Hindustan College of Science and Technology
Farah-Mathura
(AICTE approved & affiliated to AKTU)

NAAC
CRITERIA-2

Metric No.- 2.6.1 (Q$_I$M)

Programme Outcomes (POs) and Course Outcomes (COs) for Mechanical Engineering

B.Tech. (Mechanical Engineering)
SEMESTER- III

Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	KOE031-38/ KAS302	Engg. Science Course/Maths IV	3	1	0	30	20	50		100		150	4
2	KAS301/ KVE301	Technical Communication/Universal Human Values	2	1	0	30	20	50		100		150	3
			3	0	0								
3	KME301	Thermodynamics	3	1	0	30	20	50		100		150	4
4	KME302	Fluid Mechanics & Fluid Machines	3	1	0	30	20	50		100		150	4
5	KME303	Materials Engineering	3	0	0	30	20	50		100		150	3
6	KME351	Fluid Mechanics Lab	0	0	2				25		25	50	1
7	KME352	Material Testing Lab	0	0	2				25		25	50	1
8	KME353	Computer Aided Machine Drawing-I Lab	0	0	2				25		25	50	1
9	KME354	Mini Project or Internship Assessment*	0	0	2			50				50	1
10	KNC301/ KNC302	Computer System Security/Python Programming	2	0	0	15	10	25		50			0
11		MOOCs (Essential for Hons. Degree)											
		Total										950	22

*The Mini Project or internship (3-4 weeks) conducted during summer break after II semester and will be assessed during III semester.

Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
		SEMESTER- IV											
			L	T	P	CT	TA	Total	PS	TE	PE		
1	KAS402/ KOE041-48	Maths IV/Engg. Science Course	3	1	0	30	20	50		100		150	4
2	KVE401/ KAS401	Universal Human Values/Technical Communication	3	0	0	30	20	50		100		150	3
			2	1	0								
3	KME401	Applied Thermodynamics	3	0	0	30	20	50		100		150	3
4	KME402	Engineering Mechanics	3	1	0	30	20	50		100		150	4
5	KME403	Manufacturing Processes	3	1	0	30	20	50		100		150	4
6	KME451	Applied Thermodynamics Lab	0	0	2				25		25	50	1
7	KME452	Manufacturing Processes Lab	0	0	2				25		25	50	1
8	KME453	Computer Aided Machine Drawing-II Lab	0	0	2				25		25	50	1
9	KNC402/ KNC401	Python Programming / Computer System Security	2	0	0	15	10	25		50			0
10		MOOCs (Essential for Hons. Degree)											
		Total										900	21

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SEMESTER-V

Sl. No.	Code	Subject	Periods			Evaluation Scheme			EndSemester			Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	KME 501	HeatandMass Transfer	3	1	0	30	20	50		100		150	4
2	KME 502	StrengthofMaterial	3	1	0	30	20	50		100		150	4
3	KME 503	IndustrialEngineering	3	1	0	30	20	50		100		150	4
4		DepartmentalElective-I	3	0	0	30	20	50		100		150	3
5		DepartmentalElective-II	3	0	0	30	20	50		100		150	3
6	KME 551	HeatTransferLAB	0	0	2				25		25	50	1
7	KME 552	Python Lab	0	0	2				25		25	50	1
8	KME 553	InternetofThingsLab	0	0	2				25		25	50	1
9	KME 554	MiniProjectorInternship Assessment*	0	0	2				50			50	1
10	NC+	ConstitutionofIndia/Essence of Indian Traditional Knowledge	2	0	0	15	10	25		50			
11		MOOCs(EssentialforHons.Degree)											
		Total	17	3	6							950	22

*TheMiniProjectorinternship(4-5weeks)conductedduringsummerbreakafterIVsemesterandwill be assessed during V semester.

