



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.



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.

Course Outcomes

Year	Course Code & Course Name	Course Outcomes
SY	ET2001: Electronic Circuits	Students will be able to 1. Elaborate operation and characteristics of semiconductor diodes 2. Analyze diode circuits 3. Compare BJT configurations 4. Elaborate operation and characteristics of FET 5. Analyze BJT/ FET circuits to find Q point 6. Analyze BJT/ FET amplifiers to find amplifier parameters
SY	ET2003: Network Theory	The students will be able to 1. Simplify networks and circuits using network theorems and graph 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.
SY	ET2005: Signals and Systems	The student will be able to – 1. Perform operations on dependent and independent variable of one 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



		<ol style="list-style-type: none"> 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.
SY	ET2002: Data Structures & Algorithms	<p>The student will be able to –</p> <ol style="list-style-type: none"> 1. Find time complexity using Big-O notation. 2. Explain the concept of sequential organization, ordered list and dynamic memory 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.
SY	ET2111: Probability and Radom Variables	<p>The Student will be able to-</p> <ol style="list-style-type: none"> 1. Distinguish between various types of variables 2. Apply concepts of probability such as independence, conditional probability 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
SY	ET2007: Control Systems	<p>The student will be able to –</p> <ol style="list-style-type: none"> 1. Model a given system using transfer function approach 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.



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		6. Design proportional, proportional-integral, proportional-derivative, and proportional-integral-derivative feedback control systems meeting specific system performance requirements.
SY	ET2004: Communication Engineering	The student will be able to – <ol style="list-style-type: none"> 1. Classify communication channels and noise. 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.
SY	ET2006: Electromagnetic Engineering	The Student will be able to- <ol style="list-style-type: none"> 1. Apply knowledge of Vector 2. Use Boundary conditions and Laplace equations for realization of capacitance 3. Use Boundary conditions and Laplace equations for realization of Inductance 4. Implement Maxwell's Equations in various 5. Apply Phasors and Power flow concept 6. Understand the concept of Uniform Plane wave propagation and behavior at interfaces.
SY	ET2015: Digital Systems	The student will be able to – Interpret Binary arithmetic/ logic simplification Design combinational digital circuits Compare flipflops and latches Design sequential digital circuits Design finite state machine Compare different parameters of logic families
SY	ET2012: Multivariate Data Analysis	The student will be able to – <ol style="list-style-type: none"> 1. Demonstrate knowledge and understanding of the basic ideas behind several common statistical techniques for analyzing multivariate data (Discriminant analysis, classification analysis, linear regression analysis, principal component analysis, cluster analysis) 2. Identify the most appropriate statistical techniques for analyzing multivariate dataset.



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		<ol style="list-style-type: none"> 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
TY	EL3001 Microcontroller Applications	<p>The student will be able to –</p> <ol style="list-style-type: none"> 1. Explain AVR Microcontroller Architecture. 2. Develop an Assembly Language Program & Embedded C Program for AVR Microcontroller. 3. Make use of internal peripherals of AVR Microcontroller. 4. Develop an interface for Sensors and Actuators
TY	EL3002 Robotics	<p>The student will be able to –</p> <ol style="list-style-type: none"> 1. Evaluate forward and inverse kinematics of robot. 2. Describe various types of robot end effectors. 3. Compute trajectories in joint and Cartesian space. 4. Familiar with robot sensing and vision system for industrial applications.
TY	EL3003 Data Compression	<p>The student will be able to –</p> <p>Explain encoding and decoding of lossless compression methods.</p> <p>Demonstrate quantization methods.</p> <p>Explain encoding and decoding of lossy compression methods</p> <p>Implement suitable Compression algorithms on Text/ Signal /Image</p>
TY	EL3004 Power Electronics	<p>The student will be able to –</p> <ol style="list-style-type: none"> 1. Describe the operation, characteristics and applications of power devices like power diode, SCR, power BJT, power MOSFET, and IGBT. 2. Analyze controlled converter and inverter circuits in terms 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.
TY	EL3005	<ol style="list-style-type: none"> 1. Explain events and perform set operations on events.



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	Probability and Statistics	<ol style="list-style-type: none">2. Make use of probability models for discrete and continuous random variables3. 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.
TY	EL3006 Computer Vision	The student will be able to – <ol style="list-style-type: none">1. Explain camera geometry fundamentals and image formation.2. Apply pre-processing algorithms to acquired images3. Develop feature descriptor for object detection purpose.4. Make use of Computer Vision algorithms to solve real-world problems
TY	EL3007 Digital Integrated Circuit Design	The students will be able to <ol style="list-style-type: none">1. Calculate the output voltage of pass transistor2. Identify combinational function implemented in CMOS logic3. Differentiate between latch and flip-flop4. Implement logic function in MOS ROM5. Draw logic gate circuit from VHDL code6. Draw stick diagram from Euler's path
TY	EL3008 Database Management Systems	The student will be able to – <ol style="list-style-type: none">1. Differentiate database systems from file systems by enumerating the features provided by database systems and describe each in both function and benefit.2. Transform an information model into a relational database schema and to use a data definition language and/or utility to implement the schema using a DBMS3. 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
TY	EL3013 Electromagnetics Engineering	The student will be able to – <ol style="list-style-type: none">1. Estimate static electric field produced by different charge 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.



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TY	EL3010 Wireless Technologies	The student will be able to – 1. Design Cellular Networks 2. Analyze the Wireless Channel Access Protocols 3. Compare the 802.11x and 802.15.x wireless technologies 4. Plan and design wireless systems.
TY	EL3011 Artificial Intelligence	The student will be able to – 1. Identify real world problems of AI domain. 2. Write algorithms for searching techniques. 3. Develop an AI tool for practical application. 4. Develop an expert system
TY	EL3012 Electronics Product Design	The student will be able to – 1. Understand hardware design methodology. 2. Understand software design techniques. 3. Model a prototype of product. 4. Develop reliable products ergonomically and aesthetically under Emi / EMC constraints.
TY	EL3009 RF Circuit Design	The student will be able to – 1. Understand high frequency behavior of components 2. Demonstrate transmission line analysis. 3. Design RF filter. 4. Develop impedance matching circuits. 5. Design RF amplifier. 6. Explain RF transformer.
TY	EL3014 Data Communication and Networking	The student will be able to – 1. Describe how the Data Communication happens across the network layers. 2. Explain functions of all the layers of the TCP/IP Protocol suite. 3. Develop a plan for campus wide networking with total coverage. 4. Analyze different wide area networks 5. Create different personal networks 6. Interpret different network management functions.
TY	EL3015 Renewable Energy	The student will be able to – Obtain the overview of the global energy scenario, understand need on non 1. Conventional energy resources and solar radiation measurement techniques. 2. Understanding the construction of solar panel 3. Acquire understanding Solar PV as a system.



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		4. Gain a big picture and understand correlation of energy and GDP. Therefore, learn about auditing and conservation techniques.
TY	EL3016 Digital System Design	The students will be able to 1. Write the port definition in Verilog 2. Describe hardware in Verilog using any one abstraction level 3. Draw the schematic inferred by RTL description 4. Find out latency in a queue 5. Identify data hazard in digital system/circuit 6. Verify the design under test (DUT) by writing a testbench
TY	EL3017 Embedded System Design	The student will be able to – 1. Explain embedded system architecture. 2. Elaborate architecture of ARM 3. Experiment with ARM7 4. Compare various communication protocols used in embedded application 5. Relate RTOS kernel functions with general purpose OS functions.
TY	EL3018 Digital Signal Processing	The student will be able to – 1. Demonstrate use of Z Transform in analyzing LTI systems. 2. Determine DFT coefficients using FFT algorithms to minimize hardware complexity. 3. Analyze FIR filters for the given Specifications. 4. Analyze IIR filters for the given Specifications. 5. Design practical sampling rate converters.
TY	EL3019 Machine Learning	The student will be able to – 1. Select regression model to solve business problems 2. Choose a classifier model for building applications 3. Apply clustering techniques to solve real world problems 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
TY	EL3020 Ad Hoc Networks	The student will be able to – 1. Understand MAC protocols. 2. Study performance issues in Ad-hoc networks. 3. Design wireless Ad-hoc Networks. 4. Write a paper on current research going in Infrastructure less wireless communication.



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TY	EL3021 Microwave Engineering	The student will be able to- 1. Analyze microwave channel mathematically. 2. Analyze microwave components mathematically. 3. Interpret microwave sources mathematically. 4. Describe microwave solid state devices. 5. Describe real time applications of microwave engineering. 6. Explain different microwave measurements.
TY	EL3022 Internet of Things	The student will be able to – 1. Understand the vision of IoT from a global context. 2. Use of Devices, Gateways and Data Management in IoT. 3. Building state of the art architecture in IoT. 4. Application of IoT in Industrial and Commercial Building Automation and Real-World Design Constraints.
TY	EL3023 Industrial Automation	The student will be able to – 1. Develop PLC programs for industrial applications. 2. Apply advanced instruction of PLC to solve complex automation applications. 3. Understand the functionality of SCADA, HMI and DCS systems. 4. Describe and apply protocols needed for industrial communication and networking.
TY	EL 3024 VLSI Technologies	The students will be able to - 1. Locate the defect in Silicon crystal 2. Differentiate between deposition and ion implantation 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
B.Tech	EL4003 Engineering Ethics	The student will be able to – 1. Perform their professional responsibilities as Engineers. 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 Renewable Energy	The student will be able to – 1. Obtain the overview of the global energy scenario, understand need on non-conventional energy resources.



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		<ol style="list-style-type: none">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 system4. Design a plan for 100% sustainable energy system techniques.
B.Tech	EL4006 CMOS Mixed Signal Design	The students will be able to <ol style="list-style-type: none">1. Draw small signal model of an amplifier stage2. Calculate current in current mirror circuit3. Identify feedback loop in sample and hold circuit4. Find quantization noise in data converter5. Draw basic architecture of PLL6. Differentiate various architectures of ADCs
B.Tech	EL4013 Advanced Power Electronics	The student will be able to – <ol style="list-style-type: none">1. Analyze three phase AC-DC/ DC-AC power converters in terms of performance parameters.2. Analyze power factor in AC/DC converters.3. Describe series and parallel connection of power devices.4. Describe the role of converters in speed control DC & AC motors.
B.Tech	EL4008 Mobile Communication	The student will be able to – <ol style="list-style-type: none">1. Understand latest trends in wireless technologies, a path towards 5G.2. Correlate how the handsets in their hand works, what is happening on the air interfaces and how call shifts from/to 4G to 3G and then to 2G .3. Know the speed variation between technologies4. Understand Real time application of knowledge using projects with simulation software for call flow and negative events.
B.Tech	EL4023 Control Systems	The student will be able to – <ol style="list-style-type: none">1. Model a given system using transfer function approach2. 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.
B.Tech	EL4014 Artificial Neural Networks	The student will be able to – Study architecture of different Neural algorithms Solve problems using unsupervised, associative learning techniques. Solve problems using associative learning techniques. Provide an understanding of the basics of fuzzy logic
B.Tech	EL4015 Antenna Theory	The Students will be able to Understand standard antenna characterization parameters. Explore electromagnetic radiation mechanisms for common antenna structures. Design simple antennas for specified performance. Design antenna arrays with required radiation pattern characteristics.
B.Tech	EL4016 Advanced DSP	The student will be able to – 1. Explain random signals and random processes. 2. Demonstrate decimation and interpolation of signals 3. Apply the concept of adaptive filtering. 4. Implement the principles of linear prediction 5. Estimate spectral density 6. Use wavelet transform for signal processing
B.Tech	EL4018 RF Integrated Circuit Design	The student will be able to – 1. Understand the basic concepts of RF engineering. 2. Describe the behavior of components at RF. 3. Design low noise devices 4. Design low noise circuits
B.Tech	EL4019 Real Time Operating Systems	The student will be able to – 1. Explain RTOS Architecture. 2. Understand task management 3. Develop Multitasking Embedded System using RTOS services. 4. Understand synchronization and communication in RTOS
B.Tech	EL4021 Pattern Recognition	The student will be able to – 1. Explain the process of Pattern Recognition. 2. Apply probability theory to estimate classifier performance. 3. Describe the principles of parametric and non-parametric classification methods.



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		<p>4. Compare pattern classifications and pattern recognition techniques.</p> <p>5. Apply Pattern Recognition techniques to real world problems such as image analysis, character recognition, etc.</p>
B.Tech	EL4012 Design of Experiments	<p>The student will be able to –</p> <ol style="list-style-type: none">1. Identify relationships between cause and effect.2. Providing an understanding of interactions among 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. No	Year	Subject Name with code	Course Outcomes
1	Second Year	ET2001: Electronic Circuits	Students will be able to 1. Elaborate operation and characteristics of semiconductor diodes 2. Analyze diode circuits 3. Compare BJT configurations 4. Elaborate operation and characteristics of FET 5. Analyze BJT/ FET circuits to find Q point 6. Analyze BJT/ FET amplifiers to find amplifier parameters



2		ET2003: Network Theory	<ol style="list-style-type: none">1. Simplify networks and circuits using network theorems and graph theory2. Simplify networks and circuits using graph theory and Network Topology3. Find network parameters and network function4. Design Attenuators and filters5. Analyze RL, RC and RLC Circuits using steady state and transient response6. Analyze Resonance Circuits
3		ET2005: Signals and Systems	<ol style="list-style-type: none">1. Perform operations on dependent and independent variable of one dimensional signals2. Synthesize the signal using elementary signals3. Classify the systems and determine response of given CT/DT LTI system to any arbitrary input using convolution integral/sum4. 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 Systems	<ol style="list-style-type: none">1. Model a given system using transfer function approach2. 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: Probability and Radom Variables	<ol style="list-style-type: none">1. Distinguish between various types of variables2. Apply concepts of probability such as independence, conditional probability3. Apply Normal distribution and Binomial distribution concepts in case studies4. 4. Apply variance analysis tests for data analysis5. Apply Central limit theorem and carry out hypothesis testing6. Use and apply concepts of various Random Processes in modeling data



6		ET2002: Data Structures & Algorithms	<ol style="list-style-type: none">1. Find time complexity using Big-O notation.2. Explain the concept of sequential organization, ordered list and dynamic memory management.3. Solve Engineering problems by employing Stack, Queue and Linked list data structure4. 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: Communication Engineering	<ol style="list-style-type: none">1. Differentiate communication channels and noise sources.2. Analyze amplitude and frequency modulated signal and their spectrum.3. Illustrate working of analog receivers4. Discuss sampling and waveform coding techniques5. Analyze modulation techniques with respect to bandwidth, Euclidian distance.6. Evaluate performance of optimum filter.



8		ET2006: Electromagnetic Engineering	<ol style="list-style-type: none">1. Apply knowledge of Vector Calculus2. Use Boundary conditions and Laplace equations for realization of capacitance3. Use Boundary conditions and Laplace equations for realization of Inductance4. Implement Maxwell's Equations in various forms5. Apply Phasors and Power flow concept6. Understand the concept of Uniform Plane wave propagation and behavior at interfaces.
9		ET2015: Digital Systems	<ol style="list-style-type: none">1. Interpret Binary arithmetic/ logic simplification2. Design combinational digital circuits3. Compare flipflops and latches4. Design sequential digital circuits5. Design finite state machine6. Compare different parameters of logic families



10		ET2012: Multivariate Data Analysis	<ol style="list-style-type: none">1. Demonstrate different techniques for visualization of data to draw inference2. Apply an appropriate technique to achieve dimensionality reduction3. Describe the relationship between two or more independent variables and the dependent variable using regression technique.4. Apply different classifiers to classify the given data5. Apply k-means clustering algorithm to form the data clusters.6. Compare and contrast the methods for a given data analysis situation considering the benefits and the pitfalls of the methods
11	Third year	ET3001: Real Time Embedded Systems	<ol style="list-style-type: none">1. Comprehend architecture of ARM processor and its peripheral interfacing.2. Implement RS-485, CAN and Profibus protocols3. Understand approaches to solve hardware-software partitioning problems4. Explain features and policies followed by a Real-Time Operating System.5. Explain Structure of UCOS-II6. Apply concepts of system programming to develop real-time embedded system



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12	Third year	ET3003: Power Electronics	<ol style="list-style-type: none">1. Select power device for given voltage- current specifications. (CO 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 year	ET3005: VLSI Design	<ol style="list-style-type: none">1. Determine MOSFET behavior under dimension scaling. (CO 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 year	ET3007: Information Theory & Coding Techniques	<ol style="list-style-type: none">1. Evaluate the performance of source coding theorem based on entropy. (CO Attainment Level: 2)2. Analyze & implement lossless compression techniques. (CO Attainment Level: 2)3. Analyze linear block codes for error detection. (CO Attainment 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 year	ET3009: Data communication and Networking	<ol style="list-style-type: none">1. Describe OSI reference Model. (CO Attainment Level: 1)2. Design physical and data link layer functions and protocols of OSI model. (CO Attainment Level: 2)3. Analyze the TCP/IP Protocol Suite. (CO Attainment Level: 3)4. Design Local Area Networks and Wide Area Networks. (CO Attainment Level: 3)5. Describe management functions and security algorithms. (CO Attainment Level: 2)6. Develop application layer protocols. (CO Attainment Level: 4)



16		ET3019: Computer Organization and Architecture	<ol style="list-style-type: none">1. Explain the basics of computer hardware2. Demonstrate basic operations with signed and unsigned integers in decimal and binary number systems.3. Summarize basics of Instruction Set Architecture4. Develop memory organization that uses banks for different word size operation5. Outline the concept of input output organization.6. Develop scheme for Performance Enhancement of Processor
17		ET3021: Digital Image Processing	<ol style="list-style-type: none">1. Perform various enhancement operations2. Analyze image using morphological techniques3. Apply segmentation techniques to divide image into parts4. Use various image transforms to analyze and modify image5. Apply image compression approaches6. Apply image registration techniques
18	Third year	ET3115: Analog Circuits	<ol style="list-style-type: none">1. Illustrate fundamentals of op-amp in terms of block diagram. (CO 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 year	ET3002: Digital Signal Processing	<ol style="list-style-type: none">1. Apply DFT to analyze discrete time signals. (CO Attainment Level: 2)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 year	ET3004: Robotics	<ol style="list-style-type: none">1. Translate specifications to the components of robots such as arms, 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 year	ET3006: Digital Design	<ol style="list-style-type: none">1. Explain VLSI design flow and basics of Verilog HDL. (CO 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 year	ET3008: Antenna and Microwave Theory	<ol style="list-style-type: none">1. Analyze antenna measurements to assess antenna's performance. (CO Attainment Level: 4)2. Know the concept of radio wave propagation. (CO Attainment Level: 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: Biomedical Electronics	<ol style="list-style-type: none">1. Design and test the basic Diagnostic and Therapeutic Equipment2. Implement various algorithms for automatic ECG analysis.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 year	ET3012: Machine Learning and Computer Vision	<ol style="list-style-type: none">1. Develop feature vectors for object detection purpose. (CO Attainment Level: 2)2. Select algorithm for object recognition. (CO Attainment Level: 3)3. Discuss image registration techniques. (CO Attainment Level: 3)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 Level: 4)



25	Third year	ET3024: Object Oriented Programming	<ol style="list-style-type: none">1. Design classes, function and data structures for applications. (CO Attainment Level: 2)2. Make use of Operator Overloading concepts. (CO Attainment Level: 3)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 year	ET3025: Database Mangement System	<ol style="list-style-type: none">1. Examine data structures, file organizations, concepts2. Understand principles of DBMS's, data analysis, database design, data modeling,3. Understand database management, data & query optimization, and database implementation.4. Study relational data models; entity-relationship modeling, SQL, 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 year	ET3014: Wireless Communication	<ol style="list-style-type: none">1. Differentiate four generations of wireless standard for cellular networks. (CO Attainment Level: 3)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 year	ET3016: Sensors and Internet of Things	<ol style="list-style-type: none">1. Demonstrate the fundamental concepts of Internet of Things. (CO Attainment Level: 3)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 Year	ET4002: RF Circuit Design	<ol style="list-style-type: none">1. Understand behavior of passive components at high frequency and modeling of HF circuit. (CO Attainment level : 3)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		ET4024: Mobile Communication	<ol style="list-style-type: none">1. 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)2. Analyze different equalizers performance.(Co Attainment level: 3)3. Spell the trade-offs among different forward error correction methods.(Co Attainment level: 3)4. Understanding spectral efficiency & reliability gains from MIMO.(Co Attainment level: 1)5. Differentiate between network layer of TCP/IP for mobile networking & traditional TCP/IP suite. (Co Attainment level: 2)6. Describe different standard wireless systems. (Co Attainment level: 2)



32	Fourth Year	ET4025: Fiber Optic Communication	<ol style="list-style-type: none">1. Explain the key aspects of propagation through different types of fiber. (CO Attainment level : 3)2. Analyze losses of signals.(CO Attainment level : 3)3. Describe fiber optic communication system. (CO Attainment level : 3)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		ET4026: Adaptive Signal Processing	<ol style="list-style-type: none">1. Apply basic probability theory to model random signals in terms of Random Processes. (CO Attainment level: 4)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) algorithm. (CO Attainment level: 4)4. Formulate the Wiener filter as a constrained optimization problem. (CO Attainment level: 4)5. Determine suitable LMS step size to trade off convergence time and mis-adjustment. (CO Attainment level: 4)6. Derive the power spectrum of random signals. (CO Attainment level: 4).



