lendi Institute of Engineering & Technology
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DEPARTMENT OF MECHANICAL ENGINEERING

R20 REGULATION COURSE OUTCOMES (CO)

R20 REGULATION		
II YEAR – I SEMESTER		
R20BSH-MA2101	Calculus and Partial Differential Equations	Utilize mean value theorems to real life problems, Apply Infinite series to real life problems.
		Understand the concept of Fourier Series and find Fourier Series, for different functions
		Understand the concept of Fourier transforms and find, Fourier transforms for different functions
		Form a partial differential equation and solve first order linear and non-linear partial differential equations.

		solve higher order homogeneous partial differential equations. Method of separation of bles.
R20MEC-PC2101	Mechanics of solids	Determine the mechanical behaviour of engineering materials when subjected to various types of stresses and strains, and estimate the resulting stresses on the principal plane.
		Analyse how different kinds of beams bend when subjected to static loads, and find out how shear stress is distributed across various beam cross sections.
		Estimate the shear, bending, and deflection stresses as well as the slope of a beam.
		Determine the longitudinal and circumferential stresses in thick and thin cylinders that are subjected to internal and external pressure.
		Apply Euler's and Rankine's formulae to determine the buckling load of columns under different end conditions.
R20MEC-PC2102	Machine Drawing	Identify conventional representation of machine components and temporary fastenings.
		Develop views of permanent fastenings.
		Draw the projections of shaft couplings.
		Create the views of bearings.
		Construct an assembly drawing using part drawings of machine components.
R20MEC-ES2101	Engineering Thermodynamics	Identify concepts of heat, work, energy and governing rules for conversion of one form to other.
		Explain relationships between properties of matter and basic laws of thermodynamics.
		Explain the concept of available energy for maximum work conversion.
		Analyze the steam properties for working of steam power plants.
		Provide the fundamental concepts of thermodynamics cycles used in steam power plants, IC engines and gas turbines.
R20MEC-PC2103	Kinematics of Machinery	Analyze the mechanical systems with a deep understanding of kinematic principles and mechanisms.

		Analyze various mechanisms for straight line motion and their applications including steering mechanisms.
		Understand the velocity and acceleration concepts and the methodologies using graphical methods, the theories involved in cams, applications of cams and their working principles.
		Design of gears, power transmission through different types of gears and gear trains.
		Analyze various power transmission mechanisms of belt drives, and working principles.
R20MEC-PC2104	Computer Aided Engineering Drawing	Apply the various commands in AutoCAD for drafting the geometrical entities.
		Draw the orthographical projections of solids.
		Analyze the intricate details of solid parts through sectional views.
		Develop the surfaces of solids for optimization of material requirement.
		Model the 2D and 3D objects using CAD software.
R20MEC-PC2105	Mechanics of Solids Lab	Understand the stress-strain relations of Mild Steel, Tor Steel, Copper, Aluminium, and other materials through tension/compression tests.
		Determine compressive and shear strength of wood, GI sheet, and hardness numbers of Steel, Brass, Aluminium, and Copper.
		Analyse modulus of rigidity for Solid and Hollow shafts made of steel and aluminium.
		Calculate Young's modulus by conducting deflection tests on various beam configurations.
		Analyse the impact strength, buckling load of materials and deflection in leaf springs with experimental testing.
R20MEC-ES2102	Material Science and Engineering Lab	Identify various microstructures of steels and cast irons.
		Evaluate hardness of treated and untreated steels.
		Analyze the hardenability of steels.