SEMESTER-VI

Sl. No.	Code	Subject	Periods			Evaluation Scheme			EndSemester			Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	KME 601	RefrigerationandAir Conditioning	3	1	0	30	20	50		100		150	4
2	KME 602	MachineDesign	3	1	0	30	20	50		100		150	4
3	KME 603	TheoryofMachine	3	1	0	30	20	50		100		150	4
4		DepartmentalElective-III	3	0	0	30	20	50		100		150	3
5		OpenElective-I	3	0	0	30	20	50		100		150	3
6	KME 651	RefrigerationandAir Conditioning Lab	0	0	2				25		25	50	1
7	KME 652	MachineDesignLab	0	0	2				25		25	50	1
8	KME 653	TheoryofMachine Lab	0	0	2				25		25	50	1
9	NC+	EssenceofIndianTraditional Knowledge/ Constitution of India	2	0	0	15	10	25		50			
10		MOOCs(EssentialforHons.Degree)	17	3	6								
		Total										900	21

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SEMESTER-VII

Sl. No.	Code	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1		HSMC-1/HSMC-2	3	0	0	30	20	50		100		150	3
2		Departmental Elective-IV	3	0	0	30	20	50		100		150	3
3		Departmental Elective-V	3	0	0	30	20	50		100		150	3
4		Open Elective-II	3	0	0	30	20	50		100		150	3
5	KME 751	Measurement & Metrology Lab	0	0	2				25		25	50	1
6	KME 752	Mini Project or Internship Assessment*	0	0	2				50			50	1
7	KME 753	Project	0	0	8				150			150	4
8		MOOCs (Essential for Hons. Degree)											
		Total	9	0	12	21						850	18

*The Mini Project or internship (5 - 6 weeks) conducted during summer break after VI semester and will
be assessed during VII semester.

SEMESTER- VIII

Sl. No	Code	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1		HSMC-2/HSMC-1	3	0	0	30	20	50		100		150	3
2		Open Elective-III	3	0	0	30	20	50		100		150	3
3		Open Elective-IV	3	0	0	30	20	50		100		150	3
4	KME 851	Project	0	0	18				100		300	400	9
5		MOOCs (Essential for Hons. Degree)											
		Total	9	0	18	27						850	18

Program Outcomes (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and teamwork**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSOs

1. Exhibit their knowledge for problem identification and their respective solutions in the field of Design, Manufacturing, and Thermal Engineering.

2. Innovate, develop and apply scientific concepts, practical skills and advance tools in various

fields of Mechanical Engineering.

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Department: Mechanical Engineering
Course Outcomes COs-B.Tech 2nd ,3rd,4th Year
B.Tech 3rd Semester

THERMODYNAMICS	Sub Code BME301	CO1	To understand the basic terms of thermodynamics
		CO2	To apply I law to various energy conversion devices
		CO3	To evaluate the changes in properties of substances in various processes
		CO4	To understand the difference between high grade and low-grade energies
MATERIALS ENGINEERING	Sub Code BME303	CO1	Students will be able to identify the crystal structure and measure the mechanical properties of materials
		CO2	Students will be able to test the various failures of materials.
		CO3	Students will be able to identify the mechanical properties based on composition of micro-constituents depicted in the phase-diagram.
		CO4	Students will understand the concept of improving the mechanical properties through heat treatment.
		CO5	Students will learn the structure and properties of alloys and composites.
MATERIALS ENGINEERING	Sub Code BME303	CO1	Students will be able to identify the crystal structure and measure the mechanical properties of materials
		CO2	Students will be able to test the various failures of materials.
		CO3	Students will be able to identify the mechanical properties based on composition of micro-constituents depicted in the phase-diagram.
		CO4	Students will understand the concept of improving the mechanical properties through heat treatment.
		CO5	Students will learn the structure and properties of alloys and composites.
FLUID MECHANICS LAB	Sub Code BME351	CO1	Understand the principles and performance characteristics of flow and thermal devices
		CO2	Know about the measurement of the fluid properties
		CO3	Understand and analyze various properties of fluids.
		CO4	Evaluate the performance characteristics of fluid/thermal machinery
		CO5	Evaluate the velocity and pressure variations in various types of simple flows
MATERIALS TESTING LAB	Sub Code BME352	CO1	Students will be able to perform different destructive and non-destructive testing methods to measure various mechanical properties
		CO2	Students will be able to analyse the effect of different heat-treatment processes on the Hardness.
		CO3	Students will be able to simulate the material using simulating software / measure the mechanical properties of 3-D printed components..
COMPUTER AIDED MACHINE DRAWING-I LAB	Sub Code BME353	CO1	Understand and apply 2D software to develop a part model
		CO2	Understand about temporary and permanent fasteners
		CO3	Understand the need for free hand sketching, Free hand sketching of foundation bolts etc.
		CO4	Create assembly drawing of simple machine elements like rigid or flexible coupling
		CO5	Create 2D drawings and assemblies of various machine components

