Institute of Engineering & Technology
An Autonomous Institution
Accredited by NAAC with '' A'' Grade, Accredited by NBA (ECE, CSE.EEE & MECH)
Approved by A.I.C.T.E. & Permanently Affiliated to J. N. T. U. Gurajada, VIZIANAGARAM
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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE OUTCOMES (COs)

ACADEMIC YEAR 2022-23

R20 REGULATION		
I Year - I Semester (22KD Batch)		
COURSE CODE	**COURSE NAME**	**COURSE OUTCOMES**
R20BSH-EN1101	**Communicative English**	Understand the value of Human Conduct for career development through life skills: Ethics & Values and use root words and Prepositions without errors. Gain reading skills for

		comprehension, specific information, gist, and pleasure through extensive reading. Enhance pronunciation with befitting tone for clarity in a speech to communicate language effectively.
		Observe the significance of imagery in poetry to use it in real-time contexts and learn to use and misuse of Articles, Prefixes, Suffixes, and Punctuations. Gain reading skills for comprehension, specific information, gist, and pleasure through extensive reading. Participate in short conversations in routine contexts on topics of interest and ask questions and make requests politely.
		Acquire conversation skills through drama and enhance the correct use of Nouns, Pronouns, Verbs and Concord to write paragraphs effectively. Gain reading skills for comprehension, specific information, gist, and pleasure through extensive reading. Listen for specific information, gist, note-taking, note-making and comprehension and develop convincing and negotiating skills through debates
		Develop reading for inspiration, interpretation & innovation and learn to use modifiers, synonyms and antonyms to write essays effectively. Gain reading skills for comprehension, specific information, gist, and pleasure through extensive reading.
		Learn meaningful use of language by avoiding meaningless cliches, bureaucratic euphemisms and academic jargon in order to acquire the skill of summarising. Gain reading skills for comprehension, specific information, gist, and pleasure through extensive reading.
R20BSH MA1101	**Numerical Method and Ordinary Differential Equations**	Solve non-linear equations using various numerical methods and apply numerical methods to find interpolation polynomial for a given data
		Apply numerical methods to evaluate derivatives and integration of a function and find the solutions of ordinary differential equations.
		Solve the first order ordinary differential equations related to various engineering fields

		Solve the higher order differential equation and analyze physical situations
		Apply the Laplace transform for solving differential equations and integral equations.
R20BSH-CH1103	**Engineering Chemistry**	Illustrate the properties and applications of polymers
		Design the metallic materials to prevent the corrosion.
		Assess the quality of fuels and identify the suitable one.
		Analyze the suitable method for industrial water treatment.
		Demonstrate the preparation, properties and applications of nano materials and importance of green chemistry.
R20CSS-ES1101	**Computer Programming in C**	Illustrate the Fundamental concepts of Computers and basics of computer programming
		Use Control Structures and Arrays in solving complex problems.
		Develop modular program aspects and Strings fundamentals.
		Demonstrate the ideas of pointers usage.
		Solve real world problems using the concept of Structures, Unions and File operations
R20MEC-ES1102	**Engineering Graphics**	Apply the basics of Engineering Graphics to construct the polygon, curves and orthographic projections of points.
		Draw the orthographic projections of straight lines inclined to both the planes.
		Draw the projections of planes in various conditions.
		Draw the projections of regular solids, its axis inclined to one of the principle plane.
		Develop 3D isometric views from 2D orthographic views and vice versa.
R20BSH-CH1106	**Engineering Chemistry Lab**	Prepare polymers and nano materials.
		Explain the functioning of the instruments such as Conductivity meter, pH meter, Viscometer, Cleveland’s apparatus.
		Analyze the quality of ground water sample.

