



Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Program Outcomes Program Specific Outcomes Course Outcomes

Academic Year 2019-20



Program Outcomes (B. Tech)

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 team work: 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.



Department of Electronics Engineering (B. Tech)

Program Specific Outcomes

1. Analyze analog, digital signals and circuits.

2. Develop algorithms for embedded, networking and signal processing applications.

3. Design electronics systems in compliance with design standards and safety regulations.

Year	Course Code &	Course Outcomes
	Course Name	
	EL2001	The student will be able to –
	Analog	1. Understand the characteristics of basic electronics
SV	Electronics	devices
51		2. Understand the operation of basic electronic circuits.
		3. Analyze electronic circuit
		4. Design electronics circuits for practical applications.
	EL2002	The student will be able to –
	Control Systems	1. Determine transfer function of a given physical system
		and analyze the response.
SY		2. Solve system equations in state-variable form.
		3. Demonstrate various techniques of frequency domain
		analysis.
		4. Perform stability analysis of the given control system.
	EL2003	The student will be able to –
	Electronics	1. Describe analog modulation techniques.
SY	Communication	2. Evaluate the performance of analog radio receivers.
		3. Explain digital communication systems.
		4. Estimate the performance of digital radio receivers.
	El2004	The student will be able to –
	Structures and	1. Estimate time complexity using Big-O notation.
	Algorithms	2. Describe the concept of sequential organization, ordered
	_	list and dynamic memory management.
SY		3. Apply suitable operations on STACK and QUEUE data
		structure.
		4. Make use of STACK and QUEUE data structure to solve
		engineering problems.
		5. Demonstrate the usage of major Tree algorithms.

Course Outcomes



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		6. Explain major Graph algorithms.
	EL2005	The student will be able to –
	Discrete	1. Understand basics of sets, functions, and relations.
	Structure and	2. Apply basics of discrete probability and number theory
C V	Graph Theory	in problem solving
51		3. Relate basic properties of graphs and trees with practical
		examples.
		4. Appreciate number system and the basic principles of
		Boolean algebra.
	EL2006	The student will be able to –
	Antennas and	1. Elaborate fundamental concepts of antenna and its types
SY	Wave	2. Apply the principles of antennas in design and analysis.
	Propagation	3. Understand various configurations of antennas
		4. Explain basic concept of wave propagation.
	EL2007	The student will be able to –
	Network Theory	1. Elaborate fundamental concepts of antenna and its types
SY	· ·	2. Apply the principles of antennas in design and analysis.
		3. Understand various configurations of antennas
		4. Explain basic concept of wave propagation.
	EL2008	The student will be able to –
	Signals and	1. Represent and classify various signals and systems
	Systems	2. Understand LTI systems
SY		3. Find Fourier series and Fourier transform for different
		signals
		4. Analyze continuous time systems using Laplace
		transform.
	EL2009	The student will be able to –
	Digital	1. Analyze the combinational logic circuits.
	Electronics	2. Design the sequential logic circuits.
SY		3. Design the synchronous finite state machine
		4. Compare the basic programmable logic devices and
		memories.
	FI 2 010	5. Describe the characteristics of different logic families
	EL2010	1. Explain events and perform set operations on events.
	Probability and	2. Make use of probability models for discrete and
	Statistics	continuous random variables
CN 7		5. Describe a data set in terms of statistical terms.
SY		4. Estimate the values of parameters based on measured
		empirical data.
		5. Examine the relationship between dependent and
		independent variable and
		to predict the dependent variable when the independent



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		variable is know
	EL3001	The student will be able to –
	Microcontroller	1. Explain AVR Microcontroller Architecture.
	Applications	2. Develop an Assembly Language Program & Embedded
TY		C Program for AVR Microcontroller.
		3. Make use of internal peripherals of AVR
		Microcontroller.
		4. Develop an interface for Sensors and Actuators
	EL3002	The student will be able to –
	Robotics	1. Evaluate forward and inverse kinematics of robot.
		2. Describe various types of robot end effectors.
ΤY		3. Compute trajectories in joint and Cartesian space.
		4. Familiar with robot sensing and vision system for
		industrial applications.
	EL3003	The student will be able to –
	Data	1. Explain encoding and decoding of lossless compression
	Compression	methods.
	r	2. Demonstrate quantization methods.
ΤY		3. Explain encoding and decoding of lossy compression
		methods
		4. Implement suitable Compression algorithms on Text/
		Signal /Image
	EL3004	The student will be able to –
	Power	1. Describe the operation, characteristics and applications of
	Electronics	power devices like power diode, SCR, power BJT, power
		MOSFET, and IGBT.
TV		2. Analyze controlled converter and inverter circuits in terms
11		of performance parameters.
		3. Analyze dc-dc converter and ac controller circuits in terms
		of performance parameters.
		4. Illustrate the role of Power Electronics in utility-related
		applications.
	EL3005	1. Explain events and perform set operations on events.
	Probability and	2. Make use of probability models for discrete and
	Statistics	continuous random variables
TY		3. Describe a data set in terms of statistical terms.
		4. Estimate the values of parameters based on measured
		empirical data.
		5. Examine the relationship between dependent and
		independent variable and
		to predict the dependent variable when the independent
		variable is known.



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	EL3006	The student will be able to –
	Computer Vision	1. Explain camera geometry fundamentals and image
	_	formation.
TY		2. Apply pre-processing algorithms to acquired images
		3. Develop feature descriptor for object detection purpose.
		4. Make use of Computer Vision algorithms to solve real-
		world problems
	EL3007	The students will be able to
	Digital	1. Calculate the output voltage of pass transistor
	Integrated	2. Identify combinational function implemented in CMOS
ту	Circuit Design	logic
11		3. Differentiate between latch and flip-flop
		4. Implement logic function in MOS ROM
		5. Draw logic gate circuit from VHDL code
		6. Draw stick diagram from Euler's path
	EL3008	The student will be able to –
	Database	1. Differentiate database systems from file systems by
	Management	enumerating the features provided by database systems
	Systems	and describe each in both function and benefit.
		2. Transform an information model into a relational
ту		database schema and to use a data definition language
11		and/or utility to implement the schema using a DBMS
		3. Design ER diagrams for new databases and read
		(understand) ER diagrams.
		4. Read/write - Extended Relational Algebra, Simple SQL,
		Embedded SQL, SQL Queries Using Embedding
		Operators, SQL Queries with GROUP BY, HAVING
	EL3013	The student will be able to –
	Electromagnetics	1. Estimate static electric field produced by different charge
ту	Engineering	and current distribution.
		2. Understand the different laws related to electric fields.
		3. Evaluate effects of magnetic fields.
		4. Demonstrate concepts of time varying fields.
	EL3010	The student will be able to –
	Wireless	1. Design Cellular Networks
TY	Technologies	2. Analyze the Wireless Channel Access Protocols
		3. Compare the 802.11x and 802.15.x wireless technologies
		4. Plan and design wireless systems.
	EL3011	The student will be able to –
TY	Artificial	1. Identify real world problems of AI domain.
	Intelligence	2. Write algorithms for searching techniques.
		3. Develop an AI tool for practical application.



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	EL3017	The student will be able to –
	Embedded	1. Explain embedded system architecture.
	System Design	2. Elaborate architecture of ARM
	~	3. Experiment with ARM7
TY		4. Compare various communication protocols used in
		embedded application
		5 Relate RTOS kernel functions with general purpose OS
		functions
	FI 3018	The student will be able to _
	Digital Signal	1 Demonstrate use of 7 Transform in analyzing I TI
	Digital Signal	systems
	Trocessing	2 Determine DET coefficients using EET algorithms to
TY		2. Determine DIT coefficients using ITT algorithms to
		A nolyza EID filters for the given Specifications
		3. Analyze FIR filters for the given Specifications.
		4. Analyze fix finers for the given specifications.
	FI 2010	5. Design practical sampling rate converters.
	EL3019	I he student will be able to –
	Machine	1. Select regression model to solve business problems
	Learning	2. Choose a classifier model for building applications
		3. Apply clustering techniques to solve real world problems
ΤY		4. Design reinforcement learning model
		5. Develop deep learning model using artificial neural
		network
		6. Design and implement various machine learning
		algorithms in a range of real-world applications
	EL3020	The student will be able to –
	Ad Hoc Networks	1. Understand MAC protocols.
ту		2. Study performance issues in Ad-hoc networks.
11		3. Design wireless Ad-hoc Networks.
		4. Write a paper on current research going in Infrastructure
		less wireless communication.
	EL3021	The student will be able to-
	Microwave	1. Analyze microwave channel mathematically.
	Engineering	2. Analyze microwave components mathematically.
TY		3. Interpret microwave sources mathematically.
		4. Describe microwave solid state devices.
		5. Describe real time applications of microwave engineering.
		6. Explain different microwave measurements.
	EL3022	The student will be able to –
	Internet of	1. Understand the vision of IoT from a global context.
TY	Things	2. Use of Devices, Gateways and Data Management in IoT.
	8~	3. Building state of the art architecture in IoT.



		4. Application of IoT in Industrial and Commercial
		Building Automation and Real-World Design
		Constraints.
	EL3023	The student will be able to –
	Industrial	1. Develop PLC programs for industrial applications.
	Automation	2. Apply advanced instruction of PLC to solve complex
		automation applications
TY		3 Understand the functionality of SCDA HMI and DCS
		systems
		4 Describe and apply protocols needed for industrial
		communication and networking.
	EL 3024	The students will be able to -
	VLSI	1. Locate the defect in Silicon crystal
	Technologies	2. Differentiate between deposition and ion implantation
TY		3. Calculate thickness of oxide in oxidation process
		4. Design process flow for the given structure
		5. Identify the profile of etching
		6. Draw the structure from process flow
	EL4001	The student will be able to –
	Computer Vision	1. Explain camera geometry fundamentals and image
	00111P4001 (151011	formation.
B.Tech		2. Apply pre-processing algorithms to acquired images
D.Teen		3. Develop feature descriptor for object detection purpose.
		4. Make use of Computer Vision algorithms to solve real-
		world problems
	EL4002	The student will be able to –
	Embedded	1. Explain embedded system architecture.
	Systems	2. Explain architecture of ARM processor
рт і	· ·	3. Program peripheral devices with ARM7 processor.
B. I ech		4.Compare communication protocols used in embedded
		application
		5. Relate RTOS kernel functions with general purpose OS
		functions
	EL4003	The student will be able to –
	Engineering	1. Perform their professional responsibilities as Engineers.
B.Tech	Ethics	2. Recognize through ethically significant problem situations
		that are common in
		Engineering
		3. Think through ethically significant problem situations
		4 Evaluate the existing ethical standards for
		ENGINEERING Practice
B.Tech	EL4004	The student will be able to –



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	Renewable	1. Obtain the overview of the global energy scenario,
	Energy	understand need on non-conventional energy resources.
		2. Global Challenges and their limited resources.
		3. Calculate the potential attribution of different sources of
		renewable energy like wind, solar and biomass and how
		to integrate them in an energy system
		4 Design a plan for 100% sustainable energy system
		techniques
	FI 4005	The student will be able to
	Internet of	1. Understand the vision of IoT from a global context
	Thin as	2. De competent en loT anchied concent required in
	Things	2. Be competent on for enabled concept required in
DT.t		Industries as per industry 4.0
B. I ech		Standard and Connected Enterprise standard
		3. Build state of the art architecture in Io1.
		4. Understand application of Io1 in Industrial and
		Commercial Building Automation and Real World Design
		Constraints
	EL4006	The students will be able to
	CMOS Mixed	1. Draw small signal model of an amplifier stage
	Signal Design	2. Calculate current in current mirror circuit
B.Tech		3. Identify feedback loop in sample and hold circuit
		4. Find quantization noise in data converter
		5. Draw basic architecture of PLL
		6. Differentiate various architectures of ADCs
	EL4007	The Student will be able to-
	Biomedical	1. Specify methods for interfacing sensors to electronic
	Engineering	systems in biomedical applications.
		2. Measure various physiological parameters and design
		biomedical instruments such as ECG, , BP, blood flow,
		PCG etc
B.Tech		3. Specify different methods used in pathology lab to
		conduct various tests.
		4. Model and detect various EEG patterns.
		5. Describe different types of imaging instrumentation and
		their applications.
		6. Understand various applications of LASER in medical
		field.
	EL4008	The student will be able to –
	Mobile	1. Understand latest trends in wireless technologies. a path
B.Tech	Communication	towards 5G.
		2. Correlate how the handsets in their hand works. what is
		happening on the air interfaces and how call shifts



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		from/to 4G to 3G and then to 2G.
		3. Know the speed variation between technologies
		4. Understand Real time application of knowledge using
		projects with simulation software for call flow and
		negative events.
	EL4009	The student will be able to –
	Artificial	1. Identify real world problems of AI domain.
B.Tech	Intelligence	2. Write algorithms for searching techniques.
		3. Develop an AI tool for practical application.
		4. Develop an expert system
	EL4010	The student will be able to –
	Data Analytics	1. Understand statistics in data analytics.
B.Tech		2. Implement regression techniques.
		3. Describe classification techniques.
		4. Understand big data analytics
	EL4021	The student will be able to –
	Pattern	1. Explain the process of Pattern Recognition.
	Recognition	2. Apply probability theory to estimate classifier
		performance.
		3. Describe the principles of parametric and non-parametric
B.Tech		classification methods.
		4. Compare pattern classifications and pattern recognition
		techniques.
		5. Apply Pattern Recognition techniques to real world
		problems such as image analysis,
		character recognition, etc.
	EL4012	The student will be able to –
	Design of	1. Identify relationships between cause and effect.
	Experiments	2. Providing an understanding of interactions among
B.Tech		causative factors.
		3. Design the experiment and apply on systems.
		4. Understand the common mistakes done in performance
		Evaluation, Experimentation, Regression.



Department of Electronics and Telecommunication Engineering (B. Tech)

Program Specific Outcomes

E&TC Graduates will have Ability to:

1. Design, Develop and Analyze Complex Electronic Systems for Communication, Signal Processing, Embedded Systems and VLSI Applications.

2. Identify and Apply domain specific hardware and software tools to solve real-world problems in Electronics and Communication.

Course Outcomes

Sr.	Year	Subject Name	Course Outcomes
No		with code	
1	Second	ET2001:	Students will be able to
	Year	Electronic	1. Analyze diode circuits
		Circuits	2. Analyze BJT / MOSFET circuits to find Q point
			3. Analyze BJT/ FET amplifiers to find amplifier parameters
			4. Design combinational circuits
			5. Design sequential circuits
			6. Design Finite state machines
2		ET2003:	1. Simplify networks and circuits using network theorems and graph
		Network Theory	theory
			2. Simplify networks and circuits using graph theory and Network
			Topology
			3. Find network parameters and network function
			4. Design Attenuators and filters
			5. Analyze RL, RC and RLC Circuits using steady state and transient
			response
			6. Analyze Resonance Circuits
3		ET2005: Signals	1. Perform operations on dependent and independent variable of one
		and Systems	dimensional signals
			2. Synthesize the signal using elementary signals
			3. Classify the systems and determine response of given CT/DT LTI
			system to any arbitrary input using convolution integral/sum
			4. Analyze the given CT deterministic signal in spectral domain using



		Fourier series/transform.
		5. Apply sampling theorem to obtain a discrete time signal from a
		continuous signal and to find the spectral components of the discrete-
		time signal using discrete Fourier transform (DFT).
		6. Analyze the given LTI systems using Laplace transform.
4	ET2007: Control	1. Model a given system using transfer function approach
	Systems	2. Find steady state and transient response of control systems and
		understand the behavior of LTI systems qualitatively and quantitatively.
		both in the transient and steady-state region.
		3. Analyze given system for stability using root locus.
		4. Demonstrate various techniques of frequency domain analysis.
		5. Analyze given system for stability in frequency domain.
		6. Design proportional, proportional-integral, proportional-derivative.
		and proportional-integral-derivative feedback control systems meeting
		specific system performance requirements.
5	ET2011:	1. Distinguish between various types of variables
-	Probability and	2. Apply concepts of probability such as independence, conditional
	Radom	probability
	Variables	3. Apply Normal distribution and Binomial distribution concepts in
		case studies
		4. 4. Apply variance analysis tests for data analysis
		5. Apply Central limit theorem and carry out hypothesis testing
		6. Use and apply concepts of various Random Processes in modeling
		data
6	ET2002: Data	1. Find time complexity using Big-O notation.
_	Structures &	2. Explain the concept of sequential organization, ordered list and
	Algorithms	dynamic memory
	5	management.
		3. Solve Engineering problems by employing Stack, Queue and Linked
		list data structure
		4. Explain and analyze major Tree algorithms.
		5. Explain and analyze major Graph algorithms.
		6. Solve Engineering problems by employing trees and graph data
		structure
7	ET2004:	1. Classify communication channels and noise.
	Communication	2. Analyze amplitude and frequency modulated signal and their
	Engineering	spectrum.
		3. Explain working of analog receivers.
		4. Discuss encoding of analog signals in digital formats.
		5. Analyze modulation techniques with respect to bandwidth, Euclidian
		distance.
		6. Evaluate performance of optimum filter.



8		ET2006:	1. Apply knowledge of Vector Calculus
		Electromagnetic	2. Use Boundary conditions and Laplace equations for realization of
		Engineering	capacitance
		0 0	3. Use Boundary conditions and Laplace equations for realization of
			Inductance
			4. Implement Maxwell's Equations in various forms
			5. Apply Phasors and Power flow concept
			6. Understand the concept of Uniform Plane wave propagation and
			behavior at interfaces.
9		ET2008:	1. Explain the basics of computer hardware.
		Computer	2. Design arithmetic and logic unit.
		Architecture &	3. Design and analyze pipelined control units.
		Operating	4. Design process scheduling & synchronization algorithms.
		Systems	5. Design memory management scheme like best fit, worse fit etc.
			6. Design device and file management scheme.
10		ET2012:	1. Demonstrate knowledge and understanding of the basic ideas behind
		Multivariate	several common statistical techniques for analyzing multivariate data
		Data Analysis	(Discriminant analysis, classification analysis, linear regression
			analysis, principal component analysis, cluster analysis)
			2. Identify the most appropriate statistical techniques for analyzing
			multivariate dataset
			3. Apply commonly used multivariate data analysis techniques for real
			data and interpret results
			4. Describe the relationship between two or more independent variables
			and the dependent variable using a multiple regression equation.
			5. Compare and contrast the methods for a given data analysis situation
			considering the benefits and the pitfalls of the methods
			6. Select and apply an appropriate technique to achieve dimensionality
			reduction
11	Third	ET3001: Real	1. Comprehend architecture of ARM processor and its peripheral
	year	Time Embedded	interfacing.
		Systems	2. Implement RS-485, CAN and Profibus protocols
			3. Understand approaches to solve hardware-software partitioning
			problems
			4. Explain features and policies followed by a Real-Time Operating
			System.
			5. Explain Structure of UCOS-II
			6. Apply concepts of system programming to develop real-time
			embedded system
12	Third	ET3003: Power	1. Select power device for given voltage- current specifications. (CO
	year	Electronics	Attainment Level: 3)
			2. Analyze DC Drives with controlled converter. (CO Attainment



			Level: 3)			
			3. Analyze AC to AC converters. (CO Attainment Level: 3)			
			4. Analyze AC Drives with inverter. (CO Attainment Level: 4)			
			5. Analyze, compare and select SMPS configuration. (CO Attainment			
			Level: 3)			
			6. Select power converters for real life applications. (CO Attainment			
			Level: 3)			
13	Third	ET3005: VLSI	1. Determine MOSFET behavior under dimension scaling. (CO			
	year	Design	Attainment Level: 3)			
		_	2. Design CMOS based logic circuit. (CO Attainment Level: 3)			
			3. Demonstrate understanding of CMOS fabrication flow. (CO			
			Attainment Level: 2)			
			4. Analyze delays in CMOS circuits. (CO Attainment Level: 4)			
			5. Understand power dissipation in CMOS circuits. (CO Attainment			
			Level: 4)			
			6. Analyze clock signal variations and timing issues. (CO Attainment			
			Level: 5)			
14	Third	ET3007·	1 Evaluate the performance of source coding theorem based on			
1	vear	Information	entropy (CO Attainment Level: 2)			
	ycai	Theory &	2 Analyze& implement lossless compression techniques (CO			
		Coding	2. Anaryze& implement lossiess compression techniques. (CO			
		Techniques	3. Analyze linear block codes for error detection (CO Attainment			
		rechniques	Level: 2)			
			4 Decode cyclic code for error detection (CO Attainment Level: 2)			
			5. Generate Convolutional code & decode using Viterbi decoding (CO			
			Attainment Level: 3)			
			6 Analyze RS code (CO Attainment Level: 3)			
15	Third	FT3000. Data	1 Describe OSI reference Model (CO Attainment Level: 1)			
15	1 miu voor	communication	2 Design physical and data link layer functions and protocols of OSI			
	ycai	and Notworking	2. Design physical and data link layer functions and protocols of OST model (CO Attainment Level: 2)			
		and Networking	A nalyza the TCP/IP Protocol Suite (CO Attainment Level: 2)			
			A Design Legel Area Networks and Wide Area Networks (CO			
			4. Design Local Area Networks and while Area Networks. (CO			
			Attainment Level. 5) 5. Describe management functions and security electriches. (CO			
			5. Describe management functions and security algorithms. (CO			
			Attainment Level: 2)			
16		5/52010	o. Develop application layer protocols. (CO Attainment Level: 4)			
16		E 13019:	1. Explain the basics of computer hardware			
		Computer	2. Demonstrate basic operations with signed and unsigned integers in			
		Organization	decimal and binary number systems.			
		and Architecture	3. Summarize basics of Instruction Set Architecture			
			4. Develop memory organization that uses banks for different word size			
			operation			



			5. Outline the concept of input output organization.			
			6. Develop scheme for Performance Enhancement of Processor			
17		ET3021: Digital	1. Perform various enhancement operations			
		Image	2. Analyze image using morphological techniques			
		Processing	3. Apply segmentation techniques to divide image into parts			
			4. Use various image transforms to analyze and modify image			
			5. Apply image compression approaches			
			6. Apply image registration techniques			
18	Third	ET3115: Analog	1. Illustrate fundamentals of op-amp in terms of block diagram. (CO			
	vear	Circuits	Attainment Level: 3)			
	·		2. Apply knowledge about parameters in practical applications. (CO			
			Attainment Level: 2)			
			3. Design linear applications of op-amp. (CO Attainment Level: 3)			
			4. Design non-linear applications of op-amp. (CO Attainment Level: 3)			
			5. Develop function generator circuits. (CO Attainment Level: 3)			
			6. Design phase locked loop applications. (CO Attainment Level: 4)			
19	Third	ET3002: Digital	1. Apply DFT to analyze discrete time signals. (CO Attainment Level:			
	year	Signal	2)			
	•	Processing	2. Compare computational complexity of DFT and FFT algorithm. (CO			
			Attainment Level: 3)			
			3. Analyze LTI systems using Z-transform. (CO Attainment Level: 3)			
			4. Design linear phase FIR filter of given Specifications. (CO			
			Attainment Level: 4)			
			5. Design IIR filter of given Specifications from equivalent analog			
			filter. (CO Attainment Level: 4)			
			6. Implement sampling rate converter. (CO Attainment Level: 5)			
20	Third	ET3004:	1. Translate specifications to the components of robots such as arms,			
	year	Robotics	linkage, drive system and end effector. (CO Attainment Level: 2)			
			2. Understand the mechanics and kinematics of robot. (CO Attainment			
			Level: 4)			
			3. Select sensors for a given applications. (CO Attainment Level: 3)			
			4. Demonstrate use of engineering methods and problem solving			
			toward design of specified robot. (CO Attainment Level: 4)			
			5. Use robot operating system for application development. (CO			
			Attainment Level: 3)			
			6. Apply pre-requisite knowledge of programming, microcontroller,			
			sensor interfacing, and operating system for development of robot. (CO			
			Attainment Level: 4)			
21	Third	ET3006: Digital	1. Explain VLSI design flow and basics of Verilog HDL. (CO			
	year	Design	Attainment Level:2)			
			2. Develop functionality of combinational circuits using Verilog HDL.			
			(CO Attainment Level:3)			



			3. Develop functionality of sequential circuits using Verilog HDL. (CO			
			Attainment Level:3)			
			4. Propose breaking up of large procedures into smaller ones to make it			
			easier to read and debug the source description. (CO Attainment			
			Level:4)			
			5. Choose Verilog HDL statement for coding and synthesis			
			optimization. (CO Attainment Level:4)			
			6. Test and verify the functionality described by Verilog HDL. (CO			
			Attainment Level:5)			
22	Third	ET3008:	1. Analyze antenna measurements to assess antenna"s performance.			
	year	Antenna and	(CO Attainment Level: 4)			
	-	Microwave	2. Know the concept of radio wave propagation. (CO Attainment Level:			
		Theory	3)			
			3. Analyze microwave channel mathematically. (CO Attainment Level:			
			2)			
			4. Analyze microwave components mathematically. (CO Attainment			
			Level: 3)			
			5. Interpret microwave sources mathematically. (CO Attainment Level:			
			2)			
			6. Illustrate the different types of arrays and their radiation patterns.			
			(CO Attainment Level: 2)			
23		ET3010:	1. Design and test the basic Diagnostic and Therapeutic Equipment			
		Biomedical	2. Implement various algorithms for automatic ECG analysis.			
		Electronics	3. Model and detect various EEG patterns.			
			4. Implement the image acquisition and reconstruction methods in			
			radiography.			
			5. Demonstrate Data acquisition and reconstruction of Doppler image.			
			6. Develop applications of LASER in medical field.			
24	Third	ET3012:	1. Develop feature vectors for object detection purpose. (CO			
	year	Machine	Attainment Level: 2)			
		Learning and	2. Select algorithm for object recognition. (CO Attainment Level: 3)			
		Computer	3. Discuss image registration techniques. (CO Attainment Level: 3)			
		Vision	4. Discuss the concept of machine learning. (CO Attainment Level: 2)			
			5. Classify data/ signal using supervised classifiers. (CO Attainment			
			Level: 3)			
			6. Classify data/ signal using unsupervised classifiers. (CO Attainment			
07			Level: 4)			
25	Third	ET3024: Object	1. Design classes, function and data structures for applications. (CO			
	year	Uriented	Attainment Level: 2)			
		Programming	2. Make use of Operator Overloading concepts. (CO Attainment Level:			
			3. Apply the concepts of data encapsulation and inheritance. (CO			



			Attainment Level: 3)			
			4. Create a virtual function for derived class. (CO Attainment Level: 3)			
			5. Create solutions to a problem by applying the knowledge of			
			Exception handling. (CO Attainment Level: 4)			
			6. Design an application using File handling. (CO Attainment Level: 5)			
26	Third	ET3025:	1. Examine data structures, file organizations, concepts			
	vear	Database	2. Understand principles of DBMS"s, data analysis, database design,			
	•	Mangement	data modeling.			
		System	3. Understand database management, data & query optimization, and			
			database implementation.			
			4. Study relational data models; entity-relationship modeling, SOL, data			
			normalization, and database design.			
			5. Practice query coding using MySQL (or any other open system)			
			through various assignments.			
			6. Design simple multi-tier client/server architectures based and Web-			
			based database applications.			
27	Third	ET3014:	1. Differentiate four generations of wireless standard for cellular			
	year	Wireless	networks. (CO Attainment Level: 3)			
		Communication	2. Determine the type and appropriate model of wireless fading channel			
			based on the system parameters and the property of the wireless			
			medium. (CO Attainment Level: 3)			
			3. Spell the trade-offs among frequency reuse, signal-to-interference			
			ratio, capacity, and spectral efficiency. (CO Attainment Level: 2)			
			4. Evaluate performance of systems. (CO Attainment Level: 1)			
			5. Explain mobility in wireless communication System. (CO			
			Attainment Level: 3)			
			6. Describe wireless standards. (CO Attainment Level: 3)			
28	Third	ET3016: Sensors	1. Demonstrate the fundamental concepts of Internet of Things. (CO			
	year	and Internet of	Attainment Level: 3)			
		Things	2. Select sensors for different IoT applications. (CO Attainment Level:			
			3)			
			3. Design IoT applications in different domains. (CO Attainment Level:			
			5)			
			4. Apply basic protocols in Wireless Sensor Networks for			
			communication. (CO Attainment Level: 4)			
			5. Interface sensor data to cloud platforms. (CO Attainment Level: 4)			
			6. Analyze different challenges in implementing IoT applications. (CO			
			Attainment Level: 3)			
29	Fourth	ET4001: Data	1. Describe OSI reference Model.			
	Year	communication	2. Design physical and data link layer functions and protocols of OSI			
		and Networking	model.			
			3. Analyze the TCP/IP Protocol Suite.			