35		ET4024: Mobile Communication	<ol style="list-style-type: none">1. 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)2. Analyze different equalizers performance. (Co Attainment level: 3)3. Spell the trade-offs among different forward error correction methods. (Co Attainment level: 3)4. Understanding spectral efficiency & reliability gains from MIMO. (Co Attainment level: 1)5. Differentiate between network layer of TCP/IP for mobile networking & traditional TCP/IP suite. (Co Attainment level: 2)6. Describe different standard wireless systems. (Co Attainment level: 2)
36	Fourth Year	ET4004: SoC Design and Verification	<ol style="list-style-type: none">1. Understand basic concept of System Design and Interconnections. (CO Attainment level : 4)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)6. Design algorithms. (CO Attainment level : 5)



38	Fourth Year	ET4027: Speech and Audio Processing	<ol style="list-style-type: none">1. Demonstrate discrete time model of speech production system. (CO Attainment level: 2)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)
40		ET4033: Electromagnetic Engineering	<ol style="list-style-type: none">1. Apply knowledge of Vector Calculus2. Use Boundary conditions and Laplace equations for realization of capacitance3. Use Boundary conditions and Laplace equations for realization of Inductance4. Implement Maxwell's Equations in various forms5. Apply Phasors and Power flow concept6. Understand the concept of Uniform Plane wave propagation and behavior at interfaces.



42		ET4005: Industrial Automation	<ol style="list-style-type: none">1. Describe Architecture of Industrial Automation Systems2. Explain Measurement systems3. Demonstrate ladder programming skills4. Compare Hydraulic/ Pneumatic control Systems5. Compare Actuators6. Design fuzzy controller
43	Fourth Year	ET4006: Advances in Digital Communication	<ol style="list-style-type: none">1. Represent signals using the Gram-Schmidt orthogonalization procedure (CO Attainment level : 4)2. Design and study performance characteristics of optimum receiver (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 multipath channels. (CO Attainment level : 3)



45	Fourth Year	ET4028: Wavelets	<ol style="list-style-type: none">1. Understand fundamentals of continuous and discrete wavelet 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 Year	ET4017: Convergence Technology	<ol style="list-style-type: none">1. Understand the making of a network from heterogeneous multi-sources.2. Analyze the convergence between the technology providers and the other business personnel about the firm's business activities and the importance of the technology in supporting those activities3. 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 needs4. Analyze and Implement the Interoperability, the integrating of disparate systems5. To construct a weighted network by gathering data from three different sources and meta-data matching6. Understand and Analyze the current situation of convergence technology R&D.



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 life complex 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.

Course Outcomes

Sr. No	Year	Subject Name with code	CO Statements
1	M.TECH	ET5001: Advanced Engineering Mathematics	<ol style="list-style-type: none">1 Formulate and solve problems in linear algebra using general vector spaces and linear transformations2 Use various inner products and the Gram-Schmidt process to handle problems involving distance, orthogonality and projection3 Determine the eigenvalues and eigenvectors of a square matrix using the characteristic polynomial and will demonstrate how to diagonalize a matrix4 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 probabilistic models.



2		ET5003: Adaptive Signal Processing	<ol style="list-style-type: none"> 1 Apply basic probability theory to model random 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.
3		ET5005: Industrial Automation	<ol style="list-style-type: none"> 1 Describe Architecture of Industrial 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 Digital Communication	<ol style="list-style-type: none"> 1. Represent signals using the Gram-Schmidt 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		013: Speech Processing ET5	<ol style="list-style-type: none">1. Demonstrate discrete time model of speech production system.2. Detect voiced, unvoiced and silence part of a 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 algorithm6 Formulate and design a system for speech recognition and speaker recognition
6		ET5006: Computer Vision	<ol style="list-style-type: none">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 Communication	<ol style="list-style-type: none">1. Classify communication channels and noise.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 Integrated Circuit Design	<ol style="list-style-type: none">1 Demonstrate understanding of static CMOS.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 BTech	IC2001:Sensors and Transducers	1. IC2001_CO1: Understand working principle of different 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 analyze the properties of the given digital systems.
		2. IC2003_CO2: Derive Z transform of the given digital signal and compute convergence of the same. Compute inverse Z transform. Analyze the systems using Z transform
		3. IC2003_CO3: Recognize signal spectrum using DFT , compute and plot the spectrum using FFT , Analyze the signal in the frequency domain
		4. IC2003_CO4: Reconstruct time domain signal using IDFT Compute and plot time domain signal using IFFT Algorithm .
		5. IC2003_CO5: Design FIR filters on paper to meet specific magnitude and phase requirements. Use MATLAB to design the filters and analyze its response. Analyze the effect of quantization on the response of the digital filters
		6. IC2003_CO6: Design IIR filters on paper to meet specific magnitude and phase requirements. Use MATLAB to design the filters and analyze its response. 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, Boolean algebra, K-map.	
	5. IC2005_CO5: Design digital circuits using digital ICs, analog to digital and digital to analog converter ICs for a given application.	
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.	



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		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.
	IC2041:Engineering Design and Development	1. IC2041_CO1: Design solutions for given engineering problem
		2. IC2041_CO2: Demonstrate practical knowledge by constructing models/algorithms for real time applications
		3. IC2041_CO3: Express effectively in written and oral communication
		4. IC2041_CO4: Exhibit the skills to work in a team
		5. IC2041_CO5: Prepare a time chart and financial record for execution of the project
	IC2011:Discrete Structure and Graph Theory	1. IC2011_CO1: Express mathematical properties via the 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 Automation	1. IC2002_CO1: Comprehend the fundamentals of PLC, 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: Utilization of Laplace transform for system analysis- finding system transfer function, system response, stability of the 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: Design Lag/Lead compensator using Root Locus
	5. IC2004_CO5: Analyze the given system in frequency domain, derive and compute frequency domain specifications
	6. IC2004_CO6: Analyze the stability of the given system using Nyquist plot.
IC2006:Microprocessor and Microcontrollers	1. IC2006_CO1: Comprehend the fundamentals of micro 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: Interface the peripherals to ARM based system
	IC2008:Field Instrumentation	1. IC2008_CO1: Explain the working of electrical, 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 for real time applications



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	IC2042:Engineering Design and Development	1. IC2042_CO1: Design solutions for given engineering problem
		2. IC2042_CO2: Demonstrate practical knowledge by constructing models/algorithms for real time applications
		3. IC2042_CO3: Express effectively in written and oral communication
		4. IC2042_CO4: Exhibit the skills to work in a team
		5. IC2042_CO5: Prepare a time chart and financial record for execution of the project
	IC2012:Probability & Statistics	1. IC2012_CO1: Perform data analysis by various 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
TY BTech	IC3001:Process Control Components	1. IC3001_CO1: Comprehend the fundamentals of process 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.
	IC3021:Image Processing And Pattern Recognition	1. IC3021_CO1: Review the fundamental concepts of a digital image processing system.
		2. IC3021_CO2: Analyze images in the frequency domain using various transforms.
		3. IC3021_CO3: Evaluate the techniques for image enhancement and image restoration.
		4. IC3021_CO4: Interpret image segmentation and representation techniques.



		5. IC3021_CO5: Able to understand and evaluate various classifiers
		6. IC3021_CO6: Able to build a pattern recognition system
IC3008:Electronic Instrumentation		1. IC3008_CO1: Understand working of electrical 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
IC3023:Machine Learning		1. IC3023_CO1: Understand the basic theory underlying machine learning
		2. IC3023_CO2: Apply the concept of regression



		3. IC3023_CO3: Understand regularization theory and its application
		4. IC3023_CO4: Comprehend a wide variety of learning algorithms
		5. IC3023_CO5: Apply ML algorithms for classification
		6. IC3023_CO6: Be able to formulate machine learning problems corresponding to different applications
	IC3009: Analytical and Biomedical Instrumentation	1. IC3009_CO1: Employ different biomedical sensors and 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 excretory 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
	IC3007 : Process Control And Optimization	1. IC3007_CO1: Develop theoretical models of physical and chemical processes.



		2. IC3007_CO2: Develop experimental models of physical and chemical processes.
		3. IC3007_CO3: Select and use numerical methods for solving algebraic and differential equations.
		4. IC3007_CO4: Understand the fundamentals of batch
		5. IC3007_CO5: Understand the role of standards for batch process
		6. IC3007_CO6: Comprehend the control and management aspects of batch processes
	IC3027: Operating Systems	<ol style="list-style-type: none"> 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 development. 3. Apply various CPU scheduling algorithms to construct solutions to real world problems. 4. Understand Security systems and functions 5. Understand the organization of memory and memory management hardware. 6. Analyze I/O and file management techniques for better utilization of secondary memory.
	IC3041:Engineering Design and Development	1. IC3041_CO1: Design solutions for given engineering problem



		2. IC3041_CO2: Demonstrate practical knowledge by constructing models/algorithms for real time applications
		3. IC30141_CO3: Express effectively in written and oral communication
		4. IC3041_CO4: Exhibit the skills to work in a team
		5. IC3041_CO5: Prepare a time chart and financial record for execution of the project
		6. IC3041_CO1: Design solutions for given engineering problem
	IC3002:Instrumentation Project Engineering	1. IC3002_CO1: Describe the concept of project 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 used for instrumentation and control



	<p style="text-align: center;">IC3022 :: Artificial Intelligence</p>	<ol style="list-style-type: none"> 1. IC3022_CO1: Examine the useful search techniques; learn their advantages, disadvantages 2. IC3022_CO2: Be familiar with Artificial Intelligence, its foundation and principles. 3. IC3022_CO3: Be able to develop intelligent systems. 4. IC3022_CO4: Learn the practical applicability of intelligent systems, specifically its applications. 5. IC3022_CO5: Be exposed to the role of AI in different areas like NLP, Pattern Recognition etc. 6. IC3022_CO6: Understand important concepts like Expert Systems, AI applications.
	<p style="text-align: center;">IC3004:Process Instrumentation and Control</p>	<ol style="list-style-type: none"> 1. IC3004_CO1: Derive mathematical models for process 2. IC3004_CO2: Apply control strategies for Heat exchanger and dryers 3. IC3004_CO3: Develop and design instrumentation and control for Boiler 4. IC3004_CO4: Develop and implementation of control scheme for Evaporator and Distillation column 5. IC3004_CO5: Analyze multivariable systems 6. IC3004_CO6: Design and controller tuning for multivariable systems
	<p style="text-align: center;">IC3024 :: Machine Vision And Robotics</p>	<ol style="list-style-type: none"> 1. IC3024_CO1: Develop object recognition techniques by analyzing shape and geometry of the objects.



		<ol style="list-style-type: none">2. IC3024_CO2: Derive translation, rotation and scale invariant features for image registration.3. IC3024_CO3: Analyze the video streams for detecting motion and computation of associated parameters.4. IC3024_CO4: Develop D-H representation of joints and links.5. IC3024_CO5: Analyze the forward and inverse kinematics of the given configuration.6. IC3024_CO6: Design algorithm to determine the shortest path and subsequent trajectory planning in Cartesian space.
	IC3018 : Digital Control	<ol style="list-style-type: none">1. IC3018_CO1: Represent State Space models for given applications2. IC3018_CO2: Examine Controllability, Observability and Stability of systems.3. IC3018_CO3: Design control system using pole placement and observer design.4. IC3018_CO4: Comprehend Z transform for discrete time system.5. IC3018_CO5: Design controllers like dead-beat controllers.6. IC3018_CO6: Design control system using optimal control.
	IC3026 : Big Data Analysis	<ol style="list-style-type: none">1. IC3026_CO1 : Understand the process of converting data into a required format required for particular analysis.2. IC3026_CO2 : Apply various techniques to solve real-world data analysis problems3. IC3026_CO3 : Utilize data visualization tools in deriving insights from data.4. IC3026_CO4 : Apply analytic techniques and algorithms (including statistical and data



		<p>mining approaches) to large data sets to extract meaningful insights.</p> <p>5. IC3026_CO5 : Use appropriate resources to research, develop and contribute to advances and trends within the field of Data Science.</p> <p>6. IC3026_CO6 : Interpret and present visually, orally and in written form, valid conclusions drawn from data analysis.</p>
	IC3010 : Internet of Things	<p>1. IC3010_CO1: Learn and demonstrate concepts of Internet of Things</p> <p>2. IC3010_CO2: Develop and demonstrate embedded tools usage for IOT.</p> <p>3. IC3010_CO3: Demonstrate Python programming skills for IOT</p> <p>4. IC3010_CO4: Understand, develop and demonstrate the connectivity technologies protocols in IOT, Demonstrate Cloud technology concepts</p> <p>5. IC3010_CO5: Develop Web Application framework using Django</p> <p>6. IC3010_CO6: Illustrate IOT design for application of Home automation, Smart Parking, Environment, Agriculture, Productivity applications etc</p>
	IC3042:Engineering Design and Development	<p>1. IC3042_CO1: Design solutions for given engineering problem</p>
		<p>2. IC3042_CO2: Demonstrate practical knowledge by constructing models/algorithms for real time Applications</p>
		<p>3. IC3042_CO3: Express effectively in written and oral communication</p>



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		4. IC3042_CO4: Exhibit the skills to work in a team
		5. IC3042_CO5: Prepare a time chart and financial record for execution of the project
Final Year BTech	IC4001:Industrial Electronics	1. IC4001_CO1: Select suitable power device for given application.
		2. IC4001_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 Automation and Security Systems	1. IC4002_CO1: Choose different sensors and components used in building automation
		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 Control	1. IC4003_CO1: Represent State Space models for given applications
		2. IC4003_CO2: Examine Controllability, Observability and Stability of systems.
		3. IC4003_CO3: Design control system using pole placement and observer design.
		4. IC4003_CO4: Comprehend Z transform for discrete time system.
		5. IC4003_CO5: Design controllers like dead-beat controllers.
		6. IC4003_CO6: Design control system using optimal control.
	IC4008:Power Plant Instrumentation	1. IC4008_CO1: Know the fundamentals of power plant to 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
	IC4016:Machine Intelligence	1. IC4016_CO1: Represent image as a function and apply basic image processing operations on the same.
		2. IC4016_CO2: Design image segmentation algorithms for the given application
		3. IC4016_CO3: Analyze the image information for compression/restoration by transforming the image into other domains
		4. IC4016_CO4: Regress the given multivariable data using suitable methods
		5. IC4016_CO5: Derive features of the given image using advanced feature extraction selection techniques.
		6. IC4016_CO6: Design vision based automation applications using advanced pattern recognition algorithms.
	IC4015 DCS and Communication Protocols	1. IC4015_CO1: Understand working of DCS system



		2. IC4015_CO2: To understand different DCS hardware
		3. IC4015_CO3: Select medium for various types of data transmission
		4. IC4015_CO4: Understand the Serial data communications
		5. IC4015_CO5: Understand of Modbus and HART communication protocol
		6. IC4015_CO6: Understand of Foundation field bus and profibus protocol
	IC4007:Project	1. IC4007_CO1: Design solutions for given engineering problem
		2. IC4007_CO2: Demonstrate practical knowledge by constructing models/algorithms for real time applications
		3. IC4007_CO3: Express effectively in written and oral communication.
		4. IC4007_CO4: Exhibit the skills to work in a team
		5. IC4007_CO5: Prepare a time chart and financial record for execution of the project
	IC4011:Industry Internship	1. IC4011_CO1 : Technical and Analytical Competencies



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		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



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		5. IC4026_CO5: Technical Writing
	IC4040:Project Internship	1. IC4040_CO1 : Technical and Analytical Competencies
		2. IC4040_CO2: Skill Development / Modern Tool Usage
		3. IC4040_CO3: Communication & Presentation Skills
		4. IC4040_CO4: Professionalism
		5. IC4040_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

Course Outcomes

Year	Course Name and Code	CO Statements
FY MTech	IC5001:Linear Algebra and Statistics	1. IC5001_CO1: Acquire the knowledge of vector spaces, 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, 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
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 Automation	1. IC5005_CO1: Comprehend the fundamentals of 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 Processing	1. IC5007_CO1: Design FIR filters to meet specific magnitude and phase requirements.
		2. IC5007_CO2: Design IIR filters to meet specific magnitude and phase requirements.



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		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 Raspberry Pi for prototype development.
	IC5019:Engineering Design and Development	1. IC5019_CO1: Design solutions for given engineering problem
		2. IC5019_CO2: Demonstrate practical knowledge by constructing models/algorithms for real time applications
		3. IC5019_CO3: Express effectively in written and oral communication
		4. IC5019_CO4: Exhibit the skills to work in a team
		5. IC5019_CO5: Prepare a time chart and financial record for execution of the project
	IC5002:Engineering Economics	1. IC5002_CO1: Analyze the effect of inflation, currency 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 Computing	1. IC5040_CO1: Comprehend the fuzzy logic and the 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 engineering 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 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 Vision	1. IC5014_CO1: Develop object recognition techniques by 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 Cartesian space.
	IC5006:Batch Process Control	1. IC5006_CO1: Understand the fundamentals of batch process
		2. IC5006_CO2: Understand the role of standards for batch process
		3. IC5006_CO3: Comprehend the control and management aspects of batch processes IC5006_CO4: Design control strategies to a given batch processes
		4. IC5006_CO5: Specify controls and data management system
		5. IC5006_CO6: Implement of any batch process and its study
		6. IC5006_CO1: Understand the fundamentals of batch process
	IC5016:Artificial Intelligence	1. IC5016_CO1: Examine the useful search techniques; learn their advantages, disadvantages



		2. IC5016_CO2: Be familiar with Artificial Intelligence, its foundation and principles.
		3. IC5016_CO3: Be able to develop intelligent 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 Identification and Optimization	
		2. IC5008_CO2: Analyze <u>Frequency-Response Identification</u>
		3. IC5008_CO3: Analyze <u>Transfer-Function and State Space Identification</u>
		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
	IC5020:Engineering Design and Development	1. IC5020_CO1: Design solutions for given engineering problem
		2. IC5020_CO2: Demonstrate practical knowledge by constructing models/algorithms for real time applications
		3. IC5020_CO3: Express effectively in written and oral communication



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		4. IC5020_CO4: Exhibit the skills to work in a team
		5. IC5020_CO5: Prepare a time chart and financial record for execution of the project
SY MTech	IC6001: Internship 1	1. IC6001_CO1: Get acquainted with industrial 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 state 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. .



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		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 projects of industries.
		3. IC6002_CO3: Develop proficiency in soft skills and interpersonal skills. .
		4. IC6002_CO4: Design solutions to engineering problems using state of art technology. .
		5. IC6002_CO5: Effectively work in a team.
		6. IC6002_CO6: Acquire technical and soft skills to become industry ready.
	IC6004: Dissertation 2	1. IC6004_CO1: Independently carry out research and development activities.
		2. IC6004_CO2: Prepare technical articles / reports with modern 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, 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
SY	CS2034 :: DATA STRUCTURES-I	<p>Student will be able to -</p> <ol style="list-style-type: none">1. To interpret and diagnose the properties of data structures with their memory representations and time complexity analysis.2. To use Structures and union data structures with their applications.3. To demonstrate the use of different files and to perform various operations on File data structures.4. To apply operations like searching, sorting using different algorithms and perform their analysis.5. To implement and demonstrate the use of Stack and Queue data structure in real life scenarios.6. To design and analyze the appropriate data structure for real world application.



SY	CS2036 :: DIGITAL ELECTRONICS AND LOGIC DESIGN	Student will be able to - <ol style="list-style-type: none">1. Construct combinational circuits.2. Design sequential circuits.3. Develop the applications of sequential circuits.4. Analyze internal structure of logic gates.5. Select an appropriate design and give solution for the Programmable Devices.6. Make use of advance programming techniques in Digital systems
SY	CS2005 :: DISCRETE MATHEMATICS	The student will be able to – <ol style="list-style-type: none">1. Reason mathematically about elementary discrete structures (such as functions, relations, sets, graphs, and trees) used in computer algorithms and systems2. Describe the elementary properties of modular arithmetic and their applications in Computer Science like cryptography.3. Summarize graph theory fundamentals and their applications4. Develop recurrence relations for a wide variety of interesting problems5. Express mathematical properties via the formal language of propositional and predicate logic6. Demonstrate use of pigeon-hole and inclusion-exclusion principle in solving elegant and important problems.
SY	CS2038 :: OBJECT ORIENTED PROGRAMMING	The student will be able to – <ol style="list-style-type: none">1. Apply object-oriented thinking towards solving a real world problem2. Evaluate the advantages of object-oriented approach over procedural approach of solving a problem3. Implement a given object-oriented design into code using an object-oriented programming language4. Effectively use the object-oriented features of an object-oriented programming language towards developing a software solution5. Assess the quality of a given design based on the well established principles of object-oriented design.
SY	CS2033 :: COMPUTER ORGANIZATION	Student will be able to - <ol style="list-style-type: none">1. Understand the structure, function and characteristics of computer systems.



