CO List for 1st year UG

Department Name: Automobile Engineering

Program Name: B.Tech (AUE)

Paper Code	Paper Name	CO No.	CO Statement
BS-PH101	Physics	BS-PH101.1	Differentiate between different dielectric materials depending on their dielectric strength, breakdown voltage, losses and apply them to real life problems.
		BS-PH101.2	Apply the concepts of Faraday's law to analyze mechanisms of electromagnetic breaking and solve problems on induced EMF for motors, generators etc.
		BS-PH101.3	Solve for electric field, magnetic field & power flow using Maxwell's equations and analyze various media of propagations.
		BS-PH101.4	Explain the concept of black body radiation and predict its temperature from the spectrum, and comprehend the particle nature of light using Compton Effect, existence of matter waves.
		BS-PH101.5	Describe the basic formulations of Quantum Mechanics such as the concept of operators, wave function and their evolution using Schrödinger equation and apply them to understand the workings of devices like Tunnel Diode, Scanning Tunnelling Microscopy.
		BS-PH101.6	Explain the workings of various LASERs and their uses especially in optical fiber communication. Illustrate the concept of modes of an optical fiber and estimate the dispersion leading to calculation of bit rate of a communication channel.
BS-M101	Mathematics-I	BS-M101.1	Apply knowledge of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.
		BS-M101.2	Utilize mean value theorems for solution of engineering problems.
		BS-M101.3	Learn matrices, concept of rank, methods of matrix inversion and their applications.
		BS-M101.4	Determine eigen values, eigen vectors and utilize them to solve physical and engineering problems.
		BS-M101.5	Solve multiple integrals and utilize them to different physical problems.
		BS-M101.6	Apply divergence theorem, Green's and Stoke's theorem for solving engineering problems.
ES-EE101	Basic Electrical and Electronics Engineering	ES-EE101.1 (EE)	Apply the concepts of KVL/KCL and network theorems in solving DC circuits.
		ES-EE101.2 (EE)	Analyze the steady state behavior of single phase and three phase AC circuits.
		ES-EE101.3 (EE)	Illustrate the working principles of DC machines, transformer as well as induction motor and employ them in different area of applications.
		ES-EE101.4 (EE)	Describe the components of low voltage electrical installations.
		ES-EE101.5 (EE)	Describe the general structure of electrical power system.
		ES-EE101.1 (ECE)	Identify semiconductor materials, draw band-diagrams, distinguish between intrinsic and extrinsic semiconductors, n- and p-type semiconductors, calculate drift and diffusion current components.
		ES-EE101.2 (ECE)	Explain the junction properties and the phenomenon of rectification, draw the I-V characteristics and identify operating points; Calculate ripple factors, efficiency of power supplies.
		ES-EE101.3 (ECE)	Draw and explain the I-V characteristics of BJTs and FET – both input and output.
		ES-EE101.4 (ECE)	Understand basics of OPAMP and learn the use of it as amplifier.
		ES-EE101.5 (ECE)	Explain binary numbers and identify different logic gates and circuit implementation.

HM-HU101	English	HM-HU101.1	Acquire basic proficiency in English including reading comprehension, writing and speaking skills. Write grammatically correct English.
		HM-HU101.2	Acquire basic language skills (listening, speaking, reading and writing) in order to communicate in English.
		HM-HU101.3	Acquire linguistic competence necessarily required in various life situations.
		HM-HU101.4	Develop intellectual, personal and professional abilities.
BS-PH191	Physics Laboratory	BS-PH191.1	Examine various semiconductor properties (Hall coefficient, Band gap) and relate the same to the theoretical laws they have learnt.
		BS-PH191.2	Analyze various solar cell properties to get an idea of optimized performance.
		BS-PH191.3	Verify quantization of energy in atoms and calculate the least action.
		BS-PH191.4	Apply the concept of thermo-emf for thermometric calibration and calculate specific charge for charge characterization and unknown resistances using Wheatstone bridge principle.
		BS-PH191.5	Compute different fundamental elastic constants & general properties of matter.
		BS-PH191.6	Apply the concept of interference and diffraction to calculate wavelength of light sources and use lasers in fiber optic communications.
ES-EE191	Basic Electrical and Electronics Engineering Lab	ES-EE191.1 (EE)	Illustrate Thevenin's and Norton's theorems
		ES-EE191.2 (EE)	Explain the concept of single phase and three phase AC supply.
		ES-EE191.3 (EE)	Identify the parameters of a single phase transformer by open circuit and short circuit test.
		ES-EE191.4 (EE)	Demonstrate the starting and reversing of DC motor.
		ES-EE191.1 (ECE)	Identify different electronic components and can select appropriate tools and/or equipments for performing specific operation.
		ES-EE191.2 (ECE)	Realize the I-V characteristics of a p-n junction diode and a zener diode and will be able to understand the applicability of them in relation to their characteristics.
		ES-EE191.3 (ECE)	Implement half wave and full wave rectifier circuits and can analyze the performance of them.
		ES-EE191.4 (ECE)	Realize the I-V characteristics of BJT in CB and CE configurations and will be able to identify different operating regions of it.
		ES-EE191.5 (ECE)	Realize the I-V characteristics of JFET and will be able to identify different operating regions of it.
		ES-EE191.6 (ECE)	Use OPAMP as amplifier and verify the truth tables of different logic gates.
ES-ME191	Engineering Graphics and Design	ES-ME191.1	Understand the basic concepts of Engineering Drawing for lines, geometric construction of curves and different scales.
		ES-ME191.2	Understand the concepts of orthographic projections and its applications.
		ES-ME191.3	Apply the principles of Isometric projection for conversion of orthographic to isometric views and vice versa.
		ES-ME191.4	Construct 2D geometries using AutoCAD software.
BS-CH201	Chemistry	BS-CH201.1	Demonstrate microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces and understand MOT of covalent bonding and bonding in complexes.
		BS-CH201.2	Illustrate bulk properties and processes using thermodynamic considerations and understand the conditions of spontaneity and equilibrium. Use electrochemical cell to measure pH, equilibrium constant, understand working principles of modern batteries and theories of corrosion and explain different processes of waste water treatment.
		BS-CH201.3	Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques and determine the in structure elucidation and characterization of various molecules by using different types of spectroscopy.
		BS-CH201.4	Articulate periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
		BS-CH201.5	List major chemical reactions that are used in the synthesis of various drug molecules.

BS-M201	Mathematics-II	BS-M201.1	Understand different techniques to solve first and second order ordinary differential equations with its formulation to address the modelling of systems and problems of engineering sciences.
		BS-M201.2	Apply different types of transformations between two 2-dimensional planes for analysis of physical and engineering problems.
		BS-M201.3	Utilize tree and graph algorithms for solving different physical and engineering problems.
		BS-M201.4	Evaluate different types of improper integrals and apply into engineering problems.
ES-CS201	Programming for Problem Solving	ES-CS201.1	Understand the concept of structured programming language.
		ES-CS201.2	Implement conditional branching, iteration and recursive functions.
		ES-CS201.3	Apply programming concepts to solve matrix manipulation, searching and sorting problems.
		ES-CS201.4	Use pointers and structures to solve related problems of different domain.
BS-CH291	Chemistry Laboratory	BS-CH291.1	Estimate rate constants of reactions from concentration of reactants/products as a function of time.
		BS-CH291.2	Measure molecular/system properties such as viscosity, conductance of solutions, redox potentials, chloride content of water, etc.
		BS-CH291.3	Synthesize a macromolecule and determine its molecular weight by solution viscosity method.
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		ES-CS291.4	Apply programming concepts to handle memory allocation and files.
ES-ME292	Workshop/ Manufacturing Practices	ES-ME292.1	Identify and utilize machine tools for producing components through machining.
		ES-ME292.2	Demonstrate fundamental concept of pattern making, moulding and casting processes for engineering applications.
		ES-ME292.3	Practice fitting, carpentry, and smithy operations for manufacturing of components.
		ES-ME292.4	Explain concepts and applications of various types of fabrication processes.
HM-HU291	Language Laboratory	HM-HU291.1	Acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.
		HM-HU291.2	Acquire basic language skills (listening, speaking, reading and writing) in order to communicate in English.
		HM-HU291.3	Acquire linguistic competence necessarily required in various life situations.
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Department Name: **Computer Science & Engineering**
Program Name: **B.Tech (CSE)**

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Department Name: **Computer Science & Engineering (Data Science)**
Program Name: **B.Tech (CSE-DS)**

Paper Code	Paper Name	CO No.	CO Statement
BS-CH101	Chemistry	BS-CH101.1	Demonstrate microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces and understand MOT of covalent bonding and bonding in complexes.
		BS-CH101.2	Illustrate bulk properties and processes using thermodynamic considerations and understand the conditions of spontaneity and equilibrium. Use electrochemical cell to measure pH, equilibrium constant, understand working principles of modern batteries and theories of corrosion and explain different processes of waste water treatment.
		BS-CH101.3	Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques and determine the in structure elucidation and characterization of various molecules by using different types of spectroscopy.
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		BS-CH101.5	List major chemical reactions that are used in the synthesis of various drug molecules.
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Program Name: **B.Tech (CSE-AIML)**

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		HM-HU101.2	Acquire basic language skills (listening, speaking, reading and writing) in order to communicate in English.
		HM-HU101.3	Acquire linguistic competence necessarily required in various life situations.
		HM-HU101.4	Develop intellectual, personal and professional abilities.
BS-PH191	Physics Laboratory	BS-PH191.1	Examine various semiconductor properties (Hall coefficient, Band gap) and relate the same to the theoretical laws they have learnt.
		BS-PH191.2	Analyze various solar cell properties to get an idea of optimized performance.
		BS-PH191.3	Verify quantization of energy in atoms and calculate the least action.
		BS-PH191.4	Apply the concept of thermo-emf for thermometric calibration and calculate specific charge for charge characterization and unknown resistances using Wheatstone bridge principle.
		BS-PH191.5	Compute different fundamental elastic constants & general properties of matter.
		BS-PH191.6	Apply the concept of interference and diffraction to calculate wavelength of light sources and use lasers in fiber optic communications.
ES-EE191	Basic Electrical and Electronics Engineering Lab	ES-EE191.1 (EE)	Illustrate Thevenin's and Norton's theorems
		ES-EE191.2 (EE)	Explain the concept of single phase and three phase AC supply.
		ES-EE191.3 (EE)	Identify the parameters of a single phase transformer by open circuit and short circuit test.
		ES-EE191.4 (EE)	Demonstrate the starting and reversing of DC motor.
		ES-EE191.1 (ECE)	Identify different electronic components and can select appropriate tools and/or equipments for performing specific operation.
		ES-EE191.2 (ECE)	Realize the I-V characteristics of a p-n junction diode and a zener diode and will be able to understand the applicability of them in relation to their characteristics.
		ES-EE191.3 (ECE)	Implement half wave and full wave rectifier circuits and can analyze the performance of them.
		ES-EE191.4 (ECE)	Realize the I-V characteristics of BJT in CB and CE configurations and will be able to identify different operating regions of it.
		ES-EE191.5 (ECE)	Realize the I-V characteristics of JFET and will be able to identify different operating regions of it.
		ES-EE191.6 (ECE)	Use OPAMP as amplifier and verify the truth tables of different logic gates.
ES-ME191	Engineering Graphics and Design	ES-ME191.1	Understand the basic concepts of Engineering Drawing for lines, geometric construction of curves and different scales.
		ES-ME191.2	Understand the concepts of orthographic projections and its applications.
		ES-ME191.3	Apply the principles of Isometric projection for conversion of orthographic to isometric views and vice versa.
		ES-ME191.4	Construct 2D geometries using AutoCAD software.

BS-CH201	Chemistry	BS-CH201.1	Demonstrate microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces and understand MOT of covalent bonding and bonding in complexes.
		BS-CH201.2	Illustrate bulk properties and processes using thermodynamic considerations and understand the conditions of spontaneity and equilibrium. Use electrochemical cell to measure pH, equilibrium constant, understand working principles of modern batteries and theories of corrosion and explain different processes of waste water treatment.
		BS-CH201.3	Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques and determine the in structure elucidation and characterization of various molecules by using different types of spectroscopy.
		BS-CH201.4	Articulate periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
		BS-CH201.5	List major chemical reactions that are used in the synthesis of various drug molecules.
BS-M201	Mathematics-II	BS-M201.1	Understand different techniques to solve first and second order ordinary differential equations with its formulation to address the modelling of systems and problems of engineering sciences.
		BS-M201.2	Apply different types of transformations between two 2-dimensional planes for analysis of physical and engineering problems.
		BS-M201.3	Utilize tree and graph algorithms for solving different physical and engineering problems.
		BS-M201.4	Evaluate different types of improper integrals and apply into engineering problems.
ES-CS201	Programming for Problem Solving	ES-CS201.1	Understand the concept of structured programming language.
		ES-CS201.2	Implement conditional branching, iteration and recursive functions.
		ES-CS201.3	Apply programming concepts to solve matrix manipulation, searching and sorting problems.
		ES-CS201.4	Use pointers and structures to solve related problems of different domain.
BS-CH291	Chemistry Laboratory	BS-CH291.1	Estimate rate constants of reactions from concentration of reactants/products as a function of time.
		BS-CH291.2	Measure molecular/system properties such as viscosity, conductance of solutions, redox potentials, chloride content of water, etc.
		BS-CH291.3	Synthesize a macromolecule and determine its molecular weight by solution viscosity method.
ES-CS291	Programming for Problem Solving Lab	ES-CS291.1	Understand the concept of programming language.
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		ES-CS291.3	Apply programming concepts to solve basic data manipulation related problem.
		ES-CS291.4	Apply programming concepts to handle memory allocation and files.
ES-ME292	Workshop/ Manufacturing Practices	ES-ME292.1	Identify and utilize machine tools for producing components through machining.
		ES-ME292.2	Demonstrate fundamental concept of pattern making, moulding and casting processes for engineering applications.
		ES-ME292.3	Practice fitting, carpentry, and smithy operations for manufacturing of components.
		ES-ME292.4	Explain concepts and applications of various types of fabrication processes.
HM-HU291	Language Laboratory	HM-HU291.1	Acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.
		HM-HU291.2	Acquire basic language skills (listening, speaking, reading and writing) in order to communicate in English.
		HM-HU291.3	Acquire linguistic competence necessarily required in various life situations.
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Department Name: **Electrical Engineering**
Program Name: **B.Tech (EE)**

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BS-M101	Mathematics-I	BS-M101.1	Apply knowledge of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.
		BS-M101.2	Utilize mean value theorems for solution of engineering problems.
		BS-M101.3	Learn matrices, concept of rank, methods of matrix inversion and their applications.
		BS-M101.4	Determine eigen values, eigen vectors and utilize them to solve physical and engineering problems.
		BS-M101.5	Solve multiple integrals and utilize them to different physical problems.
		BS-M101.6	Apply divergence theorem, Green's and Stoke's theorem for solving engineering problems.
ES-CS101	Programming for Problem Solving	ES-CS101.1	Understand the concept of structured programming language.
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		BS-PH201.3	Solve for electric field, magnetic field & power flow using Maxwell's equations and analyze various media of propagations.
		BS-PH201.4	Explain the concept of black body radiation and predict its temperature from the spectrum, and comprehend the particle nature of light using Compton Effect, existence of matter waves.
		BS-PH201.5	Describe the basic formulations of Quantum Mechanics such as the concept of operators, wave function and their evolution using Schrödinger equation and apply them to understand the workings of devices like Tunnel Diode, Scanning Tunnelling Microscopy.
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ES-EE201	Basic Electrical and Electronics Engineering	ES-EE201.1 (EE)	Apply the concepts of KVL/KCL and network theorems in solving DC circuits.
		ES-EE201.2 (EE)	Analyze the steady state behavior of single phase and three phase AC circuits.
		ES-EE201.3 (EE)	Illustrate the working principles of DC machines, transformer as well as induction motor and employ them in different area of applications.
		ES-EE201.4 (EE)	Describe the components of low voltage electrical installations.
		ES-EE201.5 (EE)	Describe the general structure of electrical power system.
		ES-EE201.1 (ECE)	Identify semiconductor materials, draw band-diagrams, distinguish between intrinsic and extrinsic semiconductors, n- and p-type semiconductors, calculate drift and diffusion current components.
		ES-EE201.2 (ECE)	Explain the junction properties and the phenomenon of rectification, draw the I-V characteristics and identify operating points; Calculate ripple factors, efficiency of power supplies.
		ES-EE201.3 (ECE)	Draw and explain the I-V characteristics of BJTs and FET – both input and output.
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		BS-PH291.2	Analyze various solar cell properties to get an idea of optimized performance.
		BS-PH291.3	Verify quantization of energy in atoms and calculate the least action.
		BS-PH291.4	Apply the concept of thermo-emf for thermometric calibration and calculate specific charge for charge characterization and unknown resistances using Wheatstone bridge principle.
		BS-PH291.5	Compute different fundamental elastic constants & general properties of matter.
		BS-PH291.6	Apply the concept of interference and diffraction to calculate wavelength of light sources and use lasers in fiber optic communications.
ES-EE291	Basic Electrical and Electronics Engineering Lab	ES-EE291.1 (EE)	Illustrate Thevenin's and Norton's theorems
		ES-EE291.2 (EE)	Explain the concept of single phase and three phase AC supply.
		ES-EE291.3 (EE)	Identify the parameters of a single phase transformer by open circuit and short circuit test.
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		ES-EE291.1 (ECE)	Identify different electronic components and can select appropriate tools and/or equipments for performing specific operation.
		ES-EE291.2 (ECE)	Realize the I-V characteristics of a p-n junction diode and a zener diode and will be able to understand the applicability of them in relation to their characteristics.
		ES-EE291.3 (ECE)	Implement half wave and full wave rectifier circuits and can analyze the performance of them.
		ES-EE291.4 (ECE)	Realize the I-V characteristics of BJT in CB and CE configurations and will be able to identify different operating regions of it.
		ES-EE291.5 (ECE)	Realize the I-V characteristics of JFET and will be able to identify different operating regions of it.
		ES-EE291.6 (ECE)	Use OPAMP as amplifier and verify the truth tables of different logic gates.
ES-ME291	Engineering Graphics and Design	ES-ME291.1	Understand the basic concepts of Engineering Drawing for lines, geometric construction of curves and different scales.
		ES-ME291.2	Understand the concepts of orthographic projections and its applications.
		ES-ME291.3	Apply the principles of Isometric projection for conversion of orthographic to isometric views and vice versa.
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Department Name: **Electronics and Communication Engineering**
Program Name: **B.Tech (ECE)**

