrollers etc. for a given application			2								
			CO2	Model system performance and estimate the expected system behaviour		2									
			CO3	Suggest a mechatronic product design for the intended application and evaluate its performance											
			CO4	Understand digital logic and PLC			2								
57	15 ME 30B6	OPERATIONS RESEARCH	CO1	Model and solve for the optimum solutions using LPP	2										
			CO2	Model and optimize transportation and assignment problems		2									
			CO3	Model and optimize Game theory, DPP, Queuing theory & Simulation problems					2						
			CO4	Understand concepts of PERT/CPM			2								
Total					92	104	187	8	79	12	28	9	1	9	46