		<ol style="list-style-type: none"> 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 trade offs and performance issues. 5. Analyze a pipeline for consistent execution of instructions with minimum 6. Acquaint the advanced concepts of computer architecture.
TY	CS3029 :: PROBLEM SOLVING USING OOP	<p>The student will be able to –</p> <ol style="list-style-type: none"> 1. Assess the quality of a given design based on the well-established principles of object-oriented design. 2. Effectively use the object-oriented features of an object-oriented programming language towards developing a software solution 3. Apply object oriented thinking towards solving a real world problem 4. Evaluate the advantages of object-oriented approach over procedural approach of solving a problem 5. Assess the quality of a given design based on the well established principles of object oriented design
TY	CS3030 :: PRINCIPLES OF PROGRAMMING LANGUAGES	<p>The student will be able to –</p> <ol style="list-style-type: none"> 1. Apply object oriented thinking towards solving a real world problem. 2. Evaluate the advantages of object-oriented approach over procedural approach of solving a problem 3. Implement a given object oriented design into code using an object-oriented programming language 4. Effectively use the object-oriented features of an object-oriented programming language towards developing a software solution 5. Design mathematical model and apply the knowledge of an object-oriented programming for multitasking. 6. Assess the quality of a given design based on the well established principles of object oriented design.



TY	CS3002 :: DESIGN AND ANALYSIS OF ALGORITHMS	<p>The student will be able to –</p> <ol style="list-style-type: none">1. Formulate computational problems in abstract and mathematically precise manner2. Design efficient algorithms for computational problems using appropriate algorithmic paradigm3. 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 a complex computing problems
TY	CS3035 :: ALGORITHMS AND COMPLEXITY	<p>The student will be able to –</p> <ol style="list-style-type: none">1. Formulate computational problems in abstract and mathematically precise manner2. Design efficient algorithms for computational problems using appropriate algorithmic paradigm3. 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 a complex computing problems
TY	CS3003 :: MICROPROCESSOR & MICROCONTROLLERS	<p>The student will be able to –</p> <ol style="list-style-type: none">1. Describe the Structure and Internal Architecture of Pentium Processor and Microcontroller



		<ol style="list-style-type: none"> 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	CS3006 :: AUGMENTED AND VIRTUAL REALITY	<p>The student will be able to –</p> <ol style="list-style-type: none"> 1. Identify the most suitable technique for a given use case based on the understanding of the similarities and differences between virtual, augmented and mixed reality with the help of Flynn’s taxonomy 2. Design various transformations for manipulating an object in 3 dimensional 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 augmented reality experience
TY	CS3001 :: SOFTWARE ENGINEERING	<p>The student will be able to –</p> <ol style="list-style-type: none"> 1. Summarize capabilities and impact of Software Development 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.



		<ol style="list-style-type: none">3. Formulate system specifications by analyzing User-level tasks and compose software artifacts using agile principles, practices and Scrum framework4. 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.
TY	CS3036 :: SOFTWARE DESIGN PARADIGMS	<p>The student will be able to –</p> <ol style="list-style-type: none">1. Compose system analysis and design specifications indicating logical, physical, deployment, and concurrency viewpoints using object-oriented analysis and design principles and Model Driven Engineering practices2. Comprehend the nature of design patterns by understanding a 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 design criteria resulting in well-documented system profiles to the engineering and social community3. Construct and justify the evolutionary system description models expressing high-level architecture accommodating applicable architectural styles compatible to requirements and behavioral models using UML-supported modeling tools4. Examine and breakdown real-world problem scenarios into structured partitions depicting static and dynamic behavior of the system using business process management practices, object-oriented analysis principles and Model Driven Development practices.



		<ol style="list-style-type: none">5. Identify and formulate software requirements and behavioral models using static and dynamic behavioral views indicating structured problem partitioning and state-based exploration6. 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	CS3012 :: COMPILER DESIGN	<p>The student will be able to –</p> <ol style="list-style-type: none">1. Design basic components – Scanner for compiler2. Acquaint themselves with compiler writing tools– Parser and Code Generation.3. Perform semantic analysis in a syntax directed fashion using attributed definitions4. Synthesize machine code for run time environment.5. Apply local and global code optimization techniques6. Develop software solutions for the problems related to compiler construction and emerging trends in Compiler
TY	CS3016 :: SYSTEM PROGRAMMING	<p>The student will be able to –</p> <ol style="list-style-type: none">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
TY	CS3013 :: ARTIFICIAL INTELLIGENCE	<p>The student will be able to –</p>



		<ol style="list-style-type: none"> 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 a Markov decision process, etc) 3. Implement basic AI algorithms (e.g., standard search algorithms or dynamic programming). 4. Design and carry out an empirical evaluation of different algorithms on a problem formalization, and state the conclusions that the evaluation supports 5. Use various symbolic knowledge representations to specify domains and reasoning tasks of a situated software agent 6. Analyze the AI problem using different planning techniques
TY	CS3037 :: INTELLIGENCE SYSTEMS	<p>The student will be able to –</p> <ol style="list-style-type: none"> 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 a Markov decision process, etc) 3. Implement basic AI algorithms (e.g., standard search algorithms or dynamic programming). 4. Design and carry out an empirical evaluation of different algorithms on a problem formalization, and state the conclusions that the evaluation supports. 5. Use various symbolic knowledge representations to specify domains and reasoning tasks of a situated software agent. 6. Study different domains and related applications for specific group of users.
TY	CS3038 :: CLIENT SERVER COMPUTING	<p>The student will be able to –</p> <ol style="list-style-type: none"> 1. The student will be able to – 1. Prepare 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



		<ol style="list-style-type: none"> 4. Design 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
TY	CS3014 :: WEB TECHNOLOGIES	<p>The student will be able to –</p> <ol style="list-style-type: none"> 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
TY	CS3015 :: DATA SCIENCE	<p>The student will be able to –</p> <ol style="list-style-type: none"> 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	CS3019 :: MACHINE LEARNING	<p>The student will be able to –</p> <ol style="list-style-type: none"> 1. Demonstrate knowledge of learning algorithms and concept 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 supports.



BTech	CS4018 :: DATA SCIENCE	<p>The student will be able to –</p> <ol style="list-style-type: none">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.
BTech	CS4019 :: MACHINE LEARNING	<p>The student will be able to –</p> <ol style="list-style-type: none">1. Demonstrate knowledge of learning algorithms and concept 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 supports.
BTech	CS4001 :: HUMAN COMPUTER INTERACTION	<p>The student will be able to –</p> <ol style="list-style-type: none">1. Identify human factors and usability issues related with computing applications2. Differentiate computing applications into categories based on human factors3. Design a user interface by applying suitable design principles, models and usability guidelines4. Integrate ethno-cultural and accessibility computing aspects into the user interface design5. Display the impact of usability evaluation and testing in computing applications6. Follow required processes and standards while designing user interfaces



BTech	CS4003 :: CLOUD COMPUTING	<p>The student will be able to –</p> <ol style="list-style-type: none">1. Describe the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing2. Explain the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.3. Collaboratively research and write a paper on the state of the art (and open problems) in cloud computing4. Identify problems, and explain, analyze, and evaluate various cloud computing solutions5. Choose the appropriate technologies, algorithms, and approaches for the related issues6. Display new ideas and innovations in cloud computing
BTech	CS4004 :: PARALLEL COMPUTING ON GPU	<p>The student will be able to –</p> <ol style="list-style-type: none">1. The student will be able to recognize various parallel computing architectures and their fundamentals2. The student will be able to investigate parallel solutions to complex real world problems3. The student will be able to code the parallel programs on GPU using CUDA4. The student will be able to evaluate the performance on various GPU architectures5. The student will be able to optimize the parallel programs on GPU using CUDA6. The student will be able to design and develop new solutions to research problems
BTech	CS4016 :: MOBILE COMPUTING	<p>The student will be able to –</p> <ol style="list-style-type: none">1. Select components and radio spectrum for PCS based on bandwidth requirement2. Justify the Mobile Network performance parameters and design decisions3. Choose the modulation technique for setting up mobile network4. Formulate GSM/CDMA mobile network layout considering futuristic requirements which conforms to the technology5. Deploy the 3G/4G technology based network with bandwidth capacity planning



		<ol style="list-style-type: none">6. Adapt to the requirements of next generation mobile network and mobile applications
BTech	CS4017 :: NETWORK SECURITY	<p>The student will be able to –</p> <ol style="list-style-type: none">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.
BTech	CS4009 :: IMAGE PROCESSING	<p>The student will be able to –</p> <ol style="list-style-type: none">1. Describe image model2. Perform spatial filtering on image3. Identify Image Segmentation techniques4. Apply lossless and lossy compression techniques for image compression5. Use various image transforms to analyze and modify image6. Understand Wavelet transform for Image Processing Applications
BTech	CS4000 :: MAJOR PROJECT 1	<p>The student will be able to –</p> <ol style="list-style-type: none">1. Model the Real World Problem2. Identify the Design within Specification and Available Resources3. Realise the Solution within Defined reference4. Defend his Design with Technical and Ethical reasoning5. Adapt to changing Technological and Human resource advances6. Use the gained knowledge for other Real World Problems



BTech	CS4091 :: INDUSTRY INTERNSHIP	<p>The student will be able to –</p> <ol style="list-style-type: none">1. Analyze real life industry problems2. Create solutions to problems with the help of latest tools3. Maintain work ethics in organized sector4. Cooperate with diverse teams and effectively communicate with all the stake holders5. Adapt to changing work environments6. Produce solutions within the technological guidelines and standards
SY	CS2035 :: DATA STRUCTURES-II	<p>The student will be able to –</p> <ol style="list-style-type: none">1. To interpret and implement operations like searching, insertion, deletion, traversing mechanism etc. on various data structures with the help of dynamic storage representation.2. To demonstrate the use of binary tree traversals and to perform various operations on non-linear data structures.3. To Model the real world problem with the help of appropriate Advanced trees data structure.4. To implement the operations on Graph data structure and to solve the applications of Graph data structure.5. To manipulate the problems of indexing by applying various hashing techniques.6. To design and analyze the appropriate data structure for real world application
SY	CS2040 :: DATA COMMUNICATION	<ol style="list-style-type: none">1. Select line encoding methods for digital communication2. Choose serial communication signaling for digital communication3. Analyze modulation and demodulation methods for digital communication4. Understand basic principle of transmission mediums for wired and wireless networks5. Decide on physical layer technology for wired and wireless networks



		6. Estimate reliability issues based on error control, flow control and pipelining by using bandwidth, latency, throughput and efficiency
SY	CS2009 :: DATABASE MANAGEMENT SYSTEMS	The student will be able to – <ol style="list-style-type: none"> 1. Design data models as per data requirements of an organization 2. Synthesize a relational data model upto a suitable normal form 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
SY	CS2039 :: MICROPROCESSORS AND INTERFACING	The student will be able to – <ol style="list-style-type: none"> 1. Identify different operating modes of Microprocessor. 2. Design Microprocessor systems using peripheral components. 3. Learn peripherals and their interfacing with Microprocessor. 4. Analyze different operating modes of Advance Processor . 5. Evaluate various memory management & Protection techniques. 6. Understand concept of multitasking and multi-core processors.
SY	CS2032 :: ENGINEERING DESIGN & INNOVATION 2	The student will be able to – <ol style="list-style-type: none"> 1. Solve real life problems by applying knowledge. 2. Analyze alternative approaches, apply and use most appropriate one for feasible solution 3. Write precise reports and technical documents in a nutshell 4. Participate effectively in multi-disciplinary and heterogeneous teams exhibiting team work, Inter-



		personal relationships, conflict management and leadership quality
SY	CS2037 :: AUTOMATA THEORY	<p>The student will be able to –</p> <ol style="list-style-type: none">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 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 computers6. Grasp the theoretical limit of computation (independent of software or hardware used) via the concept of undecidability
TY	CS3050 :: THEORY OF COMPUTATION	<p>The student will be able to –</p> <ol style="list-style-type: none">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 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 computers6. Grasp the theoretical limit of computation (independent of software or hardware used) via the concept of undecidability
TY	CS3023 :: DATABASE MANAGEMENT SYSTEMS	<p>The student will be able to –</p> <ol style="list-style-type: none">1. Design data models as per data requirements of an organization



		<ol style="list-style-type: none"> 2. Synthesize a relational data model upto a suitable normal form 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
TY	CS3032 :: ENGINEERING DESIGN & INNOVATION 2	<p>The student will be able to –</p> <ol style="list-style-type: none"> 1. Solve real life problems by applying knowledge. 2. Analyze alternative approaches, apply and use most appropriate one for feasible solution. 3. Write precise reports and technical documents in a nutshell 4. Participate effectively in multi-disciplinary and heterogeneous teams exhibiting team work, Inter-personal relationships, conflict management and leadership quality.
BTech	CS4030 :: BUSINESS INTELLIGENCE	<p>The student will be able to –</p> <ol style="list-style-type: none"> 1. Utilize both descriptive and inferential statistical concepts in deriving useful insights from data 2. Evaluate various data pre-processing techniques to enable better data analysis in case of complex problems 3. Construct an end- to- end analytics solution for business intelligence involving various data sources, ETL, multi-dimensional modelling, OLAP, reporting and analytics 4. Demonstrate appropriate data visualization techniques for effective communication 5. Follow the research and technological advancement in the field of business intelligence and analytics 6. Apply various descriptive, predictive and prescriptive data analytics techniques to address real world challenges by making use of available data
BTech	CS4035 :: DEEP LEARNING	<p>The student will be able to –</p>



		<ol style="list-style-type: none"> 1. Develop intelligent software to automate routine labor, understand speech or images, make diagnose and support basic scientific research. 2. Solving the tasks that are easy for people to perform but hard for people to describe formally 3. Apply deep learning models for retrieval of information and machine translation 4. Develop an artificial Intelligence system for the deep neural network-based applications 5. Evaluation of various algorithms using deep learning 6. Design of intelligent model using algorithms of deep learning
BTech	CS4006 :: DATA MINING AND DATA WAREHOUSING	<p>The student will be able to –</p> <ol style="list-style-type: none"> 1. Construct an end-to-end data warehousing solution. 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
BTech	CS4032 :: INFORMATION RETRIEVAL	<p>The student will be able to –</p> <ol style="list-style-type: none"> 1. Describe various information retrieval system architecture & models 2. Validate retrieval performance of an information retrieval system 3. Construct various indexes using suitable techniques 4. Apply sequential search & pattern matching techniques 5. Illustrate working of parallel & distributed retrieval system 6. Explain various information retrieval algorithms & different types of queries
BTech	CS4001A :: MAJOR PROJECT 2	<p>The student will be able to –</p> <ol style="list-style-type: none"> 1. Model the Real World Problem 2. Identify the Design within Specification and Available Resources



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		<ol style="list-style-type: none">3. Realise the Solution within Defined references4. Defend his Design with Technical and Ethical reasoning5. Adapt to changing Technological and Human resource advances6. Use the gained knowledge for other Real World Problems
BTech	CS4291 :: INDUSTRY INTERNSHIP	<p>The student will be able to –</p> <ol style="list-style-type: none">1. Analyze real life industry problems2. Create solutions to problems with the help of latest tools3. Maintain work ethics in organized sector4. Cooperate with diverse teams and effectively communicate with all the stake holders5. Adapt to changing work environments6. Produce solutions within the technological guidelines and standards



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 considerations.
PO4	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.
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 sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms 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 leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need and have the preparation and ability to engage in independent and life-long 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.	CS6001 :: DISSERTATION BY INTERNSHIP	<p>The student will be able to –</p> <ol style="list-style-type: none"> 1. Analyze quantitative data, statistical data or human social situations and evaluate programs, services or performance of individuals 2. Compile statistical data, facts or information in order to create new systems or processes 3. Make decisions or alternatives within a certain situation by investigating the underlying causes of a problem 4. Learn the techniques of operating new equipment, new procedures at the organization and perform research by extracting information form libraries, archives 5. Utilize training and experiential learning opportunities for the development of skills in assessment, crisis intervention, consultation, outreach, and provision of supervision. 6. Work in an open and supportive environment conducive to the development of multicultural competence and sensitivity to individual differences



		in order to integrate knowledge base with diversity.
M. Tech.	CS6007 :: DISSERTATION BY RESEARCH	<p>The student will be able to –</p> <ol style="list-style-type: none">1. State the research problem along with hypothesis.2. Critically evaluate contextual literature information based on empiricism3. Perform technical analysis by making use of relevant methodology4. Propose architecture and design for solution realization by incorporating best practices and technology alternatives5. Discuss the virtuous dimensions of their research6. Present the outcomes and lessons learned of the research
M. Tech.	CS5001 :: APPLIED STATISTICS	<p>The student will be able to –</p> <ol style="list-style-type: none">1. analyze statistical data, measures of central tendency, measures of dispersion and correlation Coefficient2. Identify random variables and their probability functions3. compute population parameters and sample statistics4. demonstrate the concepts of p-value and confidence interval5. apply hypothesis tests for mean, variance, independence and goodness of fit6. translate real world problem to statistical and probabilistic model.
M. Tech.	CS5002 :: REAL TIME EMBEDDED SYSTEM	<p>The student will be able to –</p> <ol style="list-style-type: none">1. To understand Design Challenges for embedded system2. Describe the ARM microprocessor architectures and its feature



		<ol style="list-style-type: none"> 3. To understand serial communication Protocol 4. Explain features and policies followed by a Real-Time Operating System 5. To understand embedded system fiascos 6. To understand the case study of embedded system
M. Tech.	CS5003 :: DATABASE MANAGEMENT TECHNIQUES	<p>The student will be able to –</p> <ol style="list-style-type: none"> 1. Design data models as per data requirements and develop a database system using SQL. 2. Demonstrate data storage & indexing techniques and query optimization strategies. 3. Make a distinction between distributed and parallel databases. 4. Propose data warehouse dimensional modeling and perform olap operations. 5. Utilize object and object-relational databases 6. Explore advanced database models, systems, and applications for semi-structured and unstructured data
M. Tech.	CS5004 :: ADVANCED DATA STRUCTURES	<p>The student will be able to –</p> <ol style="list-style-type: none"> 1. Model the real world problem with the help of appropriate 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 processing application. 4. Apply randomized data structures for real world problems. 5. Design suitable spatial data structure for the geometric problems.



		<p>6. Analyze the problem solutions based on state of the art Data structure representation.</p>
M. Tech.	CS5006 :: HIGH PERFORMANCE NETWORK	<p>The student will be able to –</p> <ol style="list-style-type: none"> 1. Select network architecture, essential components to 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.	CS5010 :: ENGINEERING DESIGN AND INNOVATION 1	<p>The student will be able to –</p> <ol style="list-style-type: none"> 1. To set Objectives 2. Literature Survey 3. Limitations in existing systems 4. Research Methodology 5. Results 6. Conclusions and research findings
M. Tech.	CS5201 :: INTERNET OF THINGS	<p>The student will be able to –</p> <ol style="list-style-type: none"> 1. Learn and demonstrate concepts of Internet of Things 2. Develop and demonstrate embedded tools usage for IOT. 3. Demonstrate Python programming skills for IOT



		<ol style="list-style-type: none">4. Understand, develop and demonstrate the connectivity technologies and protocols in IOT, Demonstrate Cloud technology concepts5. Develop Web Application framework using Django6. Illustrate IOT design for application of Home automation, Smart Parking, Environment, Agriculture, Productivity applications etc
M. Tech.	CS5202 :: DATA SCIENCE	<p>The student will be able to –</p> <ol style="list-style-type: none">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 appropriate statistical methodology.3. Utilize statistical tools in deriving insights from data4. Apply analytic techniques and algorithms (including statistical and data mining approaches) to large data sets to extract meaningful insights5. Use appropriate resources to research, develop and contribute to advances and trends within the field of Data Science6. Interpret and present visually, orally and in written form, valid conclusions drawn from data analysis
M. Tech.	CS5208 :: CLOUD COMPUTING	<p>The student will be able to –</p> <ol style="list-style-type: none">1. Describe the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing2. Explain the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.3. Collaboratively research and write a paper on the state of the art (and open problems) in cloud computing.



		<ol style="list-style-type: none">4. Identify problems, and explain, analyze, and evaluate various cloud computing solutions.5. Choose the appropriate technologies, algorithms, and approaches for the related issues6. Display new ideas and innovations in cloud computing
M. Tech.	CS5204 :: CYBER SECURITY	<p>The student will be able to –</p> <ol style="list-style-type: none">1. Define and classify cyber crime, information security and types of malware2. Apply different cyber security techniques.3. Understand issues, challenges and guidelines for safe internet browsing , smart phone security, social media security and Wi-Fi security.4. Relate Social engineering and cyber criminal.5. Identify and apply various I.T security acts.6. Use Information destroying and recovery tools.
M. Tech.	CS5205 :: MOBILE COMPUTING	<p>The student will be able to –</p> <ol style="list-style-type: none">1. Select components and radio spectrum for PCS based on bandwidth requirement2. Justify the Mobile Network performance parameters and design decisions3. Choose the modulation technique for setting up mobile network4. Formulate GSM/CDMA mobile network layout considering futuristic requirements which conforms to the technology5. Deploy the 3G/4G technology based network with bandwidth capacity planning6. Adapt to the requirements of next generation mobile network and mobile applications
M. Tech.	CS5206 :: MULTIMEDIA PROCESSING	<p>The student will be able to –</p>



		<ol style="list-style-type: none">1. Identify the most suitable technique for a given use case based on the understanding of the similarities and differences between virtual, augmented and mixed reality with the help of Flynn's taxonomy2. Design various transformations for manipulating an object in 3 dimensional vector space3. Analyze rendering problems and rectify to provide realistic experience4. Track visual cues for marker-based and marker-less augmented reality experience5. Create local, global and secondary illumination for higher extent of presence metaphor6. Extract sensory data to implement location based augmented reality experience
MTech	CS5207 :: ENGINEERING DESIGN & INNOVATION 2	<p>The student will be able to –</p> <ol style="list-style-type: none">1. To complete literature survey2. To find out problems in existing systems3. To propose research methodology4. To implement5. To evaluate6. To find research outcome



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
SY IT (B19 pattern)	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 the applications of Graph data structure
			6 To design and analyze the appropriate data structure by applying various hashing Techniques
	IT2002	Analog & Digital Electronics	1 Understand the basic concepts of Analog Devices
			2 Construct combinational circuits.
			3 Design sequential circuits.