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B.Tech 4th Semester

Subject	Sub Code	CO	Description
APPLIED HERMODYNAMICS	Sub Code BME401	CO1	To learn about Air Standard Cycle
		CO2	To learn about of I law for reacting systems and heating value of fuels.
		CO3	To learn about gas and vapor cycles
		CO4	To learn about gas dynamics of air flow and steam through nozzles.
		CO5	To analyze the performance of steam turbines
ENGINEERING MECHANICS & STRENGTH OF MATERIAL	Sub Code BME402	CO1	Understand the force systems and application of force equilibrium to various two-dimensional problems.
		CO2	Understand the concept of stress and strain under different loading conditions.
		CO3	Determine the principal stresses and strains in structural members
		CO4	Understand and determine the stresses, slope, and deflection of the transversely loaded members
		CO5	Apply the concepts of stresses and strain in solving problems related to springs, buckling of columns and thin and
MANUFACTURING PROCESSES	Sub Code BME403	CO1	Students will learn the various conventional manufacturing processes / casting and forming processes.
		CO2	Students will understand the concepts of metal cutting and CNC machining.
		CO3	Students will comprehend the knowledge of grinding and super finishing processes.
		CO4	Students will understand the concepts of metal joining processes.
		CO5	Students will learn the concepts of unconventional machining processes.
APPLIED THERMODYNAMICS LAB	Sub CodeBME451	CO1	To understand the principles of various boilers.
		CO2	To understand the basic principles IC engines and determination of various performance parameters of IC Engines.
		CO3	To understand the principles of steam engine and Steam & Gas Turbine:
MANUFACTURING PROCESSES LAB	Sub Code BME452	CO1	Students will be able to make the component using casting and finishing methods.
		CO2	Students will be able to make the component using metal cutting / unconventional machining methods
		CO3	Students will be able to make the component using metal joining processes
COMPUTER AIDED MACHINE DRAWING-II LAB	Sub Code BME453	CO1	Understand and apply 3D software to develop a part model
		CO2	Understand conventional representation of machine components, and welded joints
		CO3	Understand and apply the basis of fit or limit system
		CO4	Understand about Plummer Block Bearing, Machine Vice, Screw Jack, Engine Stuffing box.
		CO5	Create 3D part models and assemblies of various machine components

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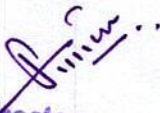Science & Technology