		Examine the microstructure of heat-treated steels.
		Identify the microstructure of non-ferrous alloys.
II YEAR – II SEMESTER		
R20BSH-MA2201	Complex Variables and Statistical Methods	Examine the analyticity of complex functions
		Evaluate complex integration using Cauchy's theorems and Cauchy's residue theorem.
		Compute probabilities, theoretical frequencies using discrete and continuous probability distributions for real data
		Apply the concept of hypothesis test to large samples.
		Apply statistical inferential methods to small samples
R20MEC-PC2201	Dynamics of Machinery	Explain the stabilization of sea vehicles, aircrafts and automobile vehicles.
		Apply the concepts of friction and its applications in various mechanical systems.
		Analyze the concept of slider crank mechanism, flywheel and governors.
		Analyze the balancing of rotating masses in single and multiple configurations across single and different planes utilizing both analytical and graphical methods.
		Analyze the dynamic behavior of mechanical systems subjected to free vibration, transverse loads, and various types of mechanical excitations.
R20MEC-PC2202	Fluid Mechanics & Hydraulic Machinery	Understand the fluid properties and importance of pressure measurement in fluid systems
		Imparting the Fluid equations (Energy, Momentum and Bernoulli's) in practical applications and concept of boundary layer theory and analyse different types of losses in fluid flow systems.
		Describe the importance of impulse momentum equation to Calculate the impact of jet on different types of vanes
		Analyse the various components of turbines and study their characteristics curves, power, and performance of the turbines.

		Calculate the performance of different types of pumps.
R20MEC-PC2203	Production Technology	Develop the fundamental Conept of the casting along with the various issues related to patterns.
		Analyze the different bulk forming techniques.
		Apply the principles of various forging operations.
		Summarize the applications, advantages of various welding processes.
		Explain various plastic deformation processes
R20BSH-HM2203	Managerial Economics and Industrial Management	.apply the forecasting techniques to estimate the demand of the goods.
		determine the breakeven point for cost optimization
		outline the functions of Management
		select inventory control techniques to optimize total costs of controlling the inventories.
		apply the concepts of CPM/PERT for Project Management.
R20MEC-PC2204	Production Technology Lab	Understood how To made different patterns, Mould preparation, Melting and Casting
		Understood usage, operations and applications of welding like ARC, GAS and TIG
		Analyzed Brazing and Soldering operations and their applications
		Described how to do Blanking & Piercing operations with simple, compound and progressive dies on Mechanical press
		Explained about bulk forming processes and sheet metal operations like Deep drawing and sheet bending operations on Hydraulic Press.
R20MEC-PC2205	Fluid Mechanics & Hydraulic Machinery Lab	Apply laws of conservation in verification of principles of fluid flow
		Calibrate flow measuring devices such as Venturimeter, orifice meter
		Examine the water supply pipe networks, by evaluating the losses incurred in pipes
		Identify suitable pumps and turbines for different working conditions
		Analyze the performance characteristics of Hydraulic Machines
R20MEC-PC2206		Evaluate critical speed of shaft, by varying different speeds, balancing of masses and also

	Theory of Machines Lab	moment of inertia of flywheel.
		Determine the working of different governors and coefficient of friction between belt and pulley.
		Analyze the effect of Gyroscopic couple, efficiency of screw jack and velocity, accelerations of slider crank mechanism
		Calculate the frequency of damped and undamped at free and forced vibration of an equivalent spring mass system.
		Explain the types of gears- Spur, Helical, Worm and Bevel Gears.
R20 REGULATION		
III YEAR - I SEMESTER		
R20MEC-PC3101	Design of Machine Members	understand the design procedure to engineering problems with technical and manufacturing constraints.
		apply the theories of failures on machine elements under the action of loads.
		analyze the bolted, riveted and welded joints under static and fatigue loads.
		design the impended loads for the keys, cotters and knuckle joints to ensure safe design.
		analyze the stresses induced in shafts and couplings.
R20MEC-PC3102	Metal Cutting & Machine Tools	Understand the mechanism of orthogonal and oblique cutting, the cutting forces developed.
		Discuss the Lathe operations Using Lathe Machine, Learned how to Use Lathe Tools and Importance of Lathe Machines.
		Analyze the Usage, operation s and Applications of Drilling, Boring Machines and their Tools
		Explain the Usage, operations and Applications of Milling Machines, shaping, plannig and their Tools.
		Describe the operations and Applications of Grinding Machines and their Tools, Importance Of Jigs, Fixtures.
		Compare the engine working on Air cycles and Air-fuel cycles