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BS-PH101	Physics	BS-PH101.1	Differentiate between different dielectric materials depending on their dielectric strength, breakdown voltage, losses and apply them to real life problems.
		BS-PH101.2	Apply the concepts of Faraday's law to analyze mechanisms of electromagnetic breaking and solve problems on induced EMF for motors, generators etc.
		BS-PH101.3	Solve for electric field, magnetic field & power flow using Maxwell's equations and analyze various media of propagations.
		BS-PH101.4	Explain the concept of black body radiation and predict its temperature from the spectrum, and comprehend the particle nature of light using Compton Effect, existence of matter waves.
		BS-PH101.5	Describe the basic formulations of Quantum Mechanics such as the concept of operators, wave function and their evolution using Schrödinger equation and apply them to understand the workings of devices like Tunnel Diode, Scanning Tunnelling Microscopy.
		BS-PH101.6	Explain the workings of various LASERs and their uses especially in optical fiber communication. Illustrate the concept of modes of an optical fiber and estimate the dispersion leading to calculation of bit rate of a communication channel.
BS-M101	Mathematics-I	BS-M101.1	Apply knowledge of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.
		BS-M101.2	Utilize mean value theorems for solution of engineering problems.
		BS-M101.3	Learn matrices, concept of rank, methods of matrix inversion and their applications.
		BS-M101.4	Determine eigen values, eigen vectors and utilize them to solve physical and engineering problems.
		BS-M101.5	Solve multiple integrals and utilize them to different physical problems.
		BS-M101.6	Apply divergence theorem, Green's and Stoke's theorem for solving engineering problems.
ES-EE101	Basic Electrical and Electronics Engineering	ES-EE101.1 (EE)	Apply the concepts of KVL/KCL and network theorems in solving DC circuits.
		ES-EE101.2 (EE)	Analyze the steady state behavior of single phase and three phase AC circuits.
		ES-EE101.3 (EE)	Illustrate the working principles of DC machines, transformer as well as induction motor and employ them in different area of applications.
		ES-EE101.4 (EE)	Describe the components of low voltage electrical installations.

		ES-EE101.5 (EE)	Describe the general structure of electrical power system.
		ES-EE101.1 (ECE)	Identify semiconductor materials, draw band-diagrams, distinguish between intrinsic and extrinsic semiconductors, n- and p-type semiconductors, calculate drift and diffusion current components.
		ES-EE101.2 (ECE)	Explain the junction properties and the phenomenon of rectification, draw the I-V characteristics and identify operating points; Calculate ripple factors, efficiency of power supplies.
		ES-EE101.3 (ECE)	Draw and explain the I-V characteristics of BJTs and FET – both input and output.
		ES-EE101.4 (ECE)	Understand basics of OPAMP and learn the use of it as amplifier.
		ES-EE101.5 (ECE)	Explain binary numbers and identify different logic gates and circuit implementation.

HM-HU101	English	HM-HU101.1	Acquire basic proficiency in English including reading comprehension, writing and speaking skills. Write grammatically correct English.
		HM-HU101.2	Acquire basic language skills (listening, speaking, reading and writing) in order to communicate in English.
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BS-PH191	Physics Laboratory	BS-PH191.1	Examine various semiconductor properties (Hall coefficient, Band gap) and relate the same to the theoretical laws they have learnt.
		BS-PH191.2	Analyze various solar cell properties to get an idea of optimized performance.
		BS-PH191.3	Verify quantization of energy in atoms and calculate the least action.
		BS-PH191.4	Apply the concept of thermo-emf for thermometric calibration and calculate specific charge for charge characterization and unknown resistances using Wheatstone bridge principle.
		BS-PH191.5	Compute different fundamental elastic constants & general properties of matter.
		BS-PH191.6	Apply the concept of interference and diffraction to calculate wavelength of light sources and use lasers in fiber optic communications.
ES-EE191	Basic Electrical and Electronics Engineering Lab	ES-EE191.1 (EE)	Illustrate Thevenin's and Norton's theorems
		ES-EE191.2 (EE)	Explain the concept of single phase and three phase AC supply.
		ES-EE191.3 (EE)	Identify the parameters of a single phase transformer by open circuit and short circuit test.
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		ES-EE191.1 (ECE)	Identify different electronic components and can select appropriate tools and/or equipments for performing specific operation.
		ES-EE191.2 (ECE)	Realize the I-V characteristics of a p-n junction diode and a zener diode and will be able to understand the applicability of them in relation to their characteristics.
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		ES-EE191.6 (ECE)	Use OPAMP as amplifier and verify the truth tables of different logic gates.
ES-ME191	Engineering Graphics and Design	ES-ME191.1	Understand the basic concepts of Engineering Drawing for lines, geometric construction of curves and different scales.
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BS-CH201	Chemistry	BS-CH201.1	Demonstrate microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces and understand MOT of covalent bonding and bonding in complexes.
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		BS-CH201.3	Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques and determine the in structure elucidation and characterization of various molecules by using different types of spectroscopy.
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		BS-CH201.5	List major chemical reactions that are used in the synthesis of various drug molecules.
BS-M201	Mathematics-II	BS-M201.1	Understand different techniques to solve first and second order ordinary differential equations with its formulation to address the modelling of systems and problems of engineering sciences.
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Department Name: **Information Technology**
Program Name: **B.Tech (IT)**

Paper Code	Paper Name	CO No.	CO Statement
BS-PH101	Physics	BS-PH101.1	Differentiate between different dielectric materials depending on their dielectric strength, breakdown voltage, losses and apply them to real life problems.
		BS-PH101.2	Apply the concepts of Faraday's law to analyze mechanisms of electromagnetic breaking and solve problems on induced EMF for motors, generators etc.
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BS-CH201	Chemistry	BS-CH201.1	Demonstrate microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces and understand MOT of covalent bonding and bonding in complexes.
		BS-CH201.2	Illustrate bulk properties and processes using thermodynamic considerations and understand the conditions of spontaneity and equilibrium. Use electrochemical cell to measure pH, equilibrium constant, understand working principles of modern batteries and theories of corrosion and explain different processes of waste water treatment.
		BS-CH201.3	Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques and determine the in structure elucidation and characterization of various molecules by using different types of spectroscopy.
		BS-CH201.4	Articulate periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
		BS-CH201.5	List major chemical reactions that are used in the synthesis of various drug molecules.
BS-M201	Mathematics-II	BS-M201.1	Understand different techniques to solve first and second order ordinary differential equations with its formulation to address the modelling of systems and problems of engineering sciences.
		BS-M201.2	Apply different types of transformations between two 2-dimensional planes for analysis of physical and engineering problems.
		BS-M201.3	Utilize tree and graph algorithms for solving different physical and engineering problems.
		BS-M201.4	Evaluate different types of improper integrals and apply into engineering problems.
ES-CS201	Programming for Problem Solving	ES-CS201.1	Understand the concept of structured programming language.
		ES-CS201.2	Implement conditional branching, iteration and recursive functions.
		ES-CS201.3	Apply programming concepts to solve matrix manipulation, searching and sorting problems.
		ES-CS201.4	Use pointers and structures to solve related problems of different domain.
BS-CH291	Chemistry Laboratory	BS-CH291.1	Estimate rate constants of reactions from concentration of reactants/products as a function of time.
		BS-CH291.2	Measure molecular/system properties such as viscosity, conductance of solutions, redox potentials, chloride content of water, etc.
		BS-CH291.3	Synthesize a macromolecule and determine its molecular weight by solution viscosity method.
ES-CS291	Programming for Problem Solving Lab	ES-CS291.1	Understand the concept of programming language.
		ES-CS291.2	Implement conditional branching, iteration and recursive functions.
		ES-CS291.3	Apply programming concepts to solve basic data manipulation related problem.
		ES-CS291.4	Apply programming concepts to handle memory allocation and files.
ES-ME292	Workshop/ Manufacturing Practices	ES-ME292.1	Identify and utilize machine tools for producing components through machining.
		ES-ME292.2	Demonstrate fundamental concept of pattern making, moulding and casting processes for engineering applications.
		ES-ME292.3	Practice fitting, carpentry, and smithy operations for manufacturing of components.
		ES-ME292.4	Explain concepts and applications of various types of fabrication processes.
HM-HU291	Language Laboratory	HM-HU291.1	Acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.
		HM-HU291.2	Acquire basic language skills (listening, speaking, reading and writing) in order to communicate in English.
		HM-HU291.3	Acquire linguistic competence necessarily required in various life situations.
		HM-HU291.4	Develop intellectual, personal and professional abilities.

Department Name: **Mechanical Engineering**
Program Name: **B.Tech (ME)**

Paper Code	Paper Name	CO No.	CO Statement
BS-CH101	Chemistry	BS-CH101.1	Demonstrate microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces and understand MOT of covalent bonding and bonding in complexes.
		BS-CH101.2	Illustrate bulk properties and processes using thermodynamic considerations and understand the conditions of spontaneity and equilibrium. Use electrochemical cell to measure pH, equilibrium constant, understand working principles of modern batteries and theories of corrosion and explain different processes of waste water treatment.
		BS-CH101.3	Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques and determine the in structure elucidation and characterization of various molecules by using different types of spectroscopy.
		BS-CH101.4	Articulate periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
		BS-CH101.5	List major chemical reactions that are used in the synthesis of various drug molecules.
BS-M101	Mathematics-I	BS-M101.1	Apply knowledge of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.
		BS-M101.2	Utilize mean value theorems for solution of engineering problems.
		BS-M101.3	Learn matrices, concept of rank, methods of matrix inversion and their applications.
		BS-M101.4	Determine eigen values, eigen vectors and utilize them to solve physical and engineering problems.
		BS-M101.5	Solve multiple integrals and utilize them to different physical problems.
		BS-M101.6	Apply divergence theorem, Green's and Stoke's theorem for solving engineering problems.
ES-CS101	Programming for Problem Solving	ES-CS101.1	Understand the concept of structured programming language.
		ES-CS101.2	Implement conditional branching, iteration and recursive functions.
		ES-CS101.3	Apply programming concepts to solve matrix manipulation, searching and sorting problems.

		ES-CS101.4	Use pointers and structures to solve related problems of different domain.
BS-CH191	Chemistry Laboratory	BS-CH191.1	Estimate rate constants of reactions from concentration of reactants/products as a function of time.
		BS-CH191.2	Measure molecular/system properties such as viscosity, conductance of solutions, redox potentials, chloride content of water, etc.
		BS-CH191.3	Synthesize a macromolecule and determine its molecular weight by solution viscosity method.
ES-CS191	Programming for Problem Solving Lab	ES-CS191.1	Understand the concept of programming language.
		ES-CS191.2	Implement conditional branching, iteration and recursive functions.
		ES-CS191.3	Apply programming concepts to solve basic data manipulation related problem.
		ES-CS191.4	Apply programming concepts to handle memory allocation and files.
ES-ME192	Workshop/ Manufacturing Practices	ES-ME192.1	Identify and utilize machine tools for producing components through machining.
		ES-ME192.2	Demonstrate fundamental concept of pattern making, moulding and casting processes for engineering applications.
		ES-ME192.3	Practice fitting, carpentry, and smithy operations for manufacturing of components.
		ES-ME192.4	Explain concepts and applications of various types of fabrication processes.
HM-HU191	Language Laboratory	HM-HU191.1	Acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.
		HM-HU191.2	Acquire basic language skills (listening, speaking, reading and writing) in order to communicate in English.
		HM-HU191.3	Acquire linguistic competence necessarily required in various life situations.
		HM-HU191.4	Develop intellectual, personal and professional abilities.
BS-PH201	Physics	BS-PH201.1	Differentiate between different dielectric materials depending on their dielectric strength, breakdown voltage, losses and apply them to real life problems.
		BS-PH201.2	Apply the concepts of Faraday's law to analyze mechanisms of electromagnetic breaking and solve problems on induced EMF for motors, generators etc.
		BS-PH201.3	Solve for electric field, magnetic field & power flow using Maxwell's equations and analyze various media of propagations.
		BS-PH201.4	Explain the concept of black body radiation and predict its temperature from the spectrum, and comprehend the particle nature of light using Compton Effect, existence of matter waves.
		BS-PH201.5	Describe the basic formulations of Quantum Mechanics such as the concept of operators, wave function and their evolution using Schrödinger equation and apply them to understand the workings of devices like Tunnel Diode, Scanning Tunnelling Microscopy.
		BS-PH201.6	Explain the workings of various LASERs and their uses especially in optical fiber communication. Illustrate the concept of modes of an optical fiber and estimate the dispersion leading to calculation of bit rate of a communication channel.
BS-M201	Mathematics-II	BS-M201.1	Understand different techniques to solve first and second order ordinary differential equations with its formulation to address the modelling of systems and problems of engineering sciences.
		BS-M201.2	Apply different types of transformations between two 2-dimensional planes for analysis of physical and engineering problems.
		BS-M201.3	Utilize tree and graph algorithms for solving different physical and engineering problems.
		BS-M201.4	Evaluate different types of improper integrals and apply into engineering problems.
ES-EE201	Basic Electrical and Electronics Engineering	ES-EE201.1 (EE)	Apply the concepts of KVL/KCL and network theorems in solving DC circuits.
		ES-EE201.2 (EE)	Analyze the steady state behavior of single phase and three phase AC circuits.
		ES-EE201.3 (EE)	Illustrate the working principles of DC machines, transformer as well as induction motor and employ them in different area of applications.
		ES-EE201.4 (EE)	Describe the components of low voltage electrical installations.
		ES-EE201.5 (EE)	Describe the general structure of electrical power system.
		ES-EE201.1 (ECE)	Identify semiconductor materials, draw band-diagrams, distinguish between intrinsic and extrinsic semiconductors, n- and p-type semiconductors, calculate drift and diffusion current components.
		ES-EE201.2 (ECE)	Explain the junction properties and the phenomenon of rectification, draw the I-V characteristics and identify operating points; Calculate ripple factors, efficiency of power supplies.
		ES-EE201.3 (ECE)	Draw and explain the I-V characteristics of BJTs and FET – both input and output.
		ES-EE201.4 (ECE)	Understand basics of OPAMP and learn the use of it as amplifier.
		ES-EE201.5 (ECE)	Explain binary numbers and identify different logic gates and circuit implementation.
HM-HU201	English	HM-HU201.1	Acquire basic proficiency in English including reading comprehension, writing and speaking skills. Write grammatically correct English.
		HM-HU201.2	Acquire basic language skills (listening, speaking, reading and writing) in order to communicate in English.
		HM-HU201.3	Acquire linguistic competence necessarily required in various life situations.
		HM-HU201.4	Develop intellectual, personal and professional abilities.