		4 Develop the applications of sequential circuits.
		5 Analyze internal structure of logic gates.
		6 Describe Programmable Logic Devices
IT2003	Computer Organization & Architecture	1 Understand the structure, function and characteristics of computer systems.
		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 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 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 undecidability
IT2006	Discrete Mathematics & Graph Theory	1 Reason mathematically about elementary discrete structures (such as functions, relations, sets, graphs, and trees) 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 principle in solving elegant and important problems
IT2007	Advanced Data Structures	1 Model the real world problem with the help of appropriate 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 processing application
		4 Apply randomized data structures for real world 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
IT2008	Computer Network	1 Select network architecture, topology and essential 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 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 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 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 Management Systems	1 Design data models as per data requirements of an organization
		2 Synthesize a relational data model up to a suitable normal form
		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 Statistics	1 Solve problems based on basic probability and random 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



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Year	Course code	Course Name	CO Statements
	IT3043:	Artificial Intelligence	Understand the basics of the theory and practice of Artificial Intelligence as a discipline and about intelligent agents capable of problem formulation.
			Evaluation of different uninformed search algorithms on well formulated problems along with stating valid conclusions that the evaluation supports.
			Design and Analysis of informed search algorithms on well formulated problems
			Formulate and solve given problem using Propositional and First order logic.
			Apply planning and neural network learning for solving AI problems
			Apply reasoning for non-monotonic AI problems.
	IT3044	Information System Security	1. Identify type of attack on a given system
			2. Analyze private key cryptographic techniques using a mathematical approach by examining nature of attack
			3. Justify various methods of access control and information flow for application of technologies to various sections of industry and society
			4. 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
			5. Display the impact of usability evaluation and testing in computing applications
			6. Evaluate cyber security techniques and forensic tools by researching current environment on a continuous basis for the benefit of society
	IT3054	System 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
	IT3042	Software Engineering	Summarize capabilities and impact of Software Development 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.
			Discriminate competing and feasible system requirements indicating correct real world problem scope and prepare stepwise system conceptual model



			using stakeholder analysis and requirement validation.
			Formulate system specifications by analyzing User-level tasks and compose software artifacts using agile principles, practices and Scrum framework
			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.
			Conform to Configuration Management principles and demonstrate cohesive teamwork skills avoiding classic mistakes and emphasizing on software safety adhering to relevant standards.
			Analyze the target system properties and recommend solution alternatives by practicing project planning, scheduling, estimation and risk management activities.
	IT3041	Human Computer Interaction	Identify human factors and usability issues related with computing applications
			Differentiate computing applications into categories based on human factors
			Design a user interface by applying suitable design principles, models and usability guidelines
			Integrate ethno-cultural and accessibility computing aspects into the user interface design
			Display the impact of usability evaluation and testing in computing applications
			Follow required processes and standards while designing user interfaces



	IT3072	Object Oriented Programming	analyze the strengths of object oriented programming	
			develop programming application using C++.	
			demonstrate the concepts of data encapsulation, reusability and polymorphism	
			create solutions to problems by applying the knowledge of Exception handling, Packages and Threads.	
			design an application using Java I/O's, File handling	
			Solve real world problems with the help of event-based GUI handling principles.	
IT IT3073	Convergence Technology	Categorize voice and data networks based on various protocols		
		Analyze the protocols and standards for converged networks.		
		Justify complexity involved in switching network.		
		Judge the impact and benefits of converged network in exploitation on environment and society		
		Prepare cost effective solutions to fulfill the need of convergence technology		
IT3052	Web Technology	Design reliable, efficient, scalable front end view of web pages using HTML5, CSS with Bootstrap framework.		
		Perform client side web page forms validation.		
		Refine web pages more dynamic and interactive.		
		Deliver realistic and extensible light weight web application using PHP.		



			Practice and utilize web framework paradigms and principles for Web development.
			Develop reliable, efficient, scalable web services.
	IT3015	Mobile Computing	Estimate performance parameters for designing the Cellular Network which comply Next Generation Cellular Network Standards.
			Formulate conceptual Telecommunication system to be deployed to fulfill bandwidth capacity planning
			Design the mobile network considering futuristic busy 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.
	IT3071	Embedded Systems	Learn the Concept of Embedded Systems
			Learn Fundamentals of Microcontrollers
			Learn Microcontrollers and IO Interfacing
			Design Systems using principles of ES
			Explore bus design issues
			Learn the fundamentals of RTOS



	IT3062	Distributed Computing	Identify the basic principles, design issues and architectural aspects of distributed systems	
			Analyze the different techniques used for Communication in distributed system	
			Develop the solutions for Clock synchronization, Mutual exclusion in distributed system	
			Construct an optimal and cost-effective solution for Distributed transaction and Deadlock	
			Use and apply important methods in distributed systems to support Scalability and Fault tolerance	
			Gain knowledge on Distributed File System and design issues of Distributed Shared Memory	
	IT3056	Internet of Things	Learn the terminology, technology and its applications of IoT	
			Analyze Embedded suite widely used in IoT	
			Describe the concept of M2M with necessary protocols	
			Understand the cloud storage for IoT applications	
			Optimize resources for different IoT applications	
			Understand Real world IoT Design constraint	
	IT3045	Object Oriented Modeling and Design	Analyze and breakdown real-world problem scenarios into structured partitions depicting static and dynamic behavior of the system using object-oriented analysis principles and Model Driven Development practices	



			<p>propose system design specifications indicating logical, physical, deployment, and concurrency viewpoints using object-oriented design principles and Model Driven Engineering practices</p>
			<p>construct and justify the evolutionary system models generated using UML-supported modelling tools</p>
			<p>prepare and present well-documented system profiles to the engineering and social community</p>
			<p>propose multi-faceted defensible solutions demonstrating team-skills accommodating design patterns reducing the potential cost and performance impedance</p>
			<p>analyze system dynamics and construct system specifications in order to realize system artifacts</p>
	IT3059	Parallel Computing on GPU	<p>recognize fundamentals of parallel computing and architectures available</p>
			<p>design parallel algorithms that better maps on GPU architecture</p>
			<p>write CUDA applications for execution on GPU</p>
			<p>apply parallel computing methods to scientific and engineering problems</p>
			<p>apply parallel computing methods to research problems</p>
			<p>Optimize CUDA code using tools for performance improvements</p>
	IT3057	Machine Learning	<p>Demonstrate knowledge learning algorithms and concept learning through implementation for sustainable solutions of applications</p>



			evaluate decision tree learning algorithms
			Analyze research based problems using Machine learning techniques
			Apply different clustering algorithms used in machine learning to generic datasets and specific multidisciplinary domains
			Formulate a given problem within the Bayesian learning framework with focus on building lifelong learning ability
			Evaluation of different algorithms on well formulated problems along with stating valid conclusions that the evaluation support
	IT3061	Image Processing	Describe image model
			Perform spatial filtering on image
			Identify Image Segmentation techniques
			Apply lossless and lossy compression techniques for image compression.
			Use various image transforms to analyze and modify image
			Understand Wavelet transform for Image Processing Applications.
Year	Course code	Course Name	CO Statements
	IT4085	DDistributed Computing	1. Identify the basic principles, design issues and architectural aspects of distributed systems
			2. IAnalyze the different techniques used for Communication in distributed system



BT Bech IT (D18 D19 pattern)			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. IUse 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
	IT4018	Convergence Technology	1. L Categorize voice and data networks based on various protocols
			2. AAalyze the protocols and standards for converged networks
			3. Justify complexity involved in switching network
			4. UDesign the converged network to fulfill the societal requirement
			5. Judge the impact and benefits of converged network in exploitation on environment and society.
			6. Prepare cost effective solutions to fulfill the need of convergence technology
	IT4006	Artificial Intelligence	Understand the basics of the theory and practice of Artificial Intelligence as a discipline and about intelligent agents capable of problem formulation.
			Evaluation of different uninformed search algorithms on well formulated problems along with stating valid conclusions that the evaluation supports
			Design and Analysis of informed search algorithms on well formulated problems
Formulate and solve given problem using Propositional and First order logic.			



			Apply planning and neural network learning for solving AI problems
			Design a small expert system using PROLOG.
	IT4012	Image Processing	Describe image model
			Perform spatial filtering on image
			. Identify Image Segmentation techniques..
			Apply lossless and lossy compression techniques for image compression
			Use various image transforms to analyze and modify image
			Understand Wavelet transform for Image Processing Applications.
	IT4019	SOFTWARE DESIGN METHODOLOGIES	Examine and breakdown real-world problem scenarios into structured partitions picting static and dynamic behavior of the system using business process management practices, object-oriented analysis principles and Model Driven Development practices
			Identify and formulate software requirements and behavioral models using static and dynamic behavioral views indicating structured problem partitioning and state-based exploration
			compose system analysis and design specifications indicating logical, physical, deployment, and concurrency viewpoints using object-oriented design principles and Model Driven Engineering practices



			<p>Construct and justify the evolutionary system description expressing high modellevel architecture accommodating applicable architectural styles compatible to requirements and behavioral models using UML-supported modeling tools</p>
			<p>Comprehend the nature of design patterns by understanding a sm ll number ofexamples from different pattern categories and apply these patterns in creating a correct design using design heuristics, published guidance, applicabilityreasonableness, and elation to other design criteria resulting inwell-documentedsystem profiles to the engineering and social community</p>
			<p>Propose multi-faceted defendable solutions demonstrating team-skills accommodating design patterns reducing the potential cost and</p>



			performance impedance in order model Driven
IT4002	Internet of Things		Learn the terminology, technology and its applications of IoT
			Analyze Embedded suite widely used in IoT
			Describe the concept of M2M with necessary protocols
			Understand the cloud storage for IoT applications
			Optimize resources for different IoT applications
			Understand Real world IoT Design constraint
IT4013	Parallel Computing on GPU		Recognize fundamentals of parallel computing and architectures available
			Design parallel algorithms that better maps on GPU architecture
			Write CUDA applications for execution on GPU.
			Apply parallel computing methods to scientific and engineering problems
			Apply parallel computing methods to research problems
			Optimize CUDA code using tools for performance improvements
IT4086	InfoObject Oriented Modeling and Design		1. . Examine and breakdown real-world problem scenarios into structured partitions depicting static and dynamic behavior of the system using object-oriented analysis principles and Model Driven Development practices



			<p>2. Compose system design specifications indicating logical, physical, deployment, and concurrency viewpoints using object-oriented design principles and Model Driven Engineering practices</p>
			<p>3. Construct and justify the evolutionary system models generated using UML-supported modelling tools</p>
			<p>4. Prepare and present well-documented system profiles to the engineering and social community.</p>
			<p>5. Propose multi-faceted defendable solutions demonstrating team-skills accommodating design patterns reducing the potential cost and performance impedance</p>
			<p>6. Frame system dynamics and construct system specifications in order to realize system artifacts</p>
	IT4075	Design and Analysis of Algorithms	<p>1. Formulate computational problems in abstract and mathematically precise manner.(</p>
			<p>2. Design efficient algorithms for computational problems using appropriate algorithmic paradigm</p>
			<p>3. Analyze asymptotic complexity of the algorithm for a complex computational problem using suitable mathematical techniques</p>
			<p>4. Formulate computational problem as linear program and apply LP, network flow, based techniques to design efficient algorithms for them</p>
			<p>5. Establish Incompleteness of some decision problems, grasp the significance of the notion of Incompleteness and its relation with intractability of the decision problems and design efficient approximation algorithms for standard NP-optimization problems</p>



			6. Incorporate appropriate data structures, algorithmic paradigms to craft innovative scientific solution for complex computing problems
IT4008	Data Science		Understand the process of converting data into a required format required for particular analysis
			Analyze data, test claims, and draw valid conclusions using appropriate statistical methodology
			Utilize statistical tools in deriving insights from data
			Apply analytic techniques and algorithms (including statistical and data mining approaches) to large data sets to extract meaningful insights
			Use appropriate resources to research, develop and contribute to advances and trends within the field of Data Science
			6. A Interpret and present visually, orally and in written form, valid conclusions drawn from data analysis
IT4077	Artificial Neural Networks		Apply neural network architecture for solving real world applications
			Solve problems using supervised learning techniques.
			Solve problems using unsupervised, associative learning techniques
			Solve problems using hybrid- fuzzy neural system
			Apply theory of fuzzy sets for complex pattern recognition applications



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, and relevant domain disciplines
PO3	Design /Development of Solutions: Design and evaluate solutions for complex computing problems, 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, 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 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
FY MCA (A18 pattern)	IT7001	Discrete Structures	1: Apply mathematical logic to solve Engineering problem on 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 problems in computer domain.
	IT7002	Programming in C	1. Solve real world problems using loops.
			2. Apply pointer concept in real world problems.
			3. Apply arrays to solve complex problems.
			4. Develop programs using String operations.
			5. Prepare programs using structure.
		6. Apply file handling concept to solve complex problems and for permanent storage	
IT7003		1. Design web pages using various HTML5 tags.	



		Web Technologies	2. Design reliable, efficient, scalable front end view of web pages using CSS with Bootstrap framework.
			3. Design the web pages more dynamic and interactive.
			4. Perform client side form validation.
			5. Establish database connectivity between front end and backend using MySQL.
			6. Design full website using PHP, AJAX and JavaScript.
	IT7004	Database Management System	Describe fundamental concepts and principles of database management systems and design an entity relationship data model.
			Construct Entity Relationship diagram.
			Analyze the relational database schema to write queries using relational query languages and SQL.
			Describe techniques used by a DBMS for data storage, access and query processing.
			Analyze and apply concurrency control and recovery techniques in case of failure.
			Apply security and privacy measures to database and describe query optimization.
	IT7007	Statistical and Mathematical Foundations	Represent statistical data using descriptive statistical tools.
			Analyze the data to evaluate central tendency of data such as mean, median, mode.
			Evaluate the dispersion of given statistical data from central value.
			Evaluate the correlation between the given parameters by applying the correlation and regression technique.
Differentiate different types of probability distribution and solve them.			



			Apply the concepts of probability distributions to solve real life problems in this domain.
	IT7008	Data Structures	Systemize incorporation of data structures in context with real worlds scenarios
			Implement and demonstrate different data structures with operations like insertion, deletion, traversing.
			Implement Binary search tree and its variations.
			Formulate a solution for a given problem with data structures and capabilities.
			Apply graphs concept to solve computational problems.
			6 .Use various types of sorting and searching techniques
	IT7009	Operating Systems	1. Analyse mechanisms and strategies of an Operating System 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.
	IT7101	Soft Skills	Perform and present self-evaluation.
			Understand importance of positive attitude in handling situations in real life
			Set the long term and short term goals from career planning perspective



			Face audience and build confidence in improving communication skill.
			Prepare the formal communication documents
			Improve use of gestures for effective communication
	IT7012	Computer Graphics	Apply mathematics and computer programming to computer graphics applications and problem solutions.
			Utilize algorithms to draw, fill and perform 2D transformations on basic geometrical shapes.
			Apply the logic to develop animation using segments.
			Develop the competency to understand the concepts related to demonstrate the use of clipping in real life.
			Develop scientific and strategic approach to solve complex problems in the domain of Computer Graphics
			Interpret the curves, fractals and hidden surfaces for representation of interactive graphics systems.
	IT7013	Linux Programming	Understand the concepts, design, and structure of the Linux Operating System.
			Use basic set of commands and utilities in Linux.
			Build effective applications using shell scripting.
			Understand Processes, process handling and file operations in Linux.
			Identify different mechanisms for Interprocess communication. Develop kernel program in Linux.
	IT7014	Computer Architecture	Demonstrate computer architecture concepts related to design of modern processors, memories and I/Os.
			Analyze the principles of computer architecture using examples drawn from commercially available computers.



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			Evaluate various design alternatives in processor organization.
			Solve problems based on computer arithmetic.
			Explain processor structure & its functions.
			Understand concepts related to memory & IO organization.
	IT7015	Advance database management system	Identify information retrieval and associated processes from text database.
			Differentiate Graph based database from relational database
			Describe semi-structured data and XML.
			Review object-oriented databases.
			Learn object-relational databases concept and its applications
			Characterize Parallel databases and its usage.
	IT7016	Advance Web Technology	Design reliable, efficient, scalable front end view of web pages 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.



SYMC A (B18 pattern)			Develop an optimal schedule chart for a given project by applying project management techniques such as PERT, CPM.
			Design Optimal time table for processing resources such as jobs, equipment, people, material etc
			Device the best inventory model for an organization by using Inventory control model.
			Design a mathematical model for decision making and identify the optimal strategies for bidding (business deal) by using game theory.
	IT8002	C++ and Core Java Programming	1. To implement polymorphism using c++.
			2. To Apply the concepts of data encapsulation , inheritance, and polymorphism 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.
			Analyze data flow between peer to peer in an IP network using Application, Transport and Network Layer Protocols.
Illustrate applications of Computer Network capabilities, selection and usage for various sectors of user community.			



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			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 and technology.
IT8004	Software Engineering		Compare different types of software models.
			Collect requirements 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.
			To apply data structures in solving computational problems.
			To be able to do testing and debugging of code written in Python
			To be able to draw various kinds of plots using PyLab.
			To be able to do text filtering with regular expressions in Python Plotting.
IT8007	Quantitative Techniques		1. Qualify all the company aptitude Test for placement.
			2. Clear Most of the Banking test based on Quantitative aptitude and Reasoning.



			3. 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.
			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 feature of Java towards achieving 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	1. Analyze asymptotic time and space complexity of an algorithm for worst, average and best cases using suitable mathematical tools.
			2. Derive and solve recurrences describing the performance of divide and conquer algorithms.
			3. Synthesize and analyze greedy algorithms.
			4. Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it.
			5. 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
		IT8013	Software Testing and quality assurance
	Identify applicable Test Strategies, Write: Test Plan, Test Cases, Test Procedures, Test Scenarios		
	Study importance of ISO, IEEE standards related to Software Testing		
	Understand the issues in Software Quality and activities present in Software Quality		
	Understand the framework and general approach of several Quality System Standards and Total Quality Management (TQM).		
	Understand required practices and processes of project management in delivering successful IT projects		
IT8014			Describe the concepts of organizational behavior and management practices.



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		Organizational Behavior	Summarize the problems occurring due to organizational change and Analyze how the theories and empirical evidence can help to solve contemporary organizational issues.
			Apply theories of motivation to practical problems in organizations in a critical manner.
			Justify the role of leadership qualities.
			Apply MBO technique to achieve the organizational objectives.
			Develop the skills that are necessary for making ethical decisions in Professional life
	IT8016	User interface design	Analyze types of user interfaces
			Design user interfaces for various applications
			Distinguish between good and bad user interaction designs
			Follow required processes and standards while designing user interfaces.
			Integrate ethno-cultural and accessibility computing aspects into the user interface design
			Describe the types of interfaces and their applications.

Year	Course code	Course Name	CO Statements
	IT9001	Network and Information Security	Identify the various types of attacks by analyzing the behaviour of data in the networks
			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
			Investigate the vulnerabilities in the existing system for the development of new system by following laws of security



TY MCA (C18 pattern)			Perform authentication of individuals or groups with cost effective Engineering solutions.
			Examine the importance of network security applications for current and future needs of organizations.
			Estimate future needs of security for a system by researching current environment on a continuous basis for the benefit of society.
	IT9002	Data warehousing and data mining	Illustrate use of appropriate analysis technique/s given the data Specifications.
			Construct a data warehousing solution for business intelligence involving various data sources, ETL, multi-dimensional modelling and OLAP.
			Understand the process of data mining and the key steps involved well enough to lead/manage a real-life data mining project
			Derive useful facts from data using different data mining algorithms
			Apply suitable data mining technique to predict useful patterns
			Solve real life problems using data analysis techniques
	IT9005	Mobile Application Development	Simplify the data manipulation using Content Providers, Shared Preferences, embedded database SQLite, Flat files and Multi Media files.
			Design UI-rich apps using all the major UI components
			Choose suitable software tools, IDE and APIs for the development of Mobile Application.
			Trace and identify the location of specific/ specialized handheld or mobile devices using Google map and other alternative techniques.
Develop android social media applications using HTTP and Socket communication protocol.			
Package and prepare real world apps for deploying on mobile device.			



	IT9003	Data Analytics	Understand the process of converting data into a required format required for particular analysis.
			Analyze data, test claims, and draw valid conclusions using appropriate statistical methodology.
			Utilize statistical tools in deriving insights from data .
			Apply analytic techniques and algorithms (including statistical and data mining
			Use appropriate resources to research, develop and contribute to advances and trends within the field of Data Science.
			Interpret and present visually, orally and in written form, valid conclusions drawn from data analysis.
	IT9009	Big data applications	Illustrate architecture of Hadoop
			Break down a computing problem into multiple parallel tasks
			Explain Hadoop Ecosystem
			0. Organize input data to handle it using HDFS
			1. Apply map reduce programming technique to address real world problems
			2. Adapt to upcoming technologies for management of complex big data problems.
	IT9010	Advanced data structures	Demonstrate memory efficient solution in order to apply basic principle of programming perspective.
			Infer memory utilization with modularization useful for programming pragmatics.
			Verify and narrate test condition in employing debugging technique to assist problem solving.
Elaborate on unrecognizable well organized problems based on realizable solutions.			
Implement and demonstrate different data structures with operations like insertion, deletion, traversing.			