R20MEC-PC3103	IC Engines & Turbo Machinery	Analyze the combustion process and factors effecting Knocking
		Identify the suitable injection, ignition, cooling, lubrication and governing systems of an Light motor and Heavy Vehicle
		Analyze engine performance characteristics for the given operating conditions
		Calculate the efficiency of turbo machinery for the given operating conditions
R20EEE-OE3101.2	Green Energy systems	Understand the classification of energy sources and their global and India-specific implications for sustainable development.
		Recognize the impact of energy technologies on ecosystems, including pollution sources, and explain the role of environmental laws in mitigating these impacts.
		Classify between solar and wind energy conversion principles and technologies and evaluate their potential for addressing energy needs.
		Explain the concept of ocean energy conversion and assess the significance of biomass as a renewable energy resource.
		Analyse various alternative energy sources, including geothermal, nuclear, and emerging technologies, and their contributions to the energy landscape.
R20CSE-OE3101.3	Data Base Management System Industrial Management	Identify major advantages of database system over file system
		Design ER-model and Relational models for different applications
		Analyze schema refinement techniques to reduce data redundancy and concurrency etc
		Identify the causes and consequences of deadlocks in a database system
		Choose different data structures used for indexing
R20MEC-PE3101.4	Advanced Machining Process	Illustrate the working principles of various modern manufacturing processes.
		Analyze the metal removal rate and issues related with unconventional machines.
		Identify the process parameters in the unconventional machining processes.
		Examine the economic implications when the unconventional machines are used.

		Identify the unconventional machines of electron beam and plasma machining for machining different materials.
R20MEC-PC3104	Metal Cutting & Machine Tools lab	Apply various lathe techniques to produce different shapes and forms.
		Perform drilling operations on various materials, adjusting settings as needed to achieve desired outcomes.
		Demonstrate the setup and calibration of shaper, slotting, and planning machines for specific machining tasks
		Understanding the surface grinding machine and can perform various operations to prepare different shapes of products.
		Operate milling machine, with understanding working principle and can perform various operations to prepare different shapes of products.
R20MEC-PC3105	Thermal Engineering Lab	Draw the valve and port timing diagram of SI engine & CI engine
		conduct performance test on IC engines & Reciprocating compressors.
		analyze the heat energy distribution using heat balance sheet for twin cylinder C.I engine
		calculate the frictional power of an IC Engine
		find the Economical speed of the engine.
R20CSE-SC3101	Python (Skill Development Course)	Apply the basic fundamentals of scripting language for solving simple python programs.
		Make use of data types, operators and control structures in program algorithm
		Apply the concept of modularity and implement different packages to solve complex problems.

		Apply the concepts of data structures to real world data.
		Categorize Object oriented concepts to handle different errors through exceptions.
R20BSH-MC3101	3D Printing Technology	Know the importance of 3D printing in Manufacturing
		Understand the liquid-based 3D printing system
		Illustrate the solid-based 3D printing system
		Explain the powder based 3D printing system
		Elucidate the application 3D printing in medical field
III YEAR – II SEMESTER		
R20MEC-PC3201	Design of Power Transmission Elements	Choose the suitable bearing depending upon the application and predict life of that bearing. .
		Solve Problems on curved beams.
		Evaluate different I.C Engine parts under the action of forces.
		Analyze the power transmission using power screws
		Analyze the load concentration factor, dynamic load factor, surface compressive strength, bending strength of spur & helical gear drives
R20MEC-PC3202	Heat Transfer	Compute the steady state heat transfer by using Fourier heat conduction equation for cartesian, cylindrical and Spherical coordinates.
		Compute the effectiveness and efficiency in extended surfaces and develop solutions for transient heat conduction in simple geometries.
		Analyse heat transfer coefficients for forced convections by using empirical relations.