BS-PH291	Physics Laboratory	BS-PH291.1	Examine various semiconductor properties (Hall coefficient, Band gap) and relate the same to the theoretical laws they have learnt.
		BS-PH291.2	Analyze various solar cell properties to get an idea of optimized performance.
		BS-PH291.3	Verify quantization of energy in atoms and calculate the least action.
		BS-PH291.4	Apply the concept of thermo-emf for thermometric calibration and calculate specific charge for charge characterization and unknown resistances using Wheatstone bridge principle.
		BS-PH291.5	Compute different fundamental elastic constants & general properties of matter.
		BS-PH291.6	Apply the concept of interference and diffraction to calculate wavelength of light sources and use lasers in fiber optic communications.
ES-EE291	Basic Electrical and Electronics Engineering Lab	ES-EE291.1 (EE)	Illustrate Thevenin's and Norton's theorems
		ES-EE291.2 (EE)	Explain the concept of single phase and three phase AC supply.
		ES-EE291.3 (EE)	Identify the parameters of a single phase transformer by open circuit and short circuit test.
		ES-EE291.4 (EE)	Demonstrate the starting and reversing of DC motor.
		ES-EE291.1 (ECE)	Identify different electronic components and can select appropriate tools and/or equipments for performing specific operation.
		ES-EE291.2 (ECE)	Realize the I-V characteristics of a p-n junction diode and a zener diode and will be able to understand the applicability of them in relation to their characteristics.
		ES-EE291.3 (ECE)	Implement half wave and full wave rectifier circuits and can analyze the performance of them.
		ES-EE291.4 (ECE)	Realize the I-V characteristics of BJT in CB and CE configurations and will be able to identify different operating regions of it.
		ES-EE291.5 (ECE)	Realize the I-V characteristics of JFET and will be able to identify different operating regions of it.
		ES-EE291.6 (ECE)	Use OPAMP as amplifier and verify the truth tables of different logic gates.
ES-ME291	Engineering Graphics and Design	ES-ME291.1	Understand the basic concepts of Engineering Drawing for lines, geometric construction of curves and different scales.
		ES-ME291.2	Understand the concepts of orthographic projections and its applications.
		ES-ME291.3	Apply the principles of Isometric projection for conversion of orthographic to isometric views and vice versa.
		ES-ME291.4	Construct 2D geometries using AutoCAD software.

CO List for 2nd year to 4th year UG

Department Name: **Automobile Engineering**
Program Name: **B.Tech (AUE)**

Paper Code	Paper Name	CO No.	CO Statement
BS-M303	Mathematics-III	BS-M303.1	Learn the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment
		BS-M303.2	To apply statistical methods for analysing experimental data.
		BS-M303.3	Apply statistical tools for analysing complex field.
		BS-M303.4	Students will be able to solve field problems in engineering involving PDEs.
BS-BIO301	Biology	BS-BIO301.1	State different engineering applications from biological perspective.
		BS-BIO301.2	Classify biological systems and identify different organisms and microorganisms depending on their morphological, biochemical and ecological criterion.
		BS-BIO301.3	Explain the concept of recessiveness and dominance during the passage of genetic material from parent to offspring and describe DNA as a genetic material in the molecular basis of information transfer.
		BS-BIO301.4	Discuss structures of different biomolecules starting from basic units and hence understand different biological processes at the reductionistic level.
		BS-BIO301.5	Describe protein structures and enzymology and also compare different mechanisms of enzyme action.
		BS-BIO301.6	Describe energy transformation processes in biological systems.
ES-AUE301	Engineering Mechanics	ES-AUE301.1	Use scalar and vector analytical techniques for analyzing forces in statically determinate structures.
		ES-AUE301.2	Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems.
		ES-AUE301.3	Apply basic knowledge of maths and physics to solve real-world problems
		ES-AUE301.4	Understand basic kinematics concepts – displacement, velocity and acceleration (and their angular counterparts).
		ES-AUE301.5	Understand basic dynamics concepts – force, momentum, work and energy.
ES-AUE302	Fluid Mechanics and Hydraulic Machines	ES-AUE302.1	Learn about the properties of fluids and analyze the forces in static fluid and forces acting on submerged surfaces.
		ES-AUE302.2	Learn about the application of mass and momentum conservation laws for fluid flows.

		ES-AUE302.3	Analyze the internal flow in pipes and channels & ability to predict loss of head.
		ES-AUE302.4	Understand the importance of dimensional & model analysis
		ES-AUE302.5	Analyze the flow in turbines and water pumps
PC-AUE301	Applied Thermodynamics	PC-AUE301.1	apply energy balance to systems and control volumes, in situations involving heat and work interactions
		PC-AUE301.2	evaluate changes in thermodynamic properties of pure substances
		PC-AUE301.3	evaluate the performance of energy conversion devices
		PC-AUE301.4	differentiate between high grade and low grade energies
PC-AUE302	Manufacturing Methods	PC-AUE302.1	describe basic principles of casting, welding and forming processes.
		PC-AUE302.2	explain different process parameters and methods of casting, welding and forming processes.
		PC-AUE302.3	solve complex problems of manufacturing using standard methods.
		PC-AUE302.4	design various defect free subsystems of primary manufacturing processes.
PC –AUE 391	Machine Drawing	PC –AUE 391.1	Describe schematic product symbols for standard components in mechanical, electrical and electronic systems, welding symbols and pipe joints.
		PC –AUE 391.2	Explain orthographic projections of machine elements, different sectional views and Isometric projection of components.
		PC –AUE 391.3	Assemble different machine elements such as a plummer block, tool head of a shaping machine, tailstock of a lathe, welded pipe joints indicating work parts before welding.
		BS-M404.1	Calculate different types of error involved in Engineering problems and learn to apply numerical methods to find approximate solutions for them.
BS-M404	Numerical Methods	BS-M404.2	Interpolate different polynomials using numerical techniques
		BS-M404.3	Derive numerical methods for integration and apply them for solving otherwise intractable Engineering problems
		BS-M404.4	To solve system of linear equations and to learn the concept of root finding for nonlinear equations
		BS-M404.5	To solve ordinary differential equation numerically
		BS-M404.6	Use various statistical tools to solve Engineering problems numerically
ES-AUE401	Materials Engineering	ES-AUE401.1	Student will be able to identify crystal structures for various materials and understand the defects in such structures.
		ES-AUE401.2	Understand how to tailor material properties of different engineering materials.
		ES-AUE401.3	Apply basic knowledge of materials structure -property to solve real-world problems
		ES-AUE401.4	How to quantify mechanical integrity and failure in materials.
PC-AUE401	Strength of Materials	PC-AUE401.1	Explain stress, strain, establish relationship between them and apply concepts oF stress, strain to solve numerical problems.
		PC-AUE401.2	Compute Shear Force and Bending Moment for determinate beams and draw Shear Force and draw Bending Moment Diagrams for various loading conditions.
		PC-AUE401.3	Determine various stresses and draw stress diagrams using the knowledge of bending and shear concepts. Ability to solve numerical problems of deflection.
		PC-AUE401.4	Explain theory of column failure with different support conditions, and develop numerical ability to solve numerical problems.
		PC-AUE401.5	Solve numerical problems by applying knowledge of strain energy, torsion and thin cylinders and spherical shells.
PC-AUE402	Machine Tools and Machining Technology	PC-AUE402.1	Describe construction, working principles &applications of conventional, non- conventional and numerically controlled machine tools and single/multi point cutting tools.
		PC-AUE402.2	Interpret relationship between different parameters and forces associated with cutting tools and machining operations.
		PC-AUE402.3	Solve problems related to parameters involved in metal cutting and machining operations
		PC-AUE402.4	Develop manual part programming for simple jobs using CNC lathe and milling machines
PC-AUE403	Theory of Machines	PC-AUE403.1	Distinguish between various mechanisms along with their inversions.
		PC-AUE403.2	Explain and compute displacement, velocity and acceleration for various mechanisms and cam profiles for various followers.
		PC-AUE403.3	Distinguish and analyze working of various gears, gear trains, governors, flywheels and dynamic forces acting on mechanical systems.
		PC-AUE403.4	Determine the balancing of masses for rotating and reciprocating machine elements
		PC-AUE403.5	Interpret the various principles of vibrations of different systems
PC-AUE404	Metrology and Instrumentation	PC-AUE404.1	Get basic idea about working principle and applications of devices of digital measurement system and transducers.
		PC-AUE404.2	Get basic idea about working principle of some indicating and display devices and their applications.
		PC-AUE404.3	Get basic idea about working principle and applications of devices of force, torque, strain, stress and temperature measurement..
		PC-AUE404.4	Get basic idea about working principle and applications of devices of temperature measurement.
PC-AUE491	Manufacturing and Materials Testing lab	PC-AUE491.1	Interpret different engineering material characters
		PC-AUE491.2	Compute stress, strains and deformation of engineering materials.
		PC-AUE491.3	Attain basic knowledge on pattern, Gear making.
		PC-AUE491.4	Examine properties of mould material in casting.
MC471	Environmental Science	MC471.1	Explain basic concepts, man, society & environment, their interrelationship, mathematics of population growth and associated problems, steady state conservation system.
		MC471.2	Demonstrate natural environmental hazards like flood, earthquake, landslide-causes, effects and control/management.

		MC471.3	Classify air pollution, water pollution, land pollution, noise pollution and their controls.
		MC471.4	Study Elements of ecology and environmental management.
PC – AUE 501	Automotive Engines	PC – AUE 501.1	Know the basics of IC engines and the influence the different parameters the operational characteristics of IC Engines.
		PC – AUE 501.2	Understand the fundamentals of various automotive Engine and their construction details.
		PC – AUE 501.3	Understand the operation of automotive engine and importance of vehicle.
PC – AUE 502	Automotive Body and Chassis Engineering	PC – AUE 502.1	Understand the operation of automotive systems and importance of vehicle frame.
		PC – AUE 502.2	Apply the knowledge of design consideration for braking system, suspension system and chassis.
		PC – AUE 502.3	Know different safety and ergonomic aspect to reduce human injury and increase comfort
		PC – AUE 502.4	Understand the fundamentals of various automotive body and their construction details.
PC-AUE503	Heat Transfer	PC-AUE503.1	Identify and formulate the heat conduction problems in rectangular, cylindrical & spherical co-ordinate system, using a mathematical model representing the physical system.
		PC-AUE503.2	Understand and analyze the time dependent (transient) heat conduction
		PC-AUE503.3	Apply the principles of convective heat transfer to compute heat transfer co-efficient in forced convection, natural convection for internal flows & external flows.
		PC-AUE503.4	Understand the constructional features & working principles of heat exchangers which include the LMTD & NTU approach
		PC-AUE503.5	Apply the radiation heat transfer problems between black & non-black bodies
PC-AUE504	Design of Machine Element	PC-AUE504.1	Design methodologies employed for the design of various machine components.
		PC-AUE504.2	Formulate and analyze a design problem of machine parts.
		PC-AUE504.3	Use of codes, standards and design guidelines.
HM-HU 501	Economics for Engineers	HM-HU 501	Discuss fundamentals of economic analysis.
		HM-HU 501	Describe rate of return and profitability analysis, Present, Future, Annuity, Risk and return, BEP and Sensitivity Analysis, Bayesian joint probability and quantitative decision making, basic accounting system and balance sheet and P & L accounts etc.
		HM-HU 501	Apply decision making skills in terms of Economic, financial considerations in practice.
		HM-HU 501	Apply knowledge to take right financial decision at the right point in time in real world situation.
PC-AUE591	Fluid Mechanics and Heat Transfer Lab	PC-AUE591.1	Measure various properties of thermal and fluids
		PC-AUE591.2	Characterize the performance of fluid/ thermal machinery
PC-AUE592	Automobile Engineering Lab I (Engine and Chassis Component Lab)	PC-AUE592.1	Ability to dismantle, assemble, inspect, measure and testing the automobile engine components.
		PC-AUE592.2	This Laboratory course is intended to give the students, experimental knowledge about various automotive chassis components.
HM-HU591	Soft Skill Development Lab	HM-HU591.1	Acquire over all Communicative Competence
		HM-HU591.2	Develop Team Building and Leadership Quality.
		HM-HU591.3	Deliver an enthusiastic and well-practiced presentation
		HM-HU591.4	Communicate with clarity and confidence thereby enhancing employability skills of the students.
PC-AUE601	Automotive Transmission	PC-AUE601.1	Explain the constructional, working principle and performance of various types of manual, semi-automatic and automatic transmission of an automobile.
		PC-AUE601.2	Gain knowledge about various hydrodynamic drives.
		PC-AUE601.3	Classify the principle of operation and performance of various hydrostatic and electric drives.
		PC-AUE601.4	Design a gear box for a given engine power and vehicle load.
PC-AUE 602	Automotive Electrical and Electronic Systems	PC-AUE 602.1	Understand the basic terminologies, components and concepts of electrical and electronics engineering.
		PC-AUE 602.2	Explain the working components and mechanism of different internal and external parts of a vehicle.
		PC-AUE 602.3	Explain the purpose, circuits, construction and working of components of starting system, ignition system, lighting and accessories systems.
		PC-AUE 602.4	Understand the role of various sensors, transducers in advanced vehicle management system and it influence in controlling pollution, enhancing safety of the vehicle.
PE-AUE601A	Hybrid and Electric Vehicles	PE-AUE601A.1	Choose a suitable drive scheme for developing an electric hybrid vehicle depending on resources.
		PE-AUE601A.2	Choose proper energy storage systems for vehicle applications.
		PE-AUE601A.3	Design and develop basic schemes of electric vehicles and hybrid electric vehicles.
HM-HU604	Quantitative methods for decision making	HM-HU604.1	Apply forecasting methods for predicting demands.
		HM-HU604.2	Make decisions under certainty, uncertainty, and conflicting situations.
		HM-HU604.3	Apply linear programming tools for optimal utilization of resources in various industries.
		HM-HU604.4	Solve transportation problems to minimize cost and understand the principles of assignment of jobs.
		HM-HU604.5	Understand the basic elements of a Queuing model and manage inventory with cost-effectiveness
		HM-HU604.6	Apply PERT/CPM for project scheduling and resource allocation in an optimal way
PC-AUE691	Automobile Engineering Lab II (Engine Testing and Pollution Measurement Lab)	PC-AUE691.1	Gain the experimental knowledge on the performance and testing of enginesG
		PC-AUE691.2	Test the fuel and oil properties.
		PC-AUE691.3	Gain the knowledge on emission test of the IC engines.
		PC-AUE691.4	Control the emission and use of different equipment to conduct performance test.

PC-AUE692	Automobile Engineering Lab III (Automotive Design Lab)	PC-AUE692.1	Construct parametric and feature model solid models
		PC-AUE692.2	Perform construction, analysis, and interrogation of Automobile parts models
		PC-AUE692.3	Build assembly models and fits
		PC-AUE692.4	Perform basic finite element analysis with CATIA/ CREO or similar 3D modeling software
PC-AUE693	Automobile Engineering Lab IV (Vehicle Maintenance Lab)	PC-AUE693.1	Service the types of clutches, gear boxes and calculation of torque carrying capacity and gear ratio
		PC-AUE693.2	Service the transaxle and rear axle assembly, brake system, identify the faults and service the same
		PC-AUE693.3	Service the steering gear boxes, and measure the turning circle radius and check wheel balancing and set wheel alignment parameters of a given vehicle.
		PC-AUE693.4	Align the head lamp and wheel of the given vehicle
		PC-AUE693.5	Know about the balancing the wheel, testing nozzle and compression testing
MC673	Essence of Indian Knowledge Tradition	MC673.1	Understand the concept of Traditional knowledge and its importance
		MC673.2	Know the need and importance of protecting traditional knowledge.
		MC673.3	Know the various enactments related to the protection of traditional knowledge.
		MC673.4	Understand the concepts of Intellectual property to protect the traditional knowledge
PC - AUE 701	Vehicle Dynamics	PC - AUE 701.1	Understand the fundamentals of Vehicle dynamics and describe various terminologies
		PC - AUE 701.2	Explain various performance mode characteristics of the vehicle
		PC - AUE 701.3	Analyse ride mode oscillations and compare their characteristics.
		PC - AUE 701.4	Evaluate the suspension and stability systems concepts and design the same according to requirements.
		PC - AUE 701.5	Analyse the cornering characteristics of the vehicle and evaluate yaw stability
PE-AUE701A	Advanced Manufacturing Technology and Management	PE-AUE701A.1	Explain the basic elements of an automated manufacturing system and recent manufacturing philosophies.
		PE-AUE701A.2	Analyze the manufacturing flow lines to reduce downtime and enhance productivity.
		PE-AUE701A.3	Explain the basic concept, elements, and applications of cellular manufacturing, flexible manufacturing systems and computer-integrated manufacturing.
		PE-AUE701A.4	Determine the planning and control of production cost, inventory, material requirement, shop floor, and enterprise resource planning.
		PE-AUE701A.5	Solve problems in different aspects related to advanced manufacturing technologies and production planning and control.
PE-AUE701B	Advanced Automotive Materials	PE-AUE701B.1	Make themselves familiar with advanced automotive materials
		PE-AUE701B.2	Acquire knowledge on different class of materials and their selection criterion
		PE-AUE701B.3	Evaluate and match materials and manufacturing processes
		PE-AUE701B.4	Evaluate the cause for failure of the components due to material or manufacturing process and recommend the appropriate remedy to avoid the failure
PE-AUE701C	Finite Element Method & its Applications	PE-AUE701C.1	Apply direct stiffness, Rayleigh-Ritz, Galerkin method to solve engineering problems.
		PE-AUE701C.2	Identify the application and characteristics of FEA elements such as bars, beams, plane and isoperimetric elements, and 2-D element.
		PE-AUE701C.3	Apply suitable boundary conditions to global equations, and reduce it to a solvable form.
		PE-AUE701C.4	Solve real life problems using finite element analysis.
PE-AUE702A	Automotive Component & System Design	PE-AUE702A.1	Analyze various forces coming on the vehicle and deduce the power of the engine.
		PE-AUE702A.2	Evaluate the working stresses and design of an automotive component such as cylinder, piston, connecting rod, cam etc.
		PE-AUE702A.3	Estimate the working stresses and design of an automotive component such as brakes, spring, propeller shaft, etc.
		PE-AUE702A.4	Analyze various forces coming on the Clutch and Gear box and design the components.
PE-AUE702B	Automotive Pollution control & Alternate Fuels	PE-AUE702B.1	Explain the importance of Alternative Fuels, its properties and their application
		PE-AUE702B.2	Select an alternative fuel for specific application.
		PE-AUE702B.3	Classify and get knowledge of emission norms
		PE-AUE702B.4	Identify the emission parameters from engine emission, its causes and remedies
PE-AUE702C	Two and Three Wheelers	PE-AUE702C.1	Describe different types of two wheelers and three wheelers.
		PE-AUE702C.2	Explain the working, components and accessories of two and three-wheeler power units.
		PE-AUE702C.3	Describe the transmission and suspension system of two and three wheelers.
		PE-AUE702C.4	Describe meters, controls, brakes, wheels and tyres for two and three wheelers.
		PE-AUE702C.5	Explain the procedure for servicing and maintenance of different components used in two and three wheelers
OE-ME701C	Quality Control & Reliability Engineering	OE-ME701C.1	Express the knowledge about various concepts of descriptive statistics.
		OE-ME701C.2	Apply and use different tools and techniques used in quality control engineering.
		OE-ME701C.3	Develop a basic understanding of concepts of reliability engineering along with use of statistical and design model.
		OE-ME701C.4	Understand and apply different types of sampling methods used in control engineering.
OE-ME701B	Mechatronic Systems	OE-ME701B.1	Explain the basic concepts of mechatronic systems for an engineering application
		OE-ME701B.2	Identify sensors, transducers, and actuators to monitor and control the behavior of the process or product.
		OE-ME701B.3	Apply the concept of PLC and control systems for engineering applications.
		OE-ME701B.4	Interpret smart material for mechatronic systems and their application
		OE-ME701B.5	Demonstrate micro-mechatronic systems with fabrication techniques and their application in real life
OE-IT701C	Machine Learning	OE-IT701C.1	Distinguish between, supervised, unsupervised and semi-supervised learning.