		Compare kinematic viscosity, acid number, and flash and fire points of different lubricating oils.
		Identify the safety precautions to carry out the experiments in the laboratory using chemicals.
R20MEC-ES1103	**Engineering Workshop & IT Workshop Lab**	Apply wood working skills in real world applications.
		Build different parts with fitting in engineering applications
		Develop various basic prototypes in black smith & tiny smith applications.
		Apply different types of basic electric circuit connections.
		Understand the basic components, peripherals and basic operations of a computer.
R20CSS-ES1103	**Computer Programming in C Lab**	Implement basic programs in C and design flowcharts in Raptor.
		Use Conditional and Iterative statements to solve real time scenarios in C
		Implement the concept of Arrays and Modularity and Strings.
		Apply the Dynamic Memory Allocation functions using pointers.
		Develop programs using structures.
R20BSH-MC1101	**Environmental Science**	Understand about the environment and natural resources
		Understands about various attributes of different types of pollution and their impacts on the environment and control methods along with waste management practices.
		Illustrate about the ecosystem and know the importance of conservation of biodiversity
		Relate the current environmental impacts with societal problems.
		Identify the current population explosion and their impacts on the environment
I Year –II Semester (22KD Batch)		
R20BSH-MA1201	**Linear Algebra and Multivariable Calculus**	Apply the matrix algebra techniques to engineering applications.
		Apply the concepts of eigenvalues and eigenvectors to free vibration of a two mass system
		Apply partial differentiation to find maxima and minima of functions of several variables

		Evaluate the volume and surface area of solids using multiple integrals.
		Apply vector differential operators to find potential functions and estimate the work done against a field, circulation and flux using vector integral theorems.
R20MEC-ES1203	**Material Science and Engineering**	Explain basic concepts of bonds in metals and alloys.
		Understand the Iron-Iron-carbide diagram and Cooling curves.
		Explain the principles of surface hardening methods.
		Classify various types of steels, cast irons and their properties and applications.
		Explain the importance of non-ferrous metals and alloys in engineering applications.
R20BSH-PH1203	**Engineering Physics**	Interpret the interaction of optic energy with matter on the basis of interference & polarization 2. 3. 4. 5
		Explain the various types of crystal systems
		Apply the principles of Lasers and Acoustics to mechanical systems
		Describe the properties and applications of Ultrasonic'.
		Identify the fundamentals of modern engineering materials
R20MEC-ES1202	**Engineering Mechanics**	Find the resultant for any number of forces in mechanical system with (or) without application of concept of friction.
		Analyze the simple Structures& estimation of the work done by the forces.
		Determine the centroid /centre of gravity/moment of inertia for composite sections.
		Analyze the motion of the bodies with (or) without the application of force.
		Determine the displacement, velocity &acceleration relations in dynamic systems.
R20EEE-ES1201	**Basic Electrical & Electronics Engineering**	Apply concept of KVL/KCL and network theorems in solving electrical circuits 2. 3. 4. 5
		Understand the principle of operation of different DC Machines.
		Measure the performance quantities such as losses, efficiency of transformers

		Understand the importance and applications of p-n junction diode, Zener diode and rectifiers.
		Apply different modes of op-amps in different applications.
R20BSH-EN1201	**Communicative English Lab**	Acquire Listening skills for answering questions, make formal presentations without graphical elements, prioritize information from reading texts, paraphrase short academic texts and get awareness about plagiarized content and academic ethics.
		Comprehend academic lectures by taking notes,, make formal presentations on academic topics using PPT slides with relevant graphical elements, distinguish facts from opinions while reading, write formal letters and emails and use a range of vocabulary in formal speech and writing.
		Participate in group discussions using appropriate language strategies, comprehend complex texts, produce logically coherent argumentative essays and use appropriate vocabulary to express ideas and opinions..
		Draw inferences and conclusions using prior knowledge and verbal cues, express thoughts and ideas accurately and fluently, develop advanced reading skills for a deeper understanding of texts, prepare a CV with a cover letter to seek internship/ job, and understand the use of passive voice in academic writing.
		Develop advanced listening skills for an in-depth understanding of academic texts, make presentations collaboratively, understand the structure of Project Reports and use grammatically correct structures with a wide range of vocabulary.
R20BSH-PH1205	**Engineering Physics Lab**	Apply the working principles of laboratory experiments in optics, mechanics and acoustics.
		Compute the required parameter by suitable formula using experimental values in mechanics, optics & acoustic experiments.
		Analyze the experimental results through graphical interpretation.