		Calculate heat transfer coefficients for natural convections, rate of condensation and Evaporation by applying Boiling and Condensation heat transfer mechanism.
		Analyse heat exchanger performance and radiation heat transfer between black body & gray body surfaces
R20MEC-PC3203	Mechanical Measurements and Metrology	understand the working principles of measuring devices and errors in measurements
		explain the need for limits, fits and tolerances of work parts and design the inspection gauges
		illustrate the different methods of measurement of angles and tapers.
		infer the working of comparators, screw thread and gear teeth measuring instruments.
		identify appropriate transducers and devices for the measurement of pressure, speed, force, torque, humidity, acceleration and vibrations.
R20MEC-PE3201.1	CAD/CAM	Apply the basics of geometric transformations for image processing.
		Illustrate various geometric modeling methods for building CAD models
		understand the concepts of parametric representation to curves and surfaces
		apply the coding system for CNC programming
		explain the significance of Group Technology and Computer Integrated Manufacturing in automated systems
R20MEC-PE3201.4	Refrigeration and Air Conditioning	Illustrate the operating cycles and different systems of refrigeration.
		Analyze coefficient of performance of vapour compression Refrigeration systems
		calculate coefficient of performance by conducting test on vapour absorption and steam jet refrigeration systems.
		solve cooling load for air conditioning systems and the requirements of comfort air conditioning.
		explain different component of refrigeration and air Conditioning systems
R20EEE-OE3201.2	Non-Conventional Energy Sources	Understand the classification of energy sources and their global and India-specific implications for sustainable development.

		Recognize the impact of solar thermal systems and solar power plants and explain the role of environmental laws in mitigating these impacts.
		Between solar thermal systems and solar photovoltaic systems and evaluate their potential for addressing energy needs
		Explain the concept of wind energy conversion and assess the significance of geothermal energy as a renewable energy resource.
		Analyse various alternative energy sources, including tidal power, bio-mass energy and fuel cell emerging technologies and their contributions to the energy landscape.
R20BSH-OE3201.3	Operations Research	construct mathematical models for allocation problems.
		test for optimality to arrive the optimal solution for transportation and assignment problems.
		solve the problems of waiting lines and scheduling to arrive the optimal decisions.
		apply the concepts of PERT and CPM for project management
		develop a simulation model of discrete systems under uncertainties
R20MEC-PC3204	CAE Lab	Classify the types of Trusses (Plane Truss & Spatial Truss) and Beams (2D & 3D) with various cross sections to determine Stress, Strains and deflections under static, thermal and combined loading.
		Determine Plane stress, plane strain conditions & axisymmetric loading on plane members to predict the failure behavior and finding the SCF.
		Analyse connecting rod with tetrahedron and brick elements, performing static analysis on flat & curved shells to determine stresses, strains with different boundary conditions.
		Predict the natural frequencies and modes shapes using Modal, Harmonic analysis. Also finding the critical load using Buckling analysis
		Evaluate various part programming methods using different NC or CNC packages
R20MEC-PC3205	Heat Transfer Lab	Calculate heat transfer through lagged pipe, insulating powder and Drop and Film wise condensation.

		Find out the thermal conductivity of metal Rod and the overall heat transfer coefficient for a composite slab.
		Calculate the Heat transfer coefficient for Pin Fin, Forced convection, Natural Convection
		Analyse the performance of Fins and Heat exchanger in different configurations
		Determine the emissivity of test plate surfaces and validate the Stefan-Boltzmann constant by using Stefan-Boltzmann apparatus and interpretation of experimental data.
R20MEC-PC3206	Mechanical Measurements and Metrology Lab	measure length, height, diameter and angles using various instruments
		measure surface roughness with roughness measurement instrument
		make use of resistant temperature detector for temperature measurement
		demonstrate LVDT transducer and rotameter
		find the angle of specimens with sine bar and Vernier bevel protractor
R20BSH-MC3201	Entrepreneurship & Incubation	Enriches the knowledge of Entrepreneurial behavior, and skill development.
		Initiate business ideas that have value in the end-market.
		Identify the validity of idea and its unique selling proportion.