		OE-IT701C.2	Apply the appropriate machine learning strategy for any given problem.
		OE-IT701C.3	Suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem.
		OE-IT701C.4	Design systems that uses the appropriate graph models of machine learning.
		OE-IT701C.5	Modify existing machine learning algorithms to improve classification efficiency.
OE-CS701C	Cloud Computing	OE-CS701C.1	Describe the fundamental concept of cloud computing and its characteristics, benefits and limitations.
		OE-CS701C.2	Explain different types of cloud models, architecture and infrastructure of cloud computing and its examples.
		OE-CS701C.3	Explain abstraction and different types of virtualization, load balancing technology and their role in the cloud computing model.
		OE-CS701C.4	Explain the security, privacy and cloud management of cloud computing.
		OE-CS701C.5	Use various cloud services in different applications.
HM-HU704	Values and Ethics	HM-HU704 .1	The students are able to see that verification on the basis of natural acceptance and experiential validation through living is the only way to verify right or wrong, and referring to any external source like text or instrument or any other person cannot enable them to verify with authenticity; it will only develop assumptions
		HM-HU704 .2	The students are able to grasp the right utilization of their knowledge in their streams of Technology/Engineering/ Management to ensure mutually enriching and recyclable productions systems
		HM-HU704 .3	The students are able to see that lack of right understanding leading to lack of relationship is the major cause of problems in their family and not the lack of physical facilities in most of the cases, while they have given higher priority to earning of physical facilities in their life ignoring relationships and not being aware that right understanding is the most important requirement for any human being
PC – AUE 791	Automobile Engineering Lab V (Automotive Electrical & Electronics System Lab)	PC – AUE 791.1	Identify and explain the testing procedure of battery, alternator and starter motor
		PC – AUE 791.2	Explain different kinds of automotive wiring and fault diagnosis capabilities of relay and fuses
		PC – AUE 791.3	To understand the basics of instrumentation, measurement, data acquisition, interpretation and analysis.
		PC – AUE 791.4	To learn rectifiers, filters, A/D and D/A convertors.
PW-AUE781	Project-III	PW-AUE781.1	carry out some project works based on some design or fabrication or experimental problems in a group building up team spirit and would get sufficient exposure for the way to proceed to solve a practical or design problem
MC772	Constitution of India	MC772.1	Understand and explain the significance of Indian Constitution as the fundamental law of the land.
		MC772.2	Exercise his fundamental rights in proper sense at the same time identifies his responsibilities in national building.
		MC772.3	Analyse the Indian political system, the powers and functions of the Union, State and Local Governments in detail
		MC772.4	Understand Electoral Process, Emergency provisions and Amendment procedure.
PE – AUE 801A	Off Road Vehicles	PE – AUE 801A.1	Understand the types, special features, design methodology, working principle, application of various off–road vehicles.
		PE – AUE 801A.2	Identify various systems & subsystems of earth moving machines & agricultural machines.
		PE – AUE 801A.3	Understand the hydraulic and pneumatic circuits for various off-road vehicles
		PE – AUE 801A.4	Understand preventive maintenance of earth moving machines & agricultural machines
PE – AUE 801B	Automotive Air Conditioning	PE – AUE 801B.1	A student will be able to identify various components of Vehicle Air conditioning and heating system
		PE – AUE 801B.2	Operate manually and automatic Air conditioning and heating system
		PE – AUE 801B.3	Apply various concepts related to Air conditioning and heating system
		PE – AUE 801B.4	Diagnose various faults in air conditioning system by using suitable tools and instruments
		PE – AUE 801B.5	Follow safety rules while servicing of Air conditioning and heating system
PE-AUE801C	Battery Technology and Management Systems	PE-AUE801C.1	Interpret the role of battery management system.
		PE-AUE801C.2	Identify the requirements of Battery Management System.
		PE-AUE801C.3	Understand the requirements of battery systems for automotive applications and understand the modelling of battery systems.
		PE-AUE801C.4	Interpret the concept associated with battery charging / discharging process.
PE-AUE801D	Fuel cell Technology	PE-AUE801D.1	Describe the working principles of Fuel cells and its component
		PE-AUE801D.2	Develop clear understanding about functioning and types of Fuel cells
		PE-AUE801D.3	Familiarize with the reaction kinetics involved in fuel cell
		PE-AUE801D.4	Build skill on thermodynamics concepts involved in fuel cell.
PE-AUE802A	Thermal Management of Hybrid Systems	PE-AUE802A.1	Apply the concepts of thermodynamics to understand the thermal management system
		PE-AUE802A.2	Understood and apply the thermal management system of different component of hybrid systems like Motors, Batteries and Power Electronics
		PE-AUE802A.3	Develop the thermal system model due to flow of heat & phase change over different types of geometrical shapes and different materials.
PE-AUE802B	Noise, Vibrations and Harshness	PE-AUE802B.1	Identify and analyze vibrations and noise coming out of automobiles.
		PE-AUE802B.2	Investigate level of harm caused by noise and harshness and to provide measures to control it.
PE-AUE 802C	Electric Motors for Automotive Applications	PE-AUE 802C.1	Understand requirement of electric motors.
		PE-AUE 802C.2	Understand the operation, performance of electric motors
		PE-AUE 802C.3	Understand suitability of electric motor & their control
OE-ME801F	Tribology	OE-ME801F.1	Apply knowledge of tribology for industrial component design
		OE-ME801F.2	Apply design concepts practically for automotive lubrication systems.

OE-IT801C	Internet of Things	OE-IT801C.1	Understand the internet of Things and its hardware and software components.
		OE-IT801C.2	Interface I/O devices, sensors & communication Modules.
		OE-IT801C.3	Remotely monitor data and control devices.
		OE-IT801C.4	Develop real-life IoT based projects.
OE-CS801H	Soft Computing	OE-CS801H.1	Explain various neural network architectures, back propagation neural networks, and their application
		OE-CS801H.2	Explain the concepts of fuzzy systems, fuzzy membership, and rules
		OE-CS801H.3	Illustrate the genetic algorithms and their applications.
		OE-CS801H.4	Apply concepts of neural networks, fuzzy logic, and genetic algorithm for solving problems in real life
OE-ME801B	Computational Fluid Dynamics	OE-ME801B.1	Develop mathematical characteristics of partial differential equations.
		OE-ME801B.2	Choose basic properties of computational methods– accuracy, stability, consistency.
		OE-ME801B.3	Analyze computational solution techniques for time integration of ordinary differential equations.
		OE-ME801B.4	Build computational solution techniques for various types of partial differential equations.
		OE-ME801B.5	Identify how to computationally solve Euler and Navier-Stokes equations
		OE-ME801B.6	Build programming and graphic skills to conduct the flow field calculations and data analysis.
OE-HU801D	Entrepreneurship Development	OE-HU801D .1	Understanding the dynamic role of entrepreneurship and small businesses
		OE-HU801D .2	Organizing and Managing a Small Business&Financial Planning and Control
		OE-HU801D .3	Demonstrate knowledge of theForms of Ownership for Small Business with strategic Marketing Planning
OE-ME801E	Robotics and Robot Application	OE-ME801E.1	Get familiarization with the basics of robots control system
		OE-ME801E.2	Get familiarization with end effectors, sensor technology and industrial application of robotapplication of robot.
OE-ME801C	Non-Destructive Testing Methods	OE-ME801C.1	Select an appropriate NDT technique as per requirement.
		OE-ME801C.2	Explain and differentiate various defect types and select the appropriate NDT methods for better evaluation.
		OE-ME801C.3	Explain and calibrate the instrument and inspect for in-service damage in the components.
		OE-ME801C.4	Determine the flaws in the material by NDT and take measures to eliminate them.
PC-AUE881	Comprehensive Viva Voce	PC-AUE881.1	Student will be able to prepare for the interview in a better way by brushing up different course papers so that overall knowledge on Automobile Engineering areas would be sharpened.
PW-AUE882	Project-IV	PW-AUE882.1	Carry out some project works based on some design or fabrication or experimental problems in a group building up team spirit and would get sufficient exposure for the way to proceed to solve a practical or design problem

Department Name: **Computer Science and Engineering**
Program Name: **B.Tech (CSE)**

Paper Code	Paper Name	CO No.	CO Statement
ES-EC301	Communication Engineering	ES-EC301.1	Understand the need for modulation and its requirements.
		ES-EC301.2	Summarize the concept of different analog and digital modulation techniques, their principles generation and detection.
		ES-EC301.3	Understand the different types of noise and its importance in system design.
		ES-EC301.4	Compute the coding efficiency of the systems and its relative merits and demerits of the different Line coding techniques.
		ES-EC301.5	Calculate the information content, entropy, information rate and error correcting techniques for given situations.
ES EC 302	Digital Electronics	ES EC 302.1	Realize number systems, basic gate operations and laws Boolean algebra.
		ES EC 302.2	Understand basic structure of different combinational circuits- multiplexer, decoder, encoder etc.
		ES EC 302.3	Perform different operations with sequential circuits.
		ES EC 302.4	Design A/D and D/A conversion techniques and articulate the basic concepts of Logic families.
BS-M301	Mathematics-III	BS-M301.1	Learn the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment
		BS-M301.2	Understand the basic ideas of statistics with different characterisation of a univariate and bivariate data set
		BS-M301.3	Apply statistical tools for analysing data samples.
		BS-M301.4	Learn the tools of Fourier transform to analyze engineering problems and apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines.
PC-CS301	Data Structures & Algorithms	PC-CS301.1	Understand the basic concepts of Data structures and complexity of algorithms
		PC-CS301.2	Comprehend the concepts of linear and nonlinear data structures and operations on them.
		PC-CS301.3	Apply the knowledge of linear and nonlinear data structures in solving problems.
		PC-CS301.4	Analyze complexity of different Sorting and Searching algorithms
BS BIO301	Biology	BS BIO301.1	State different engineering applications from biological perspective.
		BS BIO301.2	Classify biological systems and identify different organisms and microorganisms depending on their morphological, biochemical and ecological criterion.
		BS BIO301.3	Explain the concept of recessiveness and dominance during the passage of genetic material from parent to offspring and describe DNA as a genetic material in the molecular basis of information transfer.

		BS BIO301.4	Discuss structures of different biomolecules starting from basic units and hence understand different biological processes at the reductionistic level.
		BS BIO301.5	Describe protein structures and enzymology and also compare different mechanisms of enzyme action.
		BS BIO301.6	Describe energy transformation processes in biological systems.
HM-HU 301	Introduction to Industrial Management	HM-HU 301.1	Interpret given organization structure, culture, climate and major provisions of factory acts and laws.
		HM-HU 301.2	Explain material requirement planning, store keeping procedure and PPC functions.
		HM-HU 301.3	Plot and analyze inventory control models and techniques.
		HM-HU 301.4	Prepare and analyze CPM and PERT for given activities.
ES EC 392	Digital Electronics	ES EC 392.1	Realize basic gate operations and laws of Boolean algebra.
		ES EC 392.2	Design different combinational circuits.
		ES EC 392.3	Design different sequential circuits.
		ES EC 392.4	Study A/D converter and D/A converter circuits.

PC-CS391	Data Structures & Algorithms Lab	PC-CS391.1	Write the basic codes on linear Data structures and operations performed on it.
		PC-CS391.2	Apply dynamic memory allocation concept to implement linear and nonlinear data structures.
		PC-CS391.3	Apply the knowledge of linear data structures to solve expression conversion programs.
		PC-CS391.4	Compare different Sorting and Searching techniques by writing menu driven programs.
PC-CS392	IT Workshop (Using Python) Laboratory	PC-CS392.1	Understand and develop Computational Thinking concepts.
		PC-CS392.2	Express a problem-solving strategy to breakdown a complex problem into a series of simpler tasks.
		PC-CS392.3	Describe python programs that appropriately utilize built-in functions and control flow statements.
		PC-CS392.4	Use functions for structuring Python programs
		PC-CS392.5	Represent compound data using Python lists, tuples, dictionaries
		PC-CS392.6	Apply the knowledge of different Charts along with their comparison
MC371	Environmental Science	MC371.1	Explain basic concepts, man, society & environment, their interrelationship, mathematics of population growth and associated problems, steady state conservation system.
		MC371.2	Demonstrate natural environmental hazards like flood, earthquake, landslide-causes, effects and control/management.
		MC371.3	Classify air pollution, water pollution, land pollution, noise pollution and their controls.
		MC371.4	Study Elements of ecology and environmental management.
BS-M404	Numerical Methods	BS-M404.1	Calculate different types of error involved in Engineering problems and learn to apply numerical methods to find approximate solutions for them.
		BS-M404.2	Interpolate different polynomials using numerical techniques
		BS-M404.3	Derive numerical methods for integration and apply them for solving otherwise intractable Engineering problems
		BS-M404.4	To solve system of linear equations and to learn the concept of root finding for nonlinear equations
		BS-M404.5	To solve ordinary differential equation numerically
		BS-M404.6	Use various statistical tools to solve Engineering problems numerically
PC CS401	Computer Organization	PC CS401.1	Describe Computer hardware System, Instruction sets and Addressing Mode.
		PC CS401.2	Apply the knowledge of number system to perform different arithmetical operations.
		PC CS401.3	Design memory organization that uses banks for different word size operations.
		PC CS401.4	Compare different type of control units and I/O transfer techniques
PC-CS402	Operating System	PC-CS402.1	Understand introductory concepts of operating system.
		PC-CS402.2	Apply process scheduling methods and deadlock handling schemes.
		PC-CS402.3	Understand inter process communication.
		PC-CS402.4	Apply memory management and disk management procedures.
PC-CS403	DESIGN AND ANALYSIS OF ALGORITHM	PC-CS403.1	Understand the fundamental concepts of Asymptotic Notations and their mathematical significance
		PC-CS403.2	Describe different algorithm design techniques like D&C, Greedy Method, DP, Backtracking, Branch and Bound, Graph Algorithms, NP etc and their implementations
		PC-CS403.3	Apply appropriate algorithms and required Data Structure to construct the solution of a given problem
		PC-CS403.4	Explain Randomized algorithms (expected running time, probability of error), and Approximation algorithm to compute approximation factors
		PC-CS403.5	Analyze algorithms and determine the correctness
PC-CS404	DISCRETE MATHEMATICS	PC-CS404.1	Express a logic sentence in terms of predicates, quantifiers, and logical connectives
		PC-CS404.2	Derive the solution for a given problem using deductive logic and prove the solution based on logical inference
		PC-CS404.3	Classify its algebraic structure for a given a mathematical problem
		PC-CS404.4	Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra
		PC-CS404.5	Develop the given problem as graph networks and solve with techniques of graph theory
BS-M494	Numerical Methods Lab	BS-M494.1	Apply programming concepts to solve the interpolation problems.
		BS-M494.2	Apply programming concepts to solve the numerical integration problems.
		BS-M494.3	Apply programming concepts to solve the transcendental equation
		BS-M494.4	Apply programming concepts to solve the boundary value problems of ordinary differential equation
		BS-M494.5	Apply programming concepts to fit the curve numerically & central tendancy
		BS-M494.6	Apply programming concepts to solve the system of linear eqautions
PC CS 491	Computer Organization Lab	PC-CS491.1	Verify truth-table of different types of IC.
		PC-CS491.2	Design different type of adder circuits.
		PC-CS491.3	Design ALU by applying the knowledge of Combinational circuit.
		PC-CS491.4	Design different circuits with RAM ICs and perform read-write operation.