			4. Design Local Area Networks and Wide Area Networks.			
			5. Describe management functions and security algorithms.			
			6. Develop application layer protocols.			
30	Fourth	ET4002: RF	1. Understand behavior of passive components at high frequency and			
	Year	Circuit Design	modeling of HF circuit. (CO Attainment level : 3)			
		0	2. Estimate bandwidth of RF system. (CO Attainment level : 3)			
			3. Design HF amplifiers with gain bandwidth parameters. (CO			
			Attainment level : 2)			
			4 Model low noise amplifier (CO Attainment level : 2)			
			5. Simulate & model oscillators. (CO Attainment level : 2)			
			6. Understand Mixer types and characteristics. (CO Attainment level :			
			3)			
31		FT4024 · Mobile	1 Classify communication channels and noise			
51		Communication	2 Analyze amplitude and frequency modulated signal and their			
		Communication	spectrum			
			3 Explain working of analog receivers			
			A Discuss encoding of analog signals in digital formats			
			5. Analyze modulation techniques with respect to handwidth Euclidian			
			distance			
			distance.			
20	E	ET4025. Ethan	0. Evaluate performance of optimum filter. 1. Evaluate the law expects of proposition through different types of			
32	Fourth	E 14025: Fiber	1. Explain the key aspects of propagation through different types of fiber (CO Attainment level : 2)			
	rear	Optic	1001. (CO Attainment level : 5)			
		Communication	2. Analyze 105555 of Signals. (CO Attainment level . 3)			
			3. Describe fiber optic communication system. (CO Attainment level :			
			4. Prepare the budget for implementing the fiber optic communication			
			system. (CO Attainment level : 3)			
			5. Relate type of fiber optic communication to a specific application.			
			(CO Attainment level : 2)			
			6. Explain different real world applications of fiberoptics.(CO			
			Attainment level : 2)			
33		ET4019: Digital	1. Apply DFT to analyze discrete time signals.			
		Signal	2. Compare computational complexity of DFT and FFT algorithm.			
		Processing	3. Analyze LTI systems using Z-transform.			
			4. Design linear phase FIR filter of given Specifications.			
			5. Design IIR filter of given Specifications from equivalent analog			
			filter.			
			6. Implement sampling rate converter.			
34		ET4032:	1. Translate specifications to the components of robots such as arms,			
		Robotics	linkage, drive system and end effector			
			2. Understand the mechanics and kinematics of robot			
1			3. Select sensors for a given applications			



			4. Demonstrate use of engineering methods and problem solving			
			toward design of specified robot.			
			5. Use robot operating system for application development			
			6. Apply pre-requisite knowledge of programming, microcontroller,			
			sensor interfacing, and operating system for development of robot.			
35		ET4003:	1. Differentiate four generations of wireless standard for cellular			
		Wireless	networks.			
		Communication	2. Determine the type and appropriate model of wireless fading channel			
			based on the system parameters and the property of the wireless			
			medium.			
			3. Spell the trade-offs among frequency reuse, signal-to-interference			
			ratio, capacity, and spectral efficiency			
			4. Evaluate performance of systems			
			5. Explain mobility in wireless communication System.			
			6. Describe wireless standards			
36	Fourth	ET4004: SoC	1. Understand basic concept of System Design and Interconnections.			
	Year	Design and	(CO Attainment level : 4)			
		Verification	2. Implement instruction for various Processor Architecture. (CO			
			Attainment level : 4)			
			3. Design Memory for SOC. (CO Attainment level : 4)			
			4. Solve issues related to interconnection and Bus models. (CO			
			Attainment level : 3)			
			5. Analyze concepts related to SOC customization. (CO Attainment			
			level: 3)			
07	T (1		1. Apply basic probability theory to model rendom signals in terms of			
37	Fourth	E14026:	1. Apply basic probability theory to model random signals in terms of			
	Year	Adaptive Signal	Random Processes. (CO Attainment level: 4)			
		Processing	2. Find a model to provide an accurate estimation of the signal. (CO			
			Attainment level: 5)			
			3. Represent speech signal using linear predictive coding (LPC)			
			A Formulate the Wiener filter as a constrained entimization problem			
			4. Formulate the whener liner as a constrained optimization problem. (CO Attainment level: 4)			
			5 Determine suitable LMS step size to trade off convergence time and			
			b. Determine suitable Livis step size to trade on convergence time and mis adjustment (CO Attainment level: 4)			
			6 Derive the power spectrum of random signals (CO Attainment level:			
			4)			
38	Fourth	FT4027 · Sneech	1 Demonstrate discrete time model of speech production system (CO			
50	Year	and Audio	Attainment level: 2)			
	I Cul	Processing	2. Detect voiced, unvoiced and silence part of a speech signal (CO			
			Attainment level: 3)			
			3. Implement algorithms for processing speech signals considering the			



			properties of acoustic signals and human hearing. (CO Attainment			
			level: 3)			
			4. Analyze speech signal to extract the characteristic of vocal tract			
			(formants) and vocal cords (pitch). (CO Attainment level: 4)			
			5. Extract LPC Parameters using Levinson Durbin algorithm (CO			
			Attainment level: 4)			
			6. Formulate and design a system for speech recognition and speaker			
			recognition (CO Attainment level: 5)			
39		ET4018: Digital	1. Explain VLSI design flow and basics of Verilog HDL.			
		Design	2. Develop functionality of combinational circuits using Verilog HDL.			
			3. Develop functionality of sequential circuits using Verilog HDL.			
			4. Propose breaking up of large procedures into smaller ones to make it			
			easier to read and debug the source description.			
			5. Choose Verilog HDL statement for coding and synthesis			
			optimization			
			6. Test and verify the functionality described by Verilog HDL			
40		ET4033:	1. Apply knowledge of Vector Calculus			
		Electromagnetic	2. Use Boundary conditions and Laplace equations for realization of			
		Engineering	capacitance			
			3. Use Boundary conditions and Laplace equations for realization of			
			Inductance			
			4. Implement Maxwell's Equations in various forms			
			5. Apply Phasors and Power flow concept			
			6. Understand the concept of Uniform Plane wave propagation and			
			behavior at interfaces.			
41		ET4031:	1. Evaluate the performance of source coding theorem based on			
		Information	entropy.			
		Theory &	2. Analyze& implement lossless compression techniques.			
		Coding	3. Analyze linear block codes for error detection.			
		Techniques	4. Decode cyclic code for error detection.			
			5. Generate Convolutional code & decode using Viterbi decoding.			
			6. Analyze RS code.			
42		ET4005:	1. Describe Architecture of Industrial Automation Systems			
		Industrial	2. Explain Measurement systems			
		Automation	3. Demonstrate ladder programming skills			
			4. Compare Hydraulic/ Pneumatic control Systems			
			5. Compare Actuators			
			6. Design fuzzy controller			
43	Fourth	ET4006:	1. Represent signals using the Gram-Schmidt orthogonalization			
	Year	Advances in	procedure (CO Attainment level : 4)			
		Digital	2. Design and study performance characteristics of optimum receiver			
		Communication	(CO Attainment level : 1)			



			for the various modulating methods. (CO Attainment level : 3)			
			3. Derive carrier and symbol synchronization. (CO Attainment level :			
			3)			
			4. Analyze performance characteristics of equalizer algorithms. (CO			
			Attainment level : 3)			
			5 Analyze performance of multichannel and multicarrier systems (CO			
			Attainment level · 3)			
			6 Evaluate performance of digital signaling techniques for			
			communication over fading multinath channels (CO Attainment level :			
			3)			
44		ET4020. Dool	1 Comprehend prohitecture of ADM processor and its perimbers!			
44		E 14020: Keal	interfacing			
		Time Embedded	Internacing.			
		Systems	2. Implement RS-485, CAN and Profibus protocols			
			3. Understand approaches to solve hardware-software partitioning			
			problems			
			4. Explain features and policies followed by a Real-Time Operating			
			System.			
			5. Explain Structure of UCOS-II			
			6. Apply concepts of system programming to develop real-time			
			embedded system			
45	Fourth	ET4028:	1. Understand fundamentals of continuous and discrete wavelet			
	Year	Wavelets	transform.			
			2. Interpret multi resolution analysis.			
			3. Familiarize with different wavelet families.			
			4. Apply wavelet transform for various signal processing applications.			
			5. Write a program for edge detection, object isolation, image fusion,			
			image enhancement.			
			6. Formulate and design a system for image compression			
46	Fourth	ET4017:	1. Understand the making of a network from heterogeneous multi-			
-	Year	Convergence	sources. (CO Attainment level : 2)			
		Technology	2. Analyze the convergence between the technology providers and the			
		I connorogy	other business personnel about the firm's business activities and the			
			importance of the technology in supporting those activities (CO			
			Attainment level : 3)			
			3 Implement the convergence of Voice Video image and data over			
			Internet Protocol over wired and wireless networks that provide			
			seamless and secure communication solutions for business			
			government and home technology peeds (CO Attainment level · 4)			
			A Analyza and Implement the Interenerability, the integrating of			
			4. Analyze and implement the interoperation, the integrating of dispersion systems (CO Attainment level : 2)			
			usparate systems. (CO Attainment level : 5)			
			5. To construct a weighted network by gathering data from three			
			different sources and meta-data matching.(CO Attainment level : 5)			



Bansilal Ramnath Agarwal Charitable Trust's VISHWAKARMA INSTITUTE OF TECHNOLOGY – PUNE (An autonomous Institute affiliated to University of Pune)

	6. Understand and Analyze the current situation of convergence
	technology R&D.(CO Attainment level : 5)



Department: Electronics and Telecommunication Engineering (M. Tech)

Program Outcomes (M. Tech)

- **1. Scholarship of Knowledge** Acquire in-depth knowledge of signal processing and communication with an ability to discriminate, evaluate, analyze and synthesize existing and new knowledge, and integration of the same for enhancement of knowledge.
- **2. Problem Solving** Think laterally and originally, conceptualize and solve engineering problems, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise.
- **3. Research Skill** Extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools. Design, conduct experiments, analyze and interpret data, demonstrate higher order skill and view things in a broader perspective, contribute individually/in group(s) to the development of scientific/technological knowledge in one or more domains of engineering.
- **4.** Usage of modern tools Select, learn and apply appropriate techniques, resources, and modern engineering tools, to solve complex engineering problems with an understanding of the limitations.
- **5. Project Management and Finance** Demonstrate knowledge and understanding of engineering and management principles and apply the same to one's own work, as a member and leader in a team, manage projects efficiently in respective disciplines and multidisciplinary environments with consideration of economical and financial factors.
- **6.** Communication Communicate with the engineering community, and with society at large, regarding complex engineering activities confidently and effectively, such as, being able to comprehend and write effective reports and design documentation by adhering to appropriate standards, make effective presentations, and give and receive clear instructions.
- **7.** Life-long Learning Recognize the need for, and have the preparation and ability to engage in life-long learning independently, with a high level of enthusiasm and commitment to improve knowledge and competence continuously.



Program Specific Outcomes

- 1. Have comprehensive knowledge of signal processing and telecommunication fundamentals to solve real lifecomplex problems.
- 2. Inculcate research culture with abilities to define, analyze, investigate and develop technologies.
- 3. Communicate findings effectively to engineering community and society at large, using modern tools.

Sr.	Year	Subject Name with code	CO Statements
1	M.TECH	ET5001: Advanced Engineering Mathematics	1. Formulate and solve problems in linear algebra using general vector spaces and linear transformations
			2. Use various inner products and the Gram-Schmidt process to handle problems involving distance, orthogonality and projection
			3. Determine the eigenvalues and eigenvectors of a square matrix using the characteristic polynomial and will demonstrate how to diagonalize a matrix
			4. Classify the given data samples.
			5. Analyze and interpret probability distributions and perform regression analysis for statistical data.
			6. Solve problems which involve setting up
2		ET5003: Adaptive Signal	1. Apply basic probability theory to model random
		Processing	signals in terms of Random Processes.
			2. Find a model to provide an accurate estimation of the signal.
			3. Represent speech signal using linear predictive coding (LPC) algorithm.
			4. Formulate the Wiener filter as a constrained optimization problem.
			5. Determine suitable LMS step size to trade off convergence time and misadjustment.
			6. Derive the power spectrum of random signals.

Course Outcomes



3	ET5005: Industrial	1.	Describe Architecture of Industrial Automation
	Automation		Systems
		2.	Explain Measurement systems
		3.	Demonstrate ladder programming skills
		4.	Compare Hydraulic/ Pneumatic control Systems
		5.	Compare Actuators
		6.	Design fuzzy controller
4	ET5007: Advances in	1.	Represent signals using the Gram-Schmidt
	Digital Communication		orthogonalization procedure
		2.	Design and study performance characteristics of
			optimum receiver
			for the various modulating methods.
		3.	Derive carrier and symbol synchronization
		4.	Analyze performance characteristics of equalizer
			algorithms.
		5.	Analyze performance of multichannel and
			multicarrier systems
		6.	Evaluate performance of digital signaling
			techniques for communication over fading
			multipath channels
5		1.	Demonstrate discrete time model of speech
			production system.
	ET5013: Speech	2.	Detect voiced, unvoiced and silence part of a
	Processing		speech signal.
		3.	Implement algorithms for processing speech
			signals considering the properties of acoustic
			signals and human hearing.
		4.	Analyze speech signal to extract the characteristic
		-	of vocal tract (formants) and vocal cords (pitch).
		5.	Extract LPC Parameters using Levinson Durbin
			algorithm
		6.	Formulate and design a system for speech
			recognition and speaker recognition



6		ET5006: Computer Vision	1.	Compare human and computer vision system.
			2.	Enhance the image quality by applying different
				transforms.
			3.	Segment the image to identify the region of
				interest.
			4.	Develop an algorithm to recognize the specified
				objects in the given image.
			5.	Classify the data as per the labeled classes.
			6.	Apply optical flow motion estimation technique to
				estimate the object motion in videos.
7		ET5012: Mobile	1.	Classify communication channels and noise.
		Communication	2.	Analyze amplitude and frequency modulated signal
				and their spectrum.
			3.	Explain working of analog receivers.
			4.	Discuss encoding of analog signals in digital
				formats.
			5.	Analyze modulation techniques with respect to
				bandwidth, Euclidian distance.
			6.	Evaluate performance of optimum filter.
8		ET5008: Digital	1.	Demonstrate understanding of static CMOS.
		Integrated Circuit Design	2.	Design & simulate combination circuits.
			3.	Design & simulate sequential circuits.
			4.	Design & simulate Memory circuits.
			5.	Analyze CMOS logic circuit for speed
				optimization.
			6.	Design and simulate a small digital circuit/system.



Department of Instrumentation Engineering

B.Tech. (Instrumentation and Control Engineering)

Program Specific Outcomes

Graduates shall have the ability to:

- **1.** Evaluate the performance of suitable sensors / Process components/ Electronic / Electrical components for building complete automation system.
- 2. Analyze real-world engineering problems in the area of Instrumentation and Control.
- **3.** Design or Develop measurement / electronic / embedded and control system with computational algorithms to provide practical solutions to multidisciplinary engineering problems.

Course Outcomes

Year	Course Name and Code	CO Statements
SY	IC2001:Sensors and	1. IC2001_CO1: Understand working principle of different
BTech	Transducers	sensor
		2. IC2001_CO2: Able to evaluate characteristics of sensor
		3. IC2001_CO3: Analyze the mathematical equation &
		solve different example of sensor
		4. IC2001_CO4: Select suitable sensor for given
		application
		5. IC2001_CO5: Compare different sensor with their
		performance
		6. IC2001_CO6: Demonstrate practical knowledge express
		effectively oral communication and exhibit the skills to
		work in a team
	IC2003:Signal Processing	1. IC2003_CO1: Digitize the continuous time signal
		perform various operations on the signal and derive the
		properties of the given digital systems. Use MATLAB
		to create, analyze and process signals, and to simulate
		and analyze systems sound and image synthesis and
		analysis.
		2. IC2003_CO2: Derive Z transform of the given digital



	signal and compute convergence of the same.
	3. IC2003_CO3: Analyze the signal in the frequency
	domain and compute various transforms of the same.
	4. IC2003_CO4: Design FIR filters on paper to meet
	specific magnitude and phase requirements. Use
	MATLAB to design the filters and analyze its response.
	5. IC2003_CO5: Design IIR filters on paper to meet
	specific magnitude and phase requirements. Use
	MATLAB to design the filters and analyze its response.
	6. IC2003_CO6: Analyze the effect of quantization on the
	response of the digital filters.
IC2005:Electronic Circuits	1. IC2005_CO1: Interpret op-amp datasheets and select
	suitable op-amp.
	2. IC2005_CO2: Analyze op-amp and linear IC circuits.
	3. IC2005_CO3: Design analog circuits using op-amps
	and other linear ICs.
	4. IC2005_CO4: Analyze and design digital circuits using
	suitable logic gates and flip-flops using truth-table
	5. IC2005_CO5: Design digital circuits using digital ICs
	6. IC2005_CO1: Interpret op-amp datasheets and select
	suitable op-amp.
IC2007:Data Structures	1. IC2007_CO1: To interpret and diagnose the properties of
	data structures with their memory representations
	2. IC2007_CO2: To comprehend various sorting and
	searching algorithms.
	3. IC2007_CO3: To use linear data structures like stacks,
	queues etc. with their applications
	4. IC2007_CO4: To handle operations like searching,
	insertion, deletion, traversing mechanism etc. on tree.
	5. IC2007_CO5: To demonstrate the use of binary tree
	traversals and to perform various operations on
	nonlinear data structures.
	6. IC2007_CO6: To implement the graph data structures to
	solve engineering problems.
IC2009:Engineering Design	1. IC2009_CO1: Design solutions for given engineering
and Development	problem
	2. IC2009_CO2: Demonstrate practical knowledge by
	constructing models/algorithms for real time
	applications
	3. IC2009_CO3: Express effectively in written and oral
	communication



	4. IC2009_CO4: Exhibit the skills to work in a team
	5. IC2009_CO5: Prepare a time chart and financial record
	for execution of the project
IC2011:Discrete Structure	1. IC2011_CO1: Express mathematical properties via the
and Graph Theory	formal language of propositional and predicate logic
	2. IC2011_CO2: Demonstrate use of pigeon-hole and
	inclusion-exclusion principle in solving engineering
	problems
	3. IC2011_CO3: Reason mathematically about elementary
	discrete structures used in computer algorithms and
	systems
	4. IC2011_CO4: Develop recurrence relations for a given
	problems
	5. IC2011_CO5: Justify and use various theorems'
	associated with Elementary number theory
	6. IC2011_CO6: Device effective solution for given
	problem using Graph theory and associated algorithms
IC2002:Industrial	1. IC2002_CO1: Comprehend the fundamentals of PLC,
Automation	SCADA, Robotics and Automation.
	2. IC2002_CO2: Develop PLC, SCADA programs using
	basic instructions in various programming languages for
	given application.
	3. IC2002_CO3: Apply advanced instructions to solve
	complex problems of automation.
	4. IC2002_CO4: Interface, HMI, Drives, Hydraulic-
	Pneumatic-motion control components to PLC.
	5. IC2002_CO5: Analyze the forward and inverse
	kinematics of the given configuration.
	6. IC3002_CO6: Estimate the shortest path and
	subsequent trajectory planning in Cartesian and joint
	space.
IC2004:Control Systems	1. IC2004_CO1: Derive the transfer function of a physical
	system and identify the control actions present in the
	given system.
	2. IC2004_CO2: Derive time domain specification and error
	coefficients for the given system.
	3. IC2004_CO3: Analyze the stability of the given system
	and obtain the root locus for the same.
	4. IC2004_CO4: Analyze the given system in frequency
	domain obtain the bode plot of the same and derive
	requency domain specifications of the same.



	5. IC2004_CO5: Analyze the given system in frequency
	domain obtain the polar plot of the same.
	6. IC2004_CO6: Analyze the stability of the given system
	using Nyquist plot.
IC2006:Microprocessor and	1. IC2006_CO1: Comprehend the fundamentals of micro
Microcontrollers	processors and micro controller
	2. IC2006_CO2: Configure and utilize components like
	Timer, Counter, Memory etc of micro processors &
	micro controller
	3. IC2006_CO3: Interface various off chip components like
	LCD, ADC, DAC, Motors, External memory to micro
	controller
	4. IC2006_CO4: Develop an algorithm for given application
	using Microprocessors & Microcontrollers
	5. IC2006_CO5: Write an program for given application
	using Microprocessors & Microcontroller
	6. IC2006_CO6: Device an engineering system using
	Microprocessors & Microcontrollers
IC2008:Field	1. IC2008_CO1: Explain the working of electrical,
Instrumentation	hydraulic, pneumatic components and special purpose
	motors.
	2. IC2008_CO2: Develop electrical wiring diagrams
	hydraulic and pneumatic circuits for given application.
	3. IC2008_CO3: Select and size the electrical mechanical,
	hydraulic and pneumatic components to solve a
	problem.
	4. IC2008_CO4: Identify formulate and solve a problem
	using electrical, mechanical, hydraulic and pneumatic
	system.
	5. IC2008_CO5: Define the use of mechanical components
	and control panels
	6. IC2008_CO6: Demonstrate practical knowledge
	communication and team skills, by constructing models
	tor real time applications
IC2010:Engineering Design	1. IC2010_CO1: Design solutions for given engineering
and Development	problem
	2. IC2010_CO2: Demonstrate practical knowledge by
	constructing models/algorithms for real time
	applications
	3. IC2010_CO3: Express effectively in written and oral
	communication



r		
		4. IC2010_CO4: Exhibit the skills to work in a team
		5. IC2010_CO5: Prepare a time chart and financial record
		for execution of the project
	IC2012:Probability &	1. IC2012_CO1: Perform data analysis by various
	Statistics	approaches
		2. IC2012_CO2: Define probability and perform tasks
		based on axioms of probability and various probability
		distributions
		3. IC2012_CO3: Understand behavior of various random
		variables and various data distribution functions
		4. IC2012_CO4: Perform mean and variance based
		analysis and carry out hypothesis testing
		5. IC2012_CO5: Perform linear and multiple linear
		Regression
		6. IC2012_CO6: Analyze control charts for Statistical
		Quality Control
	IC2015:Professional	1. IC2015_CO1: Be aware of career options
	Development	2. IC2015_CO2: Aspire to choose career path
		3. IC2015_CO3: Present their background and skills in
		resume
TY	IC3001:Process Control	1. IC3001_CO1: Comprehend the fundamentals of process
BTech	Components	control loop.
		2. IC3001_CO2: Develop and represent process control
		loops using standard ISA S5.1.
		3. IC3001_CO3: Explain the working of major process
		loop components.
		4. IC3001_CO4: Identify, formulate and solve a problem
		using control actions.
		5. IC3001_CO5: Select and size the control valve and
		actuators to solve a problem.
		6. IC3001_CO6: Demonstrate the working of auxiliary
		process loop components.
	IC3003:Microcontroller and	1. IC3003_CO1: Comprehend the fundamentals of micro
	Applications	controller
		2. IC3003_CO2: Configure and utilize on chip components
		like Timer, Counter, Memory etc of microcontroller
		3. IC3003_CO3: Interface various off chip components like
		LCD, ADC, DAC, Motors, External memory to micro
		controller
		4. IC3003_CO4: Develop an algorithm for given application
		using Microcontrollers



	5. IC3003_CO5: Write an program for given application
	using Microcontroller
	6. IC3003_CO6: Device an engineering system using Micro
	controllers
IC3005:Digital Signal	1. IC3005_CO1: Recognize signal spectrum using DFT
Processing	2. IC3005_CO2: Compute and plot signal spectrum using
	FFT Algorithm
	3. IC3005_CO3: Reconstruct time domain signal using
	IDFT
	4. IC3005_CO4: Compute and plot time domain signal
	using IFFT Algorithm
	5. IC3005_CO5: Design analog filter
	6. IC3005_CO6: Apply the concepts of DSP to various
	real time systems such as speech processing
IC3007:Process Control and	1. IC3007_CO1: Develop theoretical models of physical and
Optimization	chemical processes.
	2. IC3007_CO2: Develop experimental models of physical
	and chemical processes.
	3. IC300/_CO3: Select and use numerical methods for
	solving algebraic and differential equations.
	4. IC300/_CO4: Understand the fundamentals of batch
	process 5 IC2007 CO5: Understand the role of standards for
	5. IC5007_CO5. Understand the fole of standards for batch process
	6 IC3007 CO6: Comprehend the control and management
	aspects of batch processes
IC3009: Analytical and	1 IC3009 CO1: Employ different biomedical sensors and
Biomedical Instrumentation	equipments for Cardiovascular system
	2. IC3009 CO2: Apply different biomedical sensors and
	equipments for Nervous system
	3. IC3009 CO3: Append different biomedical sensors,
	equipments for respiratory and to execratory and
	pathological Systems
	4. IC3009_CO4: Understand various components in
	analytical instruments
	5. IC3009_CO5: Comprehend. various methods for
	analyzing material composition
	6. IC3009_CO6: Apply of various sensing methods for
	different application
IC3011:Engineering Design	1. IC3011_CO1: Design solutions for given engineering
and Development	problem



	2.	IC3011_CO2: Demonstrate practical knowledge by
		constructing models/algorithms for real time
		applications
	3.	IC3011_CO3: Express effectively in written and oral
		communication
	4.	IC3011_CO4: Exhibit the skills to work in a team
	5.	IC3011_CO5: Prepare a time chart and financial record
		for execution of the project
	6.	IC3011_CO1: Design solutions for given engineering
		problem
IC3033:Seminar	1.	IC3033_CO1: Inculcate the reference search and
		effective technical précis writing skills.
	2.	IC3033_CO2: Enhance time management and
		presentation skills.
	3.	IC3033_CO3: Strengthen the literature survey and other
		research attributes essential for Major project activity.
IC3002:Instrumentation	1.	IC3002_CO1: Describe the concept of project
Project Engineering		engineering and management.
	2.	IC3002_CO2: Comprehend the Project Engineering and
		Management documents
	3.	IC3002_CO3: Develop Project Engineering and
		Management documents.
	4.	IC3002_CO4: Discuss the procurement and construction
		activities of project.
	5.	IC3002_CO5: Understand the importance of
		management and financial functions and tools.
	6.	IC3002_CO6: Explain different codes and standards
	1	used for instrumentation and control
IC3004:Process	1.	IC3004_CO1: Derive mathematical models for process
Instrumentation and Control	Ζ.	IC3004_CO2: Apply control strategies for Heat
	2	IC2004 CO2: Develop and design instrumentation and
	э.	acoutrol for Poilor
	1	IC2004 CO4: Develop and implementation of control
	4.	scheme for Evaporator and Distillation column
	5	IC3004 CO5: Analyze multivariable systems
	5.	IC3004_CO6: Design and controller tuning for
	0.	multivariable systems
IC3006 Industrial	1	IC3006 CO1: Comprehend the fundamentals of PLC
Automation	1.	SCADA. Robotics and Automation
	2	IC3006 CO2: Develop PLC SCADA programs using
	4.	10000_002. Develop i Le, beribri programs using



		basic instructions in various programming languages for
		given application.
	3.	IC3006_CO3: Apply advanced instructions to solve
		complex problems of automation.
	4.	IC3006_CO4: Interface, HMI, Drives, Hydraulic-
		Pneumatic-motion control components to PLC.
	5.	IC3006_CO5: Analyze the forward and inverse
		kinematics of the given configuration.
	6.	IC3006_CO6: Estimate the shortest path and subsequent
		trajectory planning in Cartesian and joint space.
IC3008:Electronic	1.	IC3008_CO1: Understand working of electrical
Instrumentation		parameter measurement circuit.
	2.	IC3008_CO2: Use of proper measurement systems
		device for any application.
	3.	IC3008_CO3: Apply electronic instruments like DSO,
		Counters, Distortion meter, Spectrum Analyzer for
		testing the instruments
	4.	IC3008_CO4: Understand the error in instrumentation
		systems associated with noise and effective noise
		minimization technique
	5.	IC3008_CO5: Understand the basic concepts of
		systems reliability
	6.	IC3008_CO6: Infer different automatic component
		testing method
IC3040:Introduction to Soft	1.	IC3040_CO1: Comprehend the fuzzy logic and the
Computing		concept of fuzziness involved in various systems and
		Tuzzy set theory.
	2.	IC3040_CO2: Understand the concepts of fuzzy sets,
		knowledge representation using fuzzy rules,
		approximate reasoning, fuzzy inference systems, and
	2	IUZZY IOGIC.
	5.	1C3040_C03: 10 understand the fundamental theory
		and concepts of neural networks, identify different
		neural network architectures, algorithms, applications
	4	and their limitations
	4.	10.5040_004: Understand appropriate learning rules for
		each of the architectures and learn several neural
	5	ICTOMOR paradigins and its applications.
	3.	models to solve angineering and other problems
	6	Inducts to solve engineering and other problems.
	0.	IC3040_CO1: Comprehend the fuzzy logic and the


		concept of fuzziness involved in various systems and
		fuzzy set theory.
	IC3010:Internet of Things	1. IC3010_CO1: Learn and demonstrate concepts of
		Internet of Things
		2. IC3010_CO2: Develop and demonstrate embedded tools
		usage for IOT.
		3. IC3010_CO3: Demonstrate Python programming skills
		for IOT
		4. IC3010_CO4: Understand develop and demonstrate the
		connectivity technologies and protocols in IOT,
		Demonstrate Cloud technology concepts
		5. IC3010_CO5: Develop Web Application framework
		using Django
		6. IC3010_CO6: Illustrate IOT design for application of
		Home automation Smart Parking, Environment,
		Agriculture, Productivity applications etc
	IC3012:Engineering Design	1. IC3012_CO1: Design solutions for given engineering
	and Development	problem
		2. IC3012_CO2: Demonstrate practical knowledge by
		constructing models/algorithms for real time
		Applications
		3. IC3012_CO3: Express effectively in written and oral
		communication
		4. IC3012_CO4: Exhibit the skills to work in a team
		5. IC3012_CO5: Prepare a time chart and financial record
	IC2020, Drofessional	1 IC2020 CO1. Find amost unities for higher education
	IC 3030:Professional	1. IC3030_CO1: Find opportunities for higher education.
	Development	2. IC3030_CO2: Present nimself well foe group discussion
		2 IC2020 CO2: Write resume
		4. IC2020 CO4: Well again himself to murgue his dream
		4. IC3050_CO4: well equip minisen to pursue his dream
Final	IC4001 Industrial	1 IC4001 CO1: Salact suitable power device for given
Voor	Electronics	application
RTech	Licentonics	2 IC4001 CO2: Estimate power losses and design a
Ditten		2. IC+001_CO2. Estimate power losses and design a required heat sink
		3 IC4001 CO3: Select suitable driver ICs and protection
		techniques for power devices
		4. IC4001 CO4: Analyze and explain the operation of
		various power electronic circuits.
		5. IC4001 CO5: Contribute in design and development of



	power electronic systems.
IC4002:Building	1. IC4002 CO1: Choose different sensors and components
Automation and Se	curity used in building automation
Systems	2. IC4002 CO2: Design of light control system for real
	world application automation
	3. IC4002 CO3: Explain the use of HVAC's for different
	applications
	4. IC4002 CO4: Select access control system for real
	world applications
	5. IC4002 CO5: Develop a fire management system for
	real world applications
	6. IC4002 CO6: Identify the energy audit process
IC4003:Digital Con	ntrol 1. IC4003 CO1: Understand Z transform and Sampling &
	holding for discrete-time systems.
	2. IC4003_CO2: Obtain pulse transfer function and digital
	PID controllers.
	3. IC4003_CO3: Design controllers like dead-beat
	controllers
	4. IC4003_CO4: Examine Controllability, Observability
	and Stability of systems.
	5. IC4003_CO5: Design digital control system using pole
	placement and observer design.
	6. IC4003_CO6: Design digital control system using
	optimal control.
IC4004:Batch Proc	ess 1. IC4004_CO1: Understand the fundamentals of batch
Control	process
	2. IC4004_CO2: Understand the role of standards for
	batch process
	3. IC4004_CO3: Comprehend the control and management
	aspects of batch processes
	4. IC4004_CO4: Comprehend control strategies to a given
	batch processes
	5. IC4004_CO5: Specify controls and data management
	system
	6. IC4004_CO6: Case study of any batch process
IC4008:Power Plan	1. IC4008_CO1: Know the fundamentals of power plant to
Instrumentation	power generation, transmission and distribution.
	2. IC4008_CO2: Develop Instrumentation and control
	required for the power plant.
	3. IC4008_CO3: Analyze the impact of power plant
	operation on environmental and social context.



		4. IC4008 CO4: Select suitable sensors and automation for
		monitoring and safety purpose
		5. IC4008 CO5: Understand the importance of nuclear
		power plant and its instrumentation for Environment
		protection purpose
		6. IC4008 CO6: Know the conventional & non
		conventional energy power plants
Ι	C4005:Process	1. IC4005_CO1: Derive mathematical models for process
Ι	Instrumentation and Control	2. IC4005_CO2: Apply control strategies for Heat
		exchanger and dryers
		3. IC4005_CO3: Develop and design instrumentation and
		control for Boiler
		4. IC4005_CO4: Develop and implementation of control
		scheme for Evaporator and Distillation column
		5. IC4005_CO5: Analyze multivariable systems
		6. IC4005_CO6:Design and controller tuning for
		multivariable systems
Ι	C4006:Biomedical	1. IC4006_CO1: Understand sensing method and its
Ι	Instrumentation	applicability
		2. IC4006_CO2: Employ different biomedical sensors and
		equipments for Cardiovascular system
		3. IC4006_CO3: Apply different biomedical sensors and
		equipments for Nervous system
		4. IC4006_CO4: Append different biomedical sensors,
		equipments for respiratory Systems
		5. IC4006_CO5: Understand different equipments related
		to execratory and pathological systems
		6. IC4006_CO6: Design a biomedical system
I	C4007:Project	5. IC4007_CO1: Design solutions for given engineering
		problem
		6. IC4007_CO2: Demonstrate practical knowledge by
		constructing models/algorithms for real time
		applications
		7. IC4007_CO3: Express effectively in written and oral
		communication.
		8. IC4007_CO4: Exhibit the skills to work in a team
		9. IC4007_CO5: Prepare a time chart and financial record
-		tor execution of the project
	C4012:Professional	1. IC4012_CO1: Appear for competitive exams.
	Development	2. IC4012_CO2: Appear for entrance examinations.
		3. IC4012_CO3: Get internship and placement



	opportunities
IC4011:Industry Internship	1. IC4011_CO1 : Technical and Analytical Competencies
	2. IC4011_CO2: Skill Development / Modern Tool Usage
	3. IC4011_CO3: Communication & Presentation Skills
	4. IC4011_CO4: Professionalism
	5. IC4011_CO5: Technical Writing
IC4024:Global Internship	1. IC4024_CO1 : Technical and Analytical Competencies
	2. IC4024_CO2: Skill Development / Modern Tool Usage
	3. IC4024_CO3: Communication & Presentation Skills
	4. IC4024_CO4: Professionalism
	5. IC4024_CO5: Technical Writing
IC4026:Research Internship	1. IC4026_CO1 : Technical and Analytical Competencies
	2. IC4026_CO2: Skill Development / Modern Tool Usage
	3. IC4026_CO3: Communication & Presentation Skills
	4. IC4026_CO4: Professionalism
	5. IC4026_CO5: Technical Writing



M. Tech. (Instrumentation and Control Engineering)

Program Educational Objectives (PEO)

The Post Graduates would demonstrate

- 1. Core competency in Process Instrumentation and Control Engineering to cater to the industry and research needs.
- 2. Ability to analyze, investigate real world problems and propose feasible / innovative solutions for the same
- 3. Preparedness to learn and apply contemporary technologies for addressing impending challenges for the benefit of organization/society.
- 4. Professional ethics in research and business knowledge for sustainable growth of the organization

Program Outcomes

Engineering Post-Graduates will be able to:

PO1: An ability to independently carry out research / investigation and development work to solve practical problems

PO2: An ability to write and present a substantial technical report/document

PO3: Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

PO4: Design innovative solutions for real world problem use core domain knowledge of Process Instrumentation and Control

Year	Course Name and Code	CO Statements
FY	IC5001:Linear Algebra and	1. IC5001_CO1: Acquire the knowledge of vector spaces,
MTech	Statistics	linear transformations, eigen values and eigen vectors,
		complex numbers and random variables.
		2. IC5001_CO2: Apply knowledge of inner product spaces
		to compute length of a vector, angle, distance between
		two vectors.
		3. IC5001_CO3: Understand to compute orthogonal basis
		using Gram-Schmidt process.
		4. IC5001_CO4: Computation and understand the
		significance of eigen-values and eigenvectors.
		5. IC5001_CO5: Compute and analyze various statistical
		measures such as histogram and Frequency Diagrams,
		Sample Mean, Sample Variance, Sample Moments,

Course Outcomes



		Order Statistics for sample random data.
	6.	IC5001_CO6: Analyze and interpret probability
		distributions and their significance and perform linear
		regression analysis for statistical sample data.
IC5003:Process Control	1.	IC5003_CO1: Evaluate the performance of the classical
		PID controller and perform tuning of the same.
	2.	IC5003 CO2: Design control strategies for the processes
		with multiple variables.
	3.	IC5003 CO3: Analyze the multivariable control
		schemes for determining interaction within the variables.
	4.	IC5003 CO4: Develop control schemes for typical
		processes.
	5.	IC5003 CO5: Design advanced control schemes for the
		given process applications.
	6.	IC5003 CO6: Analyze case studies of statistical process
		control.
IC5005:Industrial	1.	IC5005_CO1: Comprehend the fundamentals of
Automation		industrial control devices, PLC hardware, pneumatic,
		hydraulic, mechanical components and automation
		systems
	2.	IC5005_CO2: Design or develop electrical wiring
		diagrams, hydraulic and pneumatic circuits for given
		applications.
	3.	IC5005_CO3: Develop PLC programs using basic and
		advanced instructions for different applications.
	4.	IC5005_CO4: Understand the basics of DCS and
		SCADA systems.
	5.	IC5005_CO5: Identify, formulate and solve a problem
		using robot kinematics.
	6.	IC5005_CO6: Estimate the robotic trajectory planning
		and robot dynamics parameters for given application.
IC5007:Embedded Signal	1.	IC5007_CO1: Design FIR filters to meet specific
Processing		magnitude and phase requirements.
	2.	IC5007_CO2: Design IIR filters to meet specific
		magnitude and phase requirements.
	3.	IC5007_CO3: Use computers and MATLAB to create,
		analyze and process signals, and to simulate and analyze
		systems sound and image synthesis and analysis.
	4.	IC5007_CO4: Understand the components and
		architecture of a Raspberry Pi.
	5.	IC5007_CO5: Enhance programming skills using



	Python programming languages
	6 IC5007 CO6: Use of Raspherry Pi for prototype
	development
IC5009:Engineering Design	1 IC5009 CO1: Design solutions for given engineering
and Development	nrohlem
and Development	2 IC5000 CO2: Demonstrate practical knowledge by
	constructing models/algorithms for real time
	applications
	3 IC5009 CO3: Express effectively in written and oral
	communication
	4 IC5009 CO4: Exhibit the skills to work in a team
	5 IC5009 CO5: Prepare a time chart and financial record
	for execution of the project
IC5002:Engineering	1. IC5002 CO1: Analyze the effect of inflation, currency
Economics	fluctuations, and taxes on decision making
	2. IC5002 CO2: Compare and select investment
	alternatives based on costs and time value of money
	3. IC5002_CO3: Analyze the impact of demand and supply
	on pricing of product and competition
	4. IC5002_CO4: Understand the concept of utility and
	competition and its relevance in business environment
IC5040:Introduction to Soft	1. IC5040_CO1: Comprehend the fuzzy logic and the
Computing	concept of fuzziness involved in various systems and
	fuzzy set theory.
	2. IC5040_CO2: Understand the concepts of fuzzy sets,
	knowledge representation using fuzzy rules,
	approximate reasoning, fuzzy inference systems, and
	fuzzy logic.
	3. IC5040_CO3: To understand the fundamental theory
	and concepts of neural networks, Identify different
	neural network architectures, algorithms, applications
	and their limitations
	4. IC5040_CO4: Understand appropriate learning rules for
	each of the architectures and learn several neural
	network paradigms and its applications.
	5. IC5040_CO5: Reveal different applications of these models to solve angineering and other problems
IC5004:Control Theory	1 IC5004 CO1: Learn State space representations
	towards analyzing and designing systems
	2 IC5004 CO2: Analyze the discrete systems through the
	2. ICJUG4_CO2. Analyze the discrete systems unough the use of Z-Transform. Determine the transfer function of a



		system containing a sampler and zero-order-hold.
		Analyze stability
	3.	IC5004_CO3: Design a Controller or digital process
		control system, Determine the time and frequency
		domain responses of sampled-data control systems to
		arbitrary inputs.
	4.	IC5004_CO4: Design a optimal controller, optimal
		state regulator
	5.	IC5004_CO5: Describe non linearities mathematically
	6.	IC5004_CO6: Learn advanced control strategies
IC5014:Robotics and	1.	IC5014_CO1: Develop object recognition techniques by
Vision		analyzing shape and geometry of the objects.
	2.	IC5014_CO2: Derive translation, rotation and scale
		invariant features for image registration.
	3.	IC5014_CO3: Analyze the video streams for detecting
		motion and computation of associated parameters.
	4.	IC5014_CO4: Develop D-H representation of joints and
		links.
	5.	IC5014_CO5: Analyze the forward and inverse
		kinematics of the given configuration.
	6.	IC5014_CO6: Design algorithm to determine the
		shortest path and subsequent trajectory planning in
	1	Cartesian space.
IC5006:Batch Process	1.	IC5006_CO1: Understand the fundamentals of batch
Control	2	process
	2.	1C5006_CO2: Understand the role of standards for
	2	Datch process
	5.	1C5006_CO5: Comprehend the control and management
		aspects of batch processes IC3000_CO4. Design control
	1	IC5006 CO5: Specify controls and data management
	4.	iC3006_CO3: Specify controls and data management
	5	IC5006 CO6: Implement of any hotah process and its
	5.	study
	6	IC5006 CO1: Understand the fundamentals of batch
	0.	process
IC5016. Artificial	1	IC5016 CO1: Examine the useful search techniques:
Intelligence	1.	learn their advantages disadvantages
Intelligence	2	IC5016 CO2: Be familiar with Artificial Intelligence its
	4.	foundation and principles
	3	IC5016 CO3: Be able to develop intelligent systems
	5.	100010_000. De uble to develop intempont systems.