			Contribute breadth of modularization in order to understand and implement realistic solution.
IT9011	Software design and architecture		To describe what patterns are, how to use them, and why they are important.
			To understand contribution of patterns towards the design process efficiency
			To trace the relationship between patterns and traditional methods
			To learn the relationship among patterns, frameworks, object-oriented languages, and software architecture
			To identify fundamental and advanced concepts of design and architectural patterns
			To Structure systems by applying architectural patterns
IT9012	Artificial intelligence		Understand the basics of the theory and practice of Artificial Intelligence as adiscipline and about intelligent agents capable of problem formulation
			Evaluation of different uninformed search algorithms on well formulatedproblems along with stating valid conclusions that the evaluation supports
			Design and Analysis of informed search algorithms on well formulated problems.
			Formulate and solve given problem using Propositional and First order logic.
			Apply planning and neural network learning for solving AI problems
			Design a small expert system using PROLOG
IT9020	Linux Programming		Estimate performance parameters for designing the Cellular Network which comply Next Generation Cellular Network Standards.
			Formulate conceptual Telecommunication system to be deployed to fulfill bandwidth capacity planning



			Design the mobile network considering futuristic busy 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.
	IT9008	Natural Language processing	Illustrate use of appropriate NLP technique/s given the problem statement.
			Construct and evaluate language model
			Understand the process of part of speech tagging and its application to manage a real-life NLP project
			Derive useful facts from syntactic parsing data using different data mining algorithms
			Apply semantic learning technique to predict useful patterns
			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	Translate specifications to the components of robots such as arms, linkages, drive systems and end effectors Understand mechanics and kinematics of robots.



			Select sensors and design their signal conditioning circuit
			Demonstrate use of engineering methods and problem solving towards design of the specified robot
			Use robot operating system for application development
			Apply prerequisite knowledge of programming, Microcontrollers, sensor
	IT9015	Cloud Computing	Illustrate the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
			Investigate the resource virtualization technique for a given business case
			Choose the appropriate file system and database for a given business case
			Develop a algorithm for a given business case using Map-Reduce model
			Build a SaaS solution for a real world problem with collaborative efforts
			Identify the challenges in Cloud Management and Cloud Security
	IT9016	GPU computing and applications	1. Recognize fundamentals of parallel computing and architectures 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		1. Describe image model



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		Image 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. Understand Wavelet transform for Image Processing Applications.
	IT9019	Data acquisition system	7. Define the characteristics of measuring devices for an instrument.
			8. 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.

Course Outcomes

YEAR	COURSE NAME	CO STATEMENT Students will be able to	
S. Y.	CH2001:: FLUID FLOW OPERATIONS	<ol style="list-style-type: none">1. Determine various properties and flow behaviors2. Select and use manometers for pressure measurement3. Solve fluid flow problems by using conservation equations of mass, momentum, and energy.4. Develop correlations using dimensional analysis5. Design the pipe size and flow meters requirements under laminar and turbulent flow conditions.6. Determine the power requirements of pumping and transportation of fluids	
	CH2003:: PROCESS CALCULATIONS	<ol style="list-style-type: none">1. Determine the quantities of chemicals in different mode i.e. moles and equivalent mass and able to convert various physical quantities in different unit systems2. Formulate analyse and solve steady state and unsteady state material balances for unit operations and unit processes.3. Make material balances for recycling, by-passing and purging operations4. Perform energy balances for unit operations5. Perform energy balances for unit processes	



		6. Perform Psychometric calculations, non ideal calculations for gaseous and liquid mixtures, combustion calculations and solve complex chemical problems.	
	CH2005:CHEMICAL ENGINEERING THERMODYNAMICS	<ol style="list-style-type: none"> 1. Estimate thermodynamic properties of pure 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 liquid system and generate VLE data 5. Analyze phase equilibria involving vapor 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 	
	CH2061:PHYSICAL AND ORGANIC CHEMISTRY	<ol style="list-style-type: none"> 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 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 spectrophotocemical 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	
	CH2009:: DIFFERENTIAL EQUATIONS	<ol style="list-style-type: none"> 1. Employ basic analytical and numerical methods for solution of ODEs. 2. Apply ODEs to chemical processes and engineering applications. 3. Employ basic analytical and numerical methods for solution of PDEs. 4. Apply PDEs to chemical processes and engineering applications. 	
	CH2079:ENGINEERING DESIGN AND DEVELOPMENT I	<ol style="list-style-type: none"> 1. Apply chemical engineering knowledge. 2. Work in a team 3. Approach and execute a practical problem given in a project 4. Carry out research and development work. 5. Design equipments or process for chemical engineering plants 6. Apply written, oral, and graphical communication in technical and non-technical environment 	
	CH2062:: HEAT TRANSFER	<ol style="list-style-type: none"> 1. Distinguish between mechanisms of heat transfer and derive basic heat transfer equations from first principles. 2. Solve convection heat transfer problems using empirical correlations. 3. Solve boiling and condensation problems using empirical correlations. 4. Solve radiative heat transfer problems. 5. Design simple heat exchangers and condensers. 6. Design evaporators, furnaces and reboilers. 	
	CH2004:: MASS TRANSFER OPERATIONS	<ol style="list-style-type: none"> 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 3. Select and design gas absorption and stripping column 	



		<ol style="list-style-type: none"> 4. Calculate mass transfer coefficient for humidification and dehumidification and design cooling tower 5. Calculate rate of drying and Select proper dryer, and find batch time for batch drier and design rotary drier for given requirement 6. Comprehend crystallization system and fundamental of design 	
	CH2006:CHEMICAL REACTION KINETICS	<ol style="list-style-type: none"> 1. Develop rate expressions from elementary and non elementary step mechanisms using steadystate and quasi-equilibrium approximations 2. Determine rate expressions by analyzing reactor data including integral and differential analysis on constant and variable volume systems 3. Design ideal reactors i.e. plug flow and CSTR for first and second order reversible and irreversible, constant and variable volume systems. 4. Select and size isothermal reactors for series and/or parallel systems of reactions and product distribution for multiple reactions 5. Quantitatively predict the performance of common chemical reactors in various combinations 6. Generate temperature and conversion profiles for exothermic and endothermic reactions 	
	CH2008:CHEMICAL TECHNOLOGY	<ol style="list-style-type: none"> 1. Apply process fundamentals of chemical technology in process industries. 2. Apply knowledge of chemical technology in unit operations and unit processes happening in chemical industry. 3. Develop process flow sheets for production of specific chemical product. 4. Comprehend reaction temperature, pressure condition and heat network in process flowsheet. 5. Analyze different process for same product based on economics, effluent treatment, social aspects. 	



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		6. Explain Petroleum refinery operation and supplementary processes.	
	CH2010::NUMERICAL METHODS FOR CHEMICAL ENGINEERING	<ol style="list-style-type: none"> 1. Solve different Chemical engineering problems by using matrix 2. Do statically data analysis. 3. Solve different Chemical engineering problems using numerical methods. 4. Solve different elliptical and parabolic equations. 5. Solve industrial problems by using linear optimization techniques. 6. Solve different Chemical engineering problems by using matrix 	
T.Y.	CH2078 :: ENGINEERING DESIGN AND DEVELOPMENT 2	<ol style="list-style-type: none"> 1. Apply chemical engineering knowledge. 2. Work in a team 3. Approach and execute a practical problem given in a project 4. Carry out research and development work. 5. Design equipments or process for chemical engineering plants 6. Apply written, oral, and graphical communication in technical and non-technical environment 	
	CH3063:: CHEMICAL ENGINEERING MATHEMATICS	<ol style="list-style-type: none"> 1. Solve different Chemical engineering problems by using matrix. 2. Do statically data analysis. 3. Solve different Chemical engineering problems using numerical methods. 4. Solve different elliptical and parabolic equations. 5. Solve industrial problems by using linear optimization techniques. 6. Describe concept and applications of tensors. 	
	CH3061:: MECHANICAL OPERATIONS	<ol style="list-style-type: none"> 1. Recognize basic principle of particle size measurement and select suitable size reduction equipment. 2. Select suitable solid-solid, solid-fluid separation technique and storage tank. 3. Select suitable solid conveying system and solid-solid mixing process. 4. Describe concept of filtration and design filtration unit. 	



		<ol style="list-style-type: none"> 5. Describe concept of sedimentation and design sedimentation unit. 6. Describe concept of flow through packed bed and design fluidized bed. 	
	CH3065:: MASS TRANSFER OPERATIONS	<ol style="list-style-type: none"> 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 3. Select and design gas absorption and stripping column 4. Calculate mass transfer coefficient for humidification and dehumidification and design cooling tower 5. Calculate rate of drying and Select proper dryer, and find batch time for batch drier and design rotary drier for given requirement 6. Comprehend crystallization system and fundamental of design 	
	CH3067:CHEMICAL REACTION KINETICS	<ol style="list-style-type: none"> 1. Develop rate expressions from elementary and non elementary step mechanisms using steadystate and quasi-equilibrium approximations 2. Determine rate expressions by analyzing reactor data including integral and differential analysis on constant and variable volume systems 3. Design ideal reactors i.e. plug flow and CSTR for first and second order reversible and irreversible, constant and variable volume systems. 4. Select and size isothermal reactors for series and/or parallel systems of reactions and product distribution for multiple reactions 5. 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	<ol style="list-style-type: none">1. Apply chemical engineering knowledge.2. Work in a team3. Approach and execute a practical problem given in a project4. Carry out research and development work.5. Design equipments or process for chemical engineering plants6. Apply written, oral, and graphical communication in technical and non-technical environment	
CH3089:: SEMINAR	<ol style="list-style-type: none">1. Write a technical report2. Present any chosen topic3. Do literature survey of a given topic4. User modern audio visual techniques at the time of presentation5. Convey the content of any chosen topic6. The student will be able to write a technical report	
CH3060:: SEPARATION TECHNIQUES	<ol style="list-style-type: none">1. Generate VLE data for ideal and non-ideal system2. Carry out process design of distillation column3. 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 distillation4. Select suitable solvent for liquid-liquid extraction based on properties like selectivity, distribution coefficient etc. and design liquid-liquid extraction column and select equipment required for given separation5. Calculate the number of stages required for a leaching operation6. Draw analogy between adsorption and ion exchange, carry out process design of adsorption column	
CH3062:: PROCESS EQUIPMENT DESIGN	<ol style="list-style-type: none">1. Carry out the detailed thermal design of double pipe and shell and tube heat exchanger for given requirement.	



		<ol style="list-style-type: none"> 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. 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. 	
	CH3064:: INSTRUMENTATION AND PROCESS CONTROL	<ol style="list-style-type: none"> 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 PID controlled system 4. Design a control system using time-domain techniques such as root-locus 5. Design a control system using frequency-domain techniques such as Bode design 6. Carry out preliminary analysis of Advanced Process Control systems 	
	CH3066:: CHEMICAL TECHNOLOGY	<ol style="list-style-type: none"> 1. Apply process fundamentals of chemical technology in process industries. 2. Apply knowledge of chemical technology in unit operations and unit processes happening in chemical industry. 3. Develop process flow sheets for production of specific chemical product. 4. Comprehend reaction temperature, pressure condition and heat network in process flowsheet. 5. Analyze different process for same product based on economics, effluent treatment, social aspects. 6. Explain Petroleum refinery operation and supplementary processes. 	



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	CH3078:ENGINEERING DESIGN AND DEVELOPMENT2	<ol style="list-style-type: none"> 1. Apply chemical engineering knowledge. 2. Work in a team 3. to Approach and execute a practical problem given in a project 4. Carry out research and development work. 5. Design equipments or process for chemical engineering plants 6. Apply written, oral, and graphical communication in technical and non-technical environment 	
	CH3088:: SUMMER TRAINING	<ol style="list-style-type: none"> 1. Apply chemical engineering knowledge. 2. Design equipments or process for chemical engineering plants 3. Carry out research and development work. 4. Work in a team 5. Apply written, oral, and graphical communication in technical and non-technical environment 6. Follow ethics and professional standards of organization/industry. 	
Final Year	CH4063: PLANT ENGINEERING AND PROJECT ECONOMICS	<ol style="list-style-type: none"> 1. Develop various steps of chemical plant design. 2. Do and describe health & safety analysis. 3. Estimate & predict cost estimation of chemical plant. 4. Estimate & describe different types of interest. 5. Estimate & describe taxes, insurance, profit analysis. 6. Describe and calculate depreciation. 	
	CH4058: TRANSPORT PHENOMENA	<ol style="list-style-type: none"> 1. Solve shell momentum balance problems for simple systems (2. Solve shell energy balance problems for simple systems 3. Solve shell mass balance problems for simple system 4. Setup and solve macroscopic momentum 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 	



CH4057:CHEMICAL REACTION ENGINEERING	<ol style="list-style-type: none">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.3. Determine the characteristics of solid catalyst like porosity, pore volume, etc.4. Select model for fluid-particle reactions and calculate the rate of reactions5. Select model for fluid-fluid reactions and calculate the rate of reactions.6. Design the various types of reactors depending on the different types of heterogeneous Catalytic and non-catalytic reactions.
CH4093:MAJOR PROJECT 1	<ol style="list-style-type: none">1. Apply Chemical Engineering knowledge.2. Work in team.3. Carry out research and development work.4. The student will be able to design equipment or process for chemical engineering plant.5. Apply oral and graphical communication in both technical and non technical environments.6. Apply written communication in both technical and non technical environments.
CH4096: INDUSTRIAL INTERNSHIP	<ol style="list-style-type: none">1. Apply Chemical Engineering knowledge.2. Design equipments or process for chemical engineering plants or apply knowledge in core and multidisciplinary field through research and development.3. Work effectively as member or leader in team.4. Organize, comprehend and write technical report.5. Follow ethics and professional standards of organization/industry.
CH4095:RESEARCH INTERNSHIP	<ol style="list-style-type: none">1. Apply Chemical Engineering knowledge.2. Design equipments or process for chemical engineering plants or apply knowledge in core and multidisciplinary field through research and development.



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		<ol style="list-style-type: none">3. Work effectively as member or leader in team.4. Organize, comprehend and write technical report.5. Follow ethics and professional standards of organization/industry.	
	CH4070:GLOBAL INTERNSHIP	<ol style="list-style-type: none">1. Apply Chemical Engineering knowledge.2. Design equipments or process for chemical engineering plants or apply knowledge in core and multidisciplinary field through research and development.3. Work effectively as member or leader in team.4. Organize, comprehend and write technical report.5. 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

Course Outcomes

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



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FY	CH5001:MATHEMATICAL METHODS IN ENGINEERING	<ol style="list-style-type: none">1. The student will be able to apply initial tensor and tensor calculus.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 methods.
FY	CH5007:CHEMICAL PROCESS SIMULATION	<ol style="list-style-type: none">1. The student will be able to apply basic models of chemical processes and to plan calculations for simulation.2. The student will be able to model alternate 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 SEPARATION TECHNIQUES	<ol style="list-style-type: none">1. The students will be able to explain conventional and novel separation techniques.2. The students will be able to explain and analyze advanced distillation techniques3. The students will be able to explain and analyze advanced extraction processes4. The students will be able to describe and apply principle of membrane separation5. The students will be able to explain and apply adsorption principles.6. The students will be able to describe and apply ionic separation principles.
FY	CH5075 : ENGINEERING DESIGN AND INNOVATION 1	<ol style="list-style-type: none">1. The students will be able to apply chemical engineering knowledge2. The students will be able to learn how to work in team



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		<ol style="list-style-type: none">3. The students will be able to define a task (problem) and execute it4. The students will be able to carry out literature search related to topic5. The students will be able to write synopsis and complete literature search related to topic and complete report6. The students will be able to identify the idea and execute it in team
FY	CH5006: INDUSTRIAL POLLUTION CONTROL	<ol style="list-style-type: none">1. The student will be able to identify hazardous pollutants in the plant or area2. The student will be able to design reduction method and pollution treatment technique3. The student will be able to develop the analysis techniques for different pollutants4. The student will be able to determine the pollution level with respect to the pollution standards5. The student will be able to analyze the impact of various factors on the environment6. The student will be able to determine the suitability of water for different usage
FY	CH5002: ADVANCED THERMODYNAMICS	<ol style="list-style-type: none">1. The students should be able to apply various equations of state for estimation of thermodynamic properties2. The students should be able to apply criteria of phase equilibrium and calculate equilibrium compositions in vapor-liquid system and/or liquid-liquid system3. The students should be able to apply thermodynamics of electrolytic solutions4. The students should be able to calculate equilibrium compositions in vapor-liquid system and/or liquid-liquid system5. The students should be able to apply chemical reaction equilibria to determine equilibrium yield and other related quantities
FY	CH5068:ENGINEERING ECONOMICS	<ol style="list-style-type: none">1. Students will acquire the skills to apply the basics of economics and cost analysis to engineering.2. Students will acquire the skills to take economically sound decisions3. Students will acquire the skills to evaluate performance of the company



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FY	CH5024: NANO SCIENCE AND NANOTECHNOLOGY	<ol style="list-style-type: none">1. Find out synthesis and application of nanoparticles for industrial processes.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 DESIGN AND INNOVATION 2	<ol style="list-style-type: none">1. The students will be able to apply chemical engineering knowledge2. The students will be able to learn how to work in team3. The students will be able to define a task (problem) and execute it4. The students will be able to carry out literature search related to topic5. The students will be able to write synopsis and complete literature search related to topic and complete report6. The students will be able to identify the idea and execute it in team
SY	CH6093:DISSERTATION BY RESEARCH	<ol style="list-style-type: none">1. The students will be able to apply Chemical 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-technical environments.6. The students will be able to prepare scientifically correct Technical report.



SY	CH6099:DISSERTATION BY INTERNSHIP	<ol style="list-style-type: none">1. The students will be able to apply Chemical 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 BY RESEARCH	<ol style="list-style-type: none">1. The students will be able to apply Chemical 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-technical environments.6. The students will be able to prepare scientifically correct Technical report.
SY	CH6098:DISSERTATION BY INTERNSHIP	<ol style="list-style-type: none">1. The students will be able to apply Chemical 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

Course Outcomes

Year	Course Name & Code	CO Statements
SY	IE2001:: THEORY OF MACHINES	<ol style="list-style-type: none">1. Classify different types of links and mechanisms 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 & PROCESSES	<p>Understand basic construction and working of various Machine tools used for metal removal processes Select proper work and tool holding devices, attachments and accessories of a machine tool and Illustrate conventional and unconventional machining processes performed on various machines Understand various tool geometries and select appropriate cutting tools to obtain required finished component</p>



		<p>Define process parameters like cutting speed, feed and depth of cut and evaluate machining time for machining processes</p> <p>Machine simple and composite job involving few lathe and milling operations</p>
SY	IE2003:: METROLOGY AND MECHANICAL MEASUREMENT S	<p>Measure length using line-graduated instruments, i.e. vernier calipers, micrometers etc.</p> <p>Measure angle precisely using precision angular measuring instruments like vernier bevel protractor, sine bar, clinometers, angle dekkor and auto collimator.</p> <p>Design Go and No Go gauges based on principles of limits, fits and tolerance and effectively use of comparators of various types.</p> <p>Apply knowledge of various instruments and methods to determine geometry and surface finish and dimensions of industrial components.</p> <p>Use effective methods of measuring screw threads and gear teeth parameters.</p> <p>Select and measure variables using appropriate sensors and transducers</p>
SY	IE2004:: MECHANICS OF MATERIALS	<p>Calculate normal stress, shear stress, and deformation and applications of the analysis and design of members subjected to an axial load or direct shear</p> <p>Analyze and design circular determinate shafts subjected to torsional loading for its shear stress distribution and angle of twist.</p> <p>Establish the shear force and bending moment diagrams for a beam</p> <p>Determine bending and transverse shear stress in homogeneous beam having prismatic cross section and design beam for a given bending moment and shear force.</p> <p>Determine stress components by analytical and Mohr's circle method, for a plane state of stress and to obtain the maximum normal and maximum shear stress along-with orientation of elements.</p> <p>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(axial, bending, torsion)</p>
SY	IE2005:: MATHEMATICS FOR ENGINEERING APPLICATIONS-I	<ol style="list-style-type: none"> 1. Develop solutions for linear equations. 2. Interpret the various results obtained by analyzing data. 3. Understanding the Laplace Transforms. 4. Developing the insight into numerical methods useful for computing applications.