PC-CS492	Operating System Lab	PC-CS492.1	Understand UNIX commands and applications of shell script.
		PC-CS492.2	Apply Process and Thread execution.
		PC-CS492.3	Apply Signal and Semaphore.
		PC-CS492.4	Apply IPC related concepts.
PC-CS493	DESIGN AND ANALYSIS OF ALGORITHM LAB	PC-CS493.1	Implement Binary Search, Merge Sort, Quick Sort, and Max-min Problem using D&C Algorithm Design Techniques.
		PC-CS493.2	Implement Fractional Knapsack, Job Sequencing with Deadline, TSP, Matrix Chain, Graph Traversals, MST problems, Shortest Path, N- Queens, Graph Coloring, Hamiltonian Cycle, and 15 Puzzles using proper Algorithm Design Techniques.
		PC-CS493.3	Apply suitable algorithm for solving a particular problem
		PC-CS493.4	Analyze the complexities and memory usages of different algorithms
MC472	Constitution of India	MC472.1	Gain an understanding of the constitution of India.
		MC472.2	Become aware of the various levels of governance in the country.
PC-CS501	Computer Architecture	PC-CS501.1	Differentiate between pipelined and non-pipelined architecture
		PC-CS501.2	Demonstrate different page replacement techniques for physical memory with virtual memory concepts.
		PC-CS501.3	Describe Instruction level parallelism, multiprocessor architecture and different interconnection network.
		PC-CS501.4	Explain Non-von Neumann Architecture.
		PC-CS501.5	Understand and Implement circuit synthesis with HDL.
PC-CS502	Object Oriented Programming	PC – CS 502.1	Identify classes, objects, members of a class and relationships among them, needed for a specific problem.
		PC – CS 502.2	Demonstrate the concepts of polymorphism and inheritance.
		PC – CS 502.3	Implement Java collection API as well as the java standard class library.
		PC – CS 502.4	Implement error handling techniques using exception handling.
		PC – CS 502.5	Implement the concept of Multithreading and Applet programming.
PC CS503	Formal Language and Automata Theory	PC CS503.1	Understand the concept of abstract machines and their power to recognize the languages
		PC CS503.2	Construct automata for any given pattern and find its equivalent regular expressions
		PC CS503.3	Design context free grammars for formal languages.
		PC-CS503.4	Design PDA and Turing Machine.
PC-CS 504	Microprocessor and Microcontroller	PC-CS504.1	Identify the difference between Microprocessors and Microcontrollers
		PC-CS504.2	Understand the architecture, register configuration of 8085 μP
		PC-CS504.3	Identify the addressing mode of the instructions of 8085 μP and apply them to solve simple problem
		PC-CS504.4	Understand the process of interfacing μP with peripherals
		PC-CS504.5	Understand the architecture of 8086 μP and 8051 μC
HM-HU 501	Economics for Engineers	HM-HU 501.1	Discuss fundamentals of economic analysis.
		HM-HU 501.2	Describe rate of return and profitability analysis, Present, Future, Annuity, Risk and return, BEP and Sensitivity Analysis, Bayesian joint probability and quantitative decision making, basic accounting system and balance sheet and P & L accounts etc.
		HM-HU 501.3	Apply decision making skills in terms of Economic, financial considerations in practice.
		HM-HU 501.4	Apply knowledge to take right financial decision at the right point in time in real world situation.
PE-CS501A	MACHINE LEARNING	PE-CS501A.1	Explain different supervised Learning Techniques
		PE-CS501A.2	Identify the difference between Linear and Non-Linear Models
		PE-CS501A.3	Understand different unsupervised learning techniques
		PE-CS501A.4	Understand the concept of model estimation and deep learning techniques
PC-CS 591	Advanced IT Workshop	PC-CS 591.1	Generate graphs in different modes using matplotlib and seaborn.
		PC-CS 591.2	Implement different classification and clustering algorithm
		PC-CS 591.3	Implement decision tree
		PC-CS 591.4	Implement Deep Learning Techniques.
PC-CS592	Object Oriented Programming Lab	PC-CS 592.1	Apply the fundamental concept of Object oriented programming.
		PC-CS 592.2	Expertise in the concept of data encapsulation, Polymorphism, Inheritance.
		PC-CS 592.3	Implement the concept of packages and exception handling.
		PC-CS 592.4	Implement the concept of threads, Applets programming.
HM-HU591	Soft Skills Development Lab	HM-HU591.1	Honing over all Communicative Competence
		HM-HU591.2	Develop Team Building and Leadership Quality
		HM-HU591.3	Deliver an enthusiastic and well-practiced presentation
		HM-HU591.4	Communicate with clarity and confidence thereby enhancing employability skills of the students.

PC CS601	Compiler Design	PC-CS601.1	Summarize the basic concept of compiler and underlying finite state automata, regular expression, grammars and regular languages.
		PC CS601.2	Describe the functional phases of a compiler such as lexical analyzer, parser, code optimizer and code generator
		PC CS601.3	Compare LL, LR(0), LR(1) and LALR parser.
		PC CS601.4	Construct semantic rule, quadruple, triples, indirect triple and optimized code.
PC-CS602	Database Management Systems	PC-CS602.1	Describe the fundamental concept of File System and DBMS Architecture.
		PC-CS602.2	Understand the concepts of different types of attribute, keys and Entity Relationship model.
		PC-CS602.3	Apply concepts of relational algebra, calculus and Structured Query language.
		PC-CS602.4	Apply concepts of functional dependency and normalization process to construct normalized database.
		PC-CS602.5	Implement the isolation property including locking, time stamping based on recovery control and Serializability of scheduling,
		PC-CS602.6	Understand the concepts of Storage and Indexing data, File organization and indexing
PC-CS603	Computer Networks	PC-CS603.1	identify the concepts and components of computer networks, devices, physical structure/ layout, role of layered architectures /models and different addressing mechanisms
		PC-CS603.2	describe variety of protocols at application layer and security techniques
		PC-CS603.3	compare different data to signal conversion techniques, transmission medium, switching methodologies
		PC-CS603.4	analyze IP and its companion protocols, routing algorithms; TCP, UDP and different congestion control
		PC-CS603.5	evaluate different error, flow and access control techniques and protocols over variety of networks
PC-CS 604	Software Engineering	PC-CS604.1	Compare and apply the software development models.
		PC-CS604.2	Apply the data flow model, relational model and unified model to visualize the design of a system.
		PC-CS604.3	Know the degree of functionality and the relationship of modules of a software system.
		PC-CS604.4	Illustrate the validation and verification types of testing techniques and the steps of project management and scheduling.
PE-CS601A	Data Mining	PE-CS601A.1	Identify the key processes of data mining, data warehousing and knowledge discovery process.
		PE-CS601A.2	Identify appropriate data mining algorithms to solve real world problems
		PE-CS601A.3	Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining
		PE-CS601A.4	Describe complex data types with respect to spatial and web mining.
PE CS601C	Image Processing	PE CS601C.1	Understand the basic concepts of digital image fundamentals and computer processing of image models.
		PE CS601C.2	Comprehend different image enhancement techniques.
		PE CS601C.3	Develop Fourier transform for image processing in frequency domain.
		PE CS601C.4	Learn to apply the knowledge of different image processing techniques for image restoration and segmentation.
PE-CS 602B	Soft Computing	PE-CS602B.1	Identify the difference between Hard Computing and Soft Computing
		PE-CS602B.2	Practice fuzzy set theory and fuzzy logic to illustrate Fuzzy Inference System
		PE-CS602B.3	Identify and implement an appropriate Artificial Neural Network for solving a given problem
		PE-CS602B.4	Describe the Simple Genetic Algorithm and its operators
		PE-CS602B.5	Recall the other Soft Computing Techniques such as Simulated Annealing, ACO, Swarm Optimization, MOGA
PE-CS602C	Data Analytics and Visualization	PE-CS602C.1	Deploying the Data Analytics Lifecycle to address big data analytics projects
		PE-CS602C.2	Applying appropriate analytic techniques and tools to analyze big data, create statistical models, and identify insights that can lead to actionable results
		PE-CS602C.3	Selecting appropriate data visualizations to clearly communicate analytic insights to business sponsors and analytic audiences
		PE-CS602C.4	Using tools such as Tableau Software in database analytics
PC-CS692	Database Management Systems Lab	PC-CS692.1	Implement the concept of Data Definition Language, and Data manipulation language.
		PC-CS692.2	Use the concept of Column level, row level and check constraints.
		PC-CS692.3	Implement the concept of Aggregation functions, Joins and views.
		PC-CS692.4	Implement the concept of Cursors, triggers in PL/SQL.
PC-CS693	Computer Networks Lab	PC-CS693.1	prepare straight through and crossover cable using Cat5 UTP cable and RJ45 connectors and demonstrate the working principle of sliding window protocol
		PC-CS693.2	apply configuration and networking knowledge and skill to setup Ethernet Card in Windows and Linux
		PC-CS693.3	implement of Inter-Process Communication using PIPE
		PC-CS693.4	design variety of iterative and concurrent servers and implement client-server Communication using TCP and UDP socket

PC CS 694	Software Development and IT Operations Lab	PC-CS694.1	Use various AWS cloud services like storage, network, compute, and databases in different applications.
		PC-CS694.2	Use DevOps tool to build and deploy applications in a cloud infrastructure.
		PC-CS694.3	Learn how to simulate a cloud environment.
		PC-CS694.4	Use different AWS automation tools like Chef, Terraform, Packer, CloudFormation, OpsWorks, and Beanstalk.
PW-CS 681	Project - I	PW-CS681.1	Identify technical ideas, strategies, and methodologies to develop solutions of a real-world problem.
		PW-CS681.2	Differentiate between previous solutions for the underlined problem to propose new modern tools and techniques.
		PW-CS681.3	Execute work as a responsible member of a team with professional behavior.
		PW-CS681.4	Demonstrate technical and behavioral ideas in written and oral form.
PE-CS701A	Quantum Computing	PE-CS701A.1	Relate vectors to physical states of system and matrices to operators.
		PE-CS701A.2	Examine the application of various quantum gates on qubit.
		PE-CS701A.3	Discover the power of parallel computing using quantum algorithms.
		PE-CS701A.4	Construct simple quantum circuits by IBM's Qiskit
PE-CS701B	Cloud Computing	PE-CS701B .1	Explain the fundamental concept of cloud computing and its characteristics, benefits and limitations.
		PE-CS701B .2	Classify different types of cloud models, architecture and infrastructure of cloud computing and its examples.
		PE-CS701B.3	Demonstrate abstraction and different types of virtualization, load balancing technology and their role in the cloud computing model.
		PE-CS701B .4	Solve the security, privacy issues and cloud management of cloud computing.
		PE-CS701B .5	Use various cloud services in different applications.
PE-CS701C	Neural Networks and Deep Learning	PE-CS701C .1	Explain the concepts of McCulloch-Pitts Neuron, Perceptron and Sigmoid Neuron
		PE-CS701C .2	Describe the structural and functional framework of Neural Networks
		PE-CS701C.3	Interpret the learning procedure of Neural Networks
		PE-CS701C.4	Classify different deep learning models
		PE-CS701C.5	Recognize different deep learning tools, the research applications, limitations and future directions
PE- CS702A	Natural Language Processing	PE- CS702A.1	Identify the basic concepts of Natural language processing.
		PE- CS702A.2	Describe the concepts of morphology, Syntactic processing, and semantics analysis of natural language processing.
		PE- CS702A.3	Illustrate different language Models and Text classification techniques
		PE- CS702A.4	Use appropriate statistical models for a given natural language problem
		PE- CS702A.5	Use information retrieval techniques to solve real life problems.
PE-CS702B	Block Chain Technology	PE- CS702B.1	Describe the basic concepts and working of Blockchain Technology including Hash function and Consensus algorithms
		PE- CS702B.2	Explain the design principles of Bitcoin, Ethereum, Smart Contracts and role of cryptography in these architectures
		PE- CS702B.3	Explain the working of smart contracts in developing different Decentralized applications with knowledge of Bitcoin concept.
PE-CS702C	Artificial Intelligence	PE-CS702C.1	Identify the basic concepts of AI Techniques, Agents, and Production System
		PE-CS702C.2	Compare between heuristic, non-heuristic search strategies and adversarial search
		PE-CS702C.3	Apply Predicate logic, Resolution and Probability based inference in different problems
		PE-CS702C.4	Explain the expert system architecture in different domains
OE-EC701A	Adhoc and Sensor Network	OE-EC701A.1	Know the basics of Ad hoc networks and Wireless Sensor Networks
		OE-EC701A.2	Apply this knowledge to identify the suitable routing algorithm based on the network and user requirement
		OE-EC701A.3	Apply the knowledge to identify appropriate physical and MAC layer protocols.
		OE-EC701A.4	Explain the transport layer and security issues possible in Ad hoc and sensor networks
		OE-EC701A.5	Familiar with the OS used in Wireless Sensor Networks and build basic modules.
OE-EE701B	Control System	OE-EE701B.1	Develop mathematical model and compute transfer of linear system
		OE-EE701B.2	Calculate peak time, rise time, settling time, steady state error of linear system in time response analysis
		OE-EE701B.3	Compute peak response, bandwidth, gain crossover, phase crossover, gain margin and phase margin of linear system in frequency response analysis
		OE-EE701B.4	Explain stability analysis of linear system in time domain and frequency domain approach.
		OE-EE701B.5	Describe the effect of using controller and compensator to improve the system performances with given criterion.
		OE-EE701B.6	Apply the knowledge of state variable techniques for analysis of multivariable linear systems
		OE-EE701B.7	Explain the basic concept and analysis of the nonlinear control system.
OE-IT701D	Multimedia Systems	OE-IT701D.1	Explain the concepts, principles and theories of Multimedia Applications and Virtual environments.
		OE-IT701D.2	Demonstrate knowledge and understanding the various aspects and issues involved with development and deployment of multimedia system.
		OE-IT701D.3	Analyze and solve problems related to their expertise in Multimedia Applications and Virtual Environments.
		OE-IT701D.4	Demonstrate their ability to extend their basic knowledge to encompass new principles and practice.