		Recognize the required precautions to carry out the experiment and handling the apparatus in the laboratory.
		Demonstrate the working principles, procedures and applications.
R20EEE-BS1204	**Basic Electrical and Electronics Engineering Lab**	Prove the laws and theorems
		Analyze the characteristics of DC Machines
		Identify the performance of a Transformer
		Analyze the V-I characteristics of diode
		Develop Inverting and Non-Inverting Amplifier using PSPICE
R20 REGULATION		
II YEAR – I SEMESTER (21KD Batch)		
R20BSH-MA2101	**Calculus and Partial Differential Equations**	Apply mean value theorems to real world problems.
		Find the Fourier series of functions
		Evaluate Fourier integral, Fourier transform and inverse Fourier of a given function.
		Solve partial differential equations of first order using analytical methods.
		Solve wave equation and heat equations by using partial differential equation methods.
R20MEC-PC2101	**Mechanics of solids**	Understand basic concepts of stress and strain in solids and apply this knowledge during the analysis of thermal stresses and principles stresses in structures.
		Analyse the shear force and bending moment diagrams for designing of beams for given load conditions.

		Determine the bending stress, shear stress and deflection in beams to select the appropriate geometry of beam for the requirement.
		Calculate the stresses and strains produced in pressure vessels, fluid storge vessels for the given internal pressure.
		Compute the buckling load for columns with different end conditions and torsional shear strength of a machine members such as shafts, spindles, and axles.
R20MEC-PC2102	**Machine Drawing**	Learning the basic concepts of conventional representation and can easily acquire knowledge on different types of engineering materials.
		Understanding the section of planes and easily understand the different types of views including auxiliary views.
		Understanding common abbreviations & their liberal usage of drawings can easily access the development of a section or an assembly with ease.
		Understanding fasteners one can easily understands the classifications and types of fasteners and different forms of joints as well.
		Learning how to draw an assembly and how one can easily understand how to join the parts together and also can get a sound knowledge on the types of parts that are within the assembly.
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**	Describe the purpose of kinematics, Kinematic joint and mechanism and to study the relative motion of parts in a machine without taking into consideration the forces involved.
		Analyze various mechanisms for straight line motion and their applications including steering mechanisms.
		Describe 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 including gear profiles and its efficiency
		Analyze various power transmission mechanisms of belt drives, gear trains 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**	Analyse the microstructures for pure metals and alloys.
		Correlate microstructure with mechanical properties of diverse Cast iron types.
		Assess hardenability using the Jominy End Quench Test.
		Understand the impact of heat treatment on steel microstructures.
		Evaluate hardness of untreated and treated steels using appropriate techniques
R20BSH-SC2101	**Employability Skills (Skill Oriented Course)**	Enable students to identify Parts of Speech and use them flawlessly, write Emails in formal correspondence effectively, participate confidently by introducing oneself in any formal discussion.
		Attain Language Proficiency & Accuracy through Contextualized Vocabulary, Verb forms, Tense and subject verb agreement, produce coherent expressions for professional writing, introduce themselves unhesitatingly with Task-Based Activities.
		Develop the fluency and accuracy to write Technical Reports and Emails for professional communication by using appropriate vocabulary and participate confidently in any formal discussion.

		Assimilate lifelong reading habit to comprehend a passage for its gist. Avoid the errors in both Speech & Writing and write Letters and Emails for official communication.
		Realise the technical communicative competence and attainment of grammatically correct structures for formal communication.
R20BSH-MC2102	**Essence of Indian Traditional Knowledge**	Knowledge about the concept of traditional knowledge
		Apply significance of traditional knowledge protection
		Analyze various enactments related to the protecting facets of traditional knowledge
		Evaluate the significance Traditional Knowledge and modern food.
		Compare the traditional knowledge in various sectors
II YEAR – II SEMESTER (21KD Batch)		
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
		Solve the problems of frictional losses, torque transmission of mechanical systems
		Analyze the concept of slider crank mechanism, flywheel and governors
		Demonstrate the methods of balancing of rotating masses and balancing of reciprocating masses as well
		Identify the methods to calculate the natural frequencies of undamped and damped systems.