		<p>5. Analyze the relationship between variables to predict their behavior.</p> <p>6. Formulate the mathematical models to predict the approximate values of variables</p>
SY	IE2036:: THERMAL & FLUID ENGINEERING	<p>1. Understand basic concepts of fluids, classification of flows and measure fluid flow by various flow measuring devices.</p> <p>2. Distinguish various types of hydraulic turbines, pumps</p> <p>3. Analyze performance of boilers.</p> <p>4. Understand basic concepts of thermodynamics and analyze air standard cycles.</p> <p>5. Describe and analyze various types of air compressors.</p> <p>6. Understand refrigeration and air conditioning principles</p>
SY	IE2037:: MATERIAL SCIENCE	<p>1. Correlate crystal structures, crystallographic directions and planes, Plastic deformation mechanisms, cold & hot working changes in properties & with mechanical, physical, electrical & thermal properties.</p> <p>2. Apply and integrate knowledge of properties and performance to solve materials selection and design problems.</p> <p>3. Apply and integrate knowledge of equilibrium diagram</p> <p>4. Apply and integrate knowledge of strengthening mechanisms & Pyrometry</p> <p>5. Apply and integrate knowledge of Powder Metallurgy & Composite materials</p> <p>6. Apply and integrate knowledge of apply and integrate knowledge of various surface modification techniques.</p>
SY	IE2038:: CASTING & JOINING TECHNOLOGY	<p>Select and design and perform different pattern and mould making to manufacture castings.</p> <p>Understand and apply different methods of core making and melting techniques.</p> <p>Design gating system and select appropriate casting method for manufacturing castings with optimum cost and quality.</p> <p>Apply fundamentals of gas welding, soldering and brazing techniques for joining of appropriate material and job.</p> <p>Understand and apply electric arc and resistance welding and nonconventional techniques.</p> <p>Test and analyze weld quality by mechanical properties and microstructural analysis</p>
SY	IE2039:: DESIGN OF MACHINE ELEMENTS	<p>Analyze the stress and strain mechanical components such as shaft, keys and couplings and design the same for various industrial applications.</p> <p>Design spur and helical gears for various applications.</p> <p>Select different types of rolling contact bearings from manufacturer's catalogue for various industrial applications.</p>



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		<p>Analyze the stress and strain in power screw and design the same for various industrial applications.</p> <p>Analyze the stress and strain in threaded and welded joints and design the same for various industrial applications.</p> <p>Design mechanical components for fluctuating and reversible loading conditions</p>
SY	PR2006:: MACHINE DRAWING & COMPUTER GRAPHICS	<p>Analyze and draw the 2D and 3D views using AutoCAD</p> <p>Prepare part and assembly drawing along with Bill of Material using AutoCAD</p> <p>Communicate and present ideas through drawing using AutoCAD</p>
TY	IE3001:: FACILITIES PLANNING	<p>Select location of facilities for business organizations</p> <p>Learn formulations, models, and analytical procedures for the study of facilities layout planning.</p> <p>Design and improve existing and new layouts incorporating products, process and personnel requirements for manufacturing and service organizations</p> <p>Learn and apply fundamental principles of material handling</p> <p>Select appropriate material handling systems for manufacturing organizations</p> <p>Understand basics of safety measures to be followed in industry</p>
TY	IE3003:: QUALITY MANAGEMENT	<p>Understand and apply principles of quality management</p> <p>Interpret for process control, identify and analyze and eliminate/reduce causes of variation and carry out process capability studies</p> <p>Select and design an acceptance sampling plan for sampling inspection</p> <p>Develop an ability of problem solving and decision making using quality improvement tools</p> <p>Understand and apply Six Sigma Methodology and QMS and its applications</p> <p>Evaluate reliability, maintainability and availability of product/component systems</p>
TY	IE3005:: WORK SYSTEM DESIGN	<ol style="list-style-type: none"> 1. Understand and apply productivity concepts and 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 METHODS AND RESEARCH METHODOLOGY	<ol style="list-style-type: none"> 1. Explain the nature of research and data requirements 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. Understand the importance of computer oriented numerical methods and their applications
TY	IE3036:: MANUFACTURING PROCESSES & SYSTEMS	<ol style="list-style-type: none"> 1. Understand plastic deformation of metals and its 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
TY	IE3038::OPERATIONS MANAGEMENT	<ol style="list-style-type: none"> 1. Understanding of Operations management 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 5. Understanding different Aggregate production strategies used in Production system 6. Understanding of Relevance of scheduling
TY	IE3040::SUPPLY CHAIN MANAGEMENT	<p>Identify the key elements and processes in a supply chain and their interaction</p> <p>Understand and analyze the designing, planning and operational decisions of SCM.</p> <p>Identify the techniques used in management of critical components of supply chain</p> <p>Analyze, design and optimize supply chain networks for manufacturing organizations</p> <p>Design and optimize inventories across the supply chain</p> <p>Explain the likely future development of logistics and supply chain management</p>
TY	IE3042::W	Identify, eliminate and reduce the non-value added activities (wastes) in manufacturing organization



	ORLD CLASS MANUFACTURIN G	<p>Apply the tools and techniques of lean manufacturing to improve productivity in manufacturing and service organizations</p> <p>Understand the principles and benefits of Toyota Production System philosophy</p> <p>Apply the concept, tools and techniques in TPM philosophy</p> <p>Analyze, map and improve business processes for achieving improvements</p> <p>Apply the tools and techniques of constraint management to improve productivity in manufacturing and service organizations</p>
B Tech	IE4001:: HUMAN FACTORS ENGINEERING	<p>Understand need of applying Human Factors Engineering in industry & society</p> <p>Design workplaces and products ergonomically by applying principles of design, work physiology and anthropometry.</p> <p>Understand information input and processing to design visual/auditory displays.</p> <p>Evaluate and estimate human efficiency and by understanding work physiology</p> <p>Design work environment by applying knowledge of Physiological effect of environmental conditions on human performance.</p> <p>Apply knowledge of Human Factors in Ergonomic system design</p>
B Tech	IE4002:: WORLD CLASS MANUFACTURIN G	<p>Identify, eliminate and reduce the non-value added activities (wastes) in manufacturing organization</p> <p>Apply the tools and techniques of lean manufacturing to improve productivity in manufacturing and service organizations</p> <p>Understand the principles and benefits of Toyota Production System philosophy</p> <p>Apply the concept, tools and techniques in TPM philosophy</p> <p>Analyze, map and improve business processes for achieving improvements</p> <p>Apply the tools and techniques of constraint management to improve productivity in manufacturing and service organizations</p>
B Tech	IE4003:: SUPPLY CHAIN MANAGEMENT	<p>Identify the key elements and processes in a supply chain and their interaction</p> <p>Understand and analyze the designing, planning and operational decisions of SCM.</p> <p>Identify the techniques used in management of critical components of supply chain</p> <p>Analyze, design and optimize supply chain networks for manufacturing organizations</p> <p>Design and optimize inventories across the supply chain</p> <p>Explain the likely future development of logistics and supply chain management</p>



B Tech	IE4074:: MAJOR PROJECT	<p>Survey literature for problem identification Cultivate the habit of working in a team, communicate effectively and attempt a problem solution in a right approach 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</p>
B Tech	IE4004:: FINANCIAL MANAGEMENT AND MANAGEMENT ACCOUNTING	<ol style="list-style-type: none"> 1. Understand and analyze functions of financial management and budgeting, interpret financial statements through accounting ratios 2. Understand the concepts of Capital Budgeting and Working Capital management for effective financial management 3. Understand the mechanics of financial accounting for preparation of financial statements to ascertain the performance and financial position of a business 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
B Tech	IE4005:: OPERATIONS SCHEDULING	<p>Understanding of single machine scheduling, its constraints etc. Understanding of other objectives in a single machine scheduling. Understanding of Parallel Processing & Batch Sequencing. Analysis of Flow shop models & its implications Analysis of Job shop models & its implications Analysis of other models & its implications</p>
B Tech	IE4006:: SERVICES MANAGEMENT	<ol style="list-style-type: none"> 1. Explain the distinctive nature of services and characteristics of service economy 2. Analyze service encounters and service strategy 3. Plan facilities for service delivery 4. Evaluate various dimensions of service quality 5. Match requirements of service capacity and demand 6. Apply various Industrial Engineering Techniques for service competitiveness



B Tech	IE4086:: MAJOR PROJECT	<p>Survey literature for problem identification</p> <p>Cultivate the habit of working in a team, communicate effectively and attempt a problem solution in a right approach</p> <p>Correlate the theoretical and experimental/simulations results and draw the proper inferences.</p> <p>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.</p> <p>To practice data collection and analysis using different measurement equipment's and software packages.</p> <p>Prepare project report as per guideline and present it effectively</p>
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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

Course Outcomes

Year	Course Name & Code	CO Statements
FY	IE5001::STATISTICAL METHODS	<ol style="list-style-type: none">1. Explain the nature of research and data requirements2. Calculate probability by selecting appropriate probability distribution for managerial decisions3. Estimate confidence interval4. Perform test of significance for means and proportion5. Perform test of significance for variance6. Perform test of ANOVA
FY	IE5005:: PRODUCT LIFE CYCLE ENGINEERING	<ol style="list-style-type: none">1. explain characteristics of PLM2. understand features of new product development3. comprehend complexity in new product introduction4. analyze environmental aspects of product life cycle5. plan strategy for use of modern tools of PLC engineering6. analyze impact of recent advances in PLM
FY	IE5103:: MANUFACTURING	<ol style="list-style-type: none">1. Understand need of various manufacturing strategies usage.



	STRATEGY AND OPERATIONS MANAGEMENT	<ol style="list-style-type: none"> 2. Apply various methods to reduce lead time in manufacturing and services organizations 3. Analyze, assess and develop vendor selection and rating systems for manufacturing organizations for effective procurement of materials 4. Develop master production schedule, and material requirements plans for manufacturing and service organizations 5. Understand need of various functions in aggregate production system 6. Develop complete schedule of organization as a part of resource requirement planning
FY	IE5104::ADVANCED QUALITY SYSTEMS & RELIABILITY ENGINEERING	<p style="text-align: center;">Understand and apply principles of quality management</p> <ul style="list-style-type: none"> Identify and analyze causes of variation Develop an ability of problem solving and decision making using quality improvement tools Design quality improvement experiment for specific product or service Understand QMS and its applications Evaluate reliability, maintainability and availability of product/component systems
FY	IE5136:: PROJECT MANAGEMENT AND FINANCIAL ANALYSIS	<p>Learn the characteristics of projects and project management</p> <ul style="list-style-type: none"> Ascertain the feasibility of projects Plan and schedule projects Understand the concept of project cost management Analyze risks involved in projects Understand aspects of manpower management in projects
FY	IE5137:: WORK ANALYSIS AND HUMAN FACTORS ENGINEERING	<p>Understand and apply productivity concepts and principles and analyze work content</p> <ul style="list-style-type: none"> Systematically record; critically examine methods of doing work to effect improvements Design the workplace using principles of motion economy and develop improved methods Establish standard time to carry out a specified job using stop watch time study Establish standard time to carry out a specified job using video watch time study Establish standard time to carry out a specified job using predetermined time standards
FY	IE5141:: OPTIMIZATION	<ol style="list-style-type: none"> 1. Understand scope of optimization in industrial and business organizations.



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	MODELING & SIMULATION	<ol style="list-style-type: none">2. Recommend specific type of queuing system for the given situation3. Explain the need of simulation and its various uses.4. Apply Game theory and Replacement analysis techniques.5. Understand Integer and Dynamic Programming techniques in real life situations.6. Application of Decision making under uncertainty
FY	IE5039:: SUPPLY CHAIN ANALYSIS & MODELING	<ol style="list-style-type: none">1. Identify the key elements and processes in a supply chain and their interaction2. Understand and analyze the designing, planning and operational decisions of SCM.3. Identify the techniques used in management of critical components of supply chain4. Analyze, design and optimize supply chain networks for manufacturing organizations5. Design and optimize inventories across the supply chain6. Explain the likely future development of logistics and supply chain management
SY	IE6071:: DISSERTATION BY INTERNSHIP 1	<p>Apply Industrial Engineering knowledge. Prepare detailed problem statement. Learn to do relevant literature survey. Apply oral and graphical communication in both technical and non-technical environments. Apply written communication in both technical and non-technical environments. Preparing scientifically correct Technical report</p>
SY	IE6086:: DISSERTATION BY INTERNSHIP 2	<p>Apply Industrial Engineering knowledge. Prepare detailed problem statement. Learn to do relevant literature survey. Apply oral and graphical communication in both technical and non-technical environments. Apply written communication in both technical and non-technical environments. Preparing scientifically correct Technical report</p>



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

Course Outcomes

Year	Course Name & Code	CO Statements
SY	PR2001::THERMAL & FLUID ENGINEERING	Understand basic concepts of fluids, classification of flows and measure fluid flow by various flow measuring devices. Distinguish various types of hydraulic turbines, pumps Analyze performance of boilers. Understand basic concepts of thermodynamics and analyze air standard cycles. Describe and analyze various types of air compressors. Understand refrigeration and air conditioning principles.
SY	PR2002::MATERIAL SCIENCE	1. correlate crystal structures, crystallographic 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 mechanisms & Pyrometry 5. apply and integrate knowledge of Powder Metallurgy & Composite materials 6. apply and integrate knowledge of apply and integrate knowledge of various surface modification techniques.
SY	PR2003::CASTING & JOINING TECHNOLOGY	1. select and design and perform different pattern and mould making to manufacture castings. 2. understand and apply different methods of core making and melting techniques.



		<ol style="list-style-type: none"> 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	PR2004:: MECHANICS OF MATERIALS	<ol style="list-style-type: none"> 1. Calculate normal stress, shear stress, and 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 shear stress along-with orientation of elements. 6. 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 (axial, bending, torsion)
SY	PR2006:: MACHINE DRAWING & COMPUTER GRAPHICS	<ol style="list-style-type: none"> 1. Analyze and draw the 2D and 3D views using AutoCAD 2. Prepare part and assembly drawing along with Bill of Material using AutoCAD 3. Communicate and present ideas through drawing using AutoCAD
SY	PR2036::THEORY OF MACHINES	<ol style="list-style-type: none"> 1. Classify different types of links and mechanisms 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.



		<p>6. Understand the mechanism of gear trains and distinguish between various gear trains.</p> <p>7. Determine the dynamic behavior principles and operations of breaks & dynamometers</p>
SY	PR2037:: MACHINE TOOLS & PROCESSES	<p>Understand basic construction and working of various Machine tools used for metal removal processes</p> <p>Select proper work and tool holding devices, attachments and accessories of a machine tool and</p> <p>Illustrate conventional and unconventional machining processes performed on various machines</p> <p>Understand various tool geometries and select appropriate cutting tools to obtain required finished component</p> <p>Define process parameters like cutting speed, feed and depth of cut and evaluate machining time for machining processes</p> <p>Machine simple and composite job involving few lathe and milling operations</p>
SY	PR2038::METROLOGY & MECHANICAL MEASUREMENTS	<p>Measure length using line-graduated instruments, i.e. vernier calipers, micrometers etc.</p> <p>Measure angle precisely using precision angular measuring instruments like vernier bevel protractor, sine bar, clinometers, angle dekkor and auto collimator.</p> <p>Design Go and No Go gauges based on principles of limits, fits and tolerance and effectively use of comparators of various types.</p> <p>Apply knowledge of various instruments and methods to determine geometry and surface finish and dimensions of industrial components.</p> <p>Use effective methods of measuring screw threads and gear teeth parameters.</p> <p>Select and measure variables using appropriate sensors and transducers</p>
SY	PR2039::DESIGN OF MACHINE ELEMENTS	<p>Analyze the stress and strain mechanical components such as shaft, keys and couplings and design the same for various industrial applications.</p> <p>Design spur and helical gears for various applications.</p> <p>Select different types of rolling contact bearings from manufacturer's catalogue for various industrial applications.</p> <p>Analyze the stress and strain in power screw and design the same for various industrial applications.</p> <p>Analyze the stress and strain in threaded and welded joints and design the same for various industrial applications.</p> <p>Design mechanical components for fluctuating and reversible loading conditions</p>



SY	PR2040::MATHEMATICS FOR ENGINEERING APPLICATIONS-II	<ol style="list-style-type: none"> 1. Develop solutions for linear equations. 2. Interpret the various results obtained by 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
TY	PR3001::METAL FORMING TECHNOLOGIES	<p>understand fundamentals of elastic and plastic deformation of metals.</p> <p>select appropriate forging process, equipment, tools and analysis of forging load..</p> <p>classify rolling processes, equipment and analysis of rolling forces and defects.</p> <p>understand wire and tube drawing machines, tools and analyse wire and tube drawing forces.</p> <p>understand types of extrusion process and analysis of extrusion load and metal flow.</p> <p>compare and apply nonconventional forming techniques.</p>
TY	PR3002::PRODUCTION PLANNING & CONTROL	<ol style="list-style-type: none"> 1. Understanding of Operations management 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 5. Understanding different Aggregate production strategies used in Production system 6. Understanding of Relevance of scheduling
TY	PR3003::PRODUCTION METALLURGY	<p>Interpret Fe-Fe₃C equilibrium, microstructures & correlate structure-properties relationship of steels & cast irons.</p> <p>Use the concept of TTT, CCT diagrams & apply the heat treatment techniques to enhance mechanical properties of steels.</p> <p>Apply the surface hardening & isothermal heat treatment techniques to enhance mechanical properties of steels.</p> <p>Select appropriate alloy steel and tool steel for different engineering applications</p> <p>Select appropriate cast iron nonferrous material for different engineering applications.</p> <p>Select appropriate non ferrous material for different engineering applications</p>



TY	PR3004::QUALITY & RELIABILITY ENGINEERING	<p>Understand and apply principles of quality management</p> <p>Interpret for process control, identify and analyze and eliminate/reduce causes of variation and carry out process capability studies</p> <p>Select and design an acceptance sampling plan for sampling inspection</p> <p>Develop an ability of problem solving and decision making using quality improvement tools</p> <p>Understand and apply Six Sigma Methodology and QMS and its applications</p> <p>Evaluate reliability, maintainability and availability of product/component systems</p>
TY	PR3005::WORK STUDY & ERGONOMICS	<ol style="list-style-type: none"> 1. Understand and apply productivity concepts and 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	PR3006::CAD/CAM/ CIM	<p>Understand and appreciate use of computer in product development.</p> <p>Apply algorithms of graphical entity generation.</p> <p>Understand mathematical aspects of geometrical modelling</p> <p>Understand and use finite element methods for analysis of simple components.</p> <p>Understand hard and soft automation and CAM</p> <p>Describe construction and working of CNC machines.</p> <p>Understand concepts of CAM,CIM and FMS</p>
TY	PR3009::PRODUCT DESIGN & MODELLING	<ol style="list-style-type: none"> 1. Describe the product development process and account for its conditions and terms, and use the most common methods of managing teams and concept development, 2. Use standard machine drawing techniques to communicate ideas, make design and manufacturing drawings of parts and assemblies. 3. Plan, implement and present a design project using a 2D / 3D CAD-software to design products, create advanced solid, surface and assembly models, produce realistic images and simple animations of a product,



		4. Use of GD & T standards to design and understand various designs on shopfloor
TY	PR3008::DESIGN FOR MANUFACTURING & ASSEMBLY	<p>Understand product design process.</p> <p>Select materials for given objects by following material selection process.</p> <p>Understand design principles for different manufacturing processes.</p> <p>Understand DFA principles to apply for analysis of assemblies</p> <p>Apply the concept of quality and reliability for design and manufacturing</p>
TY	PR3036::ADDITIVE MANUFACTURING TECHNIQUES	<p>Understand various additive manufacturing processes for different applications</p> <p>Use correct CAD file formats in 3D printed parts manufacturing</p> <p>Select appropriate 3D printing parameters considering shape features, part quality and printer specifications</p> <p>Apply AM concepts for Bio medical and medical fields</p> <p>Perform reverse engineering steps to prepare virtual model</p> <p>Operate 3D printer machine to manufacture desired 3D objects</p>
TY	PR3037::MODERN MANUFACTURING PROCESSES	<p>Understand need of advanced machining processes and select process for any industrial job based on its complexity, cost and specifications required.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>Apply the working principles and processing characteristics of chemical type advanced machining process for production of precision components</p>



TY	PR3038:: METAL CUTTING & TOOL DESIGN	<p>Understand and represent cutting tools using designation systems</p> <p>Apply metal cutting theories to estimate and represent cutting forces</p> <p>Analyze cutting environment and cutting parameters</p> <p>Understand design principles of location, clamping for jigs and fixtures</p> <p>Design and draw jigs and fixtures by following design principles</p> <p>Design and draw single and multi-point cutting tools</p>
TY	PR3039::MANUFACTURING AUTOMATION	<ol style="list-style-type: none"> 1. Understand transfer line technology 2. Able to classify jobs according to group technology 3. Study various elements and applications of industrial robots 4. Understand concepts FMS 5. Understand and Analyze performance of automated conveyance and inspection systems 6. Understand principles of automated assembly systems
TY	PR3040::MACHINE TOOL DESIGN	<p>Design stepped speed gear boxes.</p> <p>Design spindles using minimum deflection criterion</p> <p>Design suitable bearings for spindle supports.</p> <p>Analyze and design various machine tool structure using principle of free body diagram and using minimum deflection design criterion</p> <p>Design sliding and rolling friction guideways</p> <p>Design sliding and rolling friction power screws</p>
TY	PR3041::INDUSTRIAL FLUID POWER	<p>Understand fundamentals of fluids</p> <p>Select appropriate pumps, for hydraulic systems</p> <p>Select appropriate motors, cylinders for hydraulic systems.</p> <p>Understand and select different types of hydraulic valves</p> <p>Construct and evaluate hydraulic circuits for various industrial applications such as machine tools, automobile, agricultural equipment</p> <p>Apply principles of pneumatic systems for automation systems</p>
TY	PR3042::STATISTICAL METHODS & RESEARCH METHODOLOGY	<ol style="list-style-type: none"> 1. Explain the nature of research and data requirements 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
TY	PR3043::PROJECT MANAGEMENT	<p>Learn the basic concepts of project and project management</p>