	4. IC5016_CO4: Learn the practical applicability of
	intelligent systems, specifically its applications.
	5. IC5016_CO5: Be exposed to the role of AI in different
	areas like NLP, Pattern Recognition etc.
	6. IC5016_CO6: Understand important concepts like
	Expert Systems, AI applications.
IC5008:System	1. IC5008_CO1: Investigate Unit-Pulse-Response
Identification and	Identification
Optimization	2. IC5008_CO2: Analyze Frequency-Response
	Identification
	3. IC5008_CO3: Analyze Transfer-Function and State
	Space Identification
	4. IC5008_CO4: Demonstrate use of Classical
	Optimization Techniques for solving Engineering
	problems
	5. IC5008_CO5: Comparison of different Linear
	Programming techniques for solving Engineering
	problems
	6. IC5008_CO6: Use Dynamic Programming for solving
	Engineering problems
IC5018:Internet of Things	1. IC5018_CO1: Learn and demonstrate concepts of Internet
	of Things
	2. IC5018_CO2: Develop and demonstrate embedded tools
	usage for IOT.
	3. IC5018_CO3: Demonstrate Python programming skills
	for IOT
	4. IC5018_CO4: Understand, develop and demonstrate the
	connectivity technologies and protocols in IOT,
	Demonstrate Cloud technology concepts
	5. IC5018_CO5: Develop Web Application framework
	using Django
	6. IC5018_CO6: Illustrate IOT design for application of
	Home automation, Smart Parking, Environment,
	Agriculture, Productivity applications etc
IC5010:Engineering Design	1. IC5010_CO1: Design solutions for given engineering
and Development	problem
	2. IC5010_CO2: Demonstrate practical knowledge by
	constructing models/algorithms for real time
	applications
	3. IC5010_CO3: Express effectively in written and oral
	communication



Bansilal Ramnath Agarwal Charitable Trust's VISHWAKARMA INSTITUTE OF TECHNOLOGY – PUNE (An autonomous Institute affiliated to University of Pune)

(An autonomous Institute affiliated to University of Pune) 666, Upper Indiranagar, Bibwewadi, Pune – 411 037.

		4.	IC5010_CO4: Exhibit the skills to work in a team
		5.	IC5010_CO5: Prepare a time chart and financial record
			for execution of the project
SY	IC6001:Internship 1	1.	IC6001_CO1: Get acquainted with industrial
MTech	_		environment, proceedings and functioning.
		2.	IC6001_CO2: Design and develop solutions for live
			projects of industries
		3.	IC6001_CO3: Develop proficiency in soft skills and
			interpersonal skills.
		4.	IC6001_CO4: Design solutions to engineering problems
			using stare of art technology
		5.	IC6001_CO5: Effectively work in a team.
		6.	IC6001_CO6: Acquire technical and soft skills to
			become industry ready.
	IC6003:Dissertation 1	1.	IC6003_CO1: Independently carry out research and
			development activities.
		2.	IC6003_CO2: Prepare technical articles / reports with
			modern technical writing tools.
		3.	IC6003_CO3: Analyze the technical issues in live on
			going industry projects.
		4.	IC6003_CO4: Develop engineering solutions to address
			real life problems
		5.	IC6003_CO5: Design of experimentation and associated
			analysis.
		6.	IC6003_CO6: Develop proficiency in usage of modern
			analysis and simulation tools.
	IC6002:Internship 2	1.	IC6002_CO1: Get acquainted with industrial
		-	environment, proceedings and functioning.
		2.	IC6002_CO2: Design and develop solutions for live
		2	projects of industries.
		3.	IC6002_CO3: Develop proficiency in soft skills and
		4	Interpersonal skills.
		4.	1C6002_CO4: Design solutions to engineering problems
		5	Using stare of art technology.
		5.	IC6002_CO5: Effectively work in a learn.
		0.	heapma industry ready
	IC6004: Dissortation 2	1	IC6004 CO1: Independently corry out research and
	ICOUU4.DISSertatIOII 2	1.	development activities
		2	IC6004 CO2: Prepare technical articles / reports with
		۷.	modern technical writing tools
			mouern technical writing tools.



3. IC6004_CO3: Analyze the technical issues in live on
going industry projects
4. IC6004_CO4: Develop engineering solutions to address
real life problems.
5. IC6004_CO5: Design of experimentation and associated
analysis.
6. IC6004_CO6: Develop proficiency in usage of modern
analysis and simulation tools.



Department of Computer Engineering (B. Tech)

Program Specific Outcomes

PSO	Program Specific Outcomes
PSO1	Select and incorporate appropriate computing theory principles, data structures and algorithms,
	problems.
PSO2	Adapt to new frontiers of science, engineering and technology by getting acquainted with heterogeneous computing environments and platforms, computing hardware architectures and organizations through continuous experimentation.
PSO3	Conceive well-formed design specifications and constructs assimilating new design ideas and facts for identified real world problems using relevant development methodologies and practices, architecture styles and design patterns, modeling and simulation, and CASE tools.
PSO4	Exercise research and development aptitude focusing knowledge creation and dissemination through engineering artifacts construction, preparation and presentation of engineering evidences using procedures, techniques, guidelines, and standards considering technology migration and evolution.

Course Outcomes

Year	Subject Code & Course Name	Co	o Statements
SY	CS2001: Data Structures	1.	To interpret and diagnose the properties of data structures with their memory representations and time complexity analysis.
		2.	To use linear data structures like stacks, queues etc. with their applications
		3.	To handle operations like searching, insertion, deletion, traversing mechanism etc. on various data structures with the help of dynamic storage representation.
		4.	To demonstrate the use of binary tree traversals and to perform various operations on non-linear data structures.
		5.	To handle the operations on Graph data structure and to solve the applications of Graph data structure.
		6.	To design and analyze the appropriate data structure by applying various hashing techniques.
SY	CS2002: Logic Design &	1. 2.	Construct combinational circuits. Design sequential circuits



	Processors	3.	Identify different operating modes of Microprocessor.
		4.	Design Microprocessor systems using peripheral
			components.
		5.	Learn peripherals and their interfacing with
			Microprocessor.
		6.	Analyze different operating modes of Advance Processor.
SY	CS2003: Automata Theory	1.	Infer the applicability of various automata theoretic
			models for recognizing formal languages.
		2.	Discriminate the expressive powers of various automata
			theoretic and formal language theoretic computational
			models.
		3.	Illustrate significance of nondeterminism pertaining to
			expressive powers of various automata theoretic models.
		4.	Comprehend general purpose powers and computability
			issues related to state machines and grammars.
		5	Explain the relevance of Church Turing thesis and the
		5.	computational equivalence of Turing machine model with
			the general purpose computers
		6	Grasp the theoretical limit of computation (independent of
			software or hardware used) via the concept of
			undecidability.
SY	CS2004 Computer	1.	Understand the structure, function and characteristics of
	Organization & Architecture		computer systems.
	· - g	2.	Describe the working of Central Processing Unit and
			RISC and CISC Architecture.
		3.	Explore the knowledge about Control Unit Design.
		4.	Design memory with due consideration of tradeoffs and
			performance issues.
		5.	Analyze a pipeline for consistent execution of instructions
			with minimum hazards.
		6.	Acquaint the advanced concepts of computer architecture.
SY	CS2005: Discrete Structure &	1.	Reason mathematically about elementary discrete
	Graph Theory		structures (such as functions, felations, sets, graphs, and traces) used in computer algorithms and systems
		2	Describe the elementary properties of modular
		4.	arithmetic and their applications in Computer Science like
			cryntography
		3	Summarize graph theory fundamentals and their
		5.	applications
		4.	Develop recurrence relations for a wide variety of



			interesting problems
		5.	Express mathematical properties via the formal language
			of propositional and predicate logic
		6.	Demonstrate use of pigeon-hole and inclusion-exclusion
			principle in solving elegant and important problems.
SY	CS2007: Advances inData	1.	Model the real world problem with the help of appropriate
	Structures		tree data structure.
		2.	Analyze the amortized time complexity by applying
			suitable priority queue data structure.
		3.	Comprehend and select the storage pattern for strings
		4	processing application.
		4.	problems.
		5.	Design suitable spatial data structure for the geometric problems.
		6.	Analyze the problem solutions based on state of the art
			Data structure representation
SY	CS2008: Operating Systems	1.	Examine the functions of a contemporary Operating
			system with respect to convenience, efficiency and the
			ability to evolve.
		2.	Demonstrate knowledge in applying system software and
			tools available in modern operating system (such as
			threads, system calls, semaphores, etc.) for software
		2	development.
		з.	solutions to real world problems
		4	Identify the mechanisms to deal with Deadlock
		5	Understand the organization of memory and memory
			management hardware.
		6.	Analyze I/O and file management techniques for better
			utilization of secondary memory.
SY	CS2009: Database Management	1.	Design data models as per data requirements of an
	Systems		organization
		2.	Synthesize a relational data model upto a suitable normal
		2	101111 Develop a database system using relational gueries and
		3.	PL/SQL objects
		4.	Apply indexing techniques and query optimization strategies
		5.	Understand importance of concurrency control and



		recovery techniques
		A dant to amarging trands considering societs
		6. Adapt to energing trends considering societa
017		
SY	CS2010: Computer Networks	1. Select network architecture, topology and essentia
		components to design computer networks.
		2. Estimate reliability issues based on error control, flow
		control and pipelining by using bandwidth, latency
		throughput and efficiency.
		3. Design mechanisms to demonstrate server channe
		allocation in wired and wireless computer networks
		4. Analyze data flow between peer to peer in an IP network
		using Application, Transport and Network Layer Protocol
		5. Demonstrate sustainable engineering practice indicating
		the scientific purpose and utility of communication
		frameworks and standards
		6. Develop Client-Server architectures and prototypes by the
		means of correct standards, protocols and technologies.
SY	CS2011: Mathematical	1. Relate the indispensible importance of Mathematics in
	Transforms & Applications	Engineering and symbiosis between both.
		2. Summarize the concepts of mathematical transforms and
		their applications to various engineering problems
		3. Develop the ability to solve linear differential equation
		with constant coefficients and apply it for analysis o
		electrical circuits.
		4. Describe the basic concepts of complex differentiation and
		integration and their application in mathematical and
		engineering problems
		5 Utilize Z transform and its properties in solving
		difference equations and system analysis
		6 Translate a physical problem into a mathematical mode
		and find solution of the model by selecting and applyin
		suitable mathematical method
TV	CS2001. Software Engineering	1 Summorize conspilition and impact of Coffeen
	Cooper: Software Engineering	1. Summarize capacities and impact of Softward Development Process Models and instify process maturity
		through amplication of Seference Environment
		urrougn application of Software Engineering principle
		and practices focusing tailored processes that best fit the
		technical and market demands of a modern software
		project.
		2. Discriminate competing and feasible system requirement
		indicating correct real world problem scope and prepare
		stepwise system conceptual model using stakeholde



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 mistakes and emphasizing on software safety adhered relevant standards. 6. Analyze the target system properties and reconsolution alternatives by practicing project plascheduling, estimation and risk management activities 	nning, es.
 TY CS3008: Software Design Methodologies 1. Examine and breakdown real-world problem sc into structured partitions depicting static and d behavior of the system using business management practices, object-oriented analysis pri and Model Driven Development practices. 2. Identify and formulate software requirement behavioral models using static and dynamic beh views indicating structured problem partitioning an based exploration. 3. Compose system analysis and design specifi indicating logical, physical, deployment, and concruviewpoints using object-oriented analysis and principles and Model Driven Engineering practices. 4. Construct and justify the evolutionary system deso models expressing high-level architecture accomma applicable architectural styles compatible to requir and behavioral models using UML-supported me tools. 5. Comprehend the nature of design pattern understanding a small number of examples from d pattern categories and apply these patterns in cre correct design using design heuristics, published gu applicability, reasonableness, and relation to other 	narios namic namic nocess nciples ts and avioral l state- cations rrency design ription odating ements odeling us by fferent ating a dance, design



		6.	Propose multi-faceted defendable solutions demonstrating
			team-skills accommodating design patterns reducing the
			potential cost and performance impedance in order to
			realize system artifacts with the help of Model Driven
			Development practices.
TY	CS3002: Design Analysis of	1.	Formulate computational problems in abstract and
	Algorithm		mathematically precise manner
	_	2.	Design efficient algorithms for computational problems
			using appropriate algorithmic paradigm
		3.	Analyze asymptotic complexity of the algorithm for a
			complex computational problem using suitable
			mathematical techniques.
		4.	Formulate computational problem as linear program and
			apply LP, network flow, based techniques to design
		5	Establish MDoompleteness of some decision problems
		5.	Establish NP completeness of some decision problems,
			grasp the significance of the houtin of the decision problems
			and design efficient approximation algorithms for standard
			NP-optimization problems
		6.	Incorporate appropriate data structures algorithmic
		•••	paradigms to craft innovative scientific solution for a
			complex computing problems.
ТҮ	CS3009: Randomized	1.	To Formulate computational problems in abstract and
	&Approximation Algorithms		mathematically precise manner
	·····PP- ······························	2.	Design efficient algorithms for computational problems
			using appropriate algorithmic paradigm
		3.	Analyze asymptotic complexity of the algorithm for a
			complex computational problem using suitable
			mathematical techniques.
		4.	Formulate computational problem as linear program and
			apply LP, network flow, based techniques to study
		5	problems such as bipartite graph matching problem.
		э.	Establish NPcompleteness of some decision problems,
			its relation with intractability of the decision problems and
			design efficient approximation algorithms for standard
			NP-optimization problems.
		6.	Incorporate appropriate data structures. algorithmic
			paradigms to craft innovative scientific solution for a
			complex computing problems.



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TY	CS3003: Microprocessors	1.	Describe the Structure and Internal Architecture of
	& Microcontrollers		Pentium Processor and Microcontroller.
		2.	Develop simple Programs.
		3.	Utilize the Structures to effectively solve Computing
			Problems.
		4.	Comprehend Internal Components to conceive well-
			formed Design Specifications.
		5.	Design Effective Automation Solutions.
		6.	Lead Team to deliver Effective Designs.
TY	CS3005: Embedded Systems	1.	Consider the different constraints of embedded system
		2.	Understand Real time systems concepts.
		3.	Do the analysis Linux operating system as real time
			operating system.
		4.	To use RTOS for different embedded systems
TY	CS3004: Computer Graphics	1.	Understand computer graphics fundamentals
		2.	Utilize algorithms to draw and fill geometric shapes.
		3.	Construct animation based demonstrating system using
		4	Segments and chipping algorithms.
		4.	different 2D ecometrical shares
		5	Systematically identify and solve numerical problems of
		з.	3D transformations and projections
		6	Detect hidden surfaces and Interpret the curve and fractals
		υ.	Detect model surfaces and interpret the curve and fractais
ТУ	CS3006: Augmented & Virtual	1.	Identify the most suitable technique for a given use case
••	Poolity		based on the understanding of the similarities and
	Keanty		differences between virtual, augmented and mixed reality
			with the help of Flynn's taxonomy
		2.	Design various transformations for manipulating an object
			in 3dimensional vector space
		3.	Analyze rendering problems and rectify to provide
			realistic experience
		4.	Track visual cues for marker-based and marker-less
			augmented reality experience
		5.	Create local, global and secondary illumination for higher
			extent of presence metaphor
		6.	Extract sensory data to implement location based
		L	augmented reality experience
TY	CS3012: Compiler Design	1.	Design basic components of compiler including scanner,
			parser and code generator.
		2.	Perform semantic analysis in a syntax directed fashion
			using attributed definitions.



		3.	Apply local and global code optimization techniques.
		4.	Synthesize machine code for runtime environment.
		5.	Develop software solutions for the problems related to
			compiler construction.
		6.	Adapt themselves to the emerging trends in language
			processing.
TY	CS3016: Systems Programming	1.	Discriminate among different System software and their
			functionalities
		2.	Design language translators like Macroprocessor and
			Assembler.
		3.	Develop approaches and methods for implementing
			compiler, linker and loader.
		4.	Adopt the skills and methods for implementing different
			system-level software.
		5.	Interpret the methods and techniques about instructions
			Encoding-Decoding and Implementing device drivers.
		6.	Design TSR programs for real world applications.
(D) X 7		1	
ΤY	CS3013: Artificial Intelligence	1.	Identify problems that are amenable to solution by AI
			methods, and which AI methods may be suited to solving
			a given problem.
		2.	Formalize a given problem in the language/framework of
			different AI methods (e.g., as a search problem, as a
			constraint satisfaction problem, as a planning problem, as
		2	a Markov decision process, etc).
		э.	algorithms or dynamic programming)
		1	Design and carry out an ampirical evaluation of different
		4.	algorithms on a problem formalization and state the
			conclusions that the evaluation supports
		5	Use various symbolic knowledge representations to
		5.	specify domains and reasoning tasks of a situated software
			agent
ту	CS3019: Machine Learning	1	Demonstrate knowledge of learning algorithms and
••	COSOT : Machine Learning	1.	concept learning through implementation for sustainable
			solutions of applications.
		2.	Evaluate decision tree learning algorithms.
		3.	Analyzeresearch based problems using Machine learning
			techniques.
		4.	Apply different clustering algorithms used in machine
			learning to generic datasets and specific multidisciplinary



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			domains.
		5.	Formulate a given problem within the Bayesian learning
			framework with focus on building lifelong learning ability.
		6.	Evaluation of different algorithms on well formulated
			problems along with stating valid conclusions that the
			evaluation supports.
TY	CS3014: Web Technology	1.	Design the front end view of web pages using HTML5,
			CSS with Bootstrap framework
		2.	Perform client side web page forms validation.
		3.	Refine dynamic web pages with JSP, Servlet
		4.	Deliver realistic and extensible light weight web application using PHP.
		5.	Practice and utilize web framework paradigms and
			principles for Web development.
		6.	Develop reliable, efficient, scalable web services
		1	
ΤY	CS3017: Mobile Computing	1.	Select components and radio spectrum for PCS based on
		2	Dalidwidth requirement.
		4.	design decisions
		3	Choose the modulation technique for setting up mobile
		5.	network
		4.	Formulate GSM/CDMA mobile network layout
			considering futuristic requirements which conforms to the
			technology.
		5.	Deploy the 3G/4G technology based network with
			bandwidth capacity planning.
		6.	Adapt to the requirements of next generation mobile
			network and mobile applications.
TY	CS3018: Network Security	1.	Analyze cryptographic techniques using a mathematical
			approach by examining nature of attack.
		2.	Establish type of attack on a given system.
		3.	Identify different types of attacks.
		4.	Justify various methods of authentication and access
			control for application of technologies to various sections
			of industry and society.
		5.	Design a secure system for protection from the various
			attacks for 7 layer model by determining the need of
			security from various departments of an organization.



		6.	Estimate future needs of security for a system by
			researching current environment on a continuous basis for
			the benefit of society.
TY	CS3015 Data Science	1.	Perform exploratory data analysis
		2.	Apply regression to real world examples.
		3.	Build and use classification model for given task
		4.	Identify appropriate clustering algorithm based on data set.
		5.	Detect outliers in data set.
		6.	Analyze social media sentiments.
TY	CS3020: Business Intelligence	1.	Construct an end-to-end data warehousing solution for
			business intelligence involving various data sources, ETL,
			multi-dimensional modelling, OLAP, reporting and
			analytics
		2.	Evaluate various data processing algorithms in their applicability to different problems
		3.	Display the process of converting data into a user defined
			format required for analysis
		4.	Utilize statistical tools in deriving insights from data
		5.	Describe various techniques for descriptive, predictive and
			prescriptive analytics
		6.	Apply various techniques to solve real-world data
			analysis problems.
В.	CS4001: Human Computer	1.	Identify human factors and usability issues related with
Tech.	Interaction		computing applications
		2.	Differentiate computing applications into categories based on human factors
		3.	Design a user interface by applying suitable design
			principles, models and usability guidelines
		4.	Integrate ethno-cultural and accessibility computing
			aspects into the user interface design
		5.	Display the impact of usability evaluation and testing in
			computing applications
		6.	Follow required processes and standards while designing
			user interfaces.
D Taal	CS4002. Entonneico Sectores	1	Model business requirements and business processes using
b. rech	C54002: Enterprise Systems	1.	BPMN 2.0 standard encompassing Process Orchestrations
			and Choreographies
		2	Discover the set of services with composite services
			creation and designing services to facilitate integration and



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			understand interrelationships among SOA, Web Services,
			OOD and IT infrastructure.
		3.	Explore the concepts, guidelines and technology for
			service orchestration to integrate a Business Process
			Management Solution in an Enterprise SOA in societal
			context.
		4.	Prepare well-formed specifications and reports for service
		_	composition and delivery to the stakeholders.
		5.	Understand case studies and lessons learned with
			utilization of Enterprise Architecture Integration and
			Frameworks knowledge towards planning and
			implementing complex enterprise projects.
		0.	Create sustainable Enterprise System design supported by
			enterprise modelling, architecture analysis and alignment.
B. Tech	CS4003: Cloud Computing	1.	Describe the main concepts, key technologies, strengths,
			and limitations of cloud computing and the possible
		2	applications for state-of-the-art cloud computing
		2.	Explain the architecture and infrastructure of cloud
			computing, including Saas, Paas, laas, public cloud,
		3	Collaboratively research and write a paper on the state of
		5.	the art (and open problems) in cloud computing
		4	Identify problems and explain analyze and evaluate
			various cloud computing solutions.
		5.	Choose the appropriate technologies, algorithms, and
			approaches for the related issues.
		6.	Display new ideas and innovations in cloud computing.
B. Tech	CS4004: Parallel Computing on	1.	Analyze the real problem for exploiting maximum
	GPU		parallelism on GPU architecture
		2.	Solve the complex problems using GPUs
		3.	Compare serial and parallel executions
		4.	Cup A Cup A
		5	CUDA.
		э.	apply parallel computing methods to research oriented
		6	Final success of CLIDA
B	CS4005: Component-Resed	1	Model husiness requirements and husiness processes using
D. Tach	System Construction	1.	BPMN 2.0 standard encompassing Process Orchestrations
Teen.	System Construction		and Choreographies.
		2.	Discover the set of component services with composite
			services creation and designing services to facilitate



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			integration in IT infrastructure.
		3.	Explore the concepts, guidelines and technology for
			component orchestration to integrate a Component Design
			Solution in an Enterprise Component Systems in societal
			context.
		4.	Prepare well-formed specifications and reports for
			component service composition and delivery to the
			stakeholders as being a part of development team.
		5.	Understand case studies and lessons learned with
			utilization of Component-based development patterns and
			Frameworks knowledge towards planning and
			implementing complex business projects.
		6.	Create sustainable Component System design supported
			by reuse, documentation, and testability.
B.Tech.	CS4006: Data Mining &Data	1.	Construct an end-to-end data warehousing solution.
	Warehousing	2.	Evaluate various data processing algorithms in their
			applicability to different problems
		3.	Display the process of converting data into a user defined
			format required for particular analysis
		4.	Utilize statistical tools in deriving insights from data
		5.	Describe various techniques for clustering and
			classification
		6.	Apply various techniques to solve real-world data analysis
			problems
B.Tech.	CS4007: Modeling & Simulation	1.	Demonstrate the effectiveness of modeling and simulation
			at predictingbehavior/performance/problems of systems
			under development.
		2.	Develop a model for a given problem using appropriate
			modeling and simulationtechnique/formalism.
		3.	Implement discrete event simulation models using
			general-purpose programminglanguages or DES
			frameworks
		4.	Design an agent-based simulation model for a complex
			system.
		5.	Contribute towards increased utilization of modeling and
			simulation as a problem solving approach for issues in
		_	governance and industry where it could be applied
		6.	Adapt to the changing needs of the organizations and
		-	individuals during the development process.
B.Tech.	CS4008: Internet of Things	1.	Learn the terminology, technology and its applications of
			101



		2.	Analyze Embedded suite widely used in IoT.
		3.	Describe the concept of M2M with necessary protocols
		4.	Uunderstand the cloud storage for IoT applications.
		5.	Optimize resources for different IoT applications
		6.	Understand Real world IoT Design constraint.
B.Tech.	CS4009: Image Processing	1.	Describe image model.
		2.	Perform spatial filtering on image.
		3.	Identify Image Segmentation techniques.
		4.	Apply lossless and lossy compression techniques for
			image compression.
		5.	Use various image transforms to analyze and modify
			image.
		6.	Understand Wavelet transform for Image Processing
			Applications.
B.Tech.	CS 4010: Model-Based Systems	1.	Model requirements using SysML specifications and
	Engineering		profiles encompassing requirement structures and
	0 0		catalogue.
		2.	Discover the set of behavioral and structural properties of
			complex systems by making use of UML Superstructure
			specifications and OCL.
		3.	Explore the concepts, guidelines and technology for
			System Designelements orchestration to integrate in
			Enterprise Component Systems in societal context.
		4.	Prepare well-formed specifications and reports for
			component service composition and delivery to the
			stakeholders as being a part of development team.
		5.	Understand case studies and lessons learned with
			utilization of Model-based development concepts and
			specification knowledge towards planning and
			implementing complex systems.
		6.	Create sustainable System design supported by reuse.
			documentation, and testability.
B.Tech.	CS4014: Software Testing	1.	Select and classify measurement scales and models,
	6		software metrics and measures addressing software quality
	Quality Assurance		and reliability.
		2.	Conduct unit and integration tests by determining test
			design, test automation, test coverage criteria using testing
			frameworks and test adequacy assessment using control
			flow, data flow, and program mutations.
		3.	Apply suitable higher order testing techniques and
			methods in order to achieve verified and validated



		4.5.6.	software by following testing best practices. Demonstrate the skillset as a tester to neutralize the consequences of wicked problems by narrating effective test cases and test procedures. Adapt to various test processes, types of errors and fault models and methods of test generation from requirements for continuous quality improvement of the software system along with Software Quality best practices usage. Apply software testing cycle in relation to software development and project management focusing incidents and risks management within a project towards efficient
			improvements in the software development processes by making use of standards and baselines.
B.Tech.	CS4015: Software Architecture&Design	1.	Examine and breakdown real-world problem scenarios into structured partitions depicting static and dynamic behavior of the system using Software Architecture Requirements Capture practices.
		2.	Identify and formulate software requirements and behavioral models using Architectural Assessment of behavioral views by selecting appropriate architectural views
		3.	Compose system design specifications indicating logical, physical, deployment, and concurrency viewpoints using software interface explorations, error handling, and architectural reviews
		4.	Construct and justify the evolutionary system description models expressing high-level technical architecture accommodating applicable architectural styles compatible to requirements using CASE tools
		5.	Comprehend the nature of architectural styles implementation by understanding numerous examples from different technology categories and publish guidance, applicability, reasonableness, and relation to other design criteria resulting in well-documented system profiles to the engineering and social community
		6.	Propose multi-faceted defendable solutions demonstrating team-skills accommodating architectural views and styles reducing the potential cost and performance impedance in order to realize system artifacts with the help of Architecture Derivation and Development practices.



Department of Computer Engineering (M. Tech)

Program Outcomes

PO	PO Statement
PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	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.
PO3	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
DO4	Considerations.
P04	methods including design of experiments, analysis and interpretation of data, and synthesis of the
	information to provide valid conclusions
PO5	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.
PO6	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.
PO7	Environment and sustainability: Understand the impact of the professional engineering
	solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for
POS	Explose Apply ethical principles and commit to professional ethics and responsibilities and norms
100	of the engineering practice
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in
	diverse teams, and in multidisciplinary settings.
PO10	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.
PO11	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
DO12	Life long learning. Descentize the need and have the properties and shility to ansate in
PU12	independent and life-long learning in the broadest context of technological change
	independent and me-iong learning in the broadest context of technological change.



PSO	Program Specific Outcomes
PSO1	Select and incorporate appropriate computing theory principles, data structures and algorithms, programming paradigms to innovatively craft scientific solution addressing complex computing
	problems.
PSO2	Adapt to new frontiers of science, engineering and technology by getting acquainted with
	heterogeneous computing environments and platforms, computing hardware architectures and
	organizations through continuous experimentation.
PSO3	Conceive well-formed design specifications and constructs assimilating new design ideas and
	facts for identified real world problems using relevant development methodologies and practices,
	architecture styles and design patterns, modeling and simulation, and CASE tools.
PSO4	Exercise research and development aptitude focusing knowledge creation and dissemination
	through engineering artifacts construction, preparation and presentation of engineering evidences
	using procedures, techniques, guidelines, and standards considering technology migration and
	evolution.