B.Tech 5th Semester

Subject	Sub Code	CO	Description
Heat and Mass Transfer	Sub Code KME 501	CO1	Understand the fundamentals of heat and mass transfer.
		CO2	Apply the concept of steady and transient heat conduction.
		CO3	Apply the concept of thermal behavior of fins.
		CO4	Apply the concept of forced and free convection.
		CO5	Apply the concept of radiation for black and non-black bodies.
		CO6	Conduct thermal analysis of heat exchangers
Strength of Material	Sub Code KME 502	CO1	Understand the concept of stress and strain under different conditions of loading
		CO2	Determine the principal stresses and strains in structural members.
		CO3	Determine the stresses and strains in the members subjected to axial, bending and torsional loads
		CO4	Apply the concepts of stresses and strain in solving problems related to springs, column and pressure vessels
Industrial Engineering	Sub Code KME 503	CO1	Understand the concept of production system, productivity, facility and process planning in various industries
		CO2	Apply the various forecasting and project management techniques
		CO3	Apply the concept of break-even analysis, inventory control and resource utilization using queuing theory
		CO4	Apply principles of work study and ergonomics for design of work systems
		CO5	Formulate mathematical models for optimal solution of industrial problems using
Heat and Mass Transfer Lab	Sub Code KME 551	CO1	Apply the concept of conductive heat transfer.
		CO2	Apply empirical correlations for both forced and free convection to determine the value of convection heat transfer coefficient
		CO3	Apply the concept of radiation heat transfer for black and grey body.
		CO4	Analyze the thermal behaviour of parallel or counter flow heat exchanger
		CO5	Conduct thermal analysis of a heat pipe
Python Lab	Sub Code KME 552	CO1	Apply conditional statement, loops condition and functions in python program.
		CO2	Solve mathematical and mechanical problems using python program
		CO3	Plot various type of chart using python program.
		CO4	Analyze the mechanical problem using python program
Internet of Things Lab	Sub Code KME 553	CO1	Understand Internet of Things and its hardware and software components
		CO2	Interface I/O devices, sensors & communication modules
		CO3	Remotely monitor data and control devices.
		CO4	Design prototype of IoT based smart system
		CO5	Develop IoT based projects for real life problem

Computer Integrated Manufacturing	Sub Code KME 051	CO1	Understand the basic concepts of automation, computer numeric control machining	
		CO2	Understand the algorithms of line generation, circle generation, transformation, curve, surface modeling and solid modeling	
		CO3	Understand group technology, computer aided process planning, flexible manufacturing, Industry 4.0, robotics	
		CO4	Understand information system and material handling in CIM environment, rapid prototyping	
		CO5	Apply the algorithms of line & circle generation and geometric transformations	
		CO6	Develop CNC program for simple operations	
Advance welding	Sub Code KME 055	CO1	Understand the physics of arc welding process and various operating characteristics of welding power source.	
		CO2	Analyse various welding processes and their applications.	
		CO3	Apply the knowledge of welding for repair & maintenance, along with the weldability of different materials.	
		CO4	Apply the concept of quality control and testing of weldments in industrial environment.	
		CO5	Evaluate heat flow in welding and physical metallurgy of weldments.	

B.Tech 6th Semester

Refrigeration & Air Conditioning	Sub Code KME 601	CO1	Understand the basics concepts of Refrigeration & Air-Conditioning and its future prospects.
		CO2	Explain the construction and working of various components in Refrigeration & Air-Conditioning systems.
		CO3	Understand the different types of RAC systems with their respective applications.
		CO4	Apply the basic laws to the thermodynamic analysis of different processes
Machine Design	Sub Code KME 602	CO1	Recall the basic concepts of Solid Mechanics to understand the subject.
		CO2	Classify various machine elements based on their functions and applications.
		CO3	Apply the principles of solid mechanics to machine elements subjected to static and fluctuating loads.
		CO4	Analyze forces, bending moments, twisting moments and failure causes in various machine elements to be designed.
		CO5	Design the machine elements to meet the required specification.
Theory of Machines	Sub Code KME 603	CO1	Understand the principles of kinematics and dynamics of machines.
		CO2	Calculate the velocity and acceleration for 4-bar and slider crank mechanism
		CO3	Develop cam profile for followers executing various types of motions.
		CO4	Apply the concept of gear, gear train and flywheel for power transmission
		CO5	Apply dynamic force analysis for slider crank mechanism and balance rotating & reciprocating masses in machines.
		CO6	Apply the concepts of gyroscope, governors in fluctuation of load and brake & dynamometer in power transmission
Refrigeration & Air Conditioning Lab	Sub Code KME 651	CO1	Determine the performance of different refrigeration and air-conditioning systems.
		CO2	Apply the concept of psychrometry on different air cooling systems.
		CO3	Interpret the use of different components, control systems and tools used in RAC