		<p>Ascertain the feasibility of small and medium projects with respect to managerial, marketing, operational, financial and socio-economic perspectives</p> <p>Plan and schedule small and medium projects to achieve the triple constraint of time, cost and quality using software package</p> <p>Understand the concept of earned value management system and critical chain in managing projects</p> <p>Monitor the progress of projects to determine variances and recommend corrective actions using software package</p>
B Tech	PR4001::PROCESS ENGINEERING	<p>Perform preliminary part print analysis of part</p> <p>Understand concepts of geometric dimensioning and tolerancing in product engineering</p> <p>Classify operations and achieve work piece control for manufacturing of industrial products</p> <p>Manage equipment, tools, gauges, manpower and time economically, required for manufacture of industrial products</p> <p>Select and plan process for manufacturing of industrial products cost effectively</p> <p>Design process sheet for machined component</p>
B Tech	PR4003::DIE & MOULD Design	<p>understand mechanism of shearing of sheet metals, elements of dies and equipment.</p> <p>select and design appropriate die set and equipment for shearing operations of sheet metal.</p> <p>understand principles of sheet metal forming and design of tools for deep drawing and bending operations.</p> <p>apply principals of forging operations and design dies for closed die and upset forging.</p> <p>understand different plastic processing techniques and equipment.</p> <p>design elements of injection molding dies and understand working of injection machine</p>
B Tech	PR4006::MODERN MANUFACTURING PROCESSES	<p>Understand need of advanced machining processes and select process for any industrial job based on its complexity, cost and specifications required.</p> <p>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.</p> <p>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.</p>



		<p>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.</p> <p>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.</p> <p>Apply the working principles and processing characteristics of chemical type advanced machining process for production of precision components</p>
B Tech	PR4074::MAJOR PROJECT	<p>Survey literature for problem identification</p> <p>Cultivate the habit of working in a team, communicate effectively and attempt a problem solution in a right approach</p> <p>Correlate the theoretical and experimental/simulations results and draw the proper inferences.</p> <p>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.</p> <p>To practice data collection and analysis using different measurement equipment's and software packages.</p> <p>Prepare project report as per guideline and present it effectively</p>
B Tech	PR4002::SUPPLY CHAIN ANALYSIS & MODELING	<ol style="list-style-type: none"> 3. Identify the key elements and processes in a supply chain and their interaction 4. Understand and analyze the designing, planning and operational decisions of SCM. 5. Identify the techniques used in management of critical components of supply chain 6. Analyze, design and optimize supply chain networks for manufacturing organizations 7. Design and optimize inventories across the supply chain 8. Explain the likely future development of logistics and supply chain management
B Tech	PR4004::FINANCIAL MANAGEMENT AND MANAGEMENT ACCOUNTING	<ol style="list-style-type: none"> 1. Understand and analyze functions of financial management and budgeting, interpret financial statements through accounting ratios 2. Understand the concepts of Capital Budgeting and Working Capital management for effective financial management 3. Understand the mechanics of financial accounting for preparation of financial statements to ascertain the performance and financial position of a business 4. Classify and apply different types of costs and overheads to ascertain costs of a product or a process



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



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



Year	Course Code	Course Name	CO Statements
SY	ME2052	Kinematics And Mechanisms	<p>Understand fundamentals of kinematics of mechanisms and machines.</p> <p>Do position, velocity, and acceleration analysis of planar mechanisms.</p> <p>Take kinematic analysis of geared systems for a particular application</p> <p>Design the kinematic profile of a cam to achieve a desired follower motion</p> <p>Design, simulate and develop the mechanisms in realistic application</p>
	ME2055	Strength Of Machine Elements	<p>Evaluate stresses under various loading conditions.</p> <p>Draw shear force and bending moment diagrams under various loading conditions.</p> <p>Evaluate principal stresses for plane stress problems.</p> <p>Analyze long and short columns subjected to axial loads.</p> <p>Determine slope and deflection for the given beam.</p> <p>Analyze stresses in shaft, spring, threaded & welded joints & cylinders subjected to internal pressure.</p>
	ME2157	Thermodynamics	<p>The students will be able to apply energy balance to systems and control volumes, in situations involving heat and work interactions</p> <p>Students can evaluate changes in thermodynamic properties of substances</p> <p>The students will be able to evaluate the performance of energy conversion devices</p> <p>The students will be able to differentiate between high grade and low grade energies.</p> <p>After completing this course, the students will get a good understanding of various practical power cycles and heat pump cycles</p>
	ME2059	Ordinary Differential Equations And Transform Techniques	<p>Model simple physical system</p> <p>Solve ordinary linear differential equations</p> <p>Interpret the solution of system of differential equation</p> <p>Find Laplace transform for a variety of functions</p> <p>Acquire the knowledge of Fourier series</p> <p>Apply Fourier transforms to get integral representation of the functions.</p>
	ME2091	Engineering Design And Development 1	<p>Apply critical and creative thinking in the design of engineering projects</p> <p>Plan and manage your time effectively as a team</p>



			<p>Apply knowledge of the 'real world' situations that a professional engineer can encounter</p> <p>Use fundamental knowledge and skills in engineering and apply it effectively on a pro</p> <p>Design and develop a functional product prototype while working in a team</p> <p>Present and demonstrate your product to peers, academics, general and industry community</p>
ME2053	Material Science		<p>Identify crystal structures, write miller indices of planes and directions and understand the defects in such structures</p> <p>Understand how to tailor material properties of ferrous and non-ferrous alloys</p> <p>Suggest suitable heat treatments for mechanical components.</p> <p>Suggest various corrosion prevention methods for variety of mechanical components</p>
ME2054	Manufacturing Processes		<p>Suggest suitable casting process for various components</p> <p>Calculate optimum material requirement for any sheet metal products and will be able to suggest mechanical working processes for various components</p> <p>Suggest suitable welding processes for various components</p> <p>Understand various non-conventional machining processes.</p>
ME2056	Machine Design		<p>Design lifting devices like Screw jack & clamping devices like C-Clamp</p> <p>Decide Power transmission system for a particular application</p> <p>Design drive train such as Belt, Rope, Chain drive</p> <p>Derive the design specifications for clutch & brake based on principle of uniform wear and pressure theory</p> <p>Select the material and derive the design specifications for Spur, Helical, Bevel gear & worm Gear</p> <p>Select the standard components like bearings, belts and chains from the manufacturer's catalog</p>
ME2058	Heat Transfer		<p>Students will be able to mathematically formulate and analyze heat transfer system by Conduction mode.</p> <p>Students will be able to apply the conduction heat transfer knowledge for composite systems with heat generation.</p> <p>Students will be able to apply the knowledge of unsteady state heat transfer and concept of fins to analyze the thermal systems.</p> <p>Students will be able to apply the knowledge of fluid flow and convection heat transfer to analyze the thermal system</p> <p>Students will be able to perform thermal design of various heat exchangers.</p> <p>Students will be able to analyze radiative heat transfer system.</p>
ME2060	Partial Differential Equations And Numerical Techniques		<p>write program for Gauss Seidel method with 8 equations in 8 unknowns</p> <p>Write program for Crank-Nicolson Method</p> <p>Write program for the explicit method</p>



	ME2092	Engineering Design And Development 2	<p>Apply critical and creative thinking in the design of engineering projects</p> <p>Plan and manage your time effectively as a team</p> <p>Apply knowledge of the 'real world' situations that a professional engineer can encounter</p> <p>Use fundamental knowledge and skills in engineering and apply it effectively on a project</p> <p>Design and develop a functional product prototype while working in a team</p> <p>Present and demonstrate your product to peers, academics, general and industry community</p>
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Year	Course Code	Course Name	CO Statements
TY	ME3153	Fluid Machinery and Fluid Power	1. Understand the principle, operation and design of impulse turbine.(CO Attainment level 2) 2. Understand the principle, operation and design of reaction turbines.(5) 3. Understand the principle, operation and design of centrifugal pump.(4) 4. Understand the functions of fluid power components.(3) 5. Understand the functions of hydraulic pumps and control valves.(4) 6. Analyze industrial fluid power systems and circuits(1)
	ME3061	Industrial Fluid Power	1. Understand the principle, operation and design of impulse turbine.(CO Attainment level 2) 2. Understand the principle, operation and design of reaction turbines.(5) 3. Understand the principle, operation and design of centrifugal pump.(4) 4. Understand the functions of fluid power components.(3) 5. Understand the functions of hydraulic pumps and control valves.(4) 6. Analyze industrial fluid power systems and circuits(1)
	ME3062	Dynamics of Machines	1. Design & analysis of gear train system for a particular application 2. Analyze various forces and torques acting on Mechanical component like Flywheels, 3. Understand the gyroscopic couple and its effect on ships, aero plane and vehicles. 4. Design & analyze the dynamic balancing of machines. 5. Develop the mathematical model of single degree vibratory system and perform free vibration analysis. 6. Develop the mathematical model of single degree vibratory system and perform force vibration analysis.



ME3156	Theory of Transmission Systems	<p>1. Kinematic synthesise planer mechanisms such as four bar mechanisms and its inversions by Algebraic/ Graphic methods.</p> <p>2. Design & analysis of gear train system for a particular application</p> <p>3. Design the profile of a cam to achieve a desired follower motion</p> <p>4. Analyze various forces and torques acting on Mechanical component like Flywheels, Governors, cams, gears and gear trains etc.</p> <p>5. Analyze centrifugal governor and find its coefficient of insensitiveness and stability.</p>
ME3155	I.C. Engines and Hybrid Vehicles	<p>Do analysis of engine cycles for air standard, fuel-air and real conditions.</p> <p>Demonstrate and compare engine fuel supply systems and modern trends in the engines.</p> <p>Apply internal combustion engine combustion fundamentals to interpret engine performance.</p> <p>Do analysis of engine performance parameters.</p> <p>Demonstrate knowledge about the fundamentals of hybrid vehicles.</p> <p>Demonstrate knowledge about the drive train and energy savings potential of hybrid vehicles.</p>
ME3063	Hybrid and Electric Vehicles	<p>Do analysis of engine cycles for air standard, fuel-air and real conditions.</p> <p>Demonstrate and compare engine fuel supply systems and modern trends in the engines.</p> <p>Demonstrate the and analyze electric vehicle configurations</p> <p>Do analysis of engine performance parameters.</p> <p>Demonstrate the and analyze hybrid electric vehicle configurations</p> <p>Demonstrate knowledge about electric propulsion systems and energy storage systems of the Electric and hybrid electric vehicles</p>
ME3064	Modeling & Simulation of Mechanical Systems*	<p>model an industrial problem</p> <p>solve the modelled problem numerically</p> <p>simulate industrial problems and obtain solution</p> <p>4} analyse and interpret the solutions obtained</p>
ME3065	Computer Aided Modeling and Drafting*	<p>Create, read/interpret and modify 3D models, assemblies and 2D drafting of various machine components and assemblies, Provide dimensions, tolerances and other annotations on the drawings of the components by 3D modeling software like CATIA.</p>



			<p>Develop new and utilize existing symbol libraries of standard components.</p> <p>Understand and apply limits, fits, tolerances and surface finish on the existing and new drawings, as per standards.</p> <p>Measure dimensions of components and make production drawings for the same.</p> <p>Read and understand the production drawings of mechanical components and assemblies.</p> <p>Visualize geometrical solids in 3D space through exercise in orthographic projections interpret orthographic, isometric and perspective views of objects</p>
	ME3093	Engineering Design & Innovation 1*	<p>1) Apply critical and creative thinking in the design of engineering projects (4)</p> <p>2) Plan and manage your time effectively as a team (3)</p> <p>3) Apply knowledge of the 'real world' situations that a professional engineer can encounter (3)</p> <p>4) Use fundamental knowledge and skills in engineering and apply it effectively on a project (4)</p> <p>5) Design and develop a functional product prototype while working in a team (5)</p> <p>6) Present and demonstrate your product to peers, academics, general and industry community(4)</p>
	ME3066	Thermal Engineering	<p>Illustrate the fundamental principles of entropy</p> <p>Illustrate the fundamental principles and applications of refrigeration and air conditioning system</p> <p>Understand performance parameters of IC engines</p> <p>Analyze the performance of Steam Turbines.</p> <p>Analyze the performance of Gas Turbines</p> <p>Obtain performance parameters of air compressors</p>
	ME3067	Advanced Thermodynamics	<p>Apply energy balance to complex systems and control volumes.</p> <p>Obtain performance parameters of air compressors</p> <p>Illustrate the fundamental principles and applications of refrigeration system</p> <p>Illustrate the fundamental principles and applications of air conditioning system</p> <p>Analyze the performance of Steam Turbines.</p>
	ME3068	Metrology and Quality Control	<p>1. Students will be able to carry out measurements with different measuring instruments</p> <p>Students will be able to calibrate measuring instruments like Pressure gauge, Dial gauge and thermocouples.</p> <p>3. Students will be able to carry out measurements of existing components and parts.</p> <p>4. Students will be able to design measurement processes for quality control</p>
	ME3069	Applied Metrology &	<p>1. Students will be able to carry out measurements with different measuring instruments</p>



		Quality Management Systems	Students will be able to calibrate measuring instruments like Pressure gauge, Dial gauge and thermocouples. 3. Students will be able to carry out measurements of existing components and parts. 4. Students will be able to design measurement processes for measuring various process parameters.
	ME3054	Mechatronics	Select the instruments to measure and control mechanical parameters based on the characteristics.(2) Model basic engineering systems and use it for implementing control.(4) Apply knowledge of mathematics, science and engineering to model and solve various engineering systems.(5) Use appropriate signal conditioning method to satisfy needs of the mechatronic system.(4) Implement control using various embedded systems for given application.(3) Carry out ladder programming for given application of PLC in engineering industry.(5)
	ME3070	Electrical Drives and Controls	Illustrate elements, functioning, types and influencing factors of electric drives Illustrate principle, classification, characteristics and starting of electric motors Model mechanical system of electric drives Implement suitable control action for electric drives Devise control system for electric drives using microprocessor Evaluate requirements of electric drives for various practical applications.
	ME3076	Mechanical System Design**	Design as per IS code the Mechanical components like Worm gears, Unfired Pressure vessels, and Machine Tool Gearboxes. Design mechanical systems like pressure vessels. Design material handling system like belt conveyor Use statistical considerations in design and optimize the design for mechanical elements like shaft, gear, and spring. Design Mechanical systems like IC Engine and its components. Apply DFMA, Aesthetics and Ergonomics principles in designing engineering component or product
	ME3059	Engineering Design for Off-Road Vehicles**	Understand off-highway industry and its product applications Convert customer requirements to design specifications Consider industry applicable standards Carry out design and analysis in structural and hydraulic domains Understand material selection process Implement appropriate six sigma tools and techniques for robust design



			<p>Apply systems thinking in designing components</p> <p>Understand the manufacturing processes that impacts the designs</p> <p>Conduct simple root cause analysis</p> <p>Understand various tests for designs to qualify</p>
	ME3094	Engineering Design & Innovation 2**	<p>1) Apply critical and creative thinking in the design of engineering projects (4)</p> <p>2) Plan and manage your time effectively as a team (3)</p> <p>3) Apply knowledge of the ‘real world’ situations that a professional engineer can encounter (3)</p> <p>4) Use fundamental knowledge and skills in engineering and apply it effectively on a project (4)</p> <p>5) Design and develop a functional product prototype while working in a team (5)</p> <p>6) Present and demonstrate your product to peers, academics, general and industry community(4)</p>

Year	Course Code	Course Name	CO Statements
B.Tech.	ME4051	CAD/CAM/CAE	<p>Use the underlying algorithms, mathematical concepts, supporting computer graphics. These include but are not limited to: Composite2D & 3D homogeneous matrices for translation, rotation, and scaling transformations.</p> <p>Use and demonstrate fundamental knowledge of CAD/CAM.</p> <p>Understand the basic theory behind the finite element method.</p> <p>Use the finite element method for the solution of practical engineering problems.</p> <p>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.</p> <p>Understand Rapid prototyping Technique</p>
	ME4052	Design Of Mechanical Systems	<p>Design as per IS code the Mechanical components like Worm gears, Unfired Pressure vessels, and Machine Tool Gearboxes.</p> <p>Design mechanical systems like pressure vessels.</p> <p>Design material handling system like belt conveyor</p> <p>Use statistical considerations in design and optimize the design for mechanical elements like shaft, gear, and spring.</p> <p>Design Mechanical systems like IC Engine and its components.</p> <p>Apply DFMA, Aesthetics and Ergonomics principles in designing engineering component or product.</p>



	ME4053	Vibration Analysis	<p>Demonstrate the problem solving ability related to balancing of rotor system, multi-cylinder in-line engine and radial engine.</p> <p>Demonstrate the gyroscopic couple and predict its effect related to planes, ships and automobiles.</p> <p>Develop the mathematical model of vibration system and perform free and force vibration analysis.</p> <p>Select the instruments for a vibration measurement and analyze the measured data.</p>
	ME4054	Refrigeration And Air Conditioning	<p>analyze vapour compression and vapour absorption refrigeration system</p> <p>select suitable components for vapor compression system application and compatible eco-friendly refrigerant based on international protocols and execute experimental analysis</p> <p>analyze psychrometric processes and apply for air conditioning and perform their experimental analysis</p> <p>Describe different Air conditioning systems applied for human comfort and industry and correlate the concepts with industrial applications.</p>
	ME4055	Major Project- I	<p>Define/Develop/Select methodology for executing the project work</p> <p>Apply theoretical concepts for solving the project problem, Decide and apply the manufacturing techniques and instrumentation</p> <p>To develop the procurement skills</p> <p>To assemble and demonstrate the working model</p> <p>To develop skills of technical report writing and presentation</p>
	ME4074	Summer Internship	<p>correlate the theoretical and practical concepts</p> <p>understand working of organizations and management</p> <p>demonstrate verbal, written and graphical communication skills.</p> <p>undertake technical discussions.</p>
	ME4071	Semester Internship	<p>correlate the theoretical and practical concepts</p> <p>understand working of organizations and management</p> <p>demonstrate verbal, written and graphical communication skills.</p> <p>undertake technical discussions</p>
	ME4072	Global Internship	<p>correlate the theoretical and practical concepts</p> <p>understand working of organizations and management</p> <p>demonstrate verbal, written and graphical communication skills.</p> <p>undertake technical discussions</p>
	ME4073	Research Internship	<p>correlate the theoretical and practical concepts</p> <p>understand working of organizations and management</p> <p>demonstrate verbal, written and graphical communication skills.</p> <p>undertake technical discussions</p>



	ME4058	NonConventional Energy Sources	<p>Compare different non-conventional sources of energy</p> <p>Compute efficiency of solar energy collectors</p> <p>Explain different ocean energy conversion systems</p> <p>Evaluate performance of wind energy conversion system</p> <p>Illustrate applications of biomass energy and fuel cell technology</p> <p>Describe Geothermal and Magneto-hydrodynamic (MHD) power generation systems</p>
	ME4059	Automobile Engineering	<p>Describe construction, working and other details of Internal Combustion Engines and Clutches</p> <p>Demonstrate knowledge about construction, working and other details of different Gearboxes</p> <p>Understand and explain about construction, working and other details of Steering system, Wheels and Tyres</p> <p>Demonstrate knowledge about construction, working, and other details of Propeller</p> <p>Shaft, Universal joints, Differential and Rear Axle</p> <p>Describe construction, working and other details of Suspension System</p> <p>Describe construction, working and other details of Braking System and Automotive electrical components/system</p>
	ME4060	Hybrid Electric Vehicles- Performance & Environment Impact	<p>Demonstrate general overview of the need for hybrid-electric vehicles for transportation</p> <p>Demonstrate overall fuel consumption and environmental improvement possible using HEVs.</p> <p>Demonstrate various architectures of HEVs.</p> <p>Demonstrate the vehicle dynamics related analysis</p> <p>Energy calculations for hybrid vehicles</p> <p>Sizing calculations for hybrid vehicles</p>
	ME4061	Power Plant Engineering	<p>Compare different power plants, their present status and recent trends.</p> <p>Do Mathematical analysis of Improved Rankine cycle and condenser</p> <p>Compare different high pressure boilers and do the analysis of nozzle</p> <p>Demonstrate essential and supplementary Power plant components</p> <p>Perform Testing of thermal power plant and data analysis to draw conclusions</p> <p>Perform analysis for power plant economics.</p>
	ME4062	Robotics	<p>Solve the manipulator transformations with knowledge of robotic system components and matrix algebra.</p> <p>Solve robot forward and inverse kinematic problems.</p> <p>Carry out trajectory planning and joint modeling for the simple robotic system.</p> <p>carry out velocity analysis and dynamic modeling for a manipulator</p>