R20MEC-PC2202	**Fluid Mechanics& Hydraulic Machinery**	Understand the fluid properties and importance of pressure measurement in fluid systems
		Understand 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 Concept of the casting along with the various issues related to patterns
		Analyze the different bulk forming techniques
		Understand 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 Managemen
		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.
		Understood how to make different hallow and solid plastic products using Injection Molding & Blow Molding machines
R20MEC-PC2205	**Fluid Mechanics& Hydraulic Machinery Lab**	Understand the principles of fluid flow and the operation of Venturi meters and Orifice meters. (Level 2)
		Apply calibration techniques to Venturi meters and Orifice meters to ensure accurate measurement of fluid flow rates.
		Calculate major losses in pipes due to friction to optimize system performance.
		Calculate of the impact of jets on vanes and the principles governing their operation in hydraulic systems.
		Analyse the performance characteristics of pumps and turbines.

R20MEC-PC2206	**Theory of Machines Lab**	Evaluate critical speed of shaft, by varying different speeds, balancing of masses and also 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
		Measure 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 Gear
R20BSH-SC2201	**MATLAB For Computational Methods (Skill Oriented Course)**	Apply MATLAB Basics for simple mathematical problems.
		Develop a program to find a real root of an equation using various numerical methods.
		Develop programs to find the interpolation values using Lagrange's and Newton's interpolation formulae for a given set of points.
		Develop programs to find solutions of ordinary differential equations using numerical methods.
		Develop programs to solve system of linear equations.
R20 REGULATION		
III YEAR - I SEMESTER (20KD Batch)		

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.
R20MEC-PC3103	**IC Engines & Turbo Machinery**	Compare the engine working on Air cycles and Air-fuel cycles
		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
R20CSE-OE3101.3	**Data Base Management System Industrial Management**	Understand File System Vs Databases.
		Design and implement ER-model and Relational models
		Construct simple and Complex queries using SQL.
		Analyze schema refinement techniques.
		Design and build database system for a given real world problem

R20BSH-OE3101.4	**Statistical Quality Control**	comprehend the importance of quality and role of statistical quality control.
		build knowledge of theoretical and practical aspects of process capability
		analyse the philosophy of statistical process control to interpret results.
		develop an understanding on quality control charts philosophies and frameworks.
		Identify the acceptance sampling plans to meet producer and consumer requirements.
R20MEC-PE3101.2	**Automobile Engineering**	illustrate the construction features of automobile engines and parts.
		analyze parts/modules in transmission system.
		explain types of steering mechanisms
		outline the working /features of suspension, braking and electrical systems
		analyze the methods for emission control of engine.
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 concept 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 (20KD Batch)		
R19MEC-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**	understand the modes of heat transfer and Steady state conduction
		compute the effectiveness and efficiency in extended surfaces
		analyze heat transfer coefficients for forced convections by using empirical relations
		analyze heat transfer coefficients for natural convections, regimes of boiling and mode of condensation heat transfer

		analyze heat exchanger performance and radiation heat transfer between black body & gray body surfaces.
R20MEC-PC3203	**Mechanical Measurements and Metrology**	Demonstrate a comprehensive understanding of the fundamental principles of measurement, encompassing the measurement of displacement, temperature, level, and various flow types.
		Distinguish between mechanical and electrical tachometers, explaining their principles for speed measurement, and demonstrating the practical application of these techniques.
		Analyze the design tolerances and fits for selected product quality.
		Analyze the surface measurement methods, assess gear measuring instruments for precise gear tooth profile measurement, and demonstrate proficiency in utilizing Coordinate Measuring Machines (CMM) with scanning techniques.
		Explain different power measuring instruments, considering their working principles and suitability for specific applications.
R20MEC-PE3201.1	**CAD/CAM**	Apply the basics of geometric transformations to position objects, shape object and change viewing positions of 2D or 3D images.
		Construct parametric representation of curves and surfaces
		Choose a suitable geometric modeling method for building CAD models.
		Develop the coding system for CNC programming to produce the designated part on the specified CNC machine.
		Explain the significance of Group Technology and Computer Integrated Manufacturing in automated systems.
R20EEE-OE3201.2	**Non-Conventional Energy Sources**	Understand the basic concepts of solar radiation, its data on earth's surface
		Explain the different types of solar thermal energy collectors
		Develop the maximum power point techniques in solar Photovoltaic Systems
		Understand the Wind energy conversion systems and the various geothermal resources
		Explain the methods of generation of electricity from tidal and chemical resource