			systems
		CO4	Demonstrate the working of practical applications of RAC systems.
Machine Design Lab	Sub Code KME 652	CO1	Apply the principles of solid mechanics to design various machine Elements subjected to static and fluctuating loads.
		CO2	Write computer programs and validate it for the design of different machine
		CO3	Evaluate designed machine elements to check their safety.
Theory of Machines Lab	Sub Code KME 653	CO1	Demonstrate various mechanisms, their inversions and brake and clutches in automobiles.
		CO2	Apply cam-follower mechanism to get desired motion of follower.
		CO3	Apply the concepts of gears and gear train to get desired velocity ratio for power transmission.
		CO4	Apply the concept of governors to control the fuel supply in engine.
		CO5	Determine the balancing load in static and dynamic balancing problem.
Nondestructive Testing	Sub Code KME 061	CO1	Understand the concept of destructive and Non-destructive testing methods.
		CO2	Explain the working principle and application of die penetrant test and magnetic particle inspection..
		CO3	Understand the working principle of eddy current inspection.
		CO4	Apply radiographic techniques for testing.
		CO5	Apply the principle of Ultrasonic testing and applications in medical and engineering areas.

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B.Tech 7th Semester

RURAL DEVELOPMENT: ADMINISTRATION	Sub Code KME 751	CO1	Understand the basic principles of instrumentation for measurement of surface finish, strain, temperature, pressure and flow.
		CO2	Understand the principle and operation of Coordinate Measuring Machine (CMM).
		CO3	Apply Sine Bar, Slip Gauges, Bevel Protractor, Stroboscope, Dial Indicator etc. for measurement of different attributes.
		CO4	Apply the basic concepts of limits, fits & tolerances for selective assembly
Additive manufacturing	Sub Code KME 071	CO1	Understanding the basics of additive manufacturing/rapid prototyping and its advantages and disadvantages
		CO2	Understanding the role of additive manufacturing in the design process and the implications for design.
		CO3	Understanding the processes used in additive manufacturing for a range of materials and applications
		CO4	Understand the various software tools, processes and techniques that enable advanced/additive manufacturing and personal fabrication.
		CO5	Apply knowledge of additive manufacturing for various real-life applications

B.Tech 8th Semester

Rural Development : Administration and Planning	KHU801	CO1	Students can understand the definitions, concepts and components of Rural Development
		CO2	Students will know the importance, structure, significance, resources of Indian rural economy.
		CO3	Students will have a clear idea about the area development programmes and its impact.
		CO4	Students will be able to acquire knowledge about rural entrepreneurship.
Quality Management	KOE085	CO1	Identify the contribution of quality gurus in TQM journey and acknowledge the importance of customers in manufacturing.
		CO2	Explain and analyze quality systems and organizational structures to apply quality principles in different processes
		CO3	Design an effective performance measurement system to optimize standard statistical process control techniques
		CO4	Describe and analyze various reliability methods / tests and the associated failure analysis methods
		CO5	Apply the concepts of ISO - 9000 and ISO -14000 standards in auditing techniques such as JIT and Taguchi Method.
Project	KCE 851	CO1	Analyze and understand the real life problem and apply their knowledge to get programming solution.
		CO2	Engage in the creative design process through the integration and application of diverse technical knowledge and expertise to meet customer needs and address social issues.
		CO3	Use the various tools and techniques, coding practices for developing real life solution to the problem.
		CO4	Find out the errors in software solutions and establishing the process to design maintainable software applications
		CO5	Write the report about what they are doing in project and learning the team working skills

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