			<p>identify appropriate end effectors and sensors for particular application.</p> <p>execute various steps in robot design and robot programming</p>
	ME4063	Finite Element Method	<p>Use different weighted residual methods and variational method to obtain preliminary approximate solution to a governing differential equation of a system.</p> <p>formulate and solve mechanical system involving 1D elements.</p> <p>transform systems in different coordinate systems and use Iso-parametric property to solve different problems involving triangular elements.</p> <p>formulate and solve mechanical system involving two degrees of freedom.</p> <p>explain background working of and solve engineering problems using commercial FEA code like ANSYS, NASTRAN, MATLAB etc.</p> <p>find response of the system as a function of time given the external disturbances using finite element method</p>
	ME4064	Optimization Techniques & Operation Research	<p>The student will be able to understand and use the single variable optimization algorithm to solve different problems</p> <p>The student will be able to select appropriate algorithm and implement it for multi-variable and constrained optimization problems.</p> <p>The student will be able to use mathematical software for the solution of engineering problems with conventional and evolutionary algorithms.</p> <p>The student will be able to formulate linear programming problem and apply different linear programming methods to solve it.</p> <p>The student will be able to formulate transportation and assignment problem</p> <p>The student will be able to formulate managerial decision problems for inventory model, game theory problem and queuing theory problem</p>
	ME4065	Industrial Fluid Power	<p>Illustrate the selection of components hydraulic systems.</p> <p>Evaluate the performance of hydraulic pumps..</p> <p>Analyze the performance of hydraulic control valves and develop simple hydraulic circuits.</p> <p>Evaluate the performance and applications of hydraulic actuators.</p> <p>Understand the components of pneumatic systems and develop simple pneumatic circuits.</p> <p>Design simple hydraulic and pneumatic systems based on applications.</p>
	ME4066	Tribology	<p>Perform analysis of hydrodynamic thrust bearing.</p> <p>Design the hydrodynamic journal bearing based on theoretical and practical considerations.</p>



Bansilal Ramnath Agarwal Charitable Trust's
VISHWAKARMA INSTITUTE OF TECHNOLOGY – PUNE
 (An autonomous Institute affiliated to University of Pune)
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			<p>Demonstrate knowledge about various modes of lubrication and its analysis.</p> <p>Demonstrate knowledge about laws / theories of friction and wear</p>
	ME4067	Dynamic – Kinematics	<p>Know common heat exchanger types, their advantages, limitations and applications</p> <p>Understand use and significance of heat transfer and pressure loss for flow configurations</p> <p>Apply thermal design of heat exchanger and fouling considerations</p> <p>Know how to incorporate Mechanical design and awareness of TEMA standards in designing heat exchanger</p> <p>Understand design and selection aspect of cooling towers and condensers</p> <p>Understand the concepts of modeling and simulation used for optimization of heat exchangers</p>
	ME4068	Heat Exchange Devices	<p>obtain input/output specific work/power from turbomachines</p> <p>apply scaling laws</p> <p>design and analyse centrifugal machines</p> <p>analyse axial machines</p> <p>design hydro turbines and analyse gas and wind turbines</p>
	ME4069	Turbomachines	<p>Define/Develop/Select methodology for executing the project work</p> <p>Apply theoretical concepts for solving the project problem, Decide and apply the manufacturing techniques and instrumentation</p> <p>To develop the procurement skills</p> <p>To assemble and demonstrate the working model</p> <p>To develop skills of technical report writing and presentation</p>
	ME4080	Computational Fluid Dynamics	<p>Model flows encountered in various applications</p> <p>Simulate industrial flows</p> <p>Understand the algorithms used in CFD solvers</p> <p>4} Develop algorithms for simple cases</p>



Department of Mechanical Engineering (M.Tech. Design)

Course Outcomes

Year	Course Code	Course Name	CO Statements
M.Tech Design	ME505 1	Mathematical Methods In Engineering	<ol style="list-style-type: none">1. Model and solve linear/nonlinear systems2. solve system of ODEs3. Solve elliptic, parabolic and hyperbolic PDEs
	ME505 2	Advanced Stress Analysis	<ol style="list-style-type: none">1. Students will be able to apply the mechanics of materials methods to engineering problems to understand structural responses to various loading conditions.2. Students will be able to calculate stresses in components of noncircular cross section subjected to unsymmetrical bending and torsional loading.3. Students will be able to calculate of shear stress in thin walled sections subjected to torsion and determine shear center.4. Students will be able to calculate stresses and strains associated with thick wall cylindrical pressure vessels & rotating disks.5. Students will be able to compute contact stresses and deflections for mechanical elements like gear, cam & bearings.6. 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 style="list-style-type: none">1. Develop the mathematical model of single / multi - degrees of freedom system and formulate the equation of motion2. Perform the free / forced vibration analysis using numerical techniques.3. Classify the acoustic sources and apply various noise control techniques i.e. selection of sound absorbing, barrier material, e.t.c. .4. Select the instruments for a Noise and Vibration measurement and analyse the measured data.
	ME505 4	Advanced Machine Design	<ol style="list-style-type: none">1. Analyze basic design critically for further improvements2. Formulate and solve design problems of mechanical systems related to gear profile and cam dynamics.3. Design and optimization of mechanical components to meet desired engineering requirements including



			<p>strength, dynamics and life under different conditions such as fatigue, fracture and creep</p> <ol style="list-style-type: none"> 4. Apply knowledge of statistical techniques to mechanical design problems 5. Use modern engineering tools in the analysis and design of machine components
	ME509 1	Engineering Design And Development 1	<ol style="list-style-type: none"> 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 professional engineer can encounter 4. Use fundamental knowledge and skills in engineering 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
	ME505 5	Analysis And Synthesis Of Mechanism	<ol style="list-style-type: none"> 1. Understand construction and design parameters of mechanisms 2. Analyze the simple and complex mechanisms for kinematics & dynamics 3. Analyze mechanisms for their performance in terms of 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 6	Computer Aided Engineering	
	ME505 7	Optimization Technique	<ol style="list-style-type: none"> 1. The student will be able to formulate linear programming problem and apply different linear programming methods to solve it. 2. The student will be able to understand and use the single variable optimization algorithm to solve different problems 3. The student will be able to select appropriate algorithm and implement it for multi-variable problems. 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.



	ME505 8	Industrial Tribology	<ol style="list-style-type: none"> 1. Demonstrate the principles and applications of various modes of lubrication. 2. Develop the mathematical model of lubrication problem 3. Solve lubrication problem 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 style="list-style-type: none"> 1. Students will be able to choose composite materials as competing material to traditional materials. 2. Students will be able to analyze and interpret stiffness and strength properties of composite lamina. 3. Students will be able to analyze and interpret stiffness and strength properties of composite laminates. 4. Students will understand mechanical properties determined from experiments and their utilization in composite analysis. 5. Students will be able to design elementary level representative machine components or structures made of composite materials.
	ME506 0	Vehicle Dynamics	<ol style="list-style-type: none"> 1. Students will be able to understand dynamics and performance parameters of the components related to the vehicle handling. 2. Students will be able to analyze vehicle performance criteria 3. Students will be able to understand vehicle models and analyze dynamic response of the vehicle. 4. Students will be able to understand dynamics of steering mechanism 5. Students will be able to understand dynamics of suspension
	ME506 1	Advance Manufacturing Methods	<ol style="list-style-type: none"> 1. Understand need of advanced machining processes and select process for any industrial 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 and Develop experimental, regression based, mathematical and physics based models for the



			<p>advanced machining processes and predict MRR and surface roughness.</p> <ol style="list-style-type: none"> 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
	ME506 2	Robotics	
	ME506 3	Process Equipment Design	<ol style="list-style-type: none"> 1. Students will have understanding of several design codes used in the design. 2. 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. 3. Students will have understanding of design and analysis of vessels and tanks 4. 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. 5. Students will be able to complete detailed designs of several process equipment's. 6. Students will be able to understand the concept of planning, manufacturing, inspection and erection of process equipment's
	ME509 2	Engineering Design And Development 2	<ol style="list-style-type: none"> 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 professional engineer can encounter 4. Use fundamental knowledge and skills in engineering 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



	ME605 1	Dissertation by Internship-1	<ol style="list-style-type: none"> 1. Student should identify problem and decide scope of his work. 2. Student should complete literature review for writing the report. 3. Students will be able to correlate the theoretical and practical concepts 4. Students will be able to understand various processes of product developments and services 5. Students will be able to understand industrial works and management 6. Students will be able to demonstrate verbal, written and graphical communication skills. 7. Students will be able to undertake technical discussions.
	ME605 3	Dissertation by Internship-1	<ol style="list-style-type: none"> 1. Student will be able to identify problem and decide scope of his work. 2. Student will be able to do literature review for his work. 3. Students will be able to correlate the theoretical, practical and research concepts 4. Students will be able to understand various steps on research and development 5. Students will be able to understand research processes 6. Students will be able to demonstrate verbal, written and graphical communication skills. 7. Students will be able to undertake technical discussions.
	ME605 2	Dissertation by Internship-2	<ol style="list-style-type: none"> 1. Students will be able to correlate the theoretical and practical concepts 2. Students will be able to understand various processes of product developments and services 3. Students will be able to understand industrial works and management 4. Students will be able to demonstrate verbal, written and graphical communication skills. 5. Students will be able to undertake technical discussions. 6. Report with technical conclusions based on simulation and or experimental results
	ME605 4	Dissertation by Research-2	<ol style="list-style-type: none"> 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 levels, from advancing their course materials, professional development, to funded research projects to advance the state of practice



Department of Mechanical Engineering

(M.Tech. Heat Power)

Course Outcomes

Year	Course Code	Course Name	CO Statements
M.Tech. Heat Power	ME5051	Mathematical Methods in Engineering	<ol style="list-style-type: none">1. model and solve linear/nonlinear systems2. solve system of ODEs3. Solve elliptic, parabolic and hyperbolic PDEs
	ME5071	Advanced Thermodynamics	<ol style="list-style-type: none">1. Do a thermodynamic analysis of SF systems using the concepts of entropy, available and unavailable energy2. Understand relationships between various thermodynamic properties of pure substances and P-V-T surfaces3. Derive the enthalpy entropy and internal energy correlations using Maxwell and Clayperon equations4. Solve the Gas mixture problems using the properties of gases specified in the mixture5. Understand combustion reactions, enthalpy of formation, Gibbs function of formation and absolute entropy6. Understand various models used in statistical thermodynamics and the third law of thermodynamics
	ME5072	Advanced Fluid Mechanics and CFD	<ol style="list-style-type: none">1. Apply conservation equations to various flow systems2. Model and analyze industrial flows
	ME5073	Advanced Heat Transfer and CFD	<ol style="list-style-type: none">1. Understand the basic equations and applications of 2-d heat conduction problems.2. Perform the analysis of fins and the unsteady state problems.3. Analyze the systems with internal and external convection heat transfer.4. Analyze the system of radiation heat transfer.5. Apply the heat transfer knowledge for heat exchanger applications.6. Understand the basic principles of boiling and condensation.
	ME5093	Engineering Design And Development 1	<ol style="list-style-type: none">1. Apply critical and creative thinking in the design of engineering projects2. Plan and manage your time effectively as a team3. Apply knowledge of the 'real world' situations that a professional engineer can encounter4. Use fundamental knowledge and skills in engineering and apply it effectively on a project



			<ol style="list-style-type: none"> 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
	ME5074	Advanced Applied Thermal Engineering	<ol style="list-style-type: none"> 1. Perform Analysis for performance, combustion and emission characteristics of Engine 2. Students must develop skill to understand engine based on environment pollution and methods to control the same. 3. Demonstrate modern techniques of engine management and electronic injection system and the Latest Trends in the Engine Technology 4. Analyse multistage vapour compression refrigeration cycle 5. Compare various refrigerants and evaluate the performance of multistage vapour absorption refrigeration system 6. Estimate refrigeration load and design a refrigeration system for an application
	ME5075	Heating Ventilation Air Conditioning	<ol style="list-style-type: none"> 1. Apply the concepts of psychrometry to air-conditioning systems 2. Estimate the air-conditioning load required to design an air-conditioning system 3. Design an air distribution system for air-conditioning application 4. Select appropriate system components for an air-conditioning system 5. Design an evaporative cooling system 6. Compare different air-conditioning systems
	ME5057	Optimization Technique	<ol style="list-style-type: none"> 1. The student will be able to formulate linear programming problem and apply different linear programming methods to solve it. 2. The student will be able to understand and use the single variable optimization algorithm to solve different problems 3. The student will be able to select appropriate algorithm and implement it for multi-variable problems. 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.



	ME5077	Advanced Measurement & Data Analysis	<ol style="list-style-type: none"> 1. Students will be able to do mathematical analysis for the dynamic characteristics of the instruments. 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 derived quantities 5. Students will be having the knowledge of analytical methods of advanced measurements 6. Students will be able to perform analysis for various controllers
	ME5078	Energy Conservation and Management	<ol style="list-style-type: none"> 1. Students should be able to understand 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 3. Students should be able to find performance assessment of Thermal and Electrical utilities 4. Students should be able to understand energy conservation in HVAC systems 5. Students should be able to understand energy conservation in electrical and compressed air systems 6. Students should be able to find energy performance of process equipment like Furnaces, Heat exchangers and methods to improve it.
	ME5056	Computer Aided Engineering	
	ME5076	IC Engines Fuels and Combustion	<ol style="list-style-type: none"> 1. Understand details of characteristics of fuel used in engine in detail as it affect the design, efficiency and performance of engine and also developments in alternative fuels. 2. Understand theory of combustion, flame propagation and various factors affecting the SI Engine. 3. Understand theory of combustion, delay period and various factors affecting the CI Engine. 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 conditions. 6. Understand recent research developments in the field of engine emissions and scavenging techniques.



	ME5079	Design of Heat Exchangers	<ol style="list-style-type: none"> 1. Know common heat exchanger types, their advantages, limitations and applications 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
	ME5080	Advanced Turbomachines	<ol style="list-style-type: none"> 1. Obtain input/output specific work/power from turbomachines 2. apply scaling laws 3. design and analyse centrifugal machines 4. analyse axial machines 5. design hydro turbines and analyse gas and wind turbines
	ME5094	Engineering Design And Development 2	<ol style="list-style-type: none"> 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 professional engineer can encounter 4. Use fundamental knowledge and skills in engineering 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
	ME6055	Dissertation by internship-1	<ol style="list-style-type: none"> 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 work. 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
	ME6057	Dissertation by research-1	<ol style="list-style-type: none"> 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 levels, from advancing their course materials, professional development, to funded research projects to advance the state of practice.



			<ol style="list-style-type: none">3. Students are able to develop their own writing and presentation skills.
	ME6056	Dissertation by internship-2	<ol style="list-style-type: none">1. Students will be able to formulate different solutions 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
	ME5058	Dissertation by research-2	<ol style="list-style-type: none">1. Students are able to develop research skills like literature survey and data analysis2. 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.3. Students are able to develop their own writing and presentation skills.



Department of Engineering Sciences & Humanities

(FY-Common)

Course Outcomes

Sr. No.	Course Code	Course Name	CO No.	CO Statement
1	ES1001	Calculus	CO 1	Recognize and identify Taylor series, infinite series and curves in plane.
			CO 2	Demonstrate the knowledge of partial derivative, chain rules, implicit functions, and extreme values of function of several variables.
			CO 3	Evaluate double integral.
			CO 4	Apply triple integral for engineering applications.
			CO 5	Interpret the properties of vector differentiation.
			CO 6	Use Gauss divergence and Stokes's theorem.
2	ES1004	Linear Algebra	CO 1	Set up, solve and interpret linear systems.
			CO 2	Acquire the knowledge of vector spaces.
			CO 3	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.
			CO 4	Compute and apply the knowledge of eigenvalues and eigenvectors.
			CO 5	Demonstrate linear transformations geometrically.
			CO 6	Analyse and interpret probability distribution.
3	ES1023	Robot Mechanics and Control	CO 1	Identify different mechanical, electrical and electronics components and their applications in Robotics.
			CO 2	Apply concepts of Torque and Speed to different types of electric motors.
			CO 3	Identify different electronics components and understand their use in different circuits related to Robotics.
			CO 4	Understand the significance and make basic calculations based on mechanics, kinematics and dynamics.
4	ES1024	Mechatronics and Robotics	CO 1	Identify different sensors related to Robotics and select a sensor as per the requirement.
			CO 2	Understand the internal configuration and program a use microcontroller.
			CO 3	Interface different peripherals to a microcontroller and control the same.
			CO 4	Communicate and control a Robot by using different communication protocols.



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5	CS1003	Computer Programming	CO 1	Gain a broad perspective about the uses of Computer Programming in engineering industry.
			CO 2	Develop basic understanding of computer programming, the concept of procedural programming and algorithmic thinking.
			CO 3	Develop the ability to analyse a problem & provide a programming solution to it
			CO 4	Implement programming constructs to solve real world problems.
			CO 5	Justify modular programming approach by making use of elementary as well as superior data structures
			CO 6	Apply programming fundamentals to construct concise solutions.
6	CS1004	Advanced Computer Programming	CO 1	Understand the power and simplicity of Python Programming
			CO 2	Demonstrate various features and operators available in Python Programming.
			CO 3	Justify modular programming approach by making use of functions and modules
			CO 4	Implement real world problems using Python.
			CO 5	Apply file handling and data base concepts for permanent storage of data
7			CO 1	Improve analytical and logical reasoning ability.
			CO 2	Identify and Evaluate deductive and inductive arguments.
			CO 3	Identify logical errors and false conclusions.
			CO 4	Solve real time problems by assessing facts and assumptions.
			CO 5	Improve critical thinking ability.
8	ES1022	Quantitative Aptitude	CO 1	Improve employability skills.
			CO 2	Improve aptitude, problem solving skills and reasoning ability
			CO 3	Critically evaluate various real life situations by resorting to analysis of key issues and factors
			CO 4	Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.
9	ES1025	Engineering Design and Innovation – I	CO 1	Understand concepts of discovery, invention, innovation, research etc.
			CO 2	Know socio-economic impact of research.
			CO 3	Understand various research tools , its application and methods.
			CO 4	Understand process paper publication.
			CO 5	Understand the concept and process IPR
			CO 6	Know ethical practices in research.
10	ES1026		CO 1	Identify projects relevant societal needs.



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		Engineering Design and Innovation – II	CO 2	Map the technologies learned with the project needs.
			CO 3	Apply the technological knowledge to design various feasible solution.
			CO 4	Select best possible solution to solve the problem
			CO 5	Develop/Fabricate a working model of proposed solution
11	ES1027	Graphics and Mechanical Workshop	CO 1	Learn standard practices of lines, lettering and dimensioning in Engineering Drawing.
			CO 2	Visualize and draw Orthographic as well as Isometric projections of 3D objects.
			CO 3	Draw development of lateral surfaces of solids.
			CO 4	Perform few Fitting, Welding and carpentry operations and hands on skill.
			CO 5	Follow Safety practices
12	ES1029	Graphics and Mechatronics Workshop	CO 1	Learn standard practices of lines, lettering and dimensioning in Engineering Drawing
			CO 2	Visualize and draw Orthographic as well as Isometric projections of 3D objects.
			CO 3	Draw Development of lateral surfaces of solids.
			CO 4	Understand basics of operating system and system administration
			CO 5	Study computer networking fundamentals
			CO 6	Promote creativity/ innovation (mini project).
13	CS1005	Software Development Project	CO 1	Apply problem-solving skills to software development and work effectively in different phases of software development life cycle.
			CO 2	Analyse requirements of computing problems and design solutions with correct problem scoping.
			CO 3	Select appropriate programming languages and diagramming techniques using a variety of software technologies.
			CO 4	Perform code review and inspection for computer programs express algorithmically.
			CO 5	Construct, test and document software systems
			CO 6	Demonstrate effective software development teamwork skills turning ideas into successful software solutions by managing change in technological arena.
14	HS1028	Induction Training	CO 1	Inculcate the ethics and culture of institution.
			CO 2	Explore their academic interests and activities reducing competition.
			CO 3	Develop awareness about universal human values in students.
			CO 4	Promote bonding within them and build relations between faculty members and students.
15		Life Skills	CO 1	Improve their overall wellbeing and competence.



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	HS102 9		CO 2	Translate knowledge, attitude and values into actual abilities
			CO 3	Use life skills effectively in diverse situation to cope with challenges of life.
			CO 4	Think critically and analyse all the pros and cons of the situation.
16	HS103 2	Ethics for Engineers	CO 1	Contrast the aspects of Absolute truth as laid out by the Vedanta model with the world's theistic philosophies.
			CO 2	Argue for the sake of Universal Law of Karma and the differences between monotheistic and polytheistic models.
			CO 3	Practice ethics in one's personal, professional and family life.
17	HS103 0	Personality Development	CO 1	Apply the most appropriate tool of acquiring knowledge for a suitable object of knowledge.
			CO 2	Discern the reasons for the dual model of self & body and effects of the three modes on consciousness
			CO 3	Discern Application of the 3 modes of nature in context of society and self.
18	HS103 1	Professional Development	CO 1	Find opportunities available in his domain
			CO 2	Be ready to explore opportunities.
			CO 3	Analyse strengths, weakness, opportunities and challenges.
19	ES1014	Environmental Science	CO 1	Recognize renewable and non-renewable resources and associated problems and plan different activities to create awareness among the people and hence to conserve resources by minimizing degradation of environment.
			CO 2	Understand different types of ecosystems and their importance in balancing the nature.
			CO 3	Understand concept of biodiversity at national and global level and need to preserve it.
			CO 4	Understand different types of pollutions and hence to find the remedial measures to minimize ill effects.
			CO 5	Recognize various disaster and solid waste management techniques.
			CO 6	Understand and appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.