OE-M 701A	Operations Research and Optimizing Technique	OE-M 701A.1	Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained
		OE-M 701A.2	Determine optimal strategy for Minimization of Cost of shipping of products from source to Destination/ Maximization of profits of shipping products using various methods, Finding initial basic feasible and optimal solution of the Transportation problems
		OE-M 701A.3	Optimize the allocation of resources to Demand points in the best possible way using various techniques and minimize the cost or time of completion of number of jobs by number of persons
		OE-M 701A.4	Extract the Optimum value in constrained and unconstrained situations
		OE-M 701A.5	Acquire skills in analyzing queueing models.
		OE-M 701A.6	Analyze competitive real-world phenomena using concepts from game theory. Analyze pure and mixed strategy games
		OE-M 701A.7	Formulate Network models for service and manufacturing systems, and apply operations research techniques and algorithms to solve these Network problems
OE-ME701B	Mechatronic Systems	OE-ME701B.1	Model and analyze mechatronic systems for an engineering application
		OE-ME701B.2	Identify sensors, transducers and actuators to monitor and control the behaviour of process or product.
		OE-ME701B.3	Develop PLC programs for an engineering application
		OE-ME701B.4	Evaluate the performance of mechatronic systems.
OE-EC701C	Mobile Computing	OE-EC701C.1	Identify the key components of Mobility Management and GSM Architecture
		OE-EC701C.2	Explain Wireless Application Protocol and GPRS Architecture
		OE-EC701C.3	Describe 3G, CDMA, WCDMA
		OE-EC701C.4	Differentiate between IRIDIUM and GLOBALSTAR systems
OE-HU701B	Human Resource Development and Organisational Behaviour	OE-HU701B.1	Demonstrate the applicability of the concept of organizational behavior to understand the behavior of people in the organization
		OE-HU701B.2	Demonstrate the applicability of analyzing the complexities associated with management of individual behavior in the organization.
		OE-HU701B.3	Analyze the complexities associated with management of the group behavior in the organization
		OE-HU701B.4	Demonstrate how the organizational behavior can integrate in understanding the motivation (why) behind behavior of people in the organization.
OE-IT701A	Introduction to Bioinformatics	OE-IT701A.1	Develop models for biological data
		OE-IT701A.2	Apply pattern matching techniques to bioinformatics data – protein data genomic data
		OE-IT701A.3	Apply microarray technology for genomic expression study
OE-IT 701B	Cyber Law and Security Policy	OE-IT 701B.1	Recall the basic terminology related to cybercrime and cyber security.
		OE-IT 701B.2	Identify the security challenges faced by mobile devices.
		OE-IT 701B.3	Describe the tools and methods used in cybercrime.
		OE-IT 701B.4	Explain steps of cyber forensic evidence gathering and report generation
		OE-IT 701B.5	Use different sections of Indian IT Act on cybercrimes
OE-ME701D	Robotics	OE-ME701D.1	Familiarize the basics of robots control system.
		OE-ME701D.2	Demonstrate knowledge of industrial robots, characteristics, end effectors and actuators
		OE-ME701D.3	Apply spatial transformation to obtain forward and inverse kinematics
		OE-ME701D.4	Explain industrial robotics and their applications
		OE-ME701D.5	Explain robot programming
HM-HU 802	Professional Ethics and Project Management	HM-HU 802.1	Apply the knowledge of human values and social values to contemporary ethical values and global issues.
		HM-HU 803.2	Make a framework for analyzing a project and apply their knowledge systematically to value a business
		HM-HU 804.3	Applying the principles and practices while maintaining high standards of practice, making ethical judgments and decisions in a respectful, and sustaining professional standing through a commitment to life-long learning.
		HM-HU 805.4	Implements the generally recognized framework and good practices of project management, organizational influences; operations; strategic planning; programs; project life cycles; and project management cycles
PE-CS 801A	Big Data Analytics	PE-CS 801A.1	Describe the concept of Big Data, Hadoop and HDFS
		PE-CS 801A.2	Describe the concept of Map Reduce, Hive, HBase, Pig, Sqoop and Impala
		PE-CS 801A.3	Demonstrate the concept of data transfer between HDFS, MySQL and Hive
		PE-CS 801A.4	Apply NoSQL for importing and exporting unstructured data
PE-CS801B	Cryptography & Network Security	PE-CS801B.1	Explain the principle of cryptography with different types of cipher generation and modular arithmetic's role in Cryptoanalysis.
		PE-CS801B.2	Illustrate the concept of symmetric and asymmetric algorithm with advanced concepts like ECC, Elgamel and Hash functions.
		PE-CS801B.3	Interpret integrity checks and authentication algorithms and web and system security.
		PE-CS801B.4	Explain Blockchain and Cryptocurrency and its role in different domains.
PE-CS801C	Web and Internet Technology	PE-CS801C.1	Recall the concepts of network and internet, technologies and protocols
		PE-CS801C.2	Apply different technologies such as HTML, CSS, javascript, Perl, applet and other Web technologies to develop static/ dynamic web pages for a given web application
		PE-CS801C.3	Apply javascript to implement cookie
		PE-CS801C.4	Design dynamic and interactive web pages by embedding javascript code in HTML to validate the user input
		PE-CS801C.5	Design security issues for devices like firewall
OE-AUE801A	Electric Vehicle	OE-AUE801A.1	Choose a suitable drive scheme for developing an electric hybrid vehicle depending on resources.

		OE-AUE801A.2	Choose proper energy storage systems for vehicle applications.
		OE-AUE801A.3	Design and develop basic schemes of electric vehicles
OE-HU801G	Introduction to Philosophical Thoughts	OE-HU801G.1	Describe and distinguish key philosophical concepts in the main subfields of philosophy, including concepts such as free will, mind, knowledge, belief, reality, faith, reason, good, etc.
		OE-HU801G.2	Discuss core philosophical problems, such as whether there is a god, what does it mean to be conscious, are we free to make choices, what is justice, etc.
		OE-HU801G.3	Explain and defend a position on basic philosophical problems.
		OE-HU801G.4	Read and comprehend philosophical texts, both classical and contemporary and concise explanations and arguments about basic philosophical problems
OE-IT801B	E-Commerce	OE-IT801B.1	Explain the concept of E-Commerce and Business models.
		OE-IT801B.2	Describe how procurement and supply chains relate to B2B E-commerce.
		OE-IT801B.3	Discuss legal issues surrounding e-commerce.
		OE-IT801B.4	Identify the key security threats and its solution in the E-commerce environment.
OE-IT801C	Internet of Things	OE-IT801C.1	Explain general concepts of Internet of Things (IoT).
		OE-IT801C.2	Classify various devices, sensors and applications.
		OE-IT801C.3	Explain M2M and IoT architectures.
		OE-IT801C.4	Explain the application of IoT solutions.
		OE-IT801C.5	Apply IoT solutions in various domain using sensors, actuators and Devices.
OE-ME801A	3D Printing and Design	OE-ME801A.1	Demonstrate the knowledge of Additive Manufacturing and Rapid Prototyping technologies.
		OE-ME801A.2	Describe different RP techniques.
		OE-ME801A.3	know fundamentals of Reverse Engineering.
OE-EC 801A	Information and Coding theory	OE-EC 801A.1	Define Information, Uncertainty, Entropy and channel capacity of AWGN channel.
		OE-EC 801A.2	Explain various source coding schemes.
		OE-EC 801A.3	Evaluate error control coding techniques to detect and correct the channel error.
OE-EC801B	Microelectronics and VLSI Design	OE-EC801B.1	State VLSI design methodologies.
		OE-EC801B.2	Describe different steps of VLSI fabrication process and layout design rules.
		OE-EC801B.3	Explain the operation of different CMOS analog circuits.
		OE-EC801B.4	Explain the operation of various digital CMOS logic circuits.
OE-EE801A	Renewable Energy	OE-EE801A.1	Explain the principle of conversion of solar energy, wind energy, biomass, Geothermal Energy, Ocean energy and Hydrogen energy to other form of energy.
		OE-EE801A.2	Discuss about the location to set up wind mill and biogas generation plant
		OE-EE801A.3	Use Solar energy, Wind energy, Biomass, Geothermal energy, Ocean energy, Hydrogen energy and fuel cell for different applications.
		OE-EE801A.4	Explain the principle of operation of magneto-hydrodynamic power generation
		OE-EE801A.4	Estimate conversion efficiency of fuel cell.
OE-HU 801A	Business Analytics and Entrepreneurship	OE-HU 801A.1	Explain the concept and methods of business analytics.
		OE-HU 801A.2	Apply appropriate analytical methods to find solutions to business problems.
		OE-HU 801A.3	Explain the importance of different factors and skills for entrepreneurship.
		OE-HU 801A.4	Describe the rules and regulations to establish a new venture.

Department Name: **Computer Science and Engineering**
Program Name: **B.Tech (CSE- Data Science)**

Paper Code	Paper Name	CO No.	CO Statement
ES-EC(D)301	Communication Engineering	ES-EC(D)301.1	Understand the need for modulation and its requirements.
		ES-EC(D)301.2	Summarize the concept of different analog and digital modulation techniques, their principles, generation and detection
		ES-EC(D)301.3	Understand the different types of noise and its importance in system design
		ES-EC(D)301.4	Compute the coding efficiency of the systems and its relative merits and demerits of the different line coding techniques.
		ES-EC(D)301.5	Calculate the information content, entropy, information rate and error correcting techniques for given situations.
ES EC 302	Digital Electronics	ES EC 302.1	Realize number systems, basic gate operations and laws Boolean algebra.
		ES EC 302.2	Understand basic structure of different combinational circuits- multiplexer, decoder, encoder etc.
		ES EC 302.3	Perform different operations with sequential circuits.
		ES EC 302.4	Design A/D and D/A conversion techniques and articulate the basic concepts of Logic families.
BS-M301	Mathematics-III	BS-M301.1	Learn the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment
		BS-M301.2	Understand the basic ideas of statistics with different characterisation of a univariate and bivariate data set
		BS-M301.3	Apply statistical tools for analysing data samples.
		BS-M301.4	Learn the tools of Fourier transform to analyze engineering problems and apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines.
PC-CS301	Data Structures & Algorithms	PC-CS301.1	Understand the basic concepts of Data structures and complexity of algorithms.
		PC-CS301.2	Comprehend the concepts of linear and nonlinear data structures and operations on them.
		PC-CS301.3	Apply the knowledge of linear and nonlinear data structures in solving problems.
		PC-CS301.4	Analyze complexity of different Sorting and Searching algorithms

HM-HU 301	Introduction to Industrial Management	HM-HU 301.1	Interpret given organization structure, culture, climate and major provisions of factory acts and laws.
		HM-HU 301.2	Explain material requirement planning, store keeping procedure and PPC functions.
		HM-HU 301.3	Plot and analyze inventory control models and techniques.
		HM-HU 301.4	Prepare and analyze CPM and PERT for given activities.
BS BIO301	Biology	BS BIO301.1	State different engineering applications from biological perspective.
		BS BIO301.2	Classify biological systems and identify different organisms and microorganisms depending on their morphological, biochemical and ecological criterion.
		BS BIO301.3	Explain the concept of recessiveness and dominance during the passage of genetic material from parent to offspring and describe DNA as a genetic material in the molecular basis of information transfer.
		BS BIO301.4	Discuss structures of different biomolecules starting from basic units and hence understand different biological processes at the reductionistic level.
		BS BIO301.5	Describe protein structures and enzymology and also compare different mechanisms of enzyme action.
		BS BIO301.6	Describe energy transformation processes in biological systems.
ES-EC392	Digital Electronics Lab	ES-EC392.1	Realize basic gate operations and laws of Boolean algebra.
		ES-EC392.2	Design different combinational circuits.
		ES-EC392.3	Design different sequential circuits.
		ES-EC392.4	Study A/D converter and D/A converter circuits.
PC-CS391	Data Structures & Algorithms Lab	PC-CS391.1	Write the basic codes on linear Data structures and operations performed on it.
		PC-CS391.2	Apply dynamic memory allocation concept to implement linear and nonlinear data structures.
		PC-CS391.3	Apply the knowledge of linear data structures to solve expression conversion programs.
		PC-CS391.4	Compare different Sorting and Searching techniques by writing menu driven programs.
PC-CS392	IT Workshop (Using Python) Lab	PC-CS392.1	Understand and develop Computational Thinking concepts.
		PC-CS392.2	Express a problem-solving strategy to breakdown a complex problem into a series of simpler tasks.
		PC-CS392.3	Describe python programs that appropriately utilize built-in functions and control flow statements.
		PC-CS392.4	Understand the Exception Handling and Object-oriented concept of Python.
		PC-CS392.5	Represent compound data using Python lists, tuples, dictionaries
		PC-CS392.6	Knowledge of different Charts along with the comparison of different charts.
BS-M404	Numerical Methods	BS-M404.1	Calculate different types of error involved in Engineering problems and learn to apply numerical methods to find approximate solutions for them.
		BS-M404.2	Interpolate different polynomials using numerical techniques
		BS-M404.3	Derive numerical methods for integration and apply them for solving otherwise intractable Engineering problems
		BS-M404.4	To solve system of linear equations and to learn the concept of root finding for nonlinear equations
		BS-M404.5	To solve ordinary differential equation numerically
		BS-M404.6	Use various statistical tools to solve Engineering problems numerically
PC-CS(D)401	Computer Organisation and Architecture	PC-CS(D)401.1	Describe Computer hardware, System, Instruction sets and Addressing Mode.
		PC-CS(D)401.2	Design memory organization that uses banks for different word size operations.
		PC-CS(D)401.3	Learn pipelining concepts with a prior knowledge of stored program methods
		PC-CS(D)401.4	Study of parallel architecture and interconnection network
PC-CS402	Operating System	PC-CS402.1	Understand introductory concepts of operating system.
		PC-CS402.2	Apply process scheduling methods and deadlock handling schemes.
		PC-CS402.3	Understand inter process communication.
		PC-CS402.4	Apply memory management and disk management procedures.
PC-CS403	DESIGN AND ANALYSIS OF ALGORITHM	PC-CS403.1	Understand the fundamental concepts of Asymptotic Notations and their mathematical significance
		PC-CS403.2	Describe different algorithm design techniques like D&C, Greedy Method, DP, Backtracking, Branch and Bound, Graph Algorithms, NP etc and their implementations
		PC-CS403.3	Apply appropriate algorithms and required Data Structure to construct the solution of a given problem
		PC-CS403.4	Explain Randomized algorithms (expected running time, probability of error), and Approximation algorithm to compute approximation factors
		PC-CS403.5	Analyze algorithms and determine the correctness
PC-CS404	DISCRETE MATHEMATICS	PC-CS404.1	Express a logic sentence in terms of predicates, quantifiers, and logical connectives
		PC-CS404.2	Derive the solution for a given problem using deductive logic and prove the solution based on logical inference
		PC-CS404.3	Classify its algebraic structure for a given a mathematical problem
		PC-CS404.4	Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra
		PC-CS404.5	Develop the given problem as graph networks and solve with techniques of graph theory
BS-M494	Numerical Methods(Lab)	BS-M494.1	Apply programming concepts to solve the interpolation problems.
		BS-M494.2	Apply programming concepts to solve the numerical integration problems.
		BS-M494.3	Apply programming concepts to solve the transcendental equation
		BS-M494.4	Apply programming concepts to solve the boundary value problems of ordinary differential equation

		BS-M494.5	Apply programming concepts to fit the curve numerically & central tendancy
		BS-M494.6	Apply programming concepts to solve the system of linear eqautions
PC-CS(D)491	Computer Organization and Architecture Laboratory	PC-CS(D)491.1	Familiar with different ICs and their Application
		PC-CS(D)491.2	Design different circuits with RAM ICs and perform read-write operation.
		PC-CS(D)491.3	Design various hardware circuits using VHDL software.
		PC-CS(D)491.4	Integrate components to present independent circuitry.
PC-CS492	Operating System Lab	PC-CS492.1	Understand UNIX commands and applications of shell script.
		PC-CS492.2	Apply Process and Thread execution.
		PC-CS492.3	Apply Signal and Semaphore.
		PC-CS492.4	Apply IPC related concepts.
PC-CS493	DESIGN AND ANALYSIS OF ALGORITHM LAB	PC-CS493.1	Implement Binary Search, Merge Sort, Quick Sort, and Max-min Problem using D&C Algorithm Design Techniques.
		PC-CS493.2	Implement Fractional Knapsack, Job Sequencing with Deadline, TSP, Matrix Chain, Graph Traversals, MST problems, Shortest Path, N- Queens, Graph Coloring, Hamiltonian Cycle, and 15 Puzzles using proper Algorithm Design Techniques.
		PC-CS493.3	Apply suitable algorithm for solving a particular problem
		PC-CS493.4	Analyze the complexities and memory usages of different algorithms
MC472	Constitution of India	MC472.1	Gain an understanding of the constitution of India.
		MC472.2	Become aware of the various levels of governance in the country.
PC-CS(D) 501	Machine Learning	PC-CS(D) 501.1	Explain different supervised Learning Techniques
		PC-CS(D) 501.2	Identify the difference between Linear and Non Linear Models
		PC-CS(D) 501.3	Understand different unsupervised learning techniques.
		PC-CS(D) 501.4	Understand the concept of model estimation and deep learning techniques.
PC-CS502	Object Oriented Programming	PC – CS 502.1	Identify classes, objects, members of a class and relationships among them, needed for a specific problem.
		PC – CS 502.2	Demonstrate the concepts of polymorphism and inheritance.
		PC – CS 502.3	Implement Java collection API as well as the java standard class library.
		PC – CS 502.4	Implement error handling techniques using exception handling.
		PC – CS 502.5	Implement the concept of Multithreading and Applet programming.
PC-CS 503	Formal language and Automata Theory	PC-CS503.1	Understand the concept of abstract machines and their power to recognize the languages
		PC-CS503.2	Construct automata for any given pattern and find its equivalent regular expressions
		PC-CS503.3	Design context free grammars for formal languages.
		PC-CS503.4	Design PDA and Turing Machine.
PC-CS(D)504	Introduction to Data Science	PC-CS(D)504.1	Understand the basic concepts of data and machine learning.
		PC-CS(D)504.2	Understand visual representation of data.
		PC-CS(D)504.3	Understand recommendation system.
		PC-CS(D)504.4	Understand ethical & unethical use of data.
PE-CS(D)501A	Software Engineering	PE-CS(D)501A.1	Compare and apply the software development models.
		PE-CS(D)501A.2	Apply the data flow model, relational model and unified model to visualize the design of a system.
		PE-CS(D)501A.3	Know the degree of functionality and the relationship of modules of a software system.
		PE-CS(D)501A.4	Illustrate the validation and verification types of testing techniques and the steps of project management and scheduling.
PE-CS501B	ADVANCED ALGORITHM	PE-CS501B.1	Explain lower bound theorem, various graph algorithms along with analysis of different sorting algorithms
		PE-CS501B.2	Understand matroids, disjoint set manipulation, graph matching algorithm, different string matching algorithms, and operations on Strassen's matrix manipulation etc.
		PE-CS501B.3	Understand different DFT algorithms and modulo representation of Integer/ Polynomial
		PE-CS501B.4	Explain Convex hull, Voronoi diagram, Range search, Bin packing and other methods under computational geometry
		PE-CS501B.5	Understand Linear programming, NP-completeness and recent activities in the field of advanced data structure
PE-CS501C	Computer Graphics	PE-CS501C.1	Understand contemporary graphics hardware components.
		PE-CS501C.2	Implement different algorithms for drawing basic graphics structures like straight line, circle and ellipse.
		PE-CS501C.3	Demonstrate working of clipping algorithms and distinguish between different clipping methods.
		PE-CS501C.4	Analyze methods of transformations and solve problems on them.
		PE-CS501C.5	Use spline properties, shading models and hidden surface removal algorithms for creating real world object.
HM-HU 501	Economics for Engineers	HM-HU 501.1	Discuss fundamentals of economic analysis.
		HM-HU 501.2	Describe rate of return and profitability analysis, Present, Future, Annuity, Risk and return, BEP and Sensitivity Analysis, Bayesian joint probability and quantitative decision making, basic accounting system and balance sheet and P & L accounts etc.