Course Outcomes

Year	Subject Code & Course Name	Co Statements
M.Tech.	CS5001: Linear Algebra and Statistics	 Demonstrate Knowledge of vector spaces, inner product spaces, orthogonality, positive definite matrices, random variables and probability distributions Apply the Knowledge of vector spaces, orthogonality, diagonalization, Random variables, and probability distributions.
		 Determine and analyse basis, dimensions, Networks, types of Matrices, Failure and Hazard Rate, random sums, stochastic process. Understand Collection of random variables known as random processes and the Markov process, the Poisson process and the knowledge of other processes.
M. Tech.	CS5002: Database Mgmt. Technique	 Master the basic concepts and appreciate the applications of database systems, Master the basics of SQL and construct queries using SQL. Be familiar with a commercial relational database system (Oracle) by writing SQL using the system, relational
		 database theory, and be able to write relational algebra expressions for queries. 3. Mater sound design principles for logical design of databases, including the E- R method and normalization approach, familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B- tree, and hashing. 4. Master the basics of query evaluation techniques and and and and and and and and and and
		5. Be familiar with the basic issues of transaction



			processing and concurrency control.
		6.	Master working successfully on a team by design and
			development of a database application system as part of
			a team.
M. Tech.	CS5017: Embedded and real	1.	To study Fundamentals of Operating Systems.
	time OS	2.	Implementation aspects of real time concepts and few
			applications on RTOS
		3.	Design aspects of real time concepts and few
			applications on RTOS
		4.	To study advanced operating systems
		5.	To write an assembly language programs for real time
			Operating System
		6.	To design and implement advanced real time operating
			system applications
M. Tech.	CS5004: High Performance	1.	Select network architecture, essential components to
	Networks		setup LAN and WAN.
		2.	Estimate reliability issues based on error control, flow
			control and pipelining by using bandwidth, latency,
			throughput and efficiency.
		3.	Choose multiplexing mechanism for server channel
			allocation in wired and wireless computer networks.
		4.	Demonstrate sustainable engineering practice indicating
			the scientific purpose and utility of communication
			frameworks and standards.
		5.	Analyze routing data flow in IP network using for best
			routing route.
		6.	Adapt to the requirements of next generation network
M. Tech.	CS5008: Machine Learning	1.	Demonstrate knowledge learning algorithms and concept
			learning through implementation for sustainable
			solutions of applications.
		2.	Evaluate decision tree learning algorithms.
		3.	Analyseresearchbased problems using Machine learning
			techniques.
		4.	Apply different clustering algorithms used in machine
			learning to generic datasets and specific
		_	multidisciplinary domains.
		5.	Formulate a given problem within the Bayesian learning
			framework with focus on building lifelong learning
			ability.
		6.	Evaluation of different algorithms on well formulated
			problems along with stating valid conclusions that the
			evaluation support.
M. Tech.	CS5007:DATA SCIENCE	1.	Perform exploratory data analysis
		2.	Apply regression to real world examples.
		3.	Build and use classification model for given task.
		4.	Identify appropriate clustering algorithm based on data
		1	set.



		5.	Detect outliers in data set.
		6.	Analyse social media sentiments.
M. Tech.	CS5009: IMAGE	1.	Describe image model.
	PROCESSING	2.	Perform spatial filtering on image.
		3.	Identify Image Segmentation techniques.
		4.	Apply lossless and lossy compression techniques for
			image compression.
		5.	Use various image transforms to analyze and modify
			image.
		6.	6. Understand Wavelet transform for Image Processing
			Applications.
M. Tech.	CS5011:User Interface Design	1.	Identify human factors and usability issues related with
	(UID)		computing applications
		2.	Differentiate computing applications into categories
			based on human factors
		3.	Design a user interface by applying suitable design
			principles, models and usability guidelines
		4.	Integrate ethno-cultural and accessibility computing
			aspects into the user interface design
		5.	Display the impact of usability evaluation and testing in
			computing applications
		6.	Follow required processes and standards while designing
			user interfaces.
M. Tech.	CS5010: Internet of Things	1.	Apply the concepts of IOT.
		2.	Identify the different technology.
		3.	Apply IOT to different applications.
		4.	Analysis and evaluate protocols used in IOT.
		5.	Design and develop smart city in IOT.
		6.	Analysis and evaluate the data received through sensors
			in IOT.
M. Tech.	CS5013: Mobile Computing	1.	Select components and radio spectrum for PCS based on
			bandwidth requirements.
		2.	Justify the Mobile Network performance parameters and
			design decisions.
		3.	Choose the modulation technique for setting up mobile
			network.
		4.	Formulate GSM/CDMA mobile network layout
			considering futuristic requirements which conforms to
		_	the technology.
		5.	Deploy the 3G/4G technology-based network with
		-	bandwidth capacity planning.
		6.	Adapt to the requirements of next generation mobile
			network and mobile applications.
M. Tech.	CS5014: PCGPU	1.	Recognize fundamentals of parallel computing and
		_	architectures available
		2.	Design parallel algorithms that better maps on GPU
		1	architecture



		3.	Write CUDA applications for execution on GPU
		4.	Apply parallel computing methods to scientific and
			engineering problems
		5.	Apply parallel computing methods to research problems
		6.	Optimize CUDA code using tools for performance
			improvements.
M. Tech.	CS5015: Cyber Security	1.	Analyze cryptographic techniques using a mathematical
			approach by examining nature of attack.
		2.	Establish type of attack on a given system.
		3.	Identify different types of attacks.
		4.	Justify various methods of authentication and access
			control for application of technologies to various
			sections of industry and society.
		5.	Design a secure system for protection from the various
			attacks for 7 layer model by determining the need of
			security from various departments of an organization.
		6.	Estimate future needs of security for a system by
			researching current environment on a continuous basis
			for the benefit of society.
M. Tech.	CS5018: Natural Language	1.	Analyze Morphology for given natural language
	Processing	2.	Apply different approaches to design Lexical Analyzer
	_		for given natural language
		3.	Evaluate and devise Syntactic Analyzer design for given
			natural language
		4.	Design Type Dependency Parser using pragmatic
			approach for given natural language
		5.	Develop machine transliteration for given natural
			language using statistical approach
		6.	Develop machine translation for given natural language
			using statistical approach.
M. Tech.	CS5006:Research Methodology	1.	Perform research in a more organized and efficient
			manner
		2.	Choose ideal method to select problem statement, design
			the research, collect and analyse data and test the
			hypothesis
		3.	Efficiently read and summarize technical
			documentationSystematically write, publish and present
			technical documentation
		4.	Understand legal issue regarding research
		5.	Be aware of and use searching, documenting and
			presenting tools and technologies.



Department of Information Technology (B. Tech)

Program Specific Outcomes

PSO1	Apply information science theory, algorithmic and programming principles for comprehending						
	technological trade-off in order to determine conceptual aspects of real world problems in						
	information technology.						
PSO2	Analyze and create problem frames in order to formulate decomposition structure of information						
	technology problem with correct resources, infrastructure and technology requirements						
	determination for solution realization.						
PSO3	Compose technical design specifications using template based approaches for formally expressing						
	the solution implementation by applying techniques and methods to create, enhance, and deliver IT						
	tools with appropriate CASE tools selection.						
PSO4	Exercise research and development aptitude focusing knowledge creation and dissemination						
	through engineering artifacts construction, preparation and presentation of engineering evidences						
	using procedures, techniques, guidelines, and standards considering technology migration and						
	evolution.						

Course Outcomes

Year	Course code	Course Name	CO Statements
	IT2001	Data Structures	1 To interpret and diagnose the properties of data structures with
			their memory representations and time complexity analysis
			2 To use linear data structures like stacks, queues etc. with their
			applications
			3 To handle operations like searching, insertion, deletion,
			traversing mechanism etc. on various data structures with the help
			of dynamic storage representation
			4 To demonstrate the use of binary tree traversals and to perform
			various operations on
			Non-linear data structures.
			5 To handle the operations on Graph data structure and to solve
SY IT			the applications of Graph data structure
(B18			6 To design and analyze the appropriate data structure by
pattern)			applying various hashing Techniques
	IT2002	Analog &	1 Understand the basic concepts of Analog Devices
		Digital	2 Construct combinational circuits.
		Electronics	3Design sequential circuits.
			4 Develop the applications of sequential circuits.
			5Analyze internal structure of logic gates.
			6 Describe Programmable Logic Devices
	IT2003	Computer	1 Understand the structure, function and characteristics of
		Organization	computer systems.
		& Architecture	2 Describe the working of Central Processing Unit and RISC and
			CISC Architecture.



			3 Explore the knowledge about Control Unit Design.
			4 Design memory with due consideration of tradeoffs and
			performance issues.
			5 Analyze a pipeline for consistent execution of instructions with
			minimum hazards.
			6 Acquaint the advanced concepts of computer architecture
	IT2004	Automata	1 Infer the applicability of various automata theoretic models for
		Theory	recognizing formal languages
			2 Discriminate the expressive powers of various automata
			theoretic and formal language theoretic computational models
			3 Illustrate significance of non-determinism pertaining to
			expressive powers of various automata theoretic models
			4 Comprehend general purpose powers and computability issues
			related to state machines and grammars
			5 Explain the relevance of Church-Turing thesis, and the
			computational equivalence of Turing machine model with the
			general purpose computers
			6 Grasp the theoretical limit of computation (independent of
			software or hardware used) via the concept of undesirability
	IT2006	Discrete	1Reason mathematically about elementary discrete
		Mathematics &	structures (such as functions, relations, sets, graphs, and trees)
		Graph Theory	used in computer algorithms and systems
			2 Describe the elementary properties of modular arithmetic and
			their applications in Computer Science like cryptography.(
			3 Summarize graph theory fundamentals and their applications
			4 Develop recurrence relations for a wide variety of interesting
			problems
			5 Express mathematical properties via the formal language of
			propositional and predicate logic
			6 Demonstrate use of pigeon-hole and inclusion-exclusion
	172007		principle in solving elegant and important problems
	112007	Advanced Data	I Model the real world problem with the help of appropriate tree
		Structures	data structure
			2 Analyze the amortized time complexity by applying suitable
			2 Comprehend and colored the store of nottern for strings
			s Comprehend and select the storage pattern for strings
			A Apply rendemized data structures for real world problems
			5 Design suitable Spatial data structure for the geometric
			besign suitable spatial data suitcitule foi the geometric
			6 Analyze the problem solutions based on state of the art Date
			structure representation
	1T2008	Computer	1 Select network architecture, topology and essential components
	112000	Network	to design computer networks
		I WE WOIK	2 Estimate reliability issues based on error control flow control
			and pipelining by using bandwidth latency throughout and
			efficiency
L	I		



		3 Design mechanisms to demonstrate server channel allocation in
		wired and wireless computer networks
		4 Analyze data flow between peer to peer in an IP network using
		Application, Transport and Network Layer Protocols
		5 Demonstrate sustainable engineering practice indicating the
		scientific purpose and utility of communication frameworks and
		standards
		6 Develop Client-Server architectures and prototypes by the
		means of correct standards, protocols and technologies
IT2009	Operating	1 Examine the functions of a contemporary Operating system
	Systems	with respect to convenience, efficiency and the ability to evolve
		2 Demonstrate knowledge in applying system software and tools
		available in modern operating system (such as threads, system
		calls, semaphores, etc.) for software development
		3 Apply various CPU scheduling algorithms to construct
		solutions to real world problems
		4 Identify the mechanisms to deal with Deadlock
		5 Understand the organization of memory and memory
		management hardware
		6 Analyze I/O and file management techniques for better
		utilization of secondary memory
IT2010	Database	1 Design data models as per data requirements of an organization
	Management	2 Synthesize a relational data model up to a suitable normal form
	Systems	3 Develop a database system using relational queries and PL/SQL
		objects
		4 Apply indexing techniques and query optimization strategies
		5 Understand importance of concurrency control and recovery
		techniques
		6 Adapt to emerging trends considering societal requirements
IT2012	Probability and	1 Solve problems based on basic probability and random
	Statistics	variables
		2 Grasp the basic concepts in queuing theory
		3 Analyze the data to evaluate central tendency of data such as
		mean, median, mode
		4 Evaluate the dispersion of given statistical data from central
		value
		5 Evaluate the correlation between the given parameters by
		applying the correlation and regression technique
		6 Apply the concepts of probability distributions to solve real life
		problems in this domain

Year	Course code	Course Name	CO Statements
	IT3001	Data Base	1. Design data models as per data requirements of an organization
		Management	2. Synthesize a relational data model up to a suitable normal form
		System	3. Develop a database system using relational queries and PL/SQL



			objects
			4. Apply indexing techniques and query optimization strategies
			5. Understand importance of concurrency control and recovery
			techniques
			6. Adapt to emerging trends considering societal requirements
	IT3002	Human	1. Identify human factors and usability issues related with
		Computer	computing applications
		Interaction	2. Differentiate computing applications into categories based on
			human factors
			3. Design a user interface by applying suitable design principles,
TY IT			models and usability guidelines
(C18			4. Integrate ethno-cultural and accessibility computing aspects
pattern)			into the user interface design
• /			5. Display the impact of usability evaluation and testing in
			computing applications
			6. Follow required processes and standards while designing user
	1770010	D. C.	interfaces
	113013	Data Science	1. Understand the process of converting data into a required
			format required for particular analysis.
			2. Analyze data, test claims, and draw valid conclusions using
			2 Utiliza statistical tools in deriving insights from data
			A Apply analytic techniques and algorithms (including statistical
			and data mining
			5 Use appropriate resources to research develop and contribute
			to advances and trends within the field of Data Science.
			6. Interpret and present visually, orally and in written form, valid
			conclusions drawn from data analysis
	IT3003	Software	1. Summarize capabilities and impact of Software Development
		Engineering	Process Models and justify process maturity through
			application of Software Engineering principles and practices
			focusing tailored processes that best fit the technical and
			market demands of a modern software project.
			2. Discriminate competing and feasible system requirements
			indicating correct real world problem scope and prepare
			stepwise system conceptual model using stakeholder analysis
			and requirement validation.
			3. Formulate system specifications by analyzing User-level
			tasksand compose software artifacts using agile principles,
			practices and Scrum framework
			4. Propose and demonstrate realistic solutions supported by well-
			normed documentation with application of agile roles, sprint
			and velocity monitoring
			and velocity monitoring.
			demonstrate cohesive teamwork skills avoiding classic
			mistakes and emphasizing on software safety adhering to
			 and requirement validation. 3. Formulate system specifications by analyzing User-level tasksand compose software artifacts using agile principles, practices and Scrum framework 4. Propose and demonstrate realistic solutions supported by well-formed documentation with application of agile roles, sprint management, and agile architecture focusing project backlogs and velocity monitoring. 5. Conform to Configuration Management principles and demonstrate cohesive teamwork skills avoiding classic mistakes and emphasizing on software safety adhering to



		relevant standards.
		6. Analyze the target system properties and recommend solution
		alternatives by practicing project planning, scheduling,
		estimation and risk management activities.
IT3004	Design and	1. Formulate computational problems in abstract and
	Analysis of	mathematically precise manner.
	Algorithms	2. Design efficient algorithms for computational problems using
	C C	appropriate algorithmic paradigm.
		3. Analyze asymptotic complexity of the algorithm for a
		complex computational problem using suitable mathematical
		techniques.
		4. Formulate computational problem as linear program and
		apply LP, network flow, based techniques to design efficient
		algorithms for them.
		5. Establish NPcompleteness of some decision problems, grasp
		the significance of the notion of NPcompleteness and its
		relation with intractability of the decision problems and
		design efficient approximation algorithms for standard NP-
		optimization problems.
		6. Incorporate appropriate data structures, algorithmic paradigms
		to craft innovative scientific solution for complex computing
		problems.
IT3014	Linux	1. Understand the concepts, design, and structure of the Linux
	Programming	Operating System.
		2. Use basic set of commands and utilities in Linux.
		3. Build effective applications using shell scripting.
		4. Understand Processes, process handling, file operations and
		signals in Linux.
		5. Identify different mechanisms for Interprocess
		communication.
		6. Develop kernel program in Linux
IT3006	Web	1 Design reliable efficient scalable front end view of web
115000	Technology	nages using HTMI 5 CSS with Bootstran framework
	Technology	2 Perform client side web page forms validation
		3 Refine web pages more dynamic and interactive
		A Deliver realistic and extensible light weight web application
		using PHP
		5 Practice and utilize web framework paradigms and principles
		for Web development.
		6. Develop reliable, efficient, scalable web services.
IT3015	Mobile	1. Estimate performance parameters for designing the Cellular
	Computing	Network which comply Next Generation Cellular Network
	P	Standards.



			 Formulate conceptual Telecommunication system to be deployed to fulfill bandwidth capacity planning Design the mobile network considering futuristic busty data on cellular network. Justify the Mobile Network performance parameters and design decisions while mobile Handoff. Adapt to the requirements of next generation mobile network and mobile applications Simplify the database usage on embedded devices for enterprise applications
	IT3007	Operating System	 Examine the functions of a contemporary Operating system with respect to convenience, efficiency and the ability to evolve Demonstrate knowledge in applying system software and tools available in modern operating system (such as threads, system calls, semaphores, etc.) for software development Apply various CPU scheduling algorithms to construct solutions to real world problems
			 4 Identify the mechanisms to deal with Deadlock 5 Understand the organization of memory and memory management hardware 6 Analyze I/O and file management techniques for better utilization of secondary memory
	IT3008	Computer Networks	 Select network architecture, topology and essential components to design computer networks Estimate reliability issues based on error control, flow control and pipelining by using bandwidth, latency, throughput and efficiency Design mechanisms to demonstrate server channel allocation in wired and wireless computer networks Analyze data flow between peer to peer in an IP network using Application, Transport and Network Layer Protocols Demonstrate sustainable engineering practice indicating the scientific purpose and utility of communication frameworks and standards Develop Client-Server architectures and prototypes by the


			means of correct standards, protocols and technologies
	IT3004	Systems Programming	 Develop different system software like Macroprocessor, Assembler, Compiler, Linker and Loader. Discriminate among different System software and their functionalities. Design Device Drivers, TSR programs and DLL for real world applications. Solve critical problems related to Encoding, Decoding and Instruction set. Conforms to use proper data structures for system programming. Follow methods and techniques for implementing system- level programs.
	IT3016	Software Testing and Quality Assurance	 Select and classify measurement scales and models, software metrics and measures addressing software quality and reliability. Conduct unit and integration tests by determining test design, test automation, test coverage criteria using testing frameworks and test adequacy assessment using control flow, data flow, and program mutations. Apply suitable higher order testing techniques and methods in order to achieve verified and validated software by following testing best practices. Demonstrate the skillset as a tester to neutralize the consequences of wicked problems by narrating effective test cases and test procedures. Adapt to various test processes, types of errors and fault models and methods of test generation from requirements for continuous quality improvement of the software system along with Software Quality best practices usage. Apply software testing cycle in relation to software development and project management focusing incidents and risks management within a project towards efficient delivery of software solutions and implement improvements in the software development processes by making use of standards and baselines
Year	Course code	Course Name	CO Statements
	IT4001	Data Acquisition Systems	 Define the characteristics of measuring devices for an instrument. Identify the functioning of measuring devices in an industrial process. Design elements of signal conditioning circuit that are necessary for sensors. Describe the structural units of Microcontroller.



			5. Interconnect devices using communication buses.
			6. Develop programs for the process control systems using sensors.
	IT4002	Internet of	1. Learn the terminology, technology and its applications of IoT
		Things	2. Analyze Embedded suite widely used in IoT.
			3. Describe the concept of M2M with necessary protocols
BToch			4. Understand the cloud storage for IoT applications.
DICUI			5. Optimize resources for different IoT applications
			6. Understand Real world IoT Design constraint
(D18	IT4003	Machine	1. Demonstrate knowledge learning algorithms and concept
pattern)		Learning	learning through implementation for sustainable solutions of
			applications.
			2. Evaluate decision tree learning algorithms.
			3. Analyze research based problems using Machine learning
			techniques.
			4. Apply different clustering algorithms used in machine learning
			to generic datasets and specific multidisciplinary domains.
			5. Formulate a given problem within the Bayesian learning
			framework with focus on building lifelong learning ability.
			6. Evaluation of different algorithms on well formulated problems
			along with stating valid conclusions that the evaluation support.
	IT4004	Distributed	1. Identify the basic principles, design issues and architectural
		Computing	aspects of distributed systems.
			2. Analyze the different techniques used for Communication in
			distributed system.
			3. Develop the solutions for Clock synchronization, Mutual
			exclusion in distributed system.
			4. Construct an optimal and cost-effective solution for Distributed
			transaction and Deadlock.
			5. Use and apply important methods in distributed systems to
			support Scalability and Fault tolerance.
			6. Gain knowledge on Distributed File System and design issues of
			Distributed Shared Memory
	114005	Embedded	1. Understand the Concept of Embedded Systems
		System	2. Apply the Fundamentals of Microcontrollers
			3. Design IO interfacing using Microcontrollers
			4. Analyze Systems using principles of ES.
			5. Explore bus design issues.
	1774010		6. Build the effective applications using fundamentals of RTOS.
	114018	Convergence	1. Categorize voice and data networks based on various protocols.
		Technology	2. Analyze the protocols and standards for converged networks.
			5. Justify complexity involved in switching network.
			4. Design the converged network to fulfill the societal
			requirement.
			5. Judge the impact and benefits of converged network in
			6 Dramara and affactive colutions to fulfill the read of
			10. Trepare cost effective solutions to fulfill the need of



		convergence technology
IT4006	Artificial	1. Understand the basics of the theory and practice of Artificial
	Intelligence	Intelligence as a discipline and about intelligent agents capable
	U	of problem formulation.
		2. Evaluation of different uninformed search algorithms on well
		formulated problems along with stating valid conclusions that
		the evaluation supports.
		3. Design and Analysis of informed search algorithms on well
		formulated problems.
		4. Formulate and solve given problem using Propositional and
		First order logic.
		5. Apply planning and neural network learning for solving AI
		problems
		6. Apply reasoning for non-monotonic AI problems
IT4007	Information	1. Establish type of attack on a given system.
	System	2. Analyze private key cryptographic techniques using a
	Security	mathematical approach by examining nature of attack.
		3. Analyze public key cryptographic techniques using a
		mathematical approach by examining nature of attack.
		4. Justify various methods of access control and information flow
		for application of technologies to various sections of industry and
		society.
		5. Design a secure system for protection from the various attacks
		for 3 layer model by determining the need of security from various
		C Evoluate exher accurity techniques and forensis tools by
		6. Evaluate cyber security techniques and forensic tools by
		benefit of society
IT4010	Mobile	1 Estimate performance parameters for designing the Cellular
114010	Computing	Network which comply Next Generation Cellular Network
	Computing	Standards
		2 Formulate conceptual Telecommunication system to be
		deployed to fulfill bandwidth capacity planning
		3 Design the mobile network considering futuristic busty data on
		cellular network.
		4. Justify the Mobile Network performance parameters and
		design decisions while mobile Handoff.
		5. Adapt to the requirements of next generation mobile network
		and mobile applications
		6. Simplify the database usage on embedded devices for
		enterprise applications.
IT4011	Software	1. Select and classify measurement scales and models, software
	Testing and	metrics and measures addressing software quality and reliability.
	Quality	2. Conduct unit and integration tests by determining test design, test
	Assurance	automation, test coverage criteria using testing frameworks and
		test adequacy assessment using control flow, data flow, and
		program mutations.



			3. Apply suitable higher order testing techniques and methods in
			order to achieve verified and validated software by following
			testing best practices.
			4. Demonstrate the skill set as a tester to neutralize the consequences
			of wicked problems by narrating effective test cases and test
			procedures.
			5. Adapt to various test processes, types of errors and fault models
			and methods of test generation from requirements for continuous quality improvement of the software system along with Software
			Quality best practices usage.
			6. Apply software testing cycle in relation to software development
			and project management focusing incidents and risks management
			within a project towards efficient delivery of software solutions and
			implement improvements in the software development processes by
-			making use of standards and baselines
	IT4012	Image	1. Describe image model
		Processing	2. Perform spatial filtering on image
			3. Identify Image Segmentation techniques.
			4. Apply lossless and lossy compression techniques for image
			compression.
			5. Use various image transforms to analyze and modify image.
			A publications
-	IT/013	Darallal	Applications. 1 Recognize fundamentals of parallel computing and architectures
	114015	Computing on	available
			2 Design parallel algorithms that better maps on GPU architecture
		GPU	3. Write CUDA applications for execution on GPU
			4. Apply parallel computing methods to scientific and engineering
			problems
			5. Apply parallel computing methods to research problems
			6. Optimize CUDA code using tools for performance
			improvements
	IT4019	Software	1. Examine and breakdown real depicting static and dynamic
		Design and	behavior of the system management practices, object
		Methodologies	Development practices.
		C C	2. Identify and formulate software requirements and behavioral
			models using static and dynamic behavioral views indicating
			structured problem partitioning and state-based exploration.
			3. Compose system analysis and design specifications indicating
			logical, physical, deployment, and concurrency viewpoints
			using object design principles and Model Driven Engineering
			A Construct and justify the evolutionary system description
			models expressing high level architecture accommodating
			applicable architectural styles compatible to requirements and
			behavioral models using UML
			5. Comprehend the nature of design patterns by understanding a
		1	



		small number of examples from different pattern categories and apply these patterns in creating a correct design using design heuristics published guidance applicability reasonableness
		and relation to other system profiles to the engineering and social community.
	6.	Propose multi-faceted defendable solutions demonstrating team
		accommodating design patterns reducing the potential cost and performance impedance in order to realize system artifacts
		Model Driven Development practices



Department of Master in Computer Application

Program Outcomes

PO1	Computational Knowledge: Apply knowledge of computing fundamentals, computing specialization,
	mathematics, and domain knowledge appropriate for the computing specialization to the abstraction
	and conceptualization of computing models from defined problems and requirements.
PO2	Problem Analysis: Identify, formulate, research literature, and solve complex computing problems
	reaching substantiated conclusions using fundamental principles of mathematics, computing sciences,
PO3	Design /Development of Solutions: Design and evaluate solutions for complex computing problems
105	and design and evaluate systems, components, or processes that meet specified needs with appropriate
	consideration for public health and safety, cultural, societal, and environmental considerations
PO4	Conduct Investigations of Complex Computing 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.
PO5	Modern Tool Usage: Create, select, adapt and apply appropriate techniques, resources, and modern
	computing tools to complex computing activities, with an understanding of the limitations.
PO6	Professional Ethics : Understand and commit to professional ethics and cyber regulations
100	responsibilities, and norms of professional computing practice
PO7	Life-long Learning: Recognize the need, and have the ability, to engage in independent learning for
	continual development as a computing professional.
PO8	Project management and finance: Demonstrate knowledge and understanding of the computing and
	management principles and apply these to one's own work, as a member and leader in a team, to 16
	manage projects and in multidisciplinary environments.
PO9	Communication Efficacy: Communicate effectively with the computing community, and with society
	at large, about complex computing activities by being able to comprehend and write effective reports,
	design documentation, make effective presentations, and give and understand clear instructions
PO10	Societal and Environmental Concern: Understand and assess societal, environmental, health, safety,
	legal, and cultural issues within local and global contexts, and the consequential responsibilities
	relevant to professional computing practice.
PO11	Individual and Team Work: Function effectively as an individual and as a member or leader in
1011	diverse teams and in multidisciplinary environments
PO12	Innovation and Entrepreneurship Identify a timely opportunity and using innovation to pursue that
	opportunity to create value and wealth for the betterment of the individual and society at large.



Program Specific Outcomes

PSO1	Comprehend and apply computing theory principles, data structures, algorithms and programming
	paradigms pertaining to application domains
PSO2	Use of mathematical, statistical approaches for data handling and modeling.
PSO3	Create, enhance, and deliver application softwares along with effective use of project management
	skills.
PSO4	Apply computational techniques and development methodologies by analyzing and designing
	solution for real world problems.

Course Outcomes

Year	Course code	Course Name	CO Statements
	IT7001	Discrete	1:Apply mathematical logic to solve Engineering problem on
		Structures	this domain.
			2: Apply logical concept to prove or disprove the correctness of
			a proposition.
			3: Analyze different types of relations and functions.
			4: Solve different types of partial order Relations and functions.
			5: Analyze different types of Algebraic Structures.
			6: Apply graph techniques to Solve different graph situational
	177002	Drogramming in	1. Solve real world problems using loops
	117002	C	1. Solve lear world problems using loops.
FY		C	2. Apply pointer concept in real world problems.
MCA			3. Apply arrays to solve complex problems.
(A18			4. Develop programs using String operations.
pattern)			5. Prepare programs using structure.
			6. Apply file handling concept to solve complex problems and
	1000	XX 7 1	for permanent storage
	11/003	Web	1. Design web pages using various HTML5 tags.
		Technologies	2. Design reliable, efficient, scalable front end view of web
			2 Decign the such reason many dynamic and interactive
			4. Design the web pages more dynamic and interactive.
			4. Perform chemicale form variation.
			5. Establish database connectivity between from end and backend using MuSQL
			6 Design full website using PHP AIAY and IsvaScript
	IT7004	Databasa	1. Describe fundamental concents and principles of database
	117004	Management	management systems and design an entity relationship data
		System	model
			2 Construct Entity Relationship diagram
			3 Analyze the relational database schema to write queries using
			relational query languages and SOL.
			4. Describe techniques used by a DBMS for data storage.
			access and query processing.



		5. Analyze and apply concurrency control and recovery
		techniques in case of failure.
		6. Apply security and privacy measures to database and describe query optimization
IT7005	International	1. Pronounce the words correctly according German language
11,000	Language-	rules and formulate small and simple sentences in German
	German	using basic grammar structures. Introduce himself or herself
		2. Say, write numbers, number names. Recognize professions of
		male and female. Play dialogs related to classroom object.
		Recognize definite articles of classroom objects. Recognize
		Singular/Plural form. Tell and write days of week, Months
		and seasons
		5. Iell directions, locations. Write passage on Family and
		professions, ages of family memoers. while, formulate
		using Imperative.
		4. Read and tell clock time and use it for taking and cancelling
		formal/ informal appointments using Possessive pronouns,
		and Modal verbs.
		5. Read and understand small texts about Hobbies, free-time
		activities and read and write ordinal number, date of birth
		and important days, holidays in year.
		6. Make conversation related to Restaurant, Cares using
IT7007	Statistical and	1 Represent statistical data using descriptive statistical tools
11,001	Mathematical	2 Analyze the data to evaluate central tendency of data such as
	Foundations	mean, median, mode.
		3. Evaluate the dispersion of given statistical data from central
		value.
		4. Evaluate the correlation between the given parameters by
		applying the correlation and regression technique.
		5. Differentiate different types of probability distribution and
		Solve them.
		life problems in this domain.
IT7008	Data Structures	1. Systemize incorporation of data structures in context with real
		worlds scenarios
		2. Implement and demonstrate different data structures with
		operations like insertion, deletion, traversing.
		3. Implement Binary search tree and its variations.
		and canabilities
		5. Apply graphs concept to solve computational problems
		6 Use various types of sorting and searching techniques
IT7009	Operating	1. Analyse mechanisms and strategies of an Operating System
	Systems	in order to solve real world problems.
		2. Develop solutions based on Operating system concepts in



		various contexts.
		3. Automate the administrative tasks by means of modern tools
		in Operating System.
		4. Develop Simulate the functions of a contemporary Operating
		system with respect to convenience, efficiency and the ability to
		evolve.
		5. Engage in a team towards development of a prototype
		Operating System.
		6. Construct solutions to real world problems by applying the
		standard techniques used by Operating Systems for similar
		issues.
IT7010	Soft Skills	1. Perform and present self-evaluation.
		2. Understand importance of positive attitude in handling
		situations in real life
		3. Set the long term and short term goals from career planning
		perspective
		4. Face audience and build confidence in improving
		communication skill.
		5. Prepare the formal communication documents
		6. Improve use of gestures for effective communication
IT7012	Computer	1. Apply mathematics and computer programming to computer
	Graphics	graphics applications and problem solutions.
		2. Utilize algorithms to draw, fill and perform 2D
		transformations on basic geometrical shapes.
		3. Apply the logic to develop animation using segments.
		4. Develop the competency to understand the concepts related
		to demonstrate the use of clipping in real life.
		5. Develop scientific and strategic approach to solve complex
		problems in the domain of Computer Graphics
		6. Interpret the curves, fractals and hidden surfaces for
		representation of interactive graphics systems.
IT7013	Linux	1. Understand the concepts, design, and structure of the Linux
	Programming	Operating System.
		2. Use basic set of commands and utilities in Linux.
		3. Build effective applications using shell scripting.
		4. Understand Processes, process handling and file operations
		in Linux.
		5. Identify different mechanisms for Interprocess
		communication.
		6. Develop kernel program in Linux.
IT7014	Computer	1. Demonstrate computer architecture concepts related to
	Architecture	design of modern processors, memories and I/Os.
		2. Analyze the principles of computer architecture using
		examples drawn from commercially available computers.
		3. Evaluate various design alternatives in processor
		organization.



		4. Solve problems based on computer arithmetic.
		5. Explain processor structure & its functions.
		6. Understand concepts related to memory & IO organization.
IT7015	Advance	1. Identify information retrieval and associated processes from
	database	text database.
	management	2. Differentiate Graph based database from relational database
	system	3. Describe semi-structured data and XML.
		4. Review object-oriented databases.
		5. Learn object-relational databases concept and its applications
		6. Characterize Parallel databases and its usage.
IT7016	Advance Web	Design reliable, efficient, scalable front end view of web pages
	Technology	with Bootstrap framework.
		2. Understand concept of JSON.
		3. Apply concept of AJAX in web development.
		4. Perform database operations on web applications using a
		ADO.NET .
		5. Use of Angular JS framework for Web development.
		6. Develop reliable, efficient, scalable web services.