		Comprehend opportunity and challenges of-start up
		Analyze various Government and non-Government financial resource
R20 REGULATION		
IV YEAR - I SEMESTER (20KD Batch)		
R20MEC-PE4101.1	Finite Elements Analysis	Explain basic principles of finite element analysis, stress-strain relations and different models for formulation of finite element equations.
		Apply the basics of FEM to relate stresses and strains for structural elements such as bars for calculation of stiffness matrices, load vectors, stress-strain relations and displacements.
		Identify the applications and characteristics of FEA elements for trusses & beams for calculation of stiffness matrices, load vectors, stress-strains and displacements
		Apply the formulation techniques to solve 2D problems using triangle, axi – symmetric elements and quadrilateral elements.
		Identify how the finite element method expands beyond the structural domain, for problems involving dynamics, heat transfer and fluid flow.
R20MEC-PE4102.2	Automation In Manufacturing	Understand the characteristics of Automated Systems
		Illustrate operational aspects of flowlines
		apply the methods to balance the assembly ine
		Compare conventional and automated material transport ,storage system.
		Explain the level of automation in continuous and discrete manufacturing industries.
		explain the working of hybrid and electric vehicles

R20MEC-PE4102.3	Power Transmission in Hybrid & Electric Vehicles	select a suitable drive scheme for developing a hybrid and electric vehicles depending on resources
		develop the electric propulsion unit and its control for application of electric vehicles.
		choose proper energy storage systems for vehicle applications
		evaluate electric vehicles and hybrid electric vehicles transmission characteristics
R20MEC-PE4103.4	Advanced Materials	To explain basic concepts of composite Materials and their properties. To understand the basic requirements for the composite materials.
		Analyze the different polymers and manufacturing process of PMC,MMC,CMC,CCC Materials.
		Explain the basic Manufacturing methods of Polymer matrix composite materials and practical applications.
		Analyze The Affect of Macro mechanical Analysis of A Lamina Used In Practical Applications.
		To know the properties and applications of functionally graded materials and shape memory alloys
		To explain the properties and applications of Nano Materials
R20EEE-OE4103	Basics of Utilization of Electrical Energy	Understand the concept of illumination and working principle of various lamps and Design and Calculations of Illumination for different lighting schemes
		Understand the electrical heating and welding methods
		Analyze the various equipment associated with electric traction system

		Determine the speed time curves of different services and to Estimate Energy Consumption levels at various modes of operation
		Understand the concepts of Economic Aspects of Utilizing Electrical Energy
R20BSH-OE4103	Optimization Techniques in operation management	develop the facility layouts for mass production and job order production systems.
		select inventory control techniques to optimize total costs of controlling the inventories.
		analyze the aggregate planning strategies for cost optimization
		compare the scheduling strategies for job order and batch production systems.
		apply the concepts of operational economics
R20BSH-OE4104	Supply Chain Management	explain the strategies and models of Supply Chain Management
		identify the prospective supplier with Vendor rating
		analyze the inventory control costs related to deterministic models.
		apply the inventory management concepts to uncertainty cases.
		choose the criteria for Supply Chain Management decisions
R20EEE-OE4102	Energy conservation and Auditing	Understand the current energy scenario and importance of energy conservation.
		Understand the concepts of energy audit and energy conservation systems.
		Understand the Importance of Energy conservation Act 2001 and its significance
		Analyze the performance of electrical utilities and its efficient improvement approaches.
		Calculate payback period, NPV, IRR for the investment on technological projects.
R20BSH-HM4101	Universal Human Values and	Enrich The Knowledge On Need of Value Education.
		Consider human beings as the Co-existence of the Self and the Body

	Understanding Harmony	Identify the basic unit of human interaction with family
		Comprehend the harmony in the nature
		Analyze and explore Ethical Human Conduct.
R20MEC-SC4101	Computational Fluid Dynamics (Skill Oriented Course-5)	Select the suitable computational method for specified Fluid flow conditions
		Analyze the critical parameters of flow for the specified fluid flow conditions.
		Apply appropriate solution strategy for the given incompressible fluid system
		Formulate CFD problem for the given boundary conditions of fluid flow.
		Use the software tools to solve the specified fluid flow problem

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