		HM-HU 501.3	Apply decision making skills in terms of Economic, financial considerations in practice.
		HM-HU 501.4	Apply knowledge to take right financial decision at the right point in time in real world situation.
PC-CS(D) 591	Machine Learning Lab	PC-CS(D) 591.1	Implement different regression and classification algorithms.
		PC-CS(D) 591.2	Implement different clustering algorithms.
		PC-CS(D) 591.3	Implement Deep Learning Techniques.
PC-CS592	Object Oriented Programming Lab.	PC – CS 592.1	Apply the fundamental concept of Object oriented programming.
		PC – CS 592.2	Expertise in the concept of data encapsulation, Polymorphism, Inheritance.
		PC – CS 592.3	Implement the concept of packages and exception handling.
		PC – CS 592.4	Implement the concept of threads, Applets programming.
PC-CS593	Introduction to R Programming	PC-CS593.1	Understand the basics structure of R programming in terms of control statements, object, vector, matrix, functions.
		PC-CS593.2	Understand the use of R for Statistical analytics
		PC-CS593.3	Visualize the data with R Graphics.
HMHU591	Soft Skills Development Lab	HMHU591.1	Honing over all Communicative Competence
		HMHU591.2	Develop Team Building and Leadership Quality
		HMHU591.3	Deliver an enthusiastic and well-practiced presentation
		HMHU591.4	Communicate with clarity and confidence thereby enhancing employability skills of the students.
PC CS601	Compiler Design	PC CS601.1	Summarize the basic concept of compiler and underlying finite state automata, regular expression, grammars and regular languages.
		PC CS601.2	Describe the functional phases of a compiler such as lexical analyzer, parser, code optimizer and code generator
		PC CS601.3	Compare LL, LR(0), LR(1) and LALR parser.
		PC CS601.4	Construct semantic rule, quadruple, triples, indirect triple and optimized code.
PC-CS602	Database Management Systems	PC-CS602.1	Describe the fundamental concept of File System and DBMS Architecture.
		PC-CS602.2	Understand the concepts of different types of attribute, keys and Entity Relationship model.
		PC-CS602.3	Apply concepts of relational algebra, calculus and Structured Query language.
		PC-CS602.4	Apply concepts of functional dependency and normalization process to construct normalized database.
PC-CS603	Computer Networks	PC-CS603.1	identify the concepts and components of computer networks, devices, physical structure/ layout, role of layered architectures /models and different addressing mechanisms
		PC-CS603.2	describe variety of protocols at application layer and security techniques
		PC-CS603.3	compare different data to signal conversion techniques, transmission medium, switching methodologies
		PC-CS603.4	analyze IP and its companion protocols, routing algorithms; TCP, UDP and different congestion control
		PC-CS603.5	evaluate different error, flow and access control techniques and protocols over variety of networks
PC-CS(D)604	High Performance Computing	PC-CS(D)604.1	Investigate modern design structures of pipelined and multiprocessors systems.
		PC-CS(D)604.2	Design the architecture of parallel systems
		PC-CS(D)604.3	Understand the API for parallel programming in shared-memory environments
		PC-CS(D)604.4	Understand the implementation of MPI
PE-CS601A	Data Mining	PE-CS601A.1	Identify the key processes of data mining, data warehousing and knowledge discovery process.
		PE-CS601A.2	Identify appropriate data mining algorithms to solve real world problems
		PE-CS601A.3	Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining
		PE-CS601A.4	Describe complex data types with respect to spatial and web mining.
PE CS601C	Image Processing	PE CS601C.1	Understand the basic concepts of digital image fundamentals and computer processing of image models.
		PE CS601C.2	Comprehend different image enhancement techniques.
		PE CS601C.3	Develop Fourier transform for image processing in frequency domain.
		PE CS601C.4	Learn to apply the knowledge of different image processing techniques for image restoration and segmentation.
PE-CS602C	Data Analytics and Visualization	PE-CS602C.1	Deploying the Data Analytics Lifecycle to address big data analytics projects
		PE-CS602C.2	Applying appropriate analytic techniques and tools to analyze big data, create statistical models, and identify insights that can lead to actionable results
		PE-CS602C.3	Selecting appropriate data visualizations to clearly communicate analytic insights to business sponsors and analytic audiences
		PE-CS602C.4	Using tools such as Tableau Software in database analytics
PC-CS692	Database Management Systems Lab	PC-CS692.1	Apply the basic concepts of Database Systems and Applications.
		PC-CS692.2	Use the basics of SQL and construct queries using SQL in database creation and interaction.
		PC-CS692.3	Design a commercial relational database system (Oracle, MySQL) by writing SQL using the system.
		PC-CS692.4	Analyze and Select storage and recovery techniques of database system.

PC-CS693	Computer Networks Lab	PC-CS693.1	prepare straight through and crossover cable using Cat5 UTP cable and RJ45 connectors and demonstrate the working principle of sliding window protocol
		PC-CS693.2	apply configuration and networking knowledge and skill to setup Ethernet Card in Windows and Linux
		PC-CS693.3	implement of Inter-Process Communication using PIPE
		PC-CS693.4	design variety of iterative and concurrent servers and implement client-server Communication using TCP and UDP socket
PC CS 694	Software Development and IT Operations Lab	PC-CS694.1	Use various AWS cloud services like storage, network, compute, and databases in different applications.
		PC-CS694.2	Use DevOps tool to build and deploy applications in a cloud infrastructure.
		PC-CS694.3	Learn how to simulate a cloud environment.
		PC-CS694.4	Use different AWS automation tools like Chef, Terraform, Packer, CloudFormation, OpsWorks, and Beanstalk.
PW-CS 681	Project - I	PW-CS681.1	Identify technical ideas, strategies, and methodologies to develop solutions of a real-world problem.
		PW-CS681.2	Differentiate between previous solutions for the underlined problem to propose new modern tools and techniques.
		PW-CS681.3	Execute work as a responsible member of a team with professional behavior.
		PW-CS681.4	Demonstrate technical and behavioral ideas in written and oral form.
PE-CS(D)701A	Data Security and Authentication	PE-CS(D)701A.1	Explain the basic principles of security, block, stream cipher and the importance of keys in the principle of encryption and decryption.
		PE-CS(D)701A.2	Identify the difference between symmetric and asymmetric key and the importance of hash function and message digest in cryptography.
		PE-CS(D)701A.3	Identify the Internet Security Protocols, Digital Signature, Biometric Authentication, steganography as well as secret sharing mechanism.
		PE-CS(D)701A.4	Explain the basics of e-mail security and Firewall including DMZ network's role in Defense organizations.
PE-CS701B	Cloud Computing	PE-CS701B.1	Explain the fundamental concept of cloud computing and its characteristics, benefits and limitations.
		PE-CS701B.2	Classify different types of cloud models, architecture and infrastructure of cloud computing and its examples.
		PE-CS701B.3	Demonstrate abstraction and different types of virtualization, load balancing technology and their role in the cloud computing model.
		PE-CS701B.4	Solve the security, privacy issues and cloud management of cloud computing.
		PE-CS701B.5	Use various cloud services in different applications.
PE-CS701C	Neural Networks and Deep Learning	PE-CS701C.1	Explain the concepts of McCulloch-Pitts Neuron, Perceptron and Sigmoid Neuron.
		PE-CS701C.2	Describe the structural and functional framework of Neural Networks.
		PE-CS701C.3	Interpret the learning procedure of Neural Networks.
		PE-CS701C.4	Classify different deep learning models.
		PE-CS701C.5	Recognize different deep learning tools, the research applications, limitations and future directions.
PE-CS702A	Natural Language Processing	PE-CS702A.1	Identify the basic concepts of Natural language processing.
		PE-CS702A.2	Describe the concepts of morphology, Syntactic processing, and semantics analysis of natural language processing.
		PE-CS702A.3	Illustrate different language Models and Text classification techniques.
		PE-CS702A.4	Use appropriate statistical models for a given natural language problem.
		PE-CS702A.5	Use information retrieval techniques to solve real life problems.
PE-CS702B	Block Chain Technology	PE-CS702B.1	Describe the basic concepts and working of Blockchain Technology including Hash function and Consensus algorithms
		PE-CS702B.2	Explain the design principles of Bitcoin, Ethereum, Smart Contracts and role of cryptography in these architectures.
		PE-CS702B.3	Explain the working of smart contracts in developing different Decentralized applications with knowledge of Bitcoin concept.
PE CS(D)702C	Uncertainty Modelling and Multi-value Logic	PE CS(D)702C.1	Identify the aleatory uncertainty, epistemic uncertainty
		PE CS(D)702C.2	Explain different type of sampling methodologies like random sampling, inverse sampling technique, Latin hypercube sampling and different simulation techniques like Monte Carlo Simulation Bootstrap Confidence Interval Estimation
		PE CS(D)702C.3	Explain the concept of fuzzy set, fuzzy vertex theory, fuzzy relations and optimizations
		PE CS(D)702C.4	Explain the multicriteria decision making using TOPSIS and Fuzzy TOPSIS
		PE CS(D)702C.5	Explain the Bayesian statistics, ANOVA, ARMA and ARIMA
OE-EC701A	Adhoc and Sensor Network	OE-EC701A.1	Know the basics of Ad hoc networks and Wireless Sensor Networks
		OE-EC701A.2	Apply this knowledge to identify the suitable routing algorithm based on the network and user requirement
		OE-EC701A.3	Apply the knowledge to identify appropriate physical and MAC layer protocols.
		OE-EC701A.4	Understand the transport layer and security issues possible in Ad hoc and sensor networks.
		OE-EC701A.5	Familiar with the OS used in Wireless Sensor Networks and build basic modules.
OE-EC701B	Microprocessors and Microcontrollers	OE-EC701B.1	Apply a basic concept of digital fundamentals to Microprocessor based personal computer system
		OE-EC701B.2	Identify the detailed software and hardware structure of the Microprocessor.
		OE-EC701B.3	Illustrate the operation, interface and instructions of microprocessor and microcontroller.

OE-IT701D	Multimedia Systems	OE-IT701D.1	Understand the concepts, principles and theories of Multimedia Applications and Virtual environments.
		OE-IT701D.2	Demonstrate knowledge and understanding the various aspects and issues involved with development and deployment of multimedia system.
		OE-IT701D.3	Analyze and solve problems related to their expertise in Multimedia Applications and Virtual Environments.
		OE-IT701D.4	Demonstrate their ability to extend their basic knowledge to encompass new principles and practice.
		OE-IT701D.5	Understand the concepts, principles and theories of Multimedia Applications and Virtual environments.
		OE-IT701D.6	Demonstrate knowledge and understanding the various aspects and issues involved with development and deployment of multimedia system.
OE-M701A	Operations Research and Optimizing Technique	OE-M701A.1	Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained
		OE-M701A.2	Determine optimal strategy for Minimization of Cost of shipping of products from source to Destination/ Maximization of profits of shipping products using various methods, Finding initial basic feasible and optimal solution of the Transportation problems
		OE-M701A.3	Optimize the allocation of resources to Demand points in the best possible way using various techniques and minimize the cost or time of completion of number of jobs by number of persons
		OE-M701A.4	Extract the Optimum value in constrained and unconstrained situations
		OE-M701A.5	Acquire skills in analyzing queueing models.
		OE-M701A.6	Analyse competitive real-world phenomena using concepts from game theory. Analyse pure and mixed strategy games
		OE-M701A.7	Formulate Network models for service and manufacturing systems, and apply operations research techniques and algorithms to solve these Network problems
OE-HU 701B	Human Resource Development and Organisational Behaviour	OE-HU 701B.1	Demonstrate the applicability of the concept of organizational behavior to understand the behavior of people in the organization
		OE-HU 701B.2	Demonstrate the applicability of analyzing the complexities associated with management of individual behavior in the organization.
		OE-HU 701B.3	Analyze the complexities associated with management of the group behavior in the organization
		OE-HU 701B.4	Demonstrate how the organizational behavior can integrate in understanding the motivation (why) behind behavior of people in the organization.
OE-HU701D	Time Series Analysis & Forecasting	OE-HU701D.1	Organize Relevant data with Statistical methods and Experimentation.
		OE-HU701D.2	Implement the forecasting methods using Time Series, Regression analysis for stationary and non-stationary observations.
		OE-HU701D.3	Implement the Forecasting using ARIMA and ARMA model formulation.
		OE-HU701D.4	Infer the different results obtained from modelling and experimentation valid for parametric and non-parametric estimation techniques.
OE-IT701A	Introduction to Bioinformatics	OE-IT701A.1	Develop models for biological data.
		OE-IT701A.2	Apply pattern matching techniques to bioinformatics data – protein data genomic data.
		OE-IT701A.3	Apply microarray technology for genomic expression study.
OE-IT701B	Cyber Law and Security Policy	OE-IT701B.1	Recall the basic terminology related to cybercrime and cyber security.
		OE-IT701B.2	Identify the security challenges faced by mobile devices.
		OE-IT701B.3	Describe the tools and methods used in cybercrime.
		OE-IT701B.4	Explain steps of cyber forensic evidence gathering and report generation .
		OE-IT701B.5	Use different sections of Indian IT Act on cybercrimes .
HM-HU802	Professional Ethics and Project Management	HM-HU802.1	Apply the knowledge of human values and social values to contemporary ethical values and global issues.
		HM-HU802.2	Make a framework for analyzing a project and apply their knowledge systematically to value a business
		HM-HU802.3	Applying the principles and practices while maintaining high standards of practice, making ethical judgments and decisions in a respectful, and sustaining professional standing through a commitment to life-long learning.
		HM-HU802.4	Implements the generally recognized framework and good practices of project management, organizational influences; operations; strategic planning; programs; project life cycles; and project management cycles
PE-CS801A	Big Data Analytics	PE-CS801A.1	Describe the concept of Big Data, Hadoop and HDFS.
		PE-CS801A.2	Describe the concept of Map Reduce, Hive, HBase, Pig, Sqoop and Impala.
		PE-CS801A.3	Demonstrate the concept of data transfer between HDFS, MySQL and Hive.
		PE-CS801A.4	Apply NoSQL for importing and exporting unstructured data.
PE-CS801B	Cryptography & Network Security	PE-CS801B.1	Explain the principle of cryptography with different types of cipher generation and modular arithmetic's role in Cryptoanalysis.
		PE-CS801B.2	Illustrate the concept of symmetric and asymmetric algorithm with advanced concepts like ECC, Elgamel and Hash functions.
		PE-CS801B.3	Interpret integrity checks and authentication algorithms and web and system security.
		PE-CS801B.4	Explain Blockchain and Cryptocurrency and its role in different domains.
PE-CS801C	Web and Internet Technology	PE-CS801C.1	Recall the concepts of network and internet, technologies and protocols
		PE-CS801C.2	Apply different technologies such as HTML, CSS, javascript, Perl, applet and other Web technologies to develop static/ dynamic web pages for a given web application