Year	Course code	Course Name	CO Statements
	IT8001	Optimization techniques	 Develop linear programming models to solve real life problems. Solve linear programming problems by applying optimization
			techniques. 3. Develop an optimal schedule chart for a given project by
			applying project management techniques such as PERT, CPM.
			4. Design Optimal time table for processing resources such as jobs, equipment, people, material etc
			5. Device the best inventory model for an organization by using Inventory control model.
			6. Design a mathematical model for decision making and identify the optimal strategies for bidding (business deal) by using game theory.
(B18	IT8002	C++ and Core Java	1. To implement polymorphism using c++.
pattern)		Programming	2. To Apply the concepts of data encapsulation , inheritance, and
			porymorphism using c++.
			3. To incorporate exception handling in object-oriented programs.
			4. Understand advanced concepts like template classes and RTTI .
			5. To design a computer program to solve real world problems



		using java based on object-oriented principles.
		6. Develop Java based solution for real world problem.
IT8003	Computer Networks	 Estimate reliability issues based on error control, flow control and pipelining by using bandwidth, latency, throughput and efficiency. Build Design mechanisms to demonstrate LAN behavior utilizing network architecture, protocols, and network components.
		 3. Analyze data flow between peer to peer in an IP network using Application, Transport and Network Layer Protocols. 4. Illustrate applications of Computer Network capabilities, selection and usage for various sectors of user community.
		 5. Demonstrate sustainable engineering practice indicating the scientific purpose and utility of communication frameworks and standards. 6. Develop, Client Server, architectures, and protectures, by the
		means of correct standards and technology.
IT8004	Software Engineering	 Compare different types of software models. Collect requiems using different techniques and write SRS.
		 Analyze requirements and draw UML diagrams. Describe various design approaches. Write metric for the different levels and parts of software and identify maintenance strategies. Anticipate the software risks and suggest risk mitigation plan and summarize current trends in software engineering.
IT8005	Python programming	 To develop proficiency in creating based applications using the Python Programming Language. To be able to understand the various data structures available in Python programming language and apply them in solving computational problems.
		 3. To apply data structures in solving computational problems. 4. To be able to do testing and debugging of code written in Python
		5. To be able to draw various kinds of plots using PyLab.6. To be able to do text filtering with regular expressions in Python Plotting.
IT8007	Quantitative Techniques	 Qualify all the company aptitude Test for placement. Clear Most of the Banking test based on Quantitative aptitude and Reasoning. Qualify most of the exam based on Quantitative aptitude and
		Reasoning like railways, public services, etc.4. Qualify the exam for higher study like GRE, GMAT.



ſ				5. Qualify the exam for higher study like NDA, CDS.		
				6. Develop overall aptitude ability.		
		IT8008	Advanced Java Programming	 Analyze the nature of a problem to select appropriate advanced featureof Java towards achieving at a problematic solution. Develop Java based solution for real world problem. Employ Integrated Development Environment (IDE) for implementing and testing of software solution. Work in well-formed teams with proper skill sets to achieve effective solutions. Extend their knowledge in utilizing the appropriate advanced features of Java for using emerging frameworks. Construct software solutions by evaluating alternate architectural patterns. 		
		IT8009	Design and Analysis of Algorithms	 Analyze asymptotic time and space complexity of an algorithm for worst, average and best cases using suitable mathematical tools. Derive and solve recurrences describing the performance of divide and conquer algorithms. Synthesize and analyze greedy algorithms. Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. Use backtracking and branch and bound technique for solving problems 		
				6. Differentiate polynomial and no polynomial problems.		
		IT8012	Software Project Management	 Understand and practice the process of project management and its application in delivering successful IT projects Use risk management analysis techniques that identify the factors that put a project at risk and to quantify the likely effect of risk on project timescales Evaluate a project to develop the scope of work, provide cost estimates and to plan the activities viz. identifying the resources required for a project, produce a work plan and resource schedule Implement monitoring mechanism of progress of a project and to assess the risk of slippage, revising targets Apply quality principles of software project. Distinguish between the different types of project and follow the stages needed to 		
l		IT8013	Software	1. Learn importance of Software Testing, systematic approach to		



	Testin	g and	apply Software Techniques and Strategies		
	quality	v	2. Identify applicable Test Strategies, Write: Test Plan, Test		
	assura	nce	Cases, Test Procedures, Test Scenarios		
	ussuit		3. Study importance of ISO, IEEE standards related to Software		
			Testing		
			4. Understand the issues in Software Quality and activities		
			present in Software Quality		
			5. Understand the framework and general approach of several		
			Quality System Standards and Total Quality Management		
			(TQM).		
			6. Understand required practices and processes of project		
			management in delivering successful IT projects		
П	8014 Organ	izational	1. Describe the concepts of organizational behavior and		
	Behav	vior	management practices.		
			2. Summarize the problems occurring due to organizational		
			change and Analyze how the theories and empirical evidence		
			can help to solve contemporary organizational issues.		
			3. Apply theories of motivation to practical problems in		
			organizations in a critical manner.		
			4. Justify the role of leadership qualities.		
			5. Apply MBO technique to achieve the organizational		
			objectives.		
			6. Develop the skills that are necessary for making ethical		
			decisions in Professional life		
II	18016 User i	nterface	1. Analyze types of user interfaces		
	design	1	2. Design user interfaces for various applications		
			3. Distinguish between good and bad user interaction designs		
			4. Follow required processes and standards while designing user		
			interfaces.		
			5. Integrate ethno-cultural and accessibility computing aspects		
			into the user interface design		
			6. Describe the types of interfaces and their applications.		

Year	Course	Course Name	CO Statements	
	code			
	IT9001	Network and	1. Identify the various types of attacks by analyzing the behaviour	
		Information	of data in the networks	
		Security	2. Design a secure system for protection from the various attacks	
			for 7 layer model by determining the need of security from	
			various departments of an organization	
			3. Investigate the vulnerabilities in the existing system for the	
			development of new system by following laws of security	
			4. Perform authentication of individuals or groups with cost	
			effective Engineering solutions.	
			5. Examine the importance of network security applications for	



			current and future needs of organizations.
			6. Estimate future needs of security for a system by researching
ту			current environment on a continuous basis for the benefit of
			society.
	IT9002	Data warehousing	1. Illustrate use of appropriate analysis technique/s given the data
(C18		and data mining	Specifications.
pattern)		C C	2. Construct a data warehousing solution for business intelligence
			involving various data sources, ETL, multi-dimensional
			modelling and OLAP.
			3. Understand the process of data mining and the key steps
			involved well enough to lead/manage a real-life data mining
			project
			4. Derive useful facts from data using different data mining
			algorithms
			5. Apply suitable data mining technique to predict useful patterns
			6. Solve real life problems using data analysis techniques
	IT9005	Mobile	1. Simplify the data manipulation using Content Providers, Shared
		Application	Preferences, embedded database SQLite, Flat files and Multi
		Development	Media files.
			2. Design UI-rich apps using all the major UI components
			3. Choose suitable software tools, IDE and APIs for the
			development of Mobile Application.
			4. Trace and identify the location of specific/ specialized handheld
			or mobile devices using Google map and other alternative
			techniques.
			5. Develop android social media applications using HTTP and
			Socket communication protocol.
			6. Package and prepare real world apps for deploying on mobile
			device.
	IT9003	Data Analytics	1. Understand the process of converting data into a required
			format required forparticular analysis.
			2. Analyze data, test claims, and draw valid conclusions using
			appropriate statisticalmethodology.
			3. Utilize statistical tools in deriving insights from data .
			4. Apply analytic techniques and algorithms (including statistical
			and data mining
			5. Use appropriate resources to research, develop and contribute to
			advances andtrends within the field of Data Science.
6. Interpret a			6. Interpret and present visually, orally and in written form, valid
			conclusions drawnfrom data analysis.
	IT9009	Big data	7. Illustrate architecture of Hadoop
		applications	8. Break down a computing problem into multiple parallel tasks
			9. Explain Hadoop Ecosystem
			10. Organize input data to handle it using HDFS
			11. Apply map reduce programming technique to address real
			world problems
			12. Adapt to upcoming technologies for management of



		complex big data problems.		
IT9010	Advanced data	1. Demonstrate memory efficient solution in order to apply basic		
	structures	principle of programming perspective.		
		2. Infer memory utilization with modularization useful for		
		programming pragmatics.		
		3. Verify and narrate test condition in employing debugging		
		technique to assist problem solving.		
		4. Elaborate on unrecognizable well organized problems based on		
		realizable solutions.		
		5. Implement and demonstrate different data structures with		
		operations like insertion, deletion, traversing.		
		6. Contribute breadth of modularization in order to understand and		
		implement realistic solution.		
IT9011	Software design	1. To describe what patterns are, how to use them, and why they		
	and architecture	are important.		
		2. To understand contribution of patterns towards the design		
		process efficiency		
		3. To trace the relationship between patterns and traditional		
		methods		
		4. To learn the relationship among patterns, frameworks, object-		
		oriented languages, and software architecture		
		5. To identify fundamental and advanced concepts of design and		
		architectural patterns		
		6. To Structure systems by applying architectural patterns		
119012	Artificial	I. Understand the basics of the theory and practice of Artificial		
	intelligence	Intelligence as adiscipline and about intelligent agents capable of		
		problem formulation		
		2. Evaluation of different uninformed search algorithms on well formulated much lama along with stating valid conclusions that the		
		ionnulated problems along with stating valid conclusions that the		
		2 Design and Analysis of informed search algorithms on well		
		formulated problems		
		4 Formulate and solve given problem using Propositional and First		
		order logic		
		5 Apply planning and neural network learning for solving AI		
		nroblems		
		6 Design a small expert system using PROLOG		
IT9020	Linux	7 Estimate performance parameters for designing the Cellular		
117020	Programming	Network which comply Next Generation Cellular Network		
	1.08.000	Standards.		
		8. Formulate conceptual Telecommunication system to be		
		deployed to fulfill bandwidth capacity planning		
		9. Design the mobile network considering futuristic busty data on		
		cellular network.		
		10. Justify the Mobile Network performance parameters and design		
		decisions while mobile Handoff.		
		11. Adapt to the requirements of next generation mobile network		



		and mobile applications		
		12. Simplify the database usage on embedded devices for enterprise		
ITOOOO		applications.		
119008	Natural Language	1. Inustrate use of appropriate NLP technique/s given the problem		
	processing	Construct and evaluate language model		
		2. Construct and evaluate language model		
		application to manage a real-life NLP project		
		4. Derive useful facts from syntactic parsing data using different		
		data miningalgorithms		
		5. Apply semantic learning technique to predict useful patterns		
		6. Solve real life problems using machine translation.		
IT9004	Internet of Things	1.Learn the terminology, technology and its applications of IoT		
		2. Analyze Embedded suite widely used in IoT.		
		3. Describe the concept of M2M with necessary protocols		
		4. Understand the cloud storage for IoT applications.		
		5. Optimize resources for different IoT applications		
		6. Understand Real world IoT Design constraint		
IT9014	Robotics	1. Translate specifications to the components of robots such as		
		arms, linkages, drive systems and end effectors		
		2. Understand mechanics and kinematics of robots.		
		3. Select sensors and design their signal conditioning circuit		
		4. Demonstrate use of engineering methods and problem solving		
		towards design of the specified robot		
		5. Use robot operating system for application development		
		6. Apply prerequisite knowledge of programming, Microcontrollers, sensor		
IT9015	Cloud Computing	1. Illustrate the architecture and infrastructure of cloud computing,		
		including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid		
		cloud, etc.		
		2. Investigate the resource virtualization technique for a given		
		business case		
		3. Choose the appropriate file system and database for a given business case		
		4. Develop a algorithm for a given business case using Map-		
		Reduce model		
		5. Build a SaaS solution for a real world problem with collaborative		
		efforts		
		6. Identify the challenges in Cloud Management and Cloud		
		Security		
119016	GPU computing	1.Recognize fundamentals of parallel computing and architectures		
	and applications	available		
		2. Design parallel algorithms that better maps on GPU architecture		
		3. Write CUDA applications for execution on GPU		
		4. Apply parallel computing methods to scientific and engineering		



		problems					
		5. Apply parallel computing methods to research problems and real applications					
		6. Optimize CUDA code using tools for performance improvements					
IT9018	Image processing	1.Describe image model					
		2. Perform spatial filtering on image					
		3. Identify Image Segmentation techniques.					
		4. Apply lossless and lossy compression techniques for image					
		compression.					
		5. Use various image transforms to analyze and modify image.					
		6. Understand Wavelet transform for Image Processing					
		Applications.					
IT9019	Data acquisition	7. Define the characteristics of measuring devices for an instrument.					
	system						
		o. Identify the functioning of measuring devices in an industrial process.					
		9. Design elements of signal conditioning circuit that are necessary					
		for sensors.					
		10. Describe the structural units of Microcontroller.					
		11. Interconnect devices using communication buses.					
		Develop programs for the process control systems using sensors					



Department of Chemical Engineering (B. Tech) Program Specific Outcomes

Engineering Graduates will be able to:

- 1. Work in chemical engineering organizations demonstrating expertise in conventional chemical engineering design and operations.
- **2.** Work in diverse, multidisciplinary fields such as biotechnology, nanotechnology, food, energy, environmental, product designs etc.

YEAR	COUDSE NAME	CO STATEMENT		
	COURSE NAME	Students will be able to		
	CH2001:: FLUID FLOW OPERATIONS	 Determine various properties and flow behaviors Select and use manometers for pressure measurement Solve fluid flow problems by using conservation equations of mass, momentum, and energy. Develop correlations using dimensional analysis Design the pipe size and flow meters requirements under laminar and turbulent flow conditions. Determine the power requirements of pumping and transportation of fluids 		
S. Y.	CH2003:: PROCESS CALCULATIONS	 pumping and transportation of fluids Determine the quantities of chemicals in different mode i.e. moles and equivalent mass and able to convert various physical quantities in different unit systems Formulate analyse and solve steady state and unsteady state material balances for unit operations and unit processes. Make material balances for recycling, by- passing and purging operations Perform energy balances for unit operations Perform energy balances for unit processes Perform Psychometric calculations, non ideal calculations for gaseous and liquid mixtures, combustion calculations and solve complex chemical problems. 		

Course Outcomes



		1.	Estimate thermodynamic properties of pure
		2	substances in gas or liquid state
		2.	Estimate important thermodynamic
			properties of ideal and real mixtures of gases
			and liquids
		3.	Solve simple and complex chemical
			engineering problems using thermodynamic
			concepts, data and models
		4.	Apply criteria of phase equilibria for vapour
	CH2005:CHEMICAL		liquid system and generate VLE data
	ENGINEERING	5.	Analyze phase equilibria involving vapor
	THERMODYNAMICS		and/or liquid and/or solid
		6.	Analyze chemical reaction equilibria and use
			standard heats and free energies of formation
			to evaluate equilibrium constants and
			determine equilibrium
		1.	Find out the rate of chemical reaction and
			different kinetic parameters e.g. order or
			reaction, michaelis menten kinetics and rate
			constant etc.
		2.	Get adsorption isotherms and its study e.g.
			surface area determination Find out the
			structure and catalytic properties of metals
			etc.
		3.	Find out different thermodynamic parameters
			of chemical. Calculation and application of
			virial equation to calculate volumetric
	CH2061:PHYSICAL AND ORGANIC CHEMISTRY		parameters.
		4.	To select the reagents and physical and
			chemical conditions to carry out the desired
			reaction.
		5.	Get the stereo chemical structure and optical
			activity of organic compounds, synthesis
			mechanism of heterocyclic compounds and
			spectrophotochemical behavior of organic
			compounds.
		6.	Find out the effect of solvents on the reaction
			rate, the product formation and synthesis
			mechanism of some natural compounds
		1.	Employ basic analytical and numerical
			methods for solution of ODEs.
	CH2000··	2.	Apply ODEs to chemical processes and
	CH2009:: DIFFERENTIAL EQUATIONS		engineering applications.
		3.	Employ basic analytical and numerical
			methods for solution of PDEs.
		4.	Apply PDEs to chemical processes and
			engineering applications.



Bansilal Ramnath Agarwal Charitable Trust's VISHWAKARMA INSTITUTE OF TECHNOLOGY – PUNE (An autonomous Institute affiliated to University of Pune)

•				•
666, Upper	Indiranagar,	Bibwewadi,	Pune –	411 037.