R20BSH-OE3201.3	**Operations Research**	Construct Mathematical model for the allocation Problems
		test to arrive r optimal solutions in transportation and assignment problems
		solve the scheduling and competitive strategy problems
		apply the concepts of CPM/PERT for Project Management
		develop simulation model for discrete systems
R20MEC-PC3204	**CAE Lab**	Develop 3D models of machine components, complex geometries etc. using CATIA V6
		Develop assembly of the parts created to the whole mechanism using CATIA V6
		Develop 2D/3D sketches of the assembled parts and provide dimensions and symbols to generate 2D drawing
		Apply their knowledge in importing CAD geometries and to modify and mesh using different meshing methods and local meshing controls as a part of pre- processing of the FE problem in ANSYS workbench
		Analyse simple structural, fluid flow and thermal analysis problems in ANSYS
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 a given metal Rod and Determine the overall heat transfer coefficient for a composite slab
		Calculate the Heat transfer coefficient for Pin Fin, Forced convection, Natural Convection
		Design the Fins and Heat Exchangers
		test for Emissivity, Stefan Boltzmann Constant
R20MEC-PC3206	**Mechanical Measurements and Metrology Lab**	Acquire expertise in metrology for length, height, diameter, and angular measurements using various tools.
		Develop precision instrumentation skills through the calibration and use of transducers for angular displacement, flow, and temperature measurement.

		Enhance capabilities in assessing and measuring surface roughness using advanced equipment like Talysurf.
		find the angle of specimens with sine bar and Vernier bevel protractor
		Improve flow measurement skills by studying and calibrating a rotameter for accurate fluid flow measurement.
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 the opportunity and challenges of-start up
		Analyze various Government and non-Government financial resource.
R19 REGULATION		
IV YEAR - I SEMESTER (19KD Batch)		
R19MEC-PC4101	**Robotics**	Understand the basic components of robots
		Differentiate types of robot grippers
		Explain the manipulator kinematics
		Illustrate robot actuators and feedback components
		Elucidate the robot applications in manipulator
R19MEC-PC4102	**Engineering Metrology**	Design tolerances and fits for selected product quality.
		Understand the standards of length, angles, taper measurement
		Various optical measuring instruments and interferometry can be studied.
		The evaluation of surface finish and different comparators can be known.
		Various gear elements and thread elements can be inspected by choosing appropriate method and instruments.

		The machine tool alignment can be performed.
R19MEC-PC4103	**Operations Research**	Construct a mathematical model for allocation problems.
		Test for optimality to arrive at the optimal solution for transportation, assignment and sequencing models.
		Solve the problems of waiting lines and scheduling to arrive the optimal decisions.
		Apply the concepts of PERT and CPM for project management.
		Develop simulation model of discrete systems under uncertainties.
R19MEC-PE4101.2	**Power Transmission in Hybrid and Electric Vehicles**	Explain the Working of Hybrid and Electric Vehicles.
		Develop a Suitable Drive Scheme for Hybrid and Electric Vehicles Depending on Resources.
		Develop the Electric Propulsion Unit and its Control for Application of Electric Vehicles.
		Identify Proper Energy Storage Systems for Vehicle Applications.
		Compare Basic Schemes of Electric Vehicles and Hybrid Electric Vehicles.
R19MEC-PE4101.3	**Automation in Manufacturing**	Understand the characteristics of Automated Systems.
		Illustrate operational aspects of flowlines.
		apply the methods to balance the assembly line