		PE-CS801C.3	Apply javascript to implement cookie
		PE-CS801C.4	Design dynamic and interactive web pages by embedding javascript code in HTML to validate the user input
		PE-CS801C.5	Design security issues for devices like firewall
OE-HU801B	Business Intelligence	OE-HU801B.1	Explain BI concepts and techniques involving predictive and statistical approach.
		OE-HU801B.2	Learn the concept, process, and practice of the Data Science and methodologies applied for data visualization.
		OE-HU801B.3	Illustrate Dashboard design along with KPIs
		OE-HU801B.4	Implement BI techniques by using various tools
		OE-HU801B.5	Explain BI concepts and techniques involving predictive and statistical approach.
OE- HU 801G	Introduction to Philosophical Thoughts	OE- HU 801G.1	Describe and distinguish key philosophical concepts in the main subfields of philosophy, including concepts such as free will, mind, knowledge, belief, reality, faith, reason, good, etc.
		OE- HU 801G.2	Discuss core philosophical problems, such as whether there is a god, what does it mean to be conscious, are we free to make choices, what is justice, etc.
		OE- HU 801G.3	Explain and defend a position on basic philosophical problems.
		OE- HU 801G.4	Read and comprehend philosophical texts, both classical and contemporary and concise explanations and arguments about basic philosophical problems
OE-IT801B	E-Commerce	OE-IT801B.1	Explain the concept of E-Commerce and Business models.
		OE-IT801B.2	Describe how procurement and supply chains relate to B2B E-commerce.
		OE-IT801B.3	Discuss legal issues surrounding e-commerce.
		OE-IT801B.4	Identify the key security threats and its solution in the E-commerce environment.
OE-IT801C	Internet of Things	OE-IT801C.1	Explain general concepts of Internet of Things (IoT).
		OE-IT801C.2	Classify various devices, sensors and applications.
		OE-IT801C.3	Explain M2M and IoT architectures.
		OE-IT801C.4	Explain the application of IoT solutions.
		OE-IT801C.5	Apply IoT solutions in various domain using sensors, actuators and Devices.
OE-EC 801A	Information and Coding theory	OE-EC 801A.1	Define Information, Uncertainty, Entropy and channel capacity of AWGN channel.
		OE-EC 801A.2	Introduce various source coding schemes.
		OE-EC 801A.3	Evaluate error control coding techniques to detect and correct the channel error.
OE-HU801A	Business Analytics and Entrepreneurship	OE-HU801A.1	Explain the concept and methods of business analytics.
		OE-HU801A.2	Apply appropriate analytical methods to find solutions to business problems.
		OE-HU801A.3	Explain the importance of different factors and skills for entrepreneurship.
		OE-HU801A.4	Describe the rules and regulations to establish a new venture.
OE-HU 801E	Financial Management	OE-HU 801E.1	Identify and apply the concepts of Financial Management
		OE-HU 801E.2	Explain the basic concepts and processes in determination of products and services cost
		OE-HU 801E.3	Explain and explain the conceptual framework of Cost & Management Accounting
		OE-HU 801E.4	Analyse and understand major interest valuation models.
OE-IT 801D	Social Media and Web Analytics	OE-IT 801D.1	Explain web2.0 Framework along with different multidimensional, multivariate data structures using data Analytics techniques.
		OE-IT 801D.2	Investigate different methods of user experience measurement.
		OE-IT 801D.3	Implement web metrics and web analytics using several methodologies.

Department Name: **Computer Science and Engineering**
Program Name: **B.Tech (CSE (AI and ML))**

Paper Code	Paper Name	CO No.	CO Statement
ES-EC302	Digital Electronics	ES-EC302.1	Solve problems involving number systems, basic gate operations and laws of Boolean algebra.
		ES-EC302.2	Implement combinational logic circuits.
		ES-EC302.3	Implement sequential logic circuits.
		ES-EC302.4	Explain A/D and D/A conversion and the basic concepts of Logic families.
ES-EC304	Signals and Systems	ES-EC304.1	Explain mathematical description and representation of continuous and discrete time signals.
		ES-EC304.2	Describe the concepts of domain transformation technique & spectrum.
		ES-EC304.3	Analyze continuous and discrete time systems by using appropriate mathematical tools.
		ES-EC304.4	Evaluate the concept of sampling regarding discrete signal generation.
BS-M 305	Mathematics III	BS-M 305.1	Apply the ideas of probability and random variables, various discrete and continuous probability distributions with their properties in physical and engineering environment
		BS-M 305.2	Explain the basic ideas of statistics with different characterisation of a univariate and bivariate data set
		BS-M 305.3	Apply statistical tools for analysing data samples.
		BS-M 305.4	Apply the tools of Fourier transform and the concept of convergence of infinite series in engineering disciplines.
		BS-M 305.5	Explain the concepts of vector spaces, subspaces, bases, dimension and their properties
HM-HU 301	Introduction to Industrial Management	HM-HU 301.1	Interpret given organization structure, culture, climate and major provisions offactory acts and laws.
		HM-HU 301.2	Explain material requirement planning and store keeping procedure.
		HM-HU 301.3	Plot and analyze inventory control models and techniques.
		HM-HU 301.4	Prepare and analyze CPM and PERT for given activities.
		HM-HU 301.5	List and explain PPC functions.
PC-CS301	Data Structures and Algorithms	PC-CS301.1	Explain the basic concepts of Data structures and complexity of algorithms.
		PC-CS301.2	Interpret the concepts of linear and nonlinear data structures and operations on them.

		PC-CS301.3	Solve problems using of linear and nonlinear data structures.
		PC-CS301.4	Compare complexity of different Sorting and Searching algorithms.
BS-BIO301	Biology	BS-BIO301.1	State different engineering applications from biological perspective.
		BS-BIO301.2	Classify biological systems and identify different organisms and microorganisms depending on their morphological, biochemical and ecological criterion.
		BS-BIO301.3	Explain the concept of recessiveness and dominance during the passage of genetic material from parent to offspring and describe DNA as a genetic material in the molecular basis of information transfer.
		BS-BIO301.4	Discuss structures of different biomolecules starting from basic units and hence understand different biological processes at the reductionistic level.
		BS-BIO301.5	Describe protein structures and enzymology and also compare different mechanisms of enzyme action.
		BS-BIO301.6	Describe energy transformation processes in biological systems.
ES-EC392	Digital Electronics Lab	ES-EC392.1	Use basic gate operations and laws of Boolean algebra.
		ES-EC392.2	Implement combinational logic circuits.
		ES-EC392.3	Implement sequential logic circuits.
		ES-EC392.4	Demonstrate A/D converter and D/A converter circuits.
PC-CS391	Data Structures and Algorithms Lab	PC-CS391.1	Write the basic codes on linear Data structures and operations performed on it
		PC-CS391.2	Use dynamic memory allocation concept to implement linear and nonlinear data structures programs.
		PC-CS391.3	Use the knowledge of linear data structures to solve expression conversion programs.
		PC-CS391.4	Compare different Sorting and Searching techniques by writing menu driven programs.
PC-CS392	IT Workshop (Using Python) Lab	PC-CS392.1	Use the concept of object-oriented programming like class, methods, and objects to solve basic problems
		PC-CS392.2	Solve basic problems by using fundamentals of Python Programming like variable, data types, operators,
		PC-CS392.3	Use the conditional statements, iterative statements, and functions
		PC-CS392.4	Use the modules, packages, exception handling techniques, and file handling techniques in Python
		PC-CS392.5	Illustrate lists, tuples, set, string, and dictionaries of Python
		PC-CS392.6	Illustrate visual representations of data using libraries such as Matplotlib and Pyplot
MC371	Environmental Science	MC371.1	Explain basic concepts, man, society & environment, their interrelationship, mathematics of population growth and associated problems, steady state conservation system.
		MC371.2	Demonstrate natural environmental hazards like flood, earthquake, landslide-causes, effects and control/management.
		MC371.3	Classify air pollution, water pollution, land pollution, noise pollution and their controls.
		MC371.4	Study Elements of ecology and environmental management.
PC-CS(D)401	Computer Organization and Architecture	PC-CS(D)401.1	Identify the concept of basic computer hardware, number system, simple combinational circuits, addressing modes and Instruction formats.
		PC-CS(D)401.2	Make use of different memory and I/O organization techniques including mapping methodology.
		PC-CS(D)401.3	Examine the difference between pipelined and non-pipelined architecture including the concept of Reservation Table, with knowledge on types of pipelined architecture and different hazards.
		PC-CS(D)401.4	Identify the concept of Instruction Level Parallelism with focus on Multiprocessor Architecture.
PC-CS402	Operating System	PC-CS402.1	Explain introductory concepts of operating system.
		PC-CS402.2	Apply process scheduling methods and deadlock handling schemes.
		PC-CS402.3	Explain inter process communication.
		PC-CS402.4	Apply memory management and disk management procedures.
PC-CS403	Design and Analysis of Algorithm	PC-CS403.1	Recall the fundamental concepts of Asymptotic Notations, different recurrence relations and their mathematical significance.
		PC-CS403.2	Describe different algorithm design techniques like D&C, Greedy Method, DP, Backtracking, Branch and Bound, Graph Algorithms, NP etc.
		PC-CS403.3	Solve a given problem using appropriate algorithm and required data structure.
		PC-CS403.4	Explain Randomized algorithms (expected running time, probability of error), and Approximation algorithm and compute approximation factors.
		PC-CS403.5	Test algorithms to determine their correctness.
PC-CS404	Discrete Mathematics	PC-CS404.1	Express a logic sentence in terms of predicates, quantifiers, and logical connectives.
		PC-CS404.2	Derive the solution for a given problem using deductive logic and prove the solution based on logical inference.
		PC-CS404.3	Classify its algebraic structure for a given a mathematical problem.
		PC-CS404.4	Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra.
		PC-CS404.5	Develop the given problem as graph networks and solve with techniques of graph theory.
PC-CS405	Formal Language and Automata Theory	PC-CS405.1	Use the concept of abstract machines and their power to recognize the languages.
		PC-CS405.2	Implement automata for any given pattern and write its equivalent regular expressions.
		PC-CS405.3	Write context free grammars for formal languages.
		PC-CS405.4	Implement PDA and Turing Machine.
HM-HU 401	Economics for Engineers	HM-HU 401.1	Discuss fundamentals of economic analysis.
		HM-HU 401.2	Describe rate of return and profitability analysis, Present, Future, Annuity, Risk and return, BEP and Sensitivity Analysis, Bayesian joint probability and quantitative decision making, basic accounting system and balance sheet and P & L accounts etc.
		HM-HU 401.3	Apply decision making skills in terms of Economic, financial considerations in practice.
		HM-HU 401.4	Apply knowledge to take right financial decision at the right point in time in real world situation.

PC-CS(AM)491	Object Oriented Programming Lab	PC-CS(AM)491.1	Implement Java programs for simple applications that make use of classes, packages and interfaces.
		PC-CS(AM)491.2	Implement Java programs with array list, exception handling and multithreading.
		PC-CS(AM)491.3	Implement Java Programs using generic programming, applet and event handling.
PC-CS(AM) 492	Operating System Lab	PC-CS(AM) 492.1	Explain UNIX commands and applications of shell script.
		PC-CS(AM) 492.2	Apply Process and Thread execution.
		PC-CS(AM) 492.3	Apply Signal and Semaphore.
		PC-CS(AM) 492.4	Apply IPC related concepts.
PC-CS493	Design and Analysis of Algorithm Lab	PC-CS493.1	Implement Binary Search, Merge Sort, Quick Sort, and Max-min Problem using D&C Algorithm Design Techniques.
		PC-CS493.2	Implement Fractional Knapsack, Job Sequencing with Deadline, TSP, Matrix Chain, Graph Traversals, MST problems, Shortest Path, N- Queens, Graph Colouring, Hamiltonian Cycle, and 15 Puzzles using proper Algorithm Design Techniques.
		PC-CS493.3	Execute suitable algorithm for solving a particular problem.
		PC-CS493.4	Test the complexities and memory usages of different algorithms.
HM-HU491	Soft Skill Development Lab	HM-HU491.1	Honing over all Communicative Competence.
		HM-HU491.2	Develop Team Building and Leadership Quality.
		HM-HU491.3	Deliver an enthusiastic and well-practiced presentation
		HM-HU491.4	Communicate with clarity and confidence thereby enhancing employability skills of the students.

Department Name: **Electrical Engineering**
Program Name: **B.Tech (EE)**

Paper Code	Paper Name	CO No.	CO Statement
PC-EE301	Electric Circuit Theory	PC-EE301.1	Explain the behavior of different signals and systems
		PC-EE301.2	Apply Laplace and Fourier transforms for solving different electrical problems.
		PC-EE301.3	Understand the fundamental of different network theorems to solve basic numerical problem.
		PC-EE301.4	Apply graph theory for solving electrical problem in a simplified way.
		PC-EE301.5	Determine different parameters from a given two port electrical network.
		PC-EE301.6	Understand the application of active filters for different electric circuit.
PC-EE302	Analog Electronics	PC-EE302.1	Understand the operation of rectifier, filter and voltage regulator
		PC-EE302.2	Analyze the operation of transistor circuits as analog building block.
		PC-EE302.3	Understand the operation of OPAMPs as different active linear circuits.
		PC-EE302.4	Interpret the operation of feedback in amplifiers and oscillators.
		PC-EE302.5	Understand operational amplifier based circuits for different applications.
PC-EE303	Electromagnetic Field Theory	PC-EE303.1	Apply the Knowledge of Coordinate transformation with the concept of Vector Calculus and several Theorems (Divergence theorem, Strokes theorem and Helmholtz"s
		PC-EE303.2	Apply the knowledge of Coulomb"s law andamp; Gauss"s law to solve boundary condition problems with the concept of Poisson"s and amp; Laplace"s Equation
		PC-EE303.3	Apply the knowledge of Biot- savart"s Law and Ampere"s circuital Law to solve problems related to Magnetic Circuits.
		PC-EE303.4	Determine the effects of Transformer EMF and Motional EMF, wave equation, skin effect, skin depth having the concept of Maxwell"s equation and Pointing Theorem.
		PC-EE303.5	Determine the Transmission Line Parameters, Propagation Constant, Characteristic Impedance, Wavelength and velocity of propagation by solving Transmission line equations.
BS-M302	Mathematics-III	BS-M302.1	Learn the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment.
		BS-M302.2	Apply statistical tools for analyzing complex field.
		BS-M302.3	Learn the tools of Fourier transform to analyze engineering problems and apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines.
		BS-M302.4	To solve engineering problems using z transform and probability theory.
BS-M304	Numerical Methods	BS-M304.1	Calculate different types of error involved in Engineering problems and learn to apply numerical methods to find approximate solutions for them.
		BS-M304.2	Interpolate different polynomials using numerical techniques
		BS-M304.3	Derive numerical methods for integration and apply them for solving otherwise intractable Engineering problems
		BS-M304.4	To solve system of linear equations and to learn the concept of root finding for nonlinear equations
		BS-M304.5	To solve ordinary differential equation numerically
		BS-M304.6	Use various statistical tools to solve Engineering problems numerically
BS-BIO301	Biology	BS-BIO301.1	State different engineering applications from biological perspective.
		BS-BIO301.2	Classify biological systems and identify different organisms and microorganisms depending on their morphological, biochemical and ecological criterion.
		BS-BIO301.3	Explain the concept of recessiveness and dominance during the passage of genetic material from parent to offspring and describe DNA as a genetic material in the molecular basis of information transfer.

		BS-BIO301.4	Discuss structures of different biomolecules starting from basic units and hence understand different biological processes at the reductionistic level.
		BS-BIO301.5	Describe protein structures and enzymology and also compare different mechanisms of enzyme action
		BS-BIO301.6	Describe energy transformation processes in biological systems.
PC-EE391	Electric Circuit Theory Lab	PC-EE391.1	Demonstrate transient response of different electrical circuit
		PC-EE391.2	Determine different parameters from a two port network.
		PC-EE391.3	Demonstrate frequency response of different active filter circuit.
		PC-EE391.4	Simulate different operation of signals for output waveform using MATLAB
		PC-EE391.5	Determine Laplace and inverse Laplace transform of different functions using MATLAB
		PC-EE391.6	Analyze different network theorems.
PC-EE392	Analog Electronic Lab	PC-EE392.1	Construct a full wave rectifier circuit and voltage regulator using discrete components and study their performance.
		PC-EE392.2	Construct the circuits of different amplifier, ADC, DAC and waveform generator using 555 timer and study their performance.
		PC-EE392.3	Determine characteristics curve of BJT and FET
		PC-EE392.4	Construction of function generator using IC
BS-M394	Numerical Methods Lab	BS-M394.1	Apply programming concepts to solve the interpolation problems.
		BS-M394.2	Apply programming concepts to solve the numerical integration problems.
		BS-M394.3	Apply programming concepts to solve the transcendental equation
		BS-M394.4	Apply programming concepts to solve the boundary value problems of ordinary differential equation
		BS-M394.5	Apply programming concepts to fit the curve numerically & central tendancy
		BS-M394.6	Apply programming concepts to solve the system of linear eqautions
PC-EE401	Electric Machine-I	PC-EE401.1	Discuss general concept pertaining rotating machines and magnetic fields, EMFs and torque production
		PC-EE401.2	Explain the construction, operation, different types of DC machine and analysis of characteristics curve.
		PC-EE401.3	Describe construction, operation of single phase transformer.
		PC-EE401.4	Describe construction, operation of three phase transformer and different types of three phase transformer with their operation
		PC-EE401.5	Solve different electrical circuits sing DC machine, single and three phase Transformer depending on the desired output.
PC-EE402	Digital Electronics