		1.	Apply chemical engineering knowledge.
		2.	Work in a team
		3.	Approach and execute a practical problem
			given in a project
	CHOOTO ENCINEEDING	4.	Carry out research and development work.
	CH20/9:ENGINEERING	5.	Design equipments or process for chemical
	DESIGN AND		engineering plants
	DEVELOPMENTI	6.	Apply written, oral, and graphical
			communication in technical and non-
			technical environment
		1.	Distinguish between mechanisms of heat
			transfer and derive basic heat transfer
			equations from first principles.
		2.	Solve convection heat transfer problems
	СН2062. НЕ ЛТ		using empirical correlations.
	TDANSEED	3.	Solve boiling and condensation problems
	IKANSFEK		using empirical correlations.
		4.	Solve radiative heat transfer problems.
		5.	Design simple heat exchangers and
			condensers.
		6.	Design evaporators, furnaces and reboilers.
		1.	Apply principles of diffusion to separation
			and purification processes and calculate mass
			transfer flux and estimate mass transfer
			coefficient and diffusivity for gas-liquid and
			liquid-liquid system
		2.	Select and design appropriate gas-liquid
	~~~~		contacting devices
	CH2004:: MASS	3.	Select and design gas absorption and
	TRANSFER		stripping column
	OPERATIONS	4.	Calculate mass transfer coefficient for
			humidification and dehumidification and
		_	design cooling tower
		5.	Calculate rate of drying and Select proper
			aryer, and find batch time for batch drier and
			design rotary drier for given requirement
		6.	Comprehend crystallization system and
			tundamental of design



CH2006:CHEMICAL REACTION KINETICS	<ol> <li>Develop rate expressions from elementary and non elementary step mechanisms using steadystate and quasi-equilibrium approximations</li> <li>Determine rate expressions by analyzing reactor data including integral and differential analysis on constant and variable volume systems</li> <li>Design ideal reactors i.e. plug flow and CSTR for first and second order reversible and irreversible, constant and variable volume systems.</li> <li>Select and size isothermal reactors for series and/or parallel systems of reactions and product distribution for multiple reactions</li> <li>Quantitatively predict the performance of common chemical reactors in various combinations</li> <li>Generate temperature and conversion profiles for exothermic and endothermic reactions</li> </ol>
CH2008:CHEMICAL TECHNOLOGY	<ol> <li>Apply process fundamentals of chemical technology in process industries.</li> <li>Apply knowledge of chemical technology in unit operations and unit processes happening in chemical industry.</li> <li>Develop process flow sheets for production of specific chemical product.</li> <li>Comprehend reaction temperature, pressure condition and heat network in process flowsheet.</li> <li>Analyze different process for same product based on economics, effluent treatment, social aspects.</li> <li>Explain Petroleum refinery operation and supplementary processes.</li> </ol>
CH2010::NUMERICAL METHODS FOR CHEMICAL ENGINEERING	<ol> <li>Solve different Chemical engineering problems by using matrix</li> <li>Do statically data analysis.</li> <li>Solve different Chemical engineering problems using numerical methods.</li> <li>Solve different elliptical and parabolic equations.</li> <li>Solve industrial problems by using linear optimization techniques.</li> <li>Solve different Chemical engineering problems by using matrix</li> </ol>



T.Y.	CH2078 :: ENGINEERING DESIGN AND DEVELOPMENT 2	<ol> <li>Apply chemical engineering knowledge.</li> <li>Work in a team</li> <li>Approach and execute a practical problem given in a project</li> <li>Carry out research and development work.</li> <li>Design equipments or process for chemical engineering plants</li> <li>Apply written, oral, and graphical communication in technical and non- technical environment</li> </ol>
	CH3063:: CHEMICAL ENGINEERING MATHEMATICS	<ol> <li>Solve different Chemical engineering problems by using matrix.</li> <li>Do statically data analysis.</li> <li>Solve different Chemical engineering problems using numerical methods.</li> <li>Solve different elliptical and parabolic equations.</li> <li>Solve industrial problems by using linear optimization techniques.</li> <li>Describe concept and applications of tensors.</li> </ol>
	CH3061:: MECHANICAL OPERATIONS	<ol> <li>Recognize basic principle of particle size measurement and select suitable size reduction equipment.</li> <li>Select suitable solid-solid, solid-fluid separation technique and storage tank.</li> <li>Select suitable solid conveying system and solid-solid mixing process.</li> <li>Describe concept of filtration and design filtration unit.</li> <li>Describe concept of sedimentation and design sedimentation unit.</li> <li>Describe concept of flow through packed bed and design fluidized bed.</li> </ol>
	CH3065:: MASS TRANSFER OPERATIONS	<ol> <li>Apply principles of diffusion to separation and purification processes and calculate mass transfer flux and estimate mass transfer coefficient and diffusivity for gas-liquid and liquid-liquid system</li> <li>Select and design appropriate gas-liquid contacting devices</li> <li>Select and design gas absorption and stripping column</li> <li>Calculate mass transfer coefficient for humidification and dehumidification and design cooling tower</li> <li>Calculate rate of drying and Select proper dryer, and find batch time for batch drier and</li> </ol>



		6.	design rotary drier for given requirement Comprehend crystallization system and fundamental of design
	CH3067:CHEMICAL REACTION KINETICS	1.	Develop rate expressions from elementary and non elementary step mechanisms using steadystate and quasi-equilibrium
		2.	approximations Determine rate expressions by analyzing reactor data including integral and differential analysis on constant and variable
		3.	volume systems Design ideal reactors i.e. plug flow and CSTR for first and second order reversible and irreversible, constant and variable
		4.	Select and size isothermal reactors for series and/or parallel systems of reactions and
		5.	product distribution for multiple reactions Quantitatively predict the performance of common chemical reactors in various combinations
		6.	Generate temperature and conversion profiles for exothermic and endothermic reactions
	CH3079 :: ENGINEERING DESIGN AND DEVELOPMENT 1	1. 2. 3. 4. 5. 6.	Apply chemical engineering knowledge. Work in a team Approach and execute a practical problem given in a project Carry out research and development work. Design equipments or process for chemical engineering plants Apply written, oral, and graphical communication in technical and non- technical environment
	CH3089:: SEMINAR	1. 2. 3. 4. 5. 6.	Write a technical report Present any chosen topic Do literature survey of a given topic User modern audio visual techniques at the time of presentation Convey the content of any chosen topic The student will be able to write a technical report
	CH3060:: SEPARATION TECHNIQUES	1. 2. 3.	Generate VLE data for ideal and non-ideal system Carry out process design of distillation column Analyze implications of factors affecting distillation column operation and design like



the effect of reflux ratio, feed conditions etc. and also the implications of non-ideal phase behavior (e.g., azeotropes) and apply to multicomponent distillation 4. Select suitable solvent for liquid-liquid extraction based on properties like selectivity, distribution coefficient etc. and design liquidliquid extraction column and select equipment required for given separation 5. Calculate the number of stages required for a leaching operation 6. Draw analogy between adsorption and ion exchange, carry out process design of adsorption column 1. Carry out the detailed thermal design of double pipe and shell and tube heat exchanger for given requirement. 2. Design a multiple effect evaporation system for specific requirement of concentration. 3. Do hydraulic plate design and tray column design for desired separation needs. CH3062:: PROCESS EQUIPMENT DESIGN 4. Select type and size of packing and packed column design with internals for required separation. 5. Select and design support for vessels. 6. Choose and design auxiliary process equipment required for various simple separation & storage requirements. 1. Carry out selection and performance analysis of measuring instruments 2. Write dynamic models of chemical engineering systems 3. Carry out process identification and tune a CH3064:: **INSTRUMENTATION** PID controlled system 4. Design a control system using time-domain AND PROCESS techniques such as root-locus CONTROL 5. Design a control system using frequencydomain techniques such as Bode design 6. Carry out preliminary analysis of Advanced Process Control systems



	CH3066:: CHEMICAL TECHNOLOGY	<ol> <li>Apply process fundamentals of chemical technology in process industries.</li> <li>Apply knowledge of chemical technology in unit operations and unit processes happening in chemical industry.</li> <li>Develop process flow sheets for production of specific chemical product.</li> <li>Comprehend reaction temperature, pressure condition and heat network in process flowsheet.</li> <li>Analyze different process for same product based on economics, effluent treatment, social aspects.</li> <li>Explain Petroleum refinery operation and supplementary processes.</li> </ol>
CH3 DES DEV CH3 TRA	CH3078:ENGINEERING DESIGN AND DEVELOPMENT2	<ol> <li>Apply chemical engineering knowledge.</li> <li>Work in a team</li> <li>to Approach and execute a practical problem given in a project</li> <li>Carry out research and development work.</li> <li>Design equipments or process for chemical engineering plants</li> <li>Apply written, oral, and graphical communication in technical and non- technical environment</li> </ol>
	CH3088:: SUMMER TRAINING	<ol> <li>Apply chemical engineering knowledge.</li> <li>Design equipments or process for chemical engineering plants</li> <li>Carry out research and development work.</li> <li>Work in a team</li> <li>Apply written, oral, and graphical communication in technical and non- technical environment</li> <li>Follow ethics and professional standards of organization/industry.</li> </ol>
Final Year	CH4063: PLANT ENGINEERING AND PROJECT ECONOMICS	<ol> <li>Develop various steps of chemical plant design.</li> <li>Do and describe health &amp; safety analysis.</li> <li>Estimate &amp; predict cost estimation of chemical plant.</li> <li>Estimate &amp; describe different types of interest.</li> <li>Estimate &amp; describe taxes, insurance, profit analysis.</li> <li>Describe and calculate depreciation.</li> </ol>



		4	
		1.	Solve shell momentum balance problems for simple systems (
		n	Simple systems (
		۷.	simple systems
		3	Solve shell mass balance problems for simple
	CH4058· TRANSPORT	5.	system
	PHENOMENA	4	Setup and solve macroscopic momentum
	THENOWEINA		balances for a given system
		5.	Setup general equations of continuity and
			motion
		6.	Carry out dimensional analysis and scale up
			exercise for complex systems
		1.	Distinguish between various RTD curves and
			predict the conversion from a non-ideal
			reactor using tracer information.
		2.	Calculate the global rate of heterogeneous
			catalytic reactions.
	CH4057:CHEMICAL	3.	Determine the characteristics of solid catalyst
	REACTION		like porosity, pore volume, etc.
	ENGINEERING	4.	Select model for fluid-particle reactions and
		_	calculate the rate of reactions
		5.	Select model for fluid-fluid reactions and
		-	calculate the rate of reactions.
		6.	Design the various types of rectors depending
			on the different types of heterogeneous
_		1	Catalytic and non-catalytic reactions.
		1.	Apply Chemical Engineering knowledge.
		2. 2	work in team.
		Э. 4	The sty dent will be able to design againment.
		4.	The student will be able to design equipment
	DROJECT 1	5	A provide and anothing communication in
	PROJECT 1	Э.	Appry oral and graphical communication in both technical and non-technical
			environments
		6	Apply written communication in both
		0.	technical and non technical environments
		1	Apply Chemical Engineering knowledge
		1. 2	Design equipments or process for chemical
		2.	engineering plants or apply knowledge in
			core and multidisciplinary field though
			research and development
	CH4096: INDUSTRIAL	3	Work effectively as member or leader in
	INTERNSHIP	5.	team
		4	Organize, comprehend and write technical
			report.
		5	Follow ethics and professional standards of
			organization/industry.
			J J J.



CH4095:RESEARCH INTERNSHIP	1. 2. 3. 4. 5.	Apply Chemical Engineering knowledge. Design equipments or process for chemical engineering plants or apply knowledge in core and multidisciplinary field though research and development. Work effectively as member or leader in team. Organize, comprehend and write technical report. Follow ethics and professional standards of organization/industry.
CH4070:GLOBAL INTERNSHIP	1. 2. 3. 4. 5.	Apply Chemical Engineering knowledge. Design equipments or process for chemical engineering plants or apply knowledge in core and multidisciplinary field though research and development. Work effectively as member or leader in team. Organize, comprehend and write technical report. Follow ethics and professional standards of organization/industry.



#### Department of Chemical Engineering (M. Tech) Program Outcomes

An ability to independently carry out research /investigation and development work to solve practical problems

- 1. An ability to write and present a substantial technical report/document
- 2. Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

#### **Program Specific Outcomes**

Students should be able to

- 1. Work in diverse fields such as nanotechnology, food technology, environmental engineering, product designs etc.
- 2. Students should be able to apply advanced chemical engineering concepts/techniques to solve complex problems

Year	<b>Course Name and Code</b>	CO Statement
FY	CH5005:ADVANCED	1. The student will be able to distinguish
	REACTION	between various RTD curves and predict
	ENGINEERING	the conversion from a non-ideal reactor
		using tracer information.
		2. The student will be able to calculate the
		global rate of heterogeneous catalytic reactions
		3. The student will be able to determine the
		characteristics of solid catalyst like
		porosity, pore volume, etc.
		4. The student will be able to select model for
		fuid-particle reactions and calculate the rate of reactions
		5. The student will be able to select model for
		fuid-fuid reactions and calculate the rate of reactions.
		6. The student will be able to design the
		various types of rectors depending on the
		different types of heterogeneous catalytic
		and non-catalytic reactions.

#### **Course Outcomes**



FY	CH5001:MATHEMATICAL	1.	The student will be able to apply initial tensor
	METHODS IN		and tensor calculus.
	ENGINEERING	2.	The student will be able to explain theory of
			matrices and its extension to systems of
			differential equations.
		3.	The student will be able to apply theory of
			ordinary and partial differential equations.
		4.	The student will be able to apply perturbation
		_	theory and eigenvalue analysis.
		5.	The student will be able to apply analytical
			methods leading to local and global analysis.
		6.	The student will be able to derive
			mathematical expressions and apply numerical
EV	CH5007-CHEMICAL	1	The student will be able to apply basis models
ГІ	PROCESS SIMULATION	1.	of chemical processes and to plan calculations
	FROCESS SIMULATION		for simulation
		2	The student will be able to model alternate
		2.	class of phenomena and apply unit models.
		3.	The student will be able to simulate separation
			towers and apply synthesis theory.
		4.	The student will be able to apply numerical
			methods for nonlinear equations.
		5.	The student will be able to apply numerical
			methods for partial differential equations.
		6.	The student will be able to use various
			softwares used in simulation practice.
FY	CH5003: ADVANCED	1.	The students will be able to explain
	SEPARATION		conventional and novel separation techniques.
	TECHNIQUES	2.	The students will be able to explain and
		2	analyze advanced distillation techniques
		3.	I he students will be able to explain and
		1	The students will be able to describe and apply
		4.	ne success will be able to describe and apply principle of membrane separation
		5	The students will be able to explain and apply
		5.	adsorption principles
		6	The students will be able to describe and apply
		0.	ionic separation principles.
FY	CH5075 : ENGINEERING	1.	The students will be able to apply chemical
	DESIGN AND		engineering knowledge
	INNOVATION 1	2.	The students will be able to learn how to work
			in team
		3.	The students will be able to define a task
			(problem) and execute it
		4.	The students will be able to carry out literature
			search related to topic



#### Bansilal Ramnath Agarwal Charitable Trust's VISHWAKARMA INSTITUTE OF TECHNOLOGY – PUNE (An autonomous Institute affiliated to University of Pune)

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	666, Upper	Indiranagar,	Bibwewadi,	Pune – 411 037.	

-			
		5.	The students will be able to write synopsis and
			complete literature search related to topic and
			complete report
		6.	The students will be able to identify the idea
			and execute it in team
FY	CH5006: INDUSTRIAL	1.	The student will be able to identify hazardous
	POLLUTION CONTROL		pollutants in the plant or area
		2.	The student will be able to design reduction
			method and pollution treatment technique
		3.	The student will be able to develop the
			analysis techniques for different pollutants
		4.	The student will be able to to determine the
			pollution level with respect to the pollution
			standards
		5.	The student will be able to analyze the impact
			of various factors on the environment
		6.	The student will be able to determine the
			suitability of water for different usage
FY	CH5002: ADVANCED	1.	The students should be able to apply various
	THERMODYNAMICS		equations of state for estimation of
			thermodynamic properties
		2.	The students should be able to apply criteria of
			phase equilibrium and calculate equilibrium
			compositions in vapor-liquid system and/or
			liquid-liquid system
		3.	The students students should be able to apply
			thermodynamics of electrolytic solutions
		4.	The should be able to calculate equilibrium
			compositions in vapor-iiquid system and/or
		5	Inquid-inquid system The students should be able to emply showing
		5.	The students should be able to apply chemical
			reaction equilibria to determine equilibrium
EV	CU5069.ENCINEEDING	1	Students will acquire the skills to early the
ГТ		1.	Students will acquire the skills to apply the
			basics of economics and cost
		2	analysis to engineering. Students will acquire the skills to take
		۷.	aconomically sound decisions
		2	Students will acquire the skills to evaluate
		3.	performance of the company
			performance of the company



FY	CH5024: NANO SCIENCE	1.	Find out synthesis and application of
	AND		nanoparticles for industrial processes.
	NANOTECHNOLOGY	2.	Calculate properties like surface tension and
			interfacial tension surfaces at equilibrium
			surface tension Measurement, contact angles,
			colloidal stability, electrical phenomena at
			interfaces Van der Waals forces between
			colloidal particles.
		3.	Synthesize nanoparticles by different methods.
		4.	Calculate different parameters and properties
			of nanoparticles.
		5.	Find out zeolite working mechanism,
			properties and application.
		6.	Nano catalyst application for drug synthesis,
			activity enhancement and drug delivery
			systems.
FY	CH5076 : ENGINEERING	1.	The students will be able to apply chemical
	DESIGN AND	2	engineering knowledge
	INNOVATION 2	2.	The students will be able to learn how to work
		2	in team
		5.	(problem) and execute it
		4	(problem) and execute it
		4.	search related to topic
		5.	The students will be able to write synopsis and
			complete literature search related to topic and
			complete report
		6.	The students will be able to identify the idea
			and execute it in team
SY	CH6093:DISSERTATION	1.	The students will be able to apply Chemical
	BY RESEARCH		Engineering knowledge.
		2.	The students will be able to carry out research
			and development work.
		3.	The students will be able to learn to do
			relevant literature survey.
		4.	The students will be able to apply oral and
			graphical communication in both technical and
		_	non-technical environments.
		5.	The students will be able to apply written
			communication in both technical and non-
			tecnnical environments.
		6.	I ne students will be able to prepare
			scientifically correct Technical report.



SY	CH6099:DISSERTATION	1.	The students will be able to apply Chemical
	BY INTERNSHIP		Engineering knowledge.
		2.	The students will be able to prepare detailed
			problem statement.
		3.	The students will be able to learn to do
			relevant literature survey.
		4.	The students will be able to apply oral and
			graphical communication in both technical and
			non-technical environments.
		5.	The students will be able to apply written
			communication in both technical and non-
			technical environments.
		6.	The students will be able to prepare
			scientifically correct Technical report.
SY	CH6094:DISSERTATION	1.	The students will be able to apply Chemical
	BY RESEARCH		Engineering knowledge.
		2.	The students will be able to carry out research
		2	and development work.
		3.	The students will be able to learn to do
		4	relevant literature survey.
		4.	I he students will be able to apply oral and
			graphical communication in both technical and
		5	The students will be able to apply written
		5.	communication in both technical and non
			technical environments
		6	The students will be able to prepare
		0.	scientifically correct Technical report
SY	CH6098:DISSERTATION	1.	The students will be able to apply Chemical
	BY INTERNSHIP	-	Engineering knowledge.
		2.	The students will be able to prepare detailed
			problem statement.
		3.	The students will be able to learn to do
			relevant literature survey.
		4.	The students will be able to apply oral and
			graphical communication in both technical and
			non-technical environments.
		5.	The students will be able to apply written
			communication in both technical and non-
		_	technical environments.
		6.	The students will be able to prepare
			scientifically correct Technical report.



#### **Department of Industrial Engineering (B. Tech)**

#### **Program Specific Outcomes**

- 1. Identify, define, formulate, and analyze engineering problems in reaching substantiated conclusions using industrial engineering tools and techniques for effective / productive use of man, machine and material resources
- 2. Demonstrate ability to design and conduct experiments, interpret and analyze data using mathematical, statistical, optimization, simulation tools and techniques and present results.
- 3. Select, design, analyze, improve appropriate manufacturing processes, quality aspects, methods, operations, layouts, material handling systems, supply chain networks for products and services to meet desired standards, specifications and requirements
- 4. Analyze the impact of operational, economic and financial parameters in real life processes and projects

Year	Course Name & Code	<b>CO</b> Statements
SY	IE2001::THEORY OF	1. Classify different types of links and mechanisms
	MACHINES	used for different purposes in different machines.
		2. Draw velocity and acceleration diagrams of
		various mechanisms.
		3. Analyze different types of governor.
		4. Construct cam profile for the specific follower
		motion.
		5. Understand the mechanism of spur gear and
		identify the various types of gears.
		6. Understand the mechanism of gear trains and
		distinguish between various gear trains.
		7. Determine the dynamic behavior principles and
		operations of breaks & dynamometers
SY	IE2002::MACHINE TOOLS	1. Understand basic construction and working of
	& PROCESSES	various Machine tools used for metal removal
		processes
		2. Select proper work and tool holding devices,
		attachments and accessories of a machine tool
		and
		3. Illustrate conventional and unconventional
		machining processes performed on various
		machines
		4. Understand various tool geometries and select
		appropriate cutting tools to obtain required
		Inisned component
		5. Define process parameters like cutting speed,
		reed and depth of cut and evaluate machining
		time for machining processes

#### **Course Outcomes**



		6.	Machine simple and composite job involving few
			lathe and milling operations
SY	IE2003::METROLOGY AND	1.	Measure length using line-graduated instruments,
	MECHANICAL		i.e. vernier calipers, micrometers etc.
	MEASUREMENTS	2.	Measure angle precisely using precision angular
			measuring instruments like vernier bevel
			protractor, sine bar, clinometers, angle dekkor
		_	and auto collimator.
		3.	Design Go and No Go gauges based on
			principles of limits, fits and tolerance and
			effectively use of comparators of various types.
		4.	Apply knowledge of various instruments and
			methods to determine geometry and surface
		~	finish and dimensions of industrial components.
		э.	Use effective methods of measuring screw
		6	Soloct and measure variables using appropriate
		0.	sensors and transducers
SV	IE2004. MECHANICS OF	1	Calculate normal stress shear stress and
51	MATERIALS	1.	deformation and applications of the analysis and
			design of members subjected to an axial load or
			direct shear
		2.	Analyze and design circular determinate shafts
			subjected to torsional loading for its shear stress
			distribution and angle of twist.
		3.	Establish the shear force and bending moment
			diagrams for a beam
		4.	Determine bending and transverse shear stress in
			homogeneous beam having prismatic cross
			section and design beam for a given bending
		_	moment and shear force.
		5.	Determine stress components by analytical and
			Mohr's circle method, for a plane state of stress
			and to obtain the maximum normal and
			maximum snear stress along-with orientation of
		6	A nalyza strassas davalanad in thin wallad
		0.	pressure vessels, and to calculate resultant plane
			stresses in thin pressure vessels beam and
			circular shafts subjected to combined
			loading(axial, bending, torsion)
SY	IE2005::MATHEMATICS	1.	Develop solutions for linear equations.
~ •	FOR ENGINEERING	2.	Interpret the various results obtained by analyzing
	APPLICATIONS-I	da	ta.
		3.	Understanding the Laplace Transforms.
		4.	Developing the insight into numerical methods
		use	eful for computing applications.



		5. Analyze the relationship between variables to
		predict their behavior.
		6. Formulate the mathematical models to predict the
		approximate values of variables
SY	IE2036::THERMAL &	1. Understand basic concepts of fluids, classification
	FLUID ENGINEERING	of flows and measure fluid flow by various flow
		measuring devices.
		2. Distinguish various types of hydraulic turbines,
		pumps
		3. Analyze performance of boilers.
		4. Understand basic concepts of thermodynamics and
		analyze air standard cycles.
		5. Describe and analyze various types of air
		compressors.
		6. Understand refrigeration and air conditioning
		principles
SY	IE2037::MATERIAL	1. Correlate crystal structures, crystallographic
	SCIENCE	directions and planes, Plastic deformation
		mechanisms, cold & hot working changes in
		properties & with mechanical, physical, electrical &
		thermal properties.
		2. Apply and integrate knowledge of properties and
		performance to solve materials selection and
		design problems.
		3. Apply and integrate knowledge of equilibrium
		diagram
		4. Apply and integrate knowledge of strengthening
		5 Apply and integrate knowledge of Dowder
		Metallurgy & Composite materials
		6 Apply and integrate knowledge of apply and
		integrate knowledge of various surface modification
		techniques
SY	IE2038::CASTING &	1. Select and design and perform different pattern
~ -	JOINING TECHNOLOGY	and mould making to manufacture castings.
		2. Understand and apply different methods of core
		making and melting techniques.
		3. Design gating system and select appropriate
		casting method for manufacturing castings with
		optimum cost and quality.
		4. Apply fundamentals of gas welding, soldering
		and brazing techniques for joining of appropriate
		material and job.
		5. Understand and apply electric arc and resistance
		welding and nonconventional techniques.
		6. Test and analyze weld quality by mechanical
		properties and microstructural analysis



SY	IE2039::DESIGN OF	1. Analyze the stress and strain mechanical
	MACHINE ELEMENTS	components such as shaft, keys and couplings
		and design the same for various industrial
		applications.
		2. Design spur and helical gears for various
		applications.
		3. Select different types of rolling contact bearings
		from manufacturer's catalogue for various
		industrial applications.
		4. Analyze the stress and strain in power screw and
		design the same for various industrial
		applications.
		5. Analyze the stress and strain in threaded and welded ignits and design the same for verious
		industrial applications
		6 Design mechanical components for fluctuating
		and reversible loading conditions
SY	IE2040. MATHEMATICS	1 Understand the Fourier Transforms
51	FOR ENGINEERING	2. Develop an understanding of variables treatment
	APPLICATIONS-II	in probability.
		3. Understand vectors and their applications to
		Engineering Problems.
		4. Develop and analyze the results obtained from
		Probability Distrib
TY	IE3001::FACILITIES	1. Select location of facilities for business
	PLANNING	organizations
		2. Learn formulations, models, and analytical
		procedures for the study of facilities layout
		planning.
		3. Design and improve existing and new layouts
		incorporating products, process and personnel
		requirements for manufacturing and service
		organizations
		4. Learn and apply fundamental principles of material handling
		5 Select appropriate material handling systems for
		manufacturing organizations
		6 Understand basics of safety measures to be
		followed in industry
TY	IE3003::OUALITY	1. Understand and apply principles of quality
	MANAGEMENT	management
		2. Interpret for process control, identify and analyze
		and eliminate/reduce causes of variation and
		carry out process capability studies
		3. Select and design an acceptance sampling plan
		for sampling inspection
1		4 Develop an ability of problem solving and


		decision making using quality improvement tools
		5. Understand and apply Six Sigma Methodology
		and OMS and its applications
		6. Evaluate reliability, maintainability and
		availability of product/component systems
TY	IE3005::WORK SYSTEM	1. Understand and apply productivity concepts and
	DESIGN	principles and analyze work content
		2. Systematically record: critically examine methods
		of doing work to effect improvements
		3. Design the workplace using principles of motion
		economy and develop improved methods
		4. Establish standard time to carry out a specified job
		using stop watch time study
		5. Establish standard time to carry out a specified job
		using video watch time study
		6. Establish standard time to carry out a specified job
		using predetermined time standards
TY	IE3007::STATISTICAL	1. Explain the nature of research and data
	METHODS AND	requirements
	RESEARCH	2. Calculate probability by selecting appropriate
	METHODOLOGY	probability distribution for managerial decisions
		3. Estimate confidence interval
		4. Perform test of significance for means and
		proportion
		5. Perform test of significance for variance
		6. Understand the importance of computer oriented
		numerical methods and their applications
TY	IE3036::MANUFACTURING	1. Understand plastic deformation of metals and its
	PROCESSES & SYSTEMS	applications
		2. Apply the knowledge of press working.
		3. Analyze basic sheet metal working processes such
		as blanking, punching drawing etc.
		4. Analyze material forming forces for rolling.
		5. Apply the working principles and processing
		characteristics of advanced machining processes
		such as ECM, EDM, AJM, LBM, etc.
		6. Apply the knowledge of NC CNC and DNC
		machines
ΤY	IE3038::OPERATIONS	1. Understanding of Operations management
	MANAGEMENI	strategies and its usefulness.
		2. Understanding of effective measures like using of
		Lot Sizing mechanisms
		5. Understanding different scheduling techniques
		Used III Production System
		4. Understanding unterent Forecasting techniques
		used in Production system
1		J. Understanding different Aggregate production



		strategies used in Production system
		6. Understanding of Relevance of scheduling
TY	IE3040::SUPPLY CHAIN	1. Identify the key elements and processes in a
	MANAGEMENT	supply chain and their interaction
		2. Understand and analyze the designing, planning
		and operational decisions of SCM.
		3. Identify the techniques used in management of
		critical components of supply chain
		4. Analyze, design and optimize supply chain
		networks for manufacturing organizations
		5. Design and optimize inventories across the supply
		6. Explain the likely future development of logistics
		and supply chain management
TY	IE3042::WORLD CLASS	1. Identify, eliminate and reduce the non-value
	MANUFACTURING	added activities (wastes) in manufacturing
		organization
		2. Apply the tools and techniques of lean
		manufacturing to improve productivity in
		manufacturing and service organizations
		3. Understand the principles and benefits of Toyota
		A production System philosophy
		4. Apply the concept, tools and techniques in TPM philosophy
		5. Analyze, map and improve business processes
		for achieving improvements
		6. Apply the tools and techniques of constraint
		management to improve productivity in
		manufacturing and service organizations
В	IE4001::HUMAN FACTORS	1. Understand need of applying Human Factors
Tech	ENGINEERING	Engineering in industry & society
		2. Design workplaces and products ergonomically
		by applying principles of design, work
		physiology and anthropometry.
		3. Understand information input and processing to
		design visual/auditory displays.
		4. Evaluate and estimate human efficiency and by
		5 Decign work environment by enplying
		b. besign work environment by apprying
		environmental conditions on human
		performance.
		6. Apply knowledge of Human Factors in
		Ergonomic system design
В	IE4002::WORLD CLASS	1. Identify, eliminate and reduce the non-value
Tech	MANUFACTURING	added activities (wastes) in manufacturing
		organization



		2.	Apply the tools and techniques of lean
			manufacturing to improve productivity in
			manufacturing and service organizations
		3.	Understand the principles and benefits of Toyota
			Production System philosophy
		4.	Apply the concept, tools and techniques in TPM
			philosophy
		5.	Analyze, map and improve business processes
			for achieving improvements
		6.	Apply the tools and techniques of constraint
			management to improve productivity in
			manufacturing and service organizations
В	IE4003::SUPPLY CHAIN	1.	Identify the key elements and processes in a
Tech	MANAGEMENT		supply chain and their interaction
		2.	Understand and analyze the designing, planning
			and operational decisions of SCM.
		3.	Identify the techniques used in management of
			critical components of supply chain
		4.	Analyze, design and optimize supply chain
			networks for manufacturing organizations
		5.	Design and optimize inventories across the
			supply chain
		6.	Explain the likely future development of logistics
			and supply chain management
В	IE4074::MAJOR PROJECT	1.	Survey literature for problem identification
Tech		2.	Cultivate the habit of working in a team,
			communicate effectively and attempt a problem
			solution in a right approach
		2	
		3.	Correlate the theoretical and
		3.	Correlate the theoretical and experimental/simulations results and draw the
		3.	Correlate the theoretical and experimental/simulations results and draw the proper inferences.
		3. 4.	Correlate the theoretical and experimental/simulations results and draw the proper inferences. Apply engineering knowledge in carrying out
		3. 4.	Correlate the theoretical and experimental/simulations results and draw the proper inferences. Apply engineering knowledge in carrying out project starting from design, drafting, process
		3. 4.	Correlate the theoretical and experimental/simulations results and draw the proper inferences. Apply engineering knowledge in carrying out project starting from design, drafting, process planning, project management, costing,
		3. 4.	Correlate the theoretical and experimental/simulations results and draw the proper inferences. Apply engineering knowledge in carrying out project starting from design, drafting, process planning, project management, costing, manufacturing, QC and inspection, down to
		3. 4.	Correlate the theoretical and experimental/simulations results and draw the proper inferences. Apply engineering knowledge in carrying out project starting from design, drafting, process planning, project management, costing, manufacturing, QC and inspection, down to assembly, testing and evaluation.
		<ol> <li>3.</li> <li>4.</li> <li>5.</li> </ol>	Correlate the theoretical and experimental/simulations results and draw the proper inferences. Apply engineering knowledge in carrying out project starting from design, drafting, process planning, project management, costing, manufacturing, QC and inspection, down to assembly, testing and evaluation. To practice data collection and analysis using different measurement equipment's and software
		<ul><li>3.</li><li>4.</li><li>5.</li></ul>	Correlate the theoretical and experimental/simulations results and draw the proper inferences. Apply engineering knowledge in carrying out project starting from design, drafting, process planning, project management, costing, manufacturing, QC and inspection, down to assembly, testing and evaluation. To practice data collection and analysis using different measurement equipment's and software
		<ol> <li>3.</li> <li>4.</li> <li>5.</li> <li>6.</li> </ol>	Correlate the theoretical and experimental/simulations results and draw the proper inferences. Apply engineering knowledge in carrying out project starting from design, drafting, process planning, project management, costing, manufacturing, QC and inspection, down to assembly, testing and evaluation. To practice data collection and analysis using different measurement equipment's and software packages.
		<ol> <li>3.</li> <li>4.</li> <li>5.</li> <li>6.</li> </ol>	Correlate the theoretical and experimental/simulations results and draw the proper inferences. Apply engineering knowledge in carrying out project starting from design, drafting, process planning, project management, costing, manufacturing, QC and inspection, down to assembly, testing and evaluation. To practice data collection and analysis using different measurement equipment's and software packages. Prepare project report as per guideline and present it effectively.
B	IE4004EINANCIAI	3. 4. 5. 6.	Correlate the theoretical and experimental/simulations results and draw the proper inferences. Apply engineering knowledge in carrying out project starting from design, drafting, process planning, project management, costing, manufacturing, QC and inspection, down to assembly, testing and evaluation. To practice data collection and analysis using different measurement equipment's and software packages. Prepare project report as per guideline and present it effectively Understand and analyze functions of financial
B	IE4004::FINANCIAL MANAGEMENT AND	<ul> <li>3.</li> <li>4.</li> <li>5.</li> <li>6.</li> <li>1.</li> </ul>	Correlate the theoretical and experimental/simulations results and draw the proper inferences. Apply engineering knowledge in carrying out project starting from design, drafting, process planning, project management, costing, manufacturing, QC and inspection, down to assembly, testing and evaluation. To practice data collection and analysis using different measurement equipment's and software packages. Prepare project report as per guideline and present it effectively Understand and analyze functions of financial nagement and budgeting interpret financial
B Tech	IE4004::FINANCIAL MANAGEMENT AND MANAGEMENT	<ul> <li>3.</li> <li>4.</li> <li>5.</li> <li>6.</li> <li>1. main state</li> </ul>	Correlate the theoretical and experimental/simulations results and draw the proper inferences. Apply engineering knowledge in carrying out project starting from design, drafting, process planning, project management, costing, manufacturing, QC and inspection, down to assembly, testing and evaluation. To practice data collection and analysis using different measurement equipment's and software packages. Prepare project report as per guideline and present it effectively Understand and analyze functions of financial nagement and budgeting, interpret financial tements through accounting ratios
B Tech	IE4004::FINANCIAL MANAGEMENT AND MANAGEMENT ACCOUNTING	<ul> <li>3.</li> <li>4.</li> <li>5.</li> <li>6.</li> <li>1.</li> <li>mat stat</li> <li>2. I</li> </ul>	Correlate the theoretical and experimental/simulations results and draw the proper inferences. Apply engineering knowledge in carrying out project starting from design, drafting, process planning, project management, costing, manufacturing, QC and inspection, down to assembly, testing and evaluation. To practice data collection and analysis using different measurement equipment's and software packages. Prepare project report as per guideline and present it effectively Understand and analyze functions of financial nagement and budgeting, interpret financial tements through accounting ratios
B Tech	IE4004::FINANCIAL MANAGEMENT AND MANAGEMENT ACCOUNTING	<ul> <li>3.</li> <li>4.</li> <li>5.</li> <li>6.</li> <li>1. man statt</li> <li>2. U</li> <li>We</li> </ul>	Correlate the theoretical and experimental/simulations results and draw the proper inferences. Apply engineering knowledge in carrying out project starting from design, drafting, process planning, project management, costing, manufacturing, QC and inspection, down to assembly, testing and evaluation. To practice data collection and analysis using different measurement equipment's and software packages. Prepare project report as per guideline and present it effectively Understand and analyze functions of financial nagement and budgeting, interpret financial tements through accounting ratios Understand the concepts of Capital Budgeting and prking Capital management for effective financial



		<ul> <li>3. Understand the mechanics of financial accounting for preparation of financial statements to ascertain the performance and financial position of a business</li> <li>4. Classify and apply different types of costs and overheads to ascertain costs of a product or a process</li> <li>5. Apply different types of costing methods and techniques according to the suitability for various production processes and services.</li> <li>6. Develop an ability of decision making about</li> </ul>
		optimum product mix, profit planning, make or buy, limiting factors based on marginal costing concept
B Tech	IE4005::OPERATIONS SCHEDULING	<ol> <li>Understanding of single machine scheduling, its constraints etc.</li> <li>Understanding of other objectives in a single machine scheduling.</li> <li>Understanding of Parallel Processing &amp; Batch Sequencing.</li> <li>Analysis of Flow shop models &amp; its implications</li> <li>Analysis of other models &amp; its implications</li> <li>Analysis of other models &amp; its implications</li> </ol>
B Tech	IE4006::SERVICES MANAGEMENT	<ol> <li>Explain the distinctive nature of services and characteristics of service economy</li> <li>Analyze service encounters and service strategy</li> <li>Plan facilities for service delivery</li> <li>Evaluate various dimensions of service quality</li> <li>Match requirements of service capacity and demand</li> <li>Apply various Industrial Engineering Techniques for service competitiveness</li> </ol>
B Tech	IE4086::MAJOR PROJECT	<ol> <li>Survey literature for problem identification</li> <li>Cultivate the habit of working in a team, communicate effectively and attempt a problem solution in a right approach</li> <li>Correlate the theoretical and experimental/simulations results and draw the proper inferences.</li> <li>Apply engineering knowledge in carrying out project starting from design, drafting, process planning, project management, costing, manufacturing, QC and inspection, down to assembly, testing and evaluation.</li> <li>To practice data collection and analysis using different measurement equipment's and software packages.</li> <li>Prepare project report as per guideline and present it effectively</li> </ol>



### **Department of Industrial Engineering (M Tech)**

### **Program Outcomes**

- 1. An ability to independently carry out research / investigation and development work to solve practical problems
- 2. An ability to write and present a substantial technical report/document
- 3. Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

#### **Program Specific Outcomes**

- 1. Student will develop ability to apply various techniques of conventional and modern techniques of Industrial Engineering and Productivity Improvement for Manufacturing and Service organizations
- 2. Student will demonstrate ability to analyze data using mathematical, statistical, optimization and simulation tools and techniques and interpret results

Year	Course Name & Code	CO Statements	
FY	IE5001::STATISTICAL	1. Explain the nature of research and data requirements	
	METHODS	2. Calculate probability by selecting appropriate	
		probability distribution for managerial decisions	
		3. Estimate confidence interval	