		Compare conventional and automate material transport, storage system
		Explainthelevelofautomationincontinuousanddiscretemanufacturingindustries.
R19BSH-OE4101.2	**Total Quality Management & Six Sigma**	comprehend the importance of quality & role of statistical quality control
		analyze the assignable causes of variations in the process
		apply tools and techniques of Total Quality Management
		develop the frame-work of Six Sigma programme
		understand the Quality Systems in practice
R19CSE-OE4101.3	**Internet of Things (IoT)**	Summarize the IoT characteristics, principles and design methodology.
		Examine the typical connectivity and networking protocols typically used in a IoT design.
		Demonstrate design and development of embedded applications using Arduino and Raspberry Pi platforms.
		Recognize the importance of data processing and cloud services for IoT.
		Illustrate the different domains and applications of IoT eco-system.
R19MEC-PC4104	**Engineering Metrology Lab**	Understand the quality standards of engineering products in industries.
		Analyze the measurement of the surface roughness and perform alignment tests
		Develop the ability to apply the principles in instruments and measuring technique
		Demonstrate thread inspection with two wire/ three wire metho
		Demonstrate angle and taper measurements with bevel protractor, Sine bar, rollers and balls.(L2)

R19MEC-PC4105	**Computational fluid Dynamics Lab**	Solve problems of fluid mechanics and heat transfer with C program and MATLAB.
		Develop Programs in solving Transcendental, Tri-diagonal and algebraic equations using numerical techniques with C program and MATLAB
		Apply numerical differentiation, integration functions and methods in C and MATLAB.
		Analyze steady-state, Transient and radiation problems in heat transfer with ANSYS FLUENT
		Evaluate convective heat transfer in internal and external flow for different flow conditions with ANSYS-FLUENT.
R19MEC-SD4101	**Skill Development Course -2 Hyper Meshing and Analysis**	develop the concepts of HyperMesh, and its application to various Engineering Problems
		analyze the engineering problems using HyperMesh and factors influencing analysis process.
		outline the need and application of HyperMesh Tools depending on the type of Analysis (Structural/Thermal/Fluid flow)
		evaluate various results under different boundary conditions (Geometry/ Material properties/ loads)
		explain the domain of operation of Hypermesh for advanced applications (Dynamic analysis/Impact analysis
IV YEAR - II SEMESTER (19KD Batch)		
R19MEC-PE4201.2	**Nano Materials**	Understand historical developments and milestones in the field of nanomaterials.
		Apply basic mathematical and scientific principles to calculate and predict nanomaterial properties.

		Apply knowledge of synthesis methods to design and propose approaches for creating specific nanomaterials.
		Analyze characterization data from various techniques to determine the structure and properties of nanomaterials.
		Evaluate the ethical implications of widespread nanomaterial applications, considering issues related to safety, privacy, and societal impact.
R19MEC-PE4201.4	**Production Planning and control**	Summarize the production planning and control functions.
		Apply quantitative techniques for demand forecasting in manufacturing firms.
		Compare inventory management systems applicable to optimize cost to control different types of inventories.
		Analyze factors affecting in preparation of route sheets to make the product.
		Evaluate Scheduling methodologies applicable to job order and mass production system. (Level 4)
		Illustrate the Dispatching procedure
R19MEC-PE4202.2	**Non-Destructive Evaluation**	understand non-destructive destructive testing methods and radiographic testing in industries.
		explain ultrasonic testing and its effectiveness and limitations
		illustrate Liquid penetrate testing and types of penetrates used in die penetrating testing.
		identify internal flaws of the work piece using magnetic particle testing.
		apply knowledge of non-destructive testing techniques to test equipment/work pieces in various industrial/automobile sectors.
		Understand the Role, Applications, Benefits of NC/ CNC
		Explain the Methods of part Programming and Apply APT and its variations

R19MEC-PE4202.4	**CNC and Adaptive Control**	Explain tool offsets and work offsets.
		Apply the principle of gain scheduling controllers.
		Understand deterministic self-tuning regulators.

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