		4. Perform test of significance for means and	
		proportion	
		5. Perform test of significance for variance	
		6. Perform test of ANOVA	
FY	IE5002::WORK	1. Understand and apply productivity concepts and	
	ANALYSIS	principles and analyze work content	
	TECHNIQUES	2. Systematically record; critically examine methods of	
		doing work to effect improvements	
		3. Design the workplace using principles of motion	
		economy and develop improved methods	
		4. Establish standard time to carry out a specified job	
		using stop watch time study	
		5. Establish standard time to carry out a specified job	
		using video watch time study	
		6. Establish standard time to carry out a specified job	
		using predetermined time standards	
FY	IE5003::MATERIALS &	1. Understand scope of operations function in industrial	
	OPERATIONS	and business organizations and various elements of it	
	MANAGEMENT	from its management point of view	

#### **Course Outcomes**



		<ol> <li>Recommend specific type of Replenishment System for the given situation and will able to perform the inventory system calculations</li> <li>Explain the need for demand forecasting and its various uses in organizational decision making</li> <li>Apply Material Requirement Planning (MRP I) &amp; lot sizing techniques for managing materials levels and perform its calculations</li> <li>Understand MRP II (Manufacturing Resource Planning) scheduling techniques in real life situations and its detailing calculations</li> <li>Design Aggregate Planning system for the given product category and type</li> </ol>
FY	IE5036::FINANCIAL	1. Understand and analyze functions of financial
	MANAGEMENT AND COSTING	<ul> <li>management and budgeting, interpret financial statements through accounting ratios</li> <li>2. Understand the concepts of Capital Budgeting and Working Capital management for effective financial management</li> <li>3. Understand the mechanics of financial accounting for preparation of financial statements to ascertain the performance and financial position of a business</li> <li>4. Classify and apply different types of costs and overheads to ascertain costs of a product or a process</li> <li>5. Apply different types of costing methods and techniques according to the suitability for various production processes and services.</li> <li>6. Develop an ability of decision making about optimum product mix, profit planning, make or buy, limiting factors based on marginal costing concept</li> </ul>
FY	IE5037::HUMAN FACTORS IN DESIGN	<ol> <li>Understand need of applying Human Factors Engineering in industry &amp; society</li> <li>Design workplaces and products ergonomically by applying principles of design, work physiology and anthropometry.</li> <li>Understand information input and processing to design visual/auditory displays.</li> <li>Evaluate and estimate human efficiency and by understanding work physiology</li> <li>Design work environment by applying knowledge of Physiological effect of environmental conditions on human performance.</li> <li>Apply knowledge of Human Factors in Ergonomic system design</li> </ol>
FY	IE5040::ENTERPRISE	1. List down the factors that influence the application of the course content in the industrial environment
		2. Undertake final year project work based upon the



		application of the course content
		3. Apply the knowledge of the course in solving real
		life problems
FY	IE5038::WORLD CLASS MANUFACTURING	<ol> <li>Identify, eliminate and reduce the non-value added activities (wastes) in manufacturing organization</li> <li>Apply the tools and techniques of lean manufacturing to improve productivity in manufacturing and service organizations</li> <li>Understand the principles and benefits of Toyota Production System philosophy</li> <li>Apply the concept, tools and techniques in TPM philosophy</li> <li>Analyze, map and improve business processes for achieving improvements</li> <li>Apply the tools and techniques of constraint management to improve productivity in</li> </ol>
FY	IE5041::OPTIMIZATION TECHNIQUES & SIMULATION	<ol> <li>Formulate a liner programming model and solve it optimally</li> <li>Formulate real life queuing problems and generate optimal solutions</li> <li>Simulate various real life problems and generate optimal solutions</li> <li>Analyze the replacement policies for manufacturing and service sector</li> <li>Develop integer solution for the real life problem by applying various methods</li> <li>Divide a complex problem into no of stages and solve it optimally</li> </ol>
FY	IE5039::SUPPLY CHAIN ANALYSIS & MODELING	<ol> <li>7. Identify the key elements and processes in a supply chain and their interaction</li> <li>8. Understand and analyze the designing, planning and operational decisions of SCM.</li> <li>9. Identify the techniques used in management of critical components of supply chain</li> <li>10. Analyze, design and optimize supply chain networks for manufacturing organizations</li> <li>11. Design and optimize inventories across the supply chain</li> <li>12. Explain the likely future development of logistics and supply chain management</li> </ol>
FY	IE5042::SYSTEMS APPROACH TO INDUSTRIAL ENGINEERING	<ol> <li>Understand basic concepts of the system thinking</li> <li>Learn formulations, and analytical procedures for the system dynamics modelling</li> <li>Understand Why do so many business strategies fail</li> <li>Understand how to Map the Stock and Flow Structure of Systems</li> </ol>



		5.	Understand basics of simulation software for system
			dynamics modelling
		6.	Use of systems thinking to promote effective
			organizational learning
SY	IE6071::	1.	Apply Chemical Engineering knowledge.
	DISSERTATION BY	2.	Prepare detailed problem statement.
	INTERNSHIP 1	3.	Learn to do relevant literature survey.
		4.	Apply oral and graphical communication in both
			technical and non-technical environments.
		5.	Apply written communication in both technical and
			non-technical environments.
		6.	Preparing scientifically correct Technical report
SY	IE6086::	1.	Apply Chemical Engineering knowledge.
	DISSERTATION BY	2.	Prepare detailed problem statement.
	INTERNSHIP 2	3.	Learn to do relevant literature survey.
		4.	Apply oral and graphical communication in both
			technical and non-technical environments.
		5.	Apply written communication in both technical and
			non-technical environments.
		6.	Preparing scientifically correct Technical report



### **Department of Production Engineering (B Tech)**

### **Program Specific Outcomes**

- 1. Characterize and select appropriate materials, respective material treatments and analyze failures of engineering components.
- 2. Select and design appropriate manufacturing processes and process planning for industrial components to meet desired quality standards, specifications and requirements
- 3. Select and design components, tools, systems and processes for a specific task within realistic constraints.
- 4. Apply operational, economic and financial tools and techniques for effective/ productive utilization of resources

Year	Course Name & Code	CO Statements
SY	PR2001::THERMAL & FLUID ENGINEERING	<ol> <li>Understand basic concepts of fluids, classification of flows and measure fluid flow by various flow measuring devices.</li> <li>Distinguish various types of hydraulic turbines, pumps</li> <li>Analyze performance of boilers.</li> <li>Understand basic concepts of thermodynamics and analyze air standard cycles.</li> <li>Describe and analyze various types of air compressors.</li> <li>Understand refrigeration and air conditioning</li> </ol>
SY	PR2002::MATERIAL SCIENCE	<ol> <li>principles.</li> <li>correlate crystal structures, crystallographic directions and planes, Plastic deformation mechanisms, Cold &amp; hot working changes in properties &amp; with mechanical, physical, electrical &amp; thermal properties.</li> <li>apply and integrate knowledge of properties and performance to solve materials selection and design problems.</li> <li>apply and integrate knowledge of equilibrium diagram</li> <li>apply and integrate knowledge of strengthening mechanisms &amp; Pyrometry</li> <li>apply and integrate knowledge of Powder Metallurgy &amp; Composite materials</li> <li>apply and integrate knowledge of apply and integrate knowledge of apply and integrate knowledge of various surface modification techniques.</li> </ol>
SY	PR2003::CASTING & JOINING TECHNOLOGY	1. select and design and perform different pattern and mould making to manufacture castings.

#### **Course Outcomes**



		2. understand and apply different methods of core
		making and melting techniques
		3. design gating system and select appropriate
		casting method for manufacturing castings with
		optimum cost and quality.
		4 apply fundamentals of gas welding soldering
		and brazing techniques for joining of appropriate
		material and job
		5 understand and apply electric arc and resistance
		welding and nonconventional techniques
		test and analyze weld quality by mechanical
		properties and microstructural analysis
SV	PP2004. MECHANICS OF	7 Calculate normal stress shear stress and
51	MATEDIALS	7. Calculate normal stress, shear stress, and
	WATERIALS	design of members subjected to an axial load or
		direct choor
		A nalyza and design circular determinate shofts
		o. Analyze and design circular determinate shares
		distribution and angle of twist
		0 Establish the sheer force and handing moment
		9. Establish the shear for a hear
		10 Determine handing and transverse sheer stress in
		10. Determine bending and transverse snear stress in
		nomogeneous beam naving prismatic cross
		section and design beam for a given bending
		moment and snear force.
		11. Determine stress components by analytical and
		Monr's circle method, for a plane state of stress
		and to obtain the maximum normal and
		maximum snear stress along-with orientation of
		elements.
		12. Analyze stresses developed in thin-walled
		pressure vessels. and to calculate resultant plane
		stresses in thin pressure vessels, beam and
		circular shafts subjected to combined loading
017		(axial, bending, torsion)
SY	PR2005::MATHEMATICS	1. Develop solutions for linear equations.
	FOR ENGINEERING	2. Interpret the various results obtained by
	APPLICATIONS-I	analyzing data.
		3. Understanding the Laplace Transforms.
		4. Developing the insight into numerical methods
		useful for computing applications
		5. Analyze the relationship between variables to
		predict their behavior.
		6. Formulate the mathematical models to predict
		the approximate values of variables.
SY	PR2036::THEORY OF	1. Classify different types of links and mechanisms
	MACHINES	used for different purposes in different machines.



		2. Draw velocity and acceleration diagrams of
		various mechanisms.
		3. Analyze different types of governor.
		4. Construct cam profile for the specific follower
		motion.
		5. Understand the mechanism of spur gear and
		identify the various types of gears.
		6. Understand the mechanism of gear trains and
		distinguish between various gear trains
		7 Determine the dynamic behavior principles and
		operations of breaks & dynamometers
SY	PR2037. MACHINE TOOLS	7 Understand basic construction and working of
51	& PROCESSES	various Machine tools used for metal removal
	a moelssls	
		8 Select proper work and tool holding devices
		attachments and accessories of a machine tool
		and
		9 Illustrate conventional and unconventional
		machining processes performed on various
		machining processes performed on various
		10 Understand various tool geometries and select
		appropriate cutting tools to obtain required
		finished component
		11 Define process peremeters like cutting speed
		find and donth of out and evaluate machining
		time for machining processes
		12 Machine simple and composite job involving
		faw lathe and milling operations
SV	PP2038METPOLOGY &	7 Measure length using line graduated
51	MECHANICAI	instruments i a varnier caliners micrometers
	MECHANICAL	ate
	WEASOREWENTS	8 Measure angle precisely using precision angular
		o. Measure angle precisely using precision angular magguring instruments like version bouch
		niedsuring instruments like vermen bever
		and auto collimator
		0 Design Co and No Co gauges based on
		principles of limits fits and tolerance and
		offactively use of comparators of verious types
		10 Apply knowledge of various instruments and
		no. Apply knowledge of various instruments and
		finish and dimensions of industrial components
		11 Use offective methods of measuring correct
		threads and goar tooth parameters
		12 Select and measure variables value approximate
		12. Select and measure variables using appropriate
CV.	DD2020DEGION OF	sensors and transducers
SY	PK2039::DESIGN OF	/. Analyze the stress and strain mechanical
	MACHINE ELEMENIS	components such as shaft, keys and couplings



		and design the same for various industrial
		applications.
		8. Design spur and helical gears for various applications
		9. Select different types of rolling contact bearings
		from manufacturer's catalogue for various
		industrial applications.
		10. Analyze the stress and strain in power screw and
		design the same for various industrial
		applications.
		11. Analyze the stress and strain in threaded and
		welded joints and design the same for various
		industrial applications.
		12. Design mechanical components for fluctuating
		and reversible loading conditions
SY	PR2040::MATHEMATICS	1. Understand the Fourier Transforms.
	FOR ENGINEERING	2. Develop an understanding of variables treatment
	APPLICATIONS-II	In probability.
		5. Understand vectors and their applications to
		A Develop and analyze the results obtained from
		Probability Distributions
TY	PR3001. METAL FORMING	1 understand fundamentals of elastic and plastic
	TECHNOLOGIES	deformation of metals.
		2. select appropriate forging process, equipment,
		tools and analysis of forging load
		3. classify rolling processes, equipment and
		analysis of folling forces and defects.
		4. understand whe and tube drawing machines,
		5 understand types of extrusion process and
		analysis of extrusion load and metal flow
		6. compare and apply nonconventional forming
		techniques.
TY	PR3002::PRODUCTION	1. Understanding of Operations management
	PLANNING & CONTROL	strategies and its usefulness.
		2. Understanding of effective measures like using of
		Lot Sizing mechanisms
		3. Understanding different scheduling techniques
		used in Production system
		4. Understanding different Forecasting techniques
		used in Production system
		s. Understanding unterent Aggregate production
		6 Understanding of Relevance of scheduling
TY	PR3003PRODUCTION	1 Interpret Fe-Fe-C equilibrium microstructures
1 1 1	METALLURGY	& correlate structure-properties relationship of



		steels & cast irons.
		2. Use the concept of TTT. CCT diagrams & apply
		the heat treatment techniques to enhance
		mechanical properties of steels
		3 Apply the surface hardening & isothermal heat
		treatment techniques to enhance mechanical
		proportion of stools
		4 Select appropriate allow steel and tool steel for
		4. Select appropriate anoy steel and tool steel for
		different engineering applications
		5. Select appropriate cast iron nonferrous material
		for different engineering applications.
		6. Select appropriate non ferrous material for
		different engineering applications
TY	PR3004::QUALITY &	7. Understand and apply principles of quality
	RELIABILITY	management
	ENGINEERING	8. Interpret for process control, identify and
		analyze and eliminate/reduce causes of variation
		and carry out process capability studies
		9. Select and design an acceptance sampling plan
		for sampling inspection
		10. Develop an ability of problem solving and
		decision making using quality improvement
		tools
		11. Understand and apply Six Sigma Methodology
		and OMS and its applications
		12 Evaluate reliability maintainability and
		availability of product/component systems
TY	PR3005WORK STUDY &	1 Understand and apply productivity concepts and
11	HUMAN FACTORS	principles and analyze work content
	ENGINEERING	2 Systematically record: critically examine methods
	LIVOINTEERIIVO	of doing work to effect improvements
		2 Design the workplace using principles of motion
		5. Design the workplace using principles of motion
		4. Establish standard time to source and if a
		4. Establish standard time to carry out a specified
		job using stop watch time study
		5. Establish standard time to carry out a specified
		job using video watch time study
		6. Establish standard time to carry out a specified
		job using predetermined time standards
TY	PR3006::CAD/CAM/CIM	1. Understand and appreciate use of computer in
		product development.
		2. Apply algorithms of graphical entity generation.
		3. Understand mathematical aspects of geometrical
		modelling
		4. Understand and use finite element methods for
		analysis of simple components.
		5. Understand hard and soft automation and CAM



		6.	Describe construction and working of CNC
			machines.
		7.	Understand concepts of CAM,CIM and FMS
TY	PR3007::DESIGN OF	1.	Analyze the stress and strain mechanical
	MACHINE ELEMENTS		components such as shaft, keys and couplings
			and design the same for various industrial
			applications.
		2.	Design spur and helical gears for various
			applications.
		3.	Select different types of rolling contact bearings
			from manufacturer's catalogue for various
			industrial applications.
		4.	Analyze the stress and strain in power screw and
			design the same for various industrial
			applications.
		5.	Analyze the stress and strain in threaded and
			welded joints and design the same for various
		~	industrial applications.
		6.	Design mechanical components for fluctuating
TV	DD2008DESIGN EOD	1	and reversible loading conditions
11	PR3008::DESIGN FOR	1.	Salast materials for given objects by following
	MANUFACIUKING &	Ζ.	meterial solaction process
	ASSEMBLI	3	Understand design principles for different
		5.	manufacturing processes
		4	Understand DFA principles to apply for analysis
			of assemblies
		5.	Apply the concept of quality and reliability for
			design and manufacturing
TY	PR3036::ADDITIVE	1.	Understand various additive manufacturing
	MANUFACTURING		processes for different applications
	TECHNIQUES	2.	Use correct CAD file formats in 3D printed parts
			manufacturing
		3.	Select appropriate 3D printing parameters
			considering shape features, part quality and
			printer specifications
		4.	Apply AM concepts for Bio medical and
		_	medical fields
		5.	Perform reverse engineering steps to prepare
		~	virtual model
		0.	desired 3D objects
TY	PR3037MODERN	1	Understand need of advanced machining
11	MANUFACTURING	1.	processes and select process for any industrial
	PROCESSES		iob based on its complexity cost and
			specifications required.
		2.	Apply the working principles and processing



		characteristics of mechanical type advanced machining processes such as USM, AJM, WJM and Develop experimental, regression based, mathematical and physics based models for the advanced machining processes and predict MRR and surface roughness.
		5. Apply the working principles and processing characteristics of electro-thermal type advanced machining processes such as EDM, wire-EDM and Develop experimental, regression based, mathematical and physics based models for the advanced machining processes and predict MRR and surface roughness.
		4. Apply the working principles and processing characteristics of thermal type advanced machining processes such as PAM, LBM, EBM machining to the production of precision components.
		5. Apply the working principles and processing characteristics of chemical type advanced machining processes such as Electrochemical Machining to the production of precision micro and macro components.
		6. Apply the working principles and processing characteristics of chemical type advanced machining process for production of precision components
TY	PR3038:: METAL CUTTING & TOOL DESIGN	<ol> <li>Understand and represent cutting tools using designation systems</li> <li>Apply metal cutting theories to estimate and represent cutting forces</li> </ol>
		<ol> <li>Analyze cutting environment and cutting parameters</li> <li>Understand design principles of location, clamping for jigs and fixtures</li> </ol>
		<ol> <li>Design and draw jigs and fixtures by following design principles</li> <li>Design and draw single and multi-point cutting tools</li> </ol>
ΤΥ	PR3039::MANUFACTURING AUTOMATION	<ol> <li>Understand transfer line technology</li> <li>Able to classify jobs according to group technology</li> <li>Study various elements and applications of industrial robots</li> <li>Understand concepts FMS</li> <li>Understand and Analyze performance of automated conveyance and inspection systems</li> </ol>



		6. Understand principles of automated assembly
		systems
TY	PR3040::MACHINE TOOL	1. Design stepped speed gear boxes.
	DESIGN	2. Design spindles using minimum deflection
		criterion
		3. Design suitable bearings for spindle supports.
		4. Analyze and design various machine tool
		structure using principle of free body diagram
		5 Design sliding and rolling friction guideways
		6 Design sliding and rolling friction power screws
TY	PR3041INDUSTRIAI	1 Understand fundamentals of fluids
11	FLUID POWER	2 Select appropriate pumps for hydraulic systems
		3. Select appropriate pumps, for injutation systems
		hydraulic systems.
		4. Understand and select different types of
		hudraulic valves
		5. Construct and evaluate hydraulic circuits for
		various industrial applications such as machine
		tools, automobile, agricultural equipment
		6. Apply principles of pneumatic systems for
		automation systems
TY	PR3042::STATISTICAL	1. Explain the nature of research and data
	METHODS & RESEARCH	requirements
	METHODOLOGY	2. Calculate probability by selecting appropriate
		probability distribution for managerial decisions
		4. Derform test of significance for means and
		4. Ferform test of significance for means and
		5 Perform test of significance for variance
		6. Perform test of ANOVA
TY	PR3043::PROJECT	1. Learn the basic concepts of project and project
	MANAGEMENT	management
		2. Ascertain the feasibility of small and medium
		projects with respect to managerial, marketing,
		operational, financial and socio-economic
		perspectives
		3. Plan and schedule small and medium projects to
		achieve the triple constraint of time, cost and
		quality using software package
		4. Understand the concept of earned value
		management system and critical chain in
		managing projects
		5. Monitor the progress of projects to determine
		variances and recommend corrective actions
R	PR4001PROCESS	1 Perform preliminary part print analysis of part



Tech	ENGINEERING	2.	Understand concepts of geometric dimensioning
			and tolerancing in product engineering
		3.	Classify operations and achieve work piece
			control for manufacturing of industrial products
		4.	Manage equipment, tools, gauges, manpower
			and time economically, required for manufacture
			of industrial products
		5.	Select and plan process for manufacturing of
			industrial products cost effectively
		6.	Design process sheet for machined component
В	PR4003::DIE & MOULD	1.	understand mechanism of shearing of sheet
Tech	DESIGN		metals, elements of dies and equipment.
		2.	select and design appropriate die set and
			equipment for shearing operations of sheet
			metal.
		3.	understand principles of sheet metal forming and
			design of tools for deep drawing and bending
			operations.
		4.	apply principals of forging operations and
			design dies for closed die and upset forging.
		5.	understand different plastic processing
			techniques and equipment.
		6.	design elements of injection molding dies and
			understand working of injection machine
В	PR4006::MODERN	1.	Understand need of advanced machining
Tech	MANUFACTURING		processes and select process for any industrial
	PROCESSES		job based on its complexity, cost and
			specifications required.
		2.	Apply the working principles and processing
			characteristics of mechanical type advanced
			machining processes such as USM, AJM, WJM
			and Develop experimental, regression based,
			mathematical and physics based models for the
			advanced machining processes and predict MRR
			and surface roughness.
		3.	Apply the working principles and processing
			characteristics of electro-thermal type advanced
			machining processes such as EDM, wire-EDM
1			and Develop experimental, regression based,
			and Develop experimental, regression based, mathematical and physics based models for the
			and Develop experimental, regression based, mathematical and physics based models for the advanced machining processes and predict MRR
			and Develop experimental, regression based, mathematical and physics based models for the advanced machining processes and predict MRR and surface roughness.
		4.	and Develop experimental, regression based, mathematical and physics based models for the advanced machining processes and predict MRR and surface roughness. Apply the working principles and processing
		4.	and Develop experimental, regression based, mathematical and physics based models for the advanced machining processes and predict MRR and surface roughness. Apply the working principles and processing characteristics of thermal type advanced
		4.	and Develop experimental, regression based, mathematical and physics based models for the advanced machining processes and predict MRR and surface roughness. Apply the working principles and processing characteristics of thermal type advanced machining processes such as PAM, LBM, EBM
		4.	and Develop experimental, regression based, mathematical and physics based models for the advanced machining processes and predict MRR and surface roughness. Apply the working principles and processing characteristics of thermal type advanced machining processes such as PAM, LBM, EBM machining to the production of precision



		<ul> <li>5. Apply the working principles and processing characteristics of chemical type advanced machining processes such as Electrochemical Machining to the production of precision micro and macro components.</li> <li>6. Apply the working principles and processing characteristics of chemical type advanced machining process for production of precision components</li> </ul>
B Tech	PR4074::MAJOR PROJECT	<ol> <li>Survey literature for problem identification</li> <li>Cultivate the habit of working in a team, communicate effectively and attempt a problem solution in a right approach</li> <li>Correlate the theoretical and experimental/simulations results and draw the proper inferences.</li> <li>Apply engineering knowledge in carrying out project starting from design, drafting, process planning, project management, costing, manufacturing, QC and inspection, down to assembly, testing and evaluation.</li> <li>To practice data collection and analysis using different measurement equipment's and software packages.</li> <li>Prepare project report as per guideline and present it effectively</li> </ol>
B Tech	PR4002::SUPPLY CHAIN ANALYSIS & MODELING	<ol> <li>Identify the key elements and processes in a supply chain and their interaction</li> <li>Understand and analyze the designing, planning and operational decisions of SCM.</li> <li>Identify the techniques used in management of critical components of supply chain</li> <li>Analyze, design and optimize supply chain networks for manufacturing organizations</li> <li>Design and optimize inventories across the supply chain</li> <li>Explain the likely future development of logistics and supply chain management</li> </ol>
B Tech	PR4004::FINANCIAL MANAGEMENT AND MANAGEMENT ACCOUNTING	<ol> <li>Understand and analyze functions of financial management and budgeting, interpret financial statements through accounting ratios</li> <li>Understand the concepts of Capital Budgeting and Working Capital management for effective financial management</li> <li>Understand the mechanics of financial accounting for preparation of financial statements to ascertain the performance and financial position of a business</li> </ol>



		4. Classify and apply different types of costs and
		overheads to ascertain costs of a product or a
		process
		5. Apply different types of costing methods and
		techniques according to the suitability for
		various production processes and services.
		6. Develop an ability of decision making about
		optimum product mix, profit planning, make or buy,
		limiting factors based on marginal costing concept
В	PR4005::MECHATRONICS	1. Understand robot system and Select type of robot
Tech	& INDUSTRIAL ROBOTICS	for industrial applications
		2. Solve direct and inverse kinematic problem for
		Cartesian, polar, cylindrical and articulated arm
		robot.
		3. Understand concept of static and dynamics of
		manipulator arm
		4. Understand various types of end effectors used in
		industrial robots.
		5. Understand concepts and applications of sensors
		used in industrial robots.
		6. Study and Select appropriate drives and robot
		programming method for industrial robots
В	PR4007::POWDER	1. Select most appropriate powder manufacturing
Tech	METALLURGY	technique for cost effective manufacturing of
		powder component & characterize metal powder.
		2. Select & apply different compaction techniques
		3. Sintering techniques to obtain near net shape
		powder metallurgy parts.
		4. Understand various special powder metallurgy
		techniques and secondary operations
		5. Understand advantages, limitations and
		economics of powder metallurgy process
		6. Understand typical applications of Powder
		Metallurgy
В	PR4086::MAJOR PROJECT	1. Survey literature for problem identification
Tech		2. Cultivate the habit of working in a team,
		communicate effectively and attempt a problem
		solution in a right approach
		3. Correlate the theoretical and
		experimental/simulations results and draw the
		proper inferences.
		4. Apply engineering knowledge in carrying out
		project starting from design, drafting, process
		planning, project management, costing,
		manufacturing, QC and inspection, down to
		assembly, testing and evaluation.
		5. To practice data collection and analysis using



	different measurement equipment's and software
	packages.
6	6. Prepare project report as per guideline and
	present it effectively



### Department of Mechanical Engineering (B. Tech) Program Specific Outcomes

#### Mechanical Engineering Graduates will be able to:

1. Read & generate 2D & 3D computer based drawings of Mechanical Engineering components & systems and select appropriate materials and manufacturing processes for their production.

2. Conceptually understand Mechanical Engineering components & systems and thereby design & analyze them for enhancement of thermal & mechanical performance.

3. Conduct experiments on mechanical systems to measure different parameters required to evaluate the performance of materials, components & systems and deduce relevant conclusions

#### **Course Outcomes**

SY			<ol> <li>Understand fundamentals of kinematics of mechanisms and machines.</li> <li>Do position, velocity, and acceleration analysis of planar mechanisms.</li> </ol>
	ME2052	Kinematics And Mechanisms	<ol> <li>Take kinematic analysis of geared systems for a particular application</li> <li>Design the kinematic profile of a cam to achieve a desired follower motion</li> </ol>
			5. Design, simulate and develop the mechanisms in realistic application
	ME2055	Strength Of Machine Elements	<ol> <li>Evaluate stresses under various loading conditions.</li> <li>Draw shear force and bending moment diagrams under various loading conditions.</li> <li>Evaluate principal stresses for plane stress problems.</li> <li>Analyze long and short columns subjected to axial loads.</li> <li>Determine slope and deflection for the given beam.</li> <li>Analyze stresses in shaft, spring, threaded &amp; welded</li> </ol>
	ME2057	Applied Thermodynamics	<ol> <li>The students will be able to apply energy balance to systems and control volumes, in situations involving heat and work interactions</li> <li>Students can evaluate changes in thermodynamic properties of substances</li> <li>The students will be able to evaluate the performance of energy conversion devices</li> <li>The students will be able to differentiate between high grade and low grade energies.</li> </ol>



			5.	5. After completing this course, the students will get a
				good understanding of various practical power cycles
				and heat pump cycles
			1.	Model simple physical system
		Ordinary	2.	Solve ordinary linear differential equations
		Differential	3.	Interpret the solution of system of differential equation
	ME2059	Equations And	4.	Find Laplace transform for a variety of functions
	111111007	Transform	5	Acquire the knowledge of Fourier series
		Techniques	6	Apply Fourier transforms to get integral representation
		reeningues	0.	of the functions.
			1.	Apply critical and creative thinking in the design of
				engineering projects
			2.	Plan and manage your time effectively as a team
			3.	Apply knowledge of the 'real world' situations that a
		Engineering		professional engineer can encounter
	ME2091	Design And	4.	Use fundamental knowledge and skills in engineering
		Development 1		and apply it effectively on a pro
			5.	Design and develop a functional product prototype
				while working in a team
			6.	Present and demonstrate your product to peers,
				academics, general and industry community
			1.	Identify crystal structures, write miller indices of planes
				and directions and understand the defects in such
				structures
	ME2053		2.	Understand how to tailor material properties of ferrous
		Material Science		and non-ferrous alloys
			3.	Suggest suitable heat treatments for mechanical
				components.
			4.	Suggest various corrosion prevention methods for
				variety of mechanical components
			1.	Suggest suitable casting process for various
				components
			2.	Calculate optimum material requirement for any sheet
		Manufacturing		metal products and will be able to suggest mechanical
	ME2054	Processes		working processes for various components
		110005505	3.	Suggest suitable welding processes for various
				components
			4.	Understand various non-conventional machining
				processes.
			1.	Design lifting devices like Screw jack & clamping
				devices like C-Clamp
			2.	Decide Power transmission system for a particular
	ME2056	Machine Design	_	application
	11122050	Waenine Design	3.	Design drive train such as Belt, Rope, Chain drive
			4.	Derive the design specifications for clutch & brake
			_	based on principle of uniform wear and pressure theory
			5.	Select the material and derive the design specifications



6. Select the standard components like bearings	halts and
	, bens and
chains from the manufacturer's catalog	
1. Students will be able to mathematically form	nulate and
analyze heat transfer system by Conduction m	ode.
2. Students will be able to apply the conduct	ction heat
transfer knowledge for composite systems	with heat
generation.	
3. Students will be able to apply the know	wledge of
unsteady state heat transfer and concept of	of fins to
ME2058 Heat Transfer analyze the thermal systems.	
4. Students will be able to apply the knowledg	ge of fluid
flow and convection heat transfer to analyze the	he thermal
system	
5. Students will be able to perform thermal	design of
various heat exchangers.	
6. Students will be able to analyze radiative ner	at transfer
System.	1:41- 0
Differential acustions in 8 unknowns	i with 8
ME2060 Equations And 2 Write program for Crank Nicolson Method	
ME2000 Equations And 2. White program for the explicit method	
Tashniques	
1 Apply oritical and creative thinking in the	dagion of
and the engineering projects	design of
2 Plan and manage your time effectively as a ter	m
3 Apply knowledge of the 'real world' situati	ons that a
Engineering professional engineer can encounter	ons that a
ME2092 Design And 4. Use fundamental knowledge and skills in et	ngineering
Development 2 and apply it effectively on a project	
5. Design and develop a functional product	prototype
while working in a team	1 71
6. Present and demonstrate your product	to peers,
academics, general and industry community	-

TY	ME3051	Heat Transfer	<ol> <li>Students will be able to mathematically formulate and analyze heat transfer system by Conduction mode.</li> <li>Students will be able to apply the conduction heat transfer knowledge for composite systems with heat generation.</li> <li>Students will be able to apply the knowledge of unsteady state heat transfer and concept of fins to analyze the thermal systems.</li> <li>Students will be able to apply the knowledge of fluid flow and convection heat transfer to analyze the thermal system</li> <li>Students will be able to perform thermal design of various</li> </ol>
			<ul><li>5. Students will be able to perform thermal design of various heat exchangers.</li></ul>



		6.	Students will be able to analyze radiative heat transfer
			system.
ME3057	Mechanical Design	<ol> <li>1.</li> <li>2.</li> <li>3.</li> <li>4.</li> <li>5.</li> <li>6.</li> <li>7.</li> <li>8.</li> </ol>	Analyze the stress and strain on mechanical components and identify failure modes for mechanical parts Select material & derive specification for simple mechanical components like Cotter joint, knuckle joint, shaft, couplings, etc. Design lifting device Screw jack & clamping device C- Clamp Design mechanical component for fluctuating load Design mechanical joints like welded joint, threaded joint Design helical and torsion springs.
ME3052	Production Technology	<ol> <li>1.</li> <li>2.</li> <li>3.</li> <li>4.</li> </ol>	Estimate the requirements for machining tool operations and design the work holding devices. Suggest suitable Non conventional manufacturing processes. Select various heat treatment processes for the components. 4. Design measuring processes before and after manufacturing.
ME3053	Fluid Machinery And Fluid Power	<ol> <li>1.</li> <li>2.</li> <li>3.</li> <li>4.</li> <li>5.</li> <li>6.</li> </ol>	Understand the principle, operation and design of impulse turbine. Understand the principle, operation and design of reaction turbines. Understand the principle, operation and design of centrifugal pump. Understand the functions of fluid power components. Understand the functions of hydraulic pumps and control valves. Analyze industrial fluid power systems and circuits
ME3091	Engineering Design And Development 1	<ol> <li>1.</li> <li>2.</li> <li>3.</li> <li>4.</li> <li>5.</li> <li>6.</li> </ol>	Apply critical and creative thinking in the design of engineering projects Plan and manage your time effectively as a team Apply knowledge of the 'real world' situations that a professional engineer can encounter Use fundamental knowledge and skills in engineering and apply it effectively on a project Design and develop a functional product prototype while working in a team Present and demonstrate your product to peers, academics, general and industry community
ME3071	Seminar	1. 2. 3.	Review research papers, periodicals and magazines Discuss the recent developments in the field of mechanical engineering Develop skills of technical report writing and presentation
ME3054	Mechatronics	1.	Select the instruments to measure and control mechanical parameters based on the characteristics.



			2. Model basic engineering systems and use it for
			implementing control.
			3. Apply knowledge of mathematics, science and engineering
			to model and solve various engineering systems.
			4. Use appropriate signal conditioning method to satisfy
			needs of the mechatronic system.
			5. Implement control using various embedded systems for
			given application.
			6. Carry out ladder programming for given application of
			PLC in engineering industry.
			1. Select and Design the drive such as Belt, Rope, Chain drive
			2. Derive the design specifications for clutch & brake based
		Design Of	on principle of uniform wear and pressure theory
	ME3058	Machine	3. Select bearing from the manufacturer's catalog
		Element	4. Derive the design specifications for Spur Gear
			5. Derive the design specifications for bevel Gear
			6. Derive the design specifications for helical Gear
		Internal Combustion Engine	1. Do analysis of engine cycles for air standard, fuel-air and
			real conditions (4)
			2. Demonstrate and compare engine fuel supply systems and
			modern trends in the engines
			3. Demonstrate and compare engine ignition, cooling,
	ME3055		lubrication, governing and exhaust systems and modern
			trends in the engines
			4. Do analysis of engine performance parameters
			5. Apply internal combustion engine combustion
			fundamentals to interpret engine performance
			6. Demonstrate knowledge about the engine pollutants, its
			measurement and control and hybrid vehicles
			1. Analyze various forces and torques acting on Mechanical
			component like Flywneels, Governors, cams, gears and
			gear trains etc.
			2. Analyze centrifugal governor and find its coefficient of
			2 Kinemetic analysis of Geored systems for a particular
	ME2056	Theory Of	3. Kinematic analysis of Geared systems for a particular
	ME3056	Machines	4 Design & analysis of gear train system for a particular
			application
			5 Design the profile of a cam to achieve a desired follower
			motion
			6 Kinematic synthesize planer mechanisms such as four bar
			mechanisms and its inversions by Algebraic/ Graphic
			methods
		I	invulvub



ME309	Engineering 2 Design And Development 2	<ol> <li>Apply critical and creative thinking in the design of engineering projects</li> <li>Plan and manage your time effectively as a team</li> <li>Apply knowledge of the 'real world' situations that a professional engineer can encounter</li> <li>Use fundamental knowledge and skills in engineering and apply it effectively on a project</li> <li>Design and develop a functional product prototype while working in a team</li> <li>Present and demonstrate your product to peers, academics, general and industry community</li> </ol>
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B.Tech.	ME4051	CAD/CAM/CAE	<ol> <li>Use the underlying algorithms, mathematical concepts, supporting computer graphics. These include but are not limited to: Composite2D &amp; 3D homogeneous matrices for translation, rotation, and scaling transformations.</li> <li>Use and demonstrate fundamental knowledge of CAD/CAM.</li> <li>Understand the basic theory behind the finite element method.</li> <li>Use the finite element method for the solution of practical engineering problems.</li> <li>Create the G-code program (with a standard computer post processor) of a work- piece on a standard numerically controlled machine tool with CNC controls.</li> <li>Understand Rapid prototyping Technique</li> </ol>
	ME4052	Design Of Mechanical Systems	<ol> <li>Design as per IS code the Mechanical components like Worm gears, Unfired Pressure vessels, and Machine Tool Gearboxes.</li> <li>Design mechanical systems like pressure vessels.</li> <li>Design material handling system like belt conveyor</li> <li>Use statistical considerations in design and optimize the design for mechanical elements like shaft, gear, and spring.</li> <li>Design Mechanical systems like IC Engine and its</li> </ol>



			<ul><li>components.</li><li>6. Apply DFMA, Aesthetics and Ergonomics principles in designing engineering component or product.</li></ul>
-	ME4053	Vibration Analysis	<ol> <li>Demonstrate the problem solving ability related to balancing of rotor system, multi-cylinder in-line engine and radial engine.</li> <li>Demonstrate the gyroscopic couple and predict its effect related to planes, ships and automobiles.</li> <li>Develop the mathematical model of vibration system and perform free and force vibration analysis.</li> <li>Select the instruments for a vibration measurement and analyze the measured data.</li> </ol>
	ME4054	Refrigeration And Air Conditioning	<ol> <li>analyze vapour compression and vapour absorption refrigeration system</li> <li>select suitable components for vapor compression system application and compatible eco-friendly refrigerant based on international protocols and execute experimental analysis</li> <li>analyze psychrometric processes and apply for air conditioning and perform their experimental analysis</li> <li>Describe different Air conditioning systems applied for human comfort and industry and correlate the concepts with industrial applications.</li> </ol>
	ME4055	Major Project- I	<ol> <li>Define/Develop/Select methodology for executing the project work</li> <li>Apply theoretical concepts for solving the project problem,</li> <li>Decide and apply the manufacturing techniques and instrumentation</li> <li>To develop the procurement skills</li> <li>To assemble and demonstrate the working model</li> <li>To develop skills of technical report writing and presentation</li> </ol>
	ME4074	Summer Internship	<ol> <li>correlate the theoretical and practical concepts</li> <li>understand working of organizations and management</li> <li>demonstrate verbal, written and graphical communication skills.</li> <li>undertake technical discussions.</li> </ol>
	ME4071	Semester Internship	<ol> <li>correlate the theoretical and practical concepts</li> <li>understand working of organizations and management</li> <li>demonstrate verbal, written and graphical communication skills.</li> <li>undertake technical discussions</li> </ol>
	ME4072	Global Internship	<ol> <li>correlate the theoretical and practical concepts</li> <li>understand working of organizations and management</li> </ol>



			3.	demonstrate verbal, written and graphical
				communication skills.
			4.	undertake technical discussions
			1.	correlate the theoretical and practical concepts
	ME4073	Research	2.	understand working of organizations and management
	WIL4073	Internship	3.	demonstrate verbal, written and graphical
				communication skills.
			4.	undertake technical discussions
			1.	Compare different non-conventional sources of energy
			2.	Compute efficiency of solar energy collectors
		NonConventional	3.	Explain different ocean energy conversion systems
	ME4058	Energy Sources	4.	Evaluate performance of wind energy conversion system
		Lifergy Sources	5.	Illustrate applications of biomass energy and fuel cell
			-	technology
			6.	Describe Geothermal and Magneto-hydrodynamic
			4	(MHD) power generation systems
			Ι.	Describe construction, working and other details of
			~	Internal Combustion Engines and Clutches
			2.	Demonstrate knowledge about construction, working
			2	and other details of different Gearboxes
			3.	other details of Stearing system Wheels and Tyras
	NE 4050	Automobile	4	Demonstrate knowledge shout construction working
	ME4059	Engineering	4.	and other details of Propeller
		0 0	5	Shaft Universal joints Differential and Pear Ayle
			5. 6	Describe construction working and other details of
			0.	Suspension System
			7	Describe construction working and other details of
			<i>,</i> .	Braking System and Automotive electrical
				components/system
			1.	Demonstrate general overview of the need for hybrid-
		Hybrid Electric		electric vehicles for transportation
		Vehicles-	2.	Demonstrate overall fuel consumption and
	MF4060	Performance&		environmental improvement possible using HEVs.
	WIL4000	Environment	3	Demonstrate various architectures of HEVs
			4	Demonstrate the vehicle dynamics related analysis
		Impact	5	Energy calculations for hybrid vehicles
			5. 6	Sizing calculations for hybrid vehicles
			1	Compare different power plants their present status and
			1.	recent trends
			2	Do Mathematical analysis of Improved Rankine cycle
	ME4061	Power Plant	2.	and condenser
		Engineering	3	Compare different high pressure boilers and do the
		_	5.	analysis of nozzle
			Δ	Demonstrate essential and supplementary Power plant
			4.	components
				components



			5. Perform Testing of thermal power plant and data
			analysis to draw conclusions
			6. Perform analysis for power plant economics.
			1. Solve the manipulator transformations with knowledge
			of robotic system components and matrix algebra
			2 Solve robot forward and inverse kinematic problems
			3 Carry out trajectory planning and joint modeling for the
			simple robotic system
	ME4062	Robotics	A carry out velocity analysis and dynamic modeling for a
			4. Cally out velocity analysis and dynamic modeling for a manipulator
			5 identify appropriate and affectors and concorre for
			5. Identify appropriate end effectors and sensors for
			particular application.
			6. execute various steps in robot design and robot
			programming
			1. Use different weighted residual methods and variational
			method to obtain preliminary approximate solution to a
			governing differential equation of a system.
			2. formulate and solve mechanical system involving 1D
			elements.
			3. transform systems in different coordinate systems and
	MF4063	Finite Element Method	use Iso-parametric property to solve different problems
	WIL4005		involving triangular elements.
			4. formulate and solve mechanical system involving two
			degrees of freedom.
			5. explain background working of and solve engineering
			problems using commercial FEA code like ANSYS,
			NASTRAN, MATLAB etc.
			6. find response of the system as a function of time given
			the external disturbances using finite element method
			1. The student will be able to understand and use the single
			variable optimization algorithm to solve different
			problems
			2. The student will be able to select appropriate algorithm
			and implement it for multi-variable and constrained
			optimization problems.
		Optimization	3. The student will be able to use mathematical software
		Techniques &	for the solution of engineering problems with
	ME4064	Operation	conventional and evolutionary algorithms
			4 The student will be able to formulate linear
		Research	nrogramming problem and apply different linear
			nrogramming methods to solve it
			5 The student will be able to formulate transportation and
			assignment problem
			6 The student will be able to formulate management
			decision problems for inventory model some theory
			problem and quoting theory problem
			problem and queuing theory problem



			1. Illustrate the selection of components hydraulic systems.
			2. Evaluate the performance of hydraulic pumps
			3. Analyze the performance of hydraulic control valves and
		Industrial Fluid	develop simple hydraulic circuits.
	ME4065	Dowor	4. Evaluate the performance and applications of hydraulic
		rowei	actuators.
			5. Understand the components of pneumatic systems and
			develop simple pneumatic circuits.
			6. Design simple hydraulic and pneumatic systems based
			on applications.
			1. Perform analysis of hydrodynamic thrust bearing.
			2. Design the hydrodynamic journal bearing based on
	ME4066	Tribology	theoretical and practical considerations.
	WIL4000	Thorogy	3. Demonstrate knowledge about various modes of
			lubrication and its analysis.
			4. Demonstrate knowledge about laws / theories of friction
			and wear
			1. Know common heat exchanger types, their advantages,
			limitations and applications
			2. Understand use and significance of heat transfer and
		Dynamic –	pressure loss for flow configurations
			3. Apply thermal design of heat exchanger and fouling
	MF4067		considerations
	1012 1007	Kinematics	4. Know how to incorporate Mechanical design and
			awareness of TEMA standards in designing heat
			exchanger
			5. Understand design and selection aspect of cooling
			towers and condensers
			6. Understand the concepts of modeling and simulation
			used for optimization of heat exchangers
			1. obtain input/output specific work/power from
		Heat Exchange	turbomachines
	ME4068	Devices	2. apply scaling laws
		2011005	3. design and analyse centrifugal machines
			4. analyse axial machines
			5. design hydro turbines and analyse gas and wind turbines
			1. Define/Develop/Select methodology for executing the
			project work
			2. Apply theoretical concepts for solving the project
		<b>m</b> 1 1'	problem,
	ME4069	Turbomachines	3. Decide and apply the manufacturing techniques and
			Instrumentation
			4. To develop the procurement skills
			5. To assentible and demonstrate the working model
			o. To develop skills of technical report writing and
			presentation



### **Department of Mechanical Engineering (M.Tech. Design)**

#### **Course Outcomes**

M.Tech	ME505	Mathematical	1.	Model and solve linear/nonlinear systems
. Design	ME303	Methods In	2.	solve system of ODEs
	1	Engineering	3.	Solve elliptic, parabolic and hyperbolic PDEs
	ME505 2	Advanced Stress Analysis	<ol> <li>1.</li> <li>2.</li> <li>3.</li> <li>4.</li> <li>5.</li> <li>6.</li> </ol>	Students will be able to apply the mechanics of materials methods to engineering problems to understand structural responses to various loading conditions. Students will be able to calculate stresses in components of noncircular cross section subjected to unsymmetrical bending and torsional loading. Students will be able to calculate of shear stress in thin walled sections subjected to torsion and determine shear center. Students will be able to calculate stresses and strains associated with thick wall cylindrical pressure vessels & rotating disks. Students will be able to compute contact stresses and deflections for mechanical elements like gear, cam &bearings. Students will be able to comprehend current research findings as reported in journals in the field of solid mechanics.
	ME505 3	Vibration And Noise Control	<ol> <li>1.</li> <li>2.</li> <li>3.</li> <li>4.</li> </ol>	Develop the mathematical model of single / multi - degrees of freedom system and formulate the equation of motion Perform the free / forced vibration analysis using numerical techniques. Classify the acoustic sources and apply various noise control techniques i.e. selection of sound absorbing, barrier material, e.t.c Select the instruments for a Noise and Vibration measurement and analyse the measured data.
	ME505 4	Advanced Machine Design	<ol> <li>1.</li> <li>2.</li> <li>3.</li> <li>4.</li> <li>5.</li> </ol>	Analyze basic design critically for further improvements Formulate and solve design problems of mechanical systems related to gear profile and cam dynamics. Design and optimization of mechanical components to meet desired engineering requirements including strength, dynamics and life under different conditions such as fatigue, fracture and creep Apply knowledge of statistical techniques to mechanical design problems Use modern engineering tools in the analysis and



				design of machine components
			1.	Apply critical and creative thinking in the design of
				engineering projects
			2.	Plan and manage your time effectively as a team
			3.	Apply knowledge of the 'real world' situations that a
	MEGOO	Engineering		professional engineer can encounter
	ME509	Design And	4.	Use fundamental knowledge and skills in engineering
	1	Development 1		and apply it effectively on a project
		-	5.	Design and develop a functional product prototype
				while working in a team
			6.	Present and demonstrate your product to peers,
				academics, general and industry community
			1.	Understand construction and design parameters of
				mechanisms
			2.	Analyze the simple and complex mechanisms for
		Analysis And		kinematics & dynamics
	ME505	Synthesis Of	3.	Analyze mechanisms for their performance in terms of
	5	Mechanism		motion, path and body guidance.
			4.	Design and synthesize the mechanisms in real life
				applications
			5.	Use modern engineering tools in the analysis and
		~		design of mechanisms
	ME505	Computer Aided		
	0	Engineering	1	The student will be able to formulate linear
			1.	programming problem and apply different linear
				programming problem and appry different inical
			2	The student will be able to understand and use the
			2.	single variable optimization algorithm to solve
				different problems
			3.	The student will be able to select appropriate
				algorithm and implement it for multi-variable
	ME505	Optimization		problems.
	7	Technique	4.	The student will be able to select appropriate
		_		algorithm and implement it for constrained
				optimization problems.
			5.	The student will be able to use mathematical software
				for the solution of engineering problems with
				conventional and evolutionary algorithms.
			6.	The student will be able to formulate linear
				programming problem and apply different integer
				programming methods to solve it.
			1.	Demonstrate the principles and applications of various
	ME505	Industrial Tribology		modes of lubrication.
	8		2.	Develop the mathematical model of lubrication
			2	problem Solve hybridation mehlem mine source ( )
		1		Solve Indrication broblem using computational



		techniques.
		4. Apply the basic theories of friction, wear to predict the performance of commonly encountered sliding
		interfaces.
ME505 9	Mechanics Of Composite Materials	<ol> <li>Students will able to choose composite materials as competing material to traditional materials.</li> <li>Students will be able to analyze and interpret stiffness and strength properties of composite lamina.</li> <li>Students will be able to analyze and interpret stiffness and strength properties of composite laminates.</li> <li>Students will understand mechanical properties determined from experiments and their utilization in composite analysis.</li> <li>Students will be able to design elementary level representative machine components or structures made of composite materials.</li> </ol>
ME506 0	Vehicle Dynamics	<ol> <li>Students will be able to understand dynamics and performance parameters of the components related to the vehicle handling.</li> <li>Students will be able to analyze vehicle performance criteria</li> <li>Students will be able to understand vehicle models and analyze dynamic response of the vehicle.</li> <li>Students will be able to understand dynamics of steering mechanism</li> <li>Students will be able to understand dynamics of suspension</li> </ol>
ME506 1	Advance Manufacturing Methods	<ol> <li>Understand need of advanced machining processes and select process for any industrial job based on its complexity, cost and specifications required.</li> <li>Apply the working principles and processing characteristics of mechanical type advanced machining processes such as USM, AJM, WJM and Develop experimental, regression based, mathematical and physics based models for the advanced machining processes and predict MRR and surface roughness.</li> <li>Apply the working principles and processing characteristics of electro-thermal type advanced machining processes such as EDM, wire-EDM and Develop experimental, regression based, mathematical and physics based models for the advanced machining processes and predict MRR and surface roughness.</li> <li>Apply the working principles and processing characteristics of the advanced machining processes and predict MRR and surface roughness.</li> <li>Apply the working principles and processing characteristics of thermal type advanced machining processes such as PAM, LBM, EBM machining to the production of precision components.</li> <li>Apply the working principles and processing</li> </ol>



		<ul> <li>characteristics of chemical type advanced machining processes such as Electrochemical Machining to the production of precision micro and macro components.</li> <li>18. Apply the working principles and processing characteristics of chemical type advanced machining process for production of precision components</li> </ul>
ME506 2	Robotics	
ME506 3	Process Equipment Design	<ol> <li>Students will have understanding of several design codes used in the design.</li> <li>Students will be able to understand the calculation of line sizes and pressure drops, flow measurement sizing and develop a flow measurement process data sheet.</li> <li>Students will have understanding of design and analysis of vessels and tanks</li> <li>Students will have understanding of the principles of process equipment design, the mechanical aspects of the design and operation of process equipment, including safety considerations.</li> <li>Students will be able to complete detailed designs of several process equipment's.</li> <li>Students will be able to understand the concept of planning, manufacturing, inspection and erection of process equipment's</li> </ol>
ME509 2	Engineering Design And Development 2	<ol> <li>Apply critical and creative thinking in the design of engineering projects</li> <li>Plan and manage your time effectively as a team</li> <li>Apply knowledge of the 'real world' situations that a professional engineer can encounter</li> <li>Use fundamental knowledge and skills in engineering and apply it effectively on a project</li> <li>Design and develop a functional product prototype while working in a team</li> <li>Present and demonstrate your product to peers, academics, general and industry community</li> </ol>
ME605 1	Dissertation by Internship-1	<ol> <li>Student should identify problem and decide scope of his work.</li> <li>Student should complete literature review for writing the report.</li> <li>Students will be able to correlate the theoretical and practical concepts</li> <li>Students will be able to understand various processes of product developments and services</li> <li>Students will be able to understand industrial works and management</li> </ol>



			<ol> <li>Students will be able to demonstrate verbal, written and graphical communication skills.</li> <li>Students will be able to undertake technical discussions.</li> </ol>
	ME605 3	Dissertation by Internship-1	<ol> <li>Student will be able to identify problem and decide scope of his work.</li> <li>Student will be able to do literature review for his work.</li> <li>Students will be able to correlate the theoretical, practical and research concepts</li> <li>Students will be able to understand various steps on research and development</li> <li>Students will be able to understand research processes</li> <li>Students will be able to demonstrate verbal, written and graphical communication skills.</li> <li>Students will be able to undertake technical discussions.</li> </ol>
	ME605 2	Dissertation by Internship-2	<ol> <li>Students will be able to correlate the theoretical and practical concepts</li> <li>Students will be able to understand various processes of product developments and services</li> <li>Students will be able to understand industrial works and management</li> <li>Students will be able to demonstrate verbal, written and graphical communication skills.</li> <li>Students will be able to undertake technical discussions.</li> <li>Report with technical conclusions based on simulation and or experimental results</li> </ol>
	ME605 4	Dissertation by Research-2	<ol> <li>Students are able to develop research skills like literature survey and data analysis</li> <li>Under the influence of the project guide -To engage the student directly or indirectly in research at different levels, from advancing their course materials, professional development, to funded research projects to advance the state of practice</li> </ol>



### **Department of Mechanical Engineering**

### (M.Tech. Heat Power)

### **Course Outcomes**

M.Tech.		Mathematical	1. model and solve linear/nonlinear systems
Heat	ME5051	Methods in	2. solve system of ODEs
Power		Engineering	3. Solve elliptic, parabolic and hyperbolic PDEs
	ME5071	Advanced Thermodynamics	<ol> <li>Do a thermodynamic analysis of SF systems using the concepts of entropy, available and unavailable energy</li> <li>Understand relationships between variou thermodynamic properties of pure substances and P-V-7 surfaces</li> <li>Derive the enthalpy entropy and internal energy correlations using Maxwell and Clayperon equations</li> <li>Solve the Gas mixture problems using the properties of gases specified in the mixture</li> <li>Understand combustion reactions, enthalpy of formation, Gibbs function of formation and absolut entropy</li> <li>Understand various models used in statistica thermodynamics and the third law of thermodynamics</li> </ol>
	ME5072	Advanced Fluid Mechanics and CFD	<ol> <li>Apply conservation equations to various flow systems</li> <li>Model and analyze industrial flows</li> </ol>
	ME5073	Advanced Heat Transfer and CFD	<ol> <li>Understand the basic equations and applications of 2-heat conduction problems.</li> <li>Perform the analysis of fins and the unsteady stat problems.</li> <li>Analyze the systems with internal and external convection heat transfer.</li> <li>Analyze the system of radiation heat transfer.</li> <li>Analyze the system of radiation heat transfer.</li> <li>Apply the heat transfer knowledge for heat exchange applications.</li> <li>Understand the basic principles of boiling an condensation.</li> </ol>
	ME5093	Engineering Design And Development 1	<ol> <li>Apply critical and creative thinking in the design of engineering projects</li> <li>Plan and manage your time effectively as a team</li> <li>Apply knowledge of the 'real world' situations that professional engineer can encounter</li> <li>Use fundamental knowledge and skills in engineering and apply it effectively on a project</li> <li>Design and develop a functional product prototyp while working in a team</li> </ol>


		6. Present and demonstrate your product to peers,
MES	074 Advanced 074 Applied Thern Engineering	<ol> <li>Perform Analysis for performance, combustion and emission characteristics of Engine</li> <li>Students must develop skill to understand engine based on environment pollution and methods to control the same.</li> <li>Demonstrate modern techniques of engine management and electronic injection system and the Latest Trends in the Engine Technology</li> <li>Analyse multistage vapour compression refrigeration cycle</li> <li>Compare various refrigerants and evaluate the performance of multistage vapour absorption refrigeration system</li> <li>Estimate refrigeration load and design a refrigeration system for an application</li> </ol>
MES	Heating 075 Ventilation A Conditioning	<ol> <li>Apply the concepts of psychrometry to air-conditioning systems</li> <li>Estimate the air-conditioning load required to design an air-conditioning system</li> <li>Design an air distribution system for air-conditioning application</li> <li>Select appropriate system components for an air-conditioning system</li> <li>Design an evaporative cooling system</li> <li>Compare different air-conditioning systems</li> </ol>
ME	057 Optimization Technique	<ol> <li>The student will be able to formulate linear programming problem and apply different linear programming methods to solve it.</li> <li>The student will be able to understand and use the single variable optimization algorithm to solve different problems</li> <li>The student will be able to select appropriate algorithm and implement it for multi-variable problems.</li> <li>The student will be able to select appropriate algorithm and implement it for constrained optimization problems.</li> <li>The student will be able to use mathematical software for the solution of engineering problems with conventional and evolutionary algorithms.</li> <li>The student will be able to formulate linear programming problem and apply different integer programming methods to solve it.</li> </ol>
MES	077 Advanced Measurement	1. Students will be able to do mathematical analysis for the dynamic characteristics of the instruments.



	Data Analysis	2.	Students will be able to do uncertainty analysis,
		-	regression analysis for the experimental data
		3.	Students will be able to demonstrate and analyze
			various advanced measurements techniques for the field
			quantities
		4.	Students will be able to demonstrate and analyze
			various advanced measurements techniques for the
		5	Students will be having the knowledge of analytical
		5.	methods of advanced measurements
		6	Students will be able to perform analysis for various
		0.	controllers
		1.	Students should be able tounderstand global energy
			scenario , need of energy management and
			environmental concerns
		2.	Students should be able to use the financial analysis
			techniques like simple pay back period, return on
		•	investment, net present value for an industry
	Energy	3.	Students should be able to find performance assessment
ME50/8	Conservation and	4	of Thermal and Electrical utilities
	Management	4.	Students should be able to understand energy
		5	Students should be able to understand energy
		5.	conservation in electrical and compressed air systems
		6	Students should be able to find energy performance of
		0.	process equipment like Furnaces. Heat exchangers and
			methods to improve it.
ME5056	Computer Aided		
11120000	Engineering		
		1.	Understand details of characteristics of fuel used in
			engine in detail as it affect the design, efficiency and
			alternative fuels
		2	Understand theory of combustion flame propagation
		2.	and various factors affecting the SI Engine
		3.	Understand theory of combustion, delay period and
ME5076	IC Engines Fuels		various factors affecting the CI Engine.
	and Compusition	4.	Develop skill to understand purpose of supercharger and
			turbocharger with their effects on engine performance.
		5.	Understand influence of fuel-air ratio on engine power
			output and thermal efficiency with the various operating
		6	Conditions.
		υ.	engine emissions and scavenging techniques
		1	Know common heat exchanger types their advantages
ME5079	Design of Heat	1.	limitations and applications
	Exchangers	2.	Understand use and significance of heat transfer and



			pressure loss for flow configurations
			3. Apply thermal design of heat exchanger and fouling
			considerations
			4. Know how to incorporate Mechanical design and
			awareness of TEMA standards in designing heat
			exchanger
			5. Understand design and selection aspect of cooling
			towers and condensers
			6. Understand the concepts of modeling and simulation
			used for optimization of heat exchangers
			1. Obtain input/output specific work/power from
			turbomachines
		Advanced	2. apply scaling laws
Ν	ME5080	Turbomachines	3. design and analyse centrifugal machines
		1 di o onidonino s	4. analyse axial machines
			5 design hydro turbines and analyse gas and wind turbines
			1. Apply critical and creative thinking in the design of
			engineering projects
			2. Plan and manage your time effectively as a team
		Engineering Design And	3. Apply knowledge of the 'real world' situations that a
			professional engineer can encounter
N	ME5094		4. Use fundamental knowledge and skills in engineering
-		Development 2	and apply it effectively on a project
		20101010102	5. Design and develop a functional product prototype
			while working in a team
			6. Present and demonstrate your product to peers.
			academics, general and industry community
			1. Students will be able to formulate a problem for the
			dissertation.
			2. Students will be able do literature review to understand
			work done by other researchers in the field of project
Ν	ME6055	Dissertation by	work.
		internship-1	3. Students will be able to decide the methodology to
			obtain solution of the problem.
			4. Students will be able to plan activities and resources
			pertaining to the solution of the problem
			1. Students are able to develop research skills like
			literature survey and data analysis
			2. Under the influence of the project guide -To engage the
			student directly or indirectly in research at different
Ν	ME6057	Dissertation by	levels, from advancing their course materials,
		research-1	professional development, to funded research projects to
			advance the state of practice.
			3. Students are able to develop their own writing and
			presentation skills.
	MEGOEC	Dissertation by	1. Students will be able to formulate different solutions
I	VIE0030	internship-2	and arrive at most suitable solution systematically.



			2.	Students will be able to develop experimental test
				setups.
			3.	Students will be able to use analysis tools for practical
				problems.
			4.	Students will be able to analyze data to help draw conclusions
			5.	Students will be able to independently learn different
				engineering aspects pertaining to the project work.
			6.	Students will be able to communicate effectively both in
				written and verbal forms.
			7.	Students will be able to approve knowledge in the field
			~	of work.
			8.	Students will be able to perform collaborative work.
			9.	Students will be able to sustain in the competitive
				environment in the future engineering career
			1.	Students are able to develop research skills like
			_	literature survey and data analysis
			2.	Under the influence of the project guide -To engage the
	ME5058	Dissertation by		student directly or indirectly in research at different
		research-2		levels, from advancing their course materials,
				professional development, to funded research projects to
				advance the state of practice.
			3.	Students are able to develop their own writing and
				presentation skills.



#### **Department of Engineering Sciences & Humanities**

#### (FY-Common)

#### **Course Outcomes**

Sr No	Subject Code	Subject	Number of CO	CO Statements
			CO1	Recognize and identify Taylor series, infinite series and curves in plane
1	ES1001	Calculus	CO2	Demonstrate the knowledge of partial derivative, chain rules, implicit functions, and extreme values of function of several variables
-			CO3	Evaluate double integral
			CO4	Apply triple integral for engineering applications
			CO5	Interpret the properties of vector differentiation
			CO6	Use Gauss divergence and stokes's theorem
			CO1	Set up, solve and interpret linear systems
2			CO2	Acquire the knowledge of vector spaces
	ES1004	Linear Algebra	CO3	Apply knowledge of inner product spaces to compute length of a vector, angle, distance between two vectors, to compute orthogonal basis using Gram-Schmidt process
			CO4	Compute and apply the knowledge of eigenvalues and eigenvectors
			CO5	Demonstrate linear transformations geometrically
			CO6	Analyze and interpret probability distribution.
		C Programming	CO1	Apply programming fundamentals to construct concise solutions.
			CO2	Demonstrate available algorithmic principles to generate efficient solutions.
3	CS1001		CO3	Justify modular programming approach by making use of elementary as well as superior data structures.
			CO4	Implement programming constructs to solve real world problems.
			CO5	Construct derived data type for real world entities.
			CO6	Apply file handling for permanent storage of data.
			CO1	Understand the power and simplicity of Python Programming.
	CS1002	Dython	CO2	Demonstrate various features and operators available in Python Programming.
4	C31002	rython	CO3	Justify modular programming approach by making use of functions and modules.
			CO4	Implement real world problems using GUI libraries available in



				Python.
			CO5	Apply file handling and data base concepts for permanent storage of data.
			CO6	Use exception handling and regular expressions to build flawless applications.
			CO1	Apply the principles of different spectroscopic methods and find out the unknown concentration of given solution of complex compound by Colorimetry
5	ES1002	Applied Science	CO2	Understand the basics of different chromatographic techniques Separate and identify the components in the given mixture from retardation / retention factor
			CO3	Apply appropriate logic, Solve problems and arrive at solution based on spectroscopic principles, grading of fuels (from the results of proximate analysis)
			CO4	To analyze and quantify the electro analytical parameters
		Electrical Engineering	CO1	Understand different theorems and able to solve numerical on it.
6	ES1003		CO2	Understand concept of single phase a.c. circuit.
			CO3	Understand concept of three phase a.c. circuit.
			CO4	Find losses and efficiency of single phase transformer.
			CO5	Understand construction and working of DC machines and solve numerical problems.
			CO6	Understand construction and working of induction motor and the T-S characteristic.
			CO1	A student will be able to-Greet formally as well as informally and introduce himself or herself in French, Read and write numbers, dates, telephone numbers, days of the week.
			CO2	A student will be able to- Describe the culture of France and form grammatically correct sentences and introduce third person.
7	HS1003	French	CO3	A student will be able to- Ask or tell the directions to reach the destination and describe your family.
			CO4	A student will be able to -4. Tell and ask time, frame basic questions and describe your routine.
			CO5	A student will be able to- Write emails, letters and small essays in French and describe your room using relevant vocabulary
			CO6	A student will be able to- Make negative sentences and use them in the dialogues
			C01	Greet formally and introduce himself/herself in Japanese language with appropriate etiquetts and mannerism
8	HS1004	Japanese	CO2	Read and write Hiragana, Katakana, Scripts along with basic words, numbers, dates, telephone nos., days of the week, months, year, time



			CO3	Read/Write sentences using basic sentence pattern including all three scripts.
			CO4	Describe things using basic adjectives and actions by using basic verbs
			CO5	They become familier to fascinating country like Japan & Japanese culture.
			CO6	
			CO1	Pronounce the words correctly according German language rules and formulate small and simple sentences in German using basic grammar structures. Introduce himself or herself
		German	CO2	Say, write numbers, number names. Recognize professions of male and female. Play dialogs related to classroom object. Recognize definite articles of classroom objects. Recognize Singular/Plural form.Tell and write days of week, Months and seasons
9	HS1005		CO3	Tell directions, locations. Write passage on Family and professions, ages of family members. Write, formulate negation sentences. To give orders, make polite requests using Imperative.
			CO4	Read and tell clock time and use it for taking and cancelling formal/informal appointments using Possessive pronouns, and Modal verbs.)
			CO5	Read and understand small texts about Hobbies, free-time activities and read and write ordinal number, date of birth and important days, holidays in year.
			CO6	Make conversation related to Restaurant, Cafes using Accusative and Modal verb (möchten,wollen and können)
			CO1	Enhance their vocabulary skills
			CO2	Construct and use grammatically correct sentences.
10	US1007	English	CO3	Develop good listening skills.
10	1131007	English	CO4	Speak confidently in English.
			CO5	To be able to comprehend the printed content
			CO6	Write appropriately to communicate effectively
		** 1 1	CO1	Understand basics of operating system and system administration to study computer networking fundamentals.
11	ES1012	Hardware and Software	CO2	Built the circuit on PCB after stimulate the circuit operation on stimulating software.
		workshop -	CO3	Perform few sheet metal work and carpentry operations with safety measures
			CO1	Introduction to use of marking tools and hand tools.
12	ES1013	Machining Workshop	CO2	Perform few Fitting, Carpentry and Welding operations.
		vvorksnop	CO3	Follow safety practices
13	ES1014	Environmental	CO1	Recognize renewable and non-renewable resources and



		Science		associated problems and plan different activities to create
				awareness among the people and hence to conserve resources
				by minimizing degradation of environment.
			CO2	Understand different types of ecosystems and their importance in balancing the nature
			CO3	Understand concept of biodiversity at national and global level and need to preserve it.
			CO4	Understand different types of pollutions and hence to find the remedial measures to minimize ill effects.
			CO5	Recognize various disaster and solid waste management techniques
			CO6	Understand and appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems
			CO1	Understand concepts of discovery, invention, innovation, research etc.
		<b>.</b>	CO2	Know socio-economic impact of research
14	ES1009	Engineering Design and Development 1	CO3	Understand various research tools, their application and methods
			CO4	Understand process of paper publication
			CO5	Understand the concept and process of IPR
			CO6	Know ethical practices in research
		Engineering Design and Development 2	CO1	Identify projects relevant societal needs
			CO2	Map the technologies learned with the project needs
15	ES1010		CO3	Apply the technological knowledge to design various feasible solutions
			CO4	Select best possible solution to solve the problem
			CO5	Develop/Fabricate a working model of the proposed solution
			CO6	Testing and validate product performance
			CO1	Evaluate resultant of coplaner/non coplanar forces
			CO2	Apply equilibrium equations to beams/ assemblies
			CO3	Determine centroid and M.I. of simple lamina
16	ES1005	Engineering Mechanics	CO4	Analyze co-planar systems of forces in truss and frames, friction
			CO5	Analysis of motion of the particle along rectilinear and curved path
			CO6	Apply kinetics concepts to rectilinear motion of a particle
17	FS1002	Chomister	CO1	Find out the rate of chemical reaction and different kinetic parameters e.g. order or reaction, michaelis menten kinetics and rate constant etc.
17	£51006	Chemistry	CO2	Get adsorption isotherms and its study e.g. surface area determination and find out the structure and catalytic properties of metals etc.



			CO3	Find out different thermodynamic parameters of chemical reactions e.g. Helmholtz and Gibbs energies, Cp and Cv and get PV diagram of pure substances, calculation and application of virial equation to calculate volumetric parameters.
			CO4	To select the reagents and physical and chemical conditions to carry out the desired reaction.
			CO5	Get the stereo chemical structure and optical activity of organic compounds, synthesis mechanism of heterocyclic compounds and spectrophotochemical behaviour of organic compounds.
			CO6	Find out the effect of solvents on the reaction rate, the product formation and synthesis mechanism of some natural compounds.
			CO1	Derive physical terms from Interference, Diffraction and Polarization
			CO2	Evaluate different terms from Interference,Diffraction and Polarization and do experiments in lab
10	8 ES1007	Applied	CO3	Analyze the fundamental terms from quantum mechanics
10		Physics Behavioral Sciences	CO4	Evaluate the physical terms in semiconductor physics and do experiments in lab
			CO5	Analyze the basic terms and working mechanisms of different lasers and do experiment in lab
			CO6	NA
			CO1	Apply the most appropriate tool of acquiring knowledge for a suitable object of knowledge.
			CO2	Evaluate the purpose of the 8 steps of the Yoga sutras and their consequence on the human mind.
			CO3	Practice ethics in one"s personal, professional and family life.
19	HS1001		CO4	Be introduced to the subject matter of Psychology as a science & Understand its various applications.
			CO5	Study the concept of emotions and motivation to be able to apply in various areas of their life.
			CO6	Be introduced to Social Psychology to become an aware and responsible citizen
			CO1	A student will be able to- set his / her goals for future and use writing skills for formal documents.
			CO2	A student will be able to- demonstrate professional etiquettes in a workplace
20	HS1002	Soft Skills	CO3	A student will be able to- apply proper communication skills and hence enable him to be an effective communicator.
			CO4	A student will be able to-become a good listener and perform his / her tasks as per expectations
			CO5	A student will be able to- lead a team successfully and work as a good team player as well.



			CO6	A student will be able to apply time management skills and participate in group discussions
			CO1	To learn standard practices of lines, lettering and dimensioning in Engineering Drawing
- 1	EC1000	Engineering	CO2	Visualize and draw orthographic projections of 3D objects
21	E21002	Drawing	CO3	Visualize the object and draw isometric views from given orthographic projections
			CO4	To develop lateral surfaces of solids
			CO1	Demonstrate blocks and beats
			CO2	Demonstrate floor exercise
22	1101000	Assabias	CO3	Make their own steps
22	H21009	Aerobics	CO4	Make their own choreography
			CO5	Coordinate their own steps with songs
			CO6	Self independent of aerobic workout
			CO1	Perform the basic steps of bharatnatyam
			CO2	Demonstrate "Mudras" and their uses in dance.
	1101000		CO3	Perform the groups in different speeds
23	H51009	Bharathatyam	CO4	Use the 9 Emotions in dance
			CO5	Set up or choreograph a small dance piece on music
			CO6	Set up a dance drama in groups set to music
		Chess	CO1	Improve concentration, planning, calculations and management skills (management skills includes time management as well as resource management)
24	HS1010		CO2	Calculate at least next 3 to 4 moves at the time of playing a game
			CO3	Solve all types of checkmates (1 Queen, 2 Rooks, 1 Rook, and 2 Bishops)
			CO4	Know all types of themes that are used in chess.
			CO5	Participate in the chess tournament and can score very well.
			CO1	Understand fundamental of visual art, colour study, human proportion etc
			CO2	Enable student to enhance their practical skills
25	HS1011	Drawing and	CO3	Facilitate awareness of current trend and movement in the field of visual art
		Fainting	CO4	To cultivate good communication skills and appreciation of work.
			CO5	Develop leadership competency qualities among follow binges.
		-	CO6	Provide interdisciplinary approach in visual art.
	1101010		CO1	Knowledge of basic Theory of Flute & Music and Best Finger movements on flute.
26 HS	HS1012	Flute	CO2	Knowledge of Swaras & Ragas and also know relationship between them. Able to play Sargams, Dhuns, and songs



			CO3	Play any lead song with the help of Notation.
			CO4	Able to recognize the knowledge of swaras in every
			0.04	Saptak.(Shudha, Komal and Trivra Swaras)
			CO5	Able to play full length lead Songs on flute
			CO6	Able to accompaniment for any song with Different rhythm patterns.
			CO1	Identify different parts of guitar
			CO2	Recognize different scale of music for guitar
			CO3	Play the skills and identify notes and scales for song
27	HS1013	Guitar	CO4	Demonstrate the chords based on scales
			CO5	Play chords and rhythm pattern on guitar
			CO6	Accompany and play complete song on guitar by using chords and scales
			CO1	Handle digital camera confidently
		Photography	CO2	Use different camera modes and also understand the difference between these modes
28 H	UC1017		CO3	Capture photograph with different composition techniques
	H51014		CO4	Put desired aesthetic sense and effects in the created photograph
			CO5	Convey the story through photograph
			CO6	Understand different types of digital cameras and basic digital sensor technology
			CO1	Identify the various components of Tabla and know the beats
			CO2	Know the language of Tabla
20	1101015	<b>Τ-</b>	CO3	Understand how to utter the padhan
29	п51015	Tabla	CO4	Know about the taal
			CO5	Know about taal with padhan
			CO6	Know about the basic performance about taal and tukada
			CO1	Demonstrate and identify different basic stances
			CO2	Demonstrate and identify different blocks and to use them
			CO3	Demonstrate and identify different kicks
30	HS1016	Taekwondo	CO4	Demonstrate Sparring Stance and variety of kicks and double or even triple kicks can be performed in quick succession
			CO5	Engage and attempt to best each other in a controlled form of mock combat or fight
			CO6	Demonstrate certain self defence techniques like wrist grab, headlock etc.
			CO1	To know what is vocal music
			CO2	Sing basic swaras
31	HS1017	Vocal	CO3	Sing & knowledge of swaralankar
			CO4	knowledge of Raag Yaman
			CO5	knowledge of Raag Sarang & Bhimpalas



			CO6	Knowledge & sing different music such as Bhajan,Gazal,Duet song etc.
			CO1	Perform various types of Pranayam like Nadishodhan, Sooryabhyas, Chandrabhyas, Bhasrika, Rapid inhalation and exhalation and various types of Mudra Pranayam.
			CO2	Chant "Omkar" in its root form as well as modified form. Students shall be able to feel the positive vibrations created by correct chanting of "Omkar".
32	HS1018	Yoga and Pranayam	CO3	Perform various yogasans in their correct posture form and experience their benefits towards health, body posture and flexibility
			CO4	Demonstrate scientifically correct Sun Salutions i.e Sooryanamaskars and reap its benefits.
			CO5	Harmonise Sooryanamaskars alongwith Pranayam and energies themselves.
			CO6	Relax their body and mind through guided Meditation and Yoganidra helping thereby to calm down, channelize their energy in the right manner and concentrate better.
		Film Appreciation	CO1	Understand the purpose and development of art in its historical context
			CO2	Understand the development of cinema in its historical context
22	HS1019		CO3	Analyze and interpret framework of cinema
33			CO4	Understand the development of language of cinema
			CO5	Have information about the history of cinema
			CO6	Know the experimentation in world cinema and influence of cinema over other art forms
			CO1	Identify different parts of violin.
			CO2	Identify different scales.
34	HS1020	Violin	CO3	Play the sargam.
54	1151020	v iolin	CO4	Skillfully manage the bow and fingers simultaneously.
			CO5	Play along with tabla.
			CO6	Perform raag Bhoop with alaap
			CO1	Knowledge and understanding of Human Anatomy
			CO2	Science of Fitness Management
25	1101001	<b>F</b> - 11 - <b>F</b> ² 4	CO3	Concept of Indian FOLK Culture
32	H51021	FOIK FITNESS	CO4	How to conduct result oriented Group Exercise Routine for Adults.
			CO5	Skills for developing and running a successful business as a Fitness Trainer
			CO1	Understand rules and regulations of Volleyball game.
36	HS1022	Volleyball	CO2	Gain overall fitness and stamina development.
			CO3	Develop good sportsmanship, integrity, teamwork and



				leadership
			CO4	Develop the ability to work as referee.
37	HS1023	Synthesizer	CO1	Students will gate adequate knowledge of music
			CO2	Students will be able to play instruments solemnly.
			CO3	Students will be able to give a stage performance
			CO4	Music knowledge will boost their running performance.
38	HS1025	Trekking	CO1	Organize hiking, trekking, camping, mountaineering and allied open air activities.
			CO2	Maintain archives, prepare and provide information and data regarding trekking activities
			CO3	Allow students to appreciate their environment and natural surroundings
			CO4	Provide opportunities for students to be independent, and exercise self-discipline.
			CO5	Develop team spirit and harness leadership skills
39	HS1026	Aero Modelling	CO1	experience and explore the basic principles of flight,
			CO2	use of hands on tools to make their own paper aerofoil, airplane, boom rang that actually fly,
			CO3	logically reason why some airplanes fly better than other on the basis of design,
			CO4	develop team spirit and harness leadership skills by working in team to design airplane that actually fly
			CO5	trained in life to COPE UP WITH FAILURE while repairing damaged flying models
40	ES1011	Professional Development 1	CO1	A student will be able to find opportunities available in his domain
			CO2	A student will be able to be ready to explore opportunities
			CO3	A student will be able to analyze strengths, weakness, opportunities and challenges
41	HS1028	Induction Training	CO1	A student should adjust in new environment
			CO2	A student should inculcate ethose and culture of institution in them
			CO3	A student should be able to develope bonds with other students as well as faculty members of institution
			CO4	A student should expose them to a sense of larger purpose and self exploration.
			CO5	A student should adjust to or acclimatize to their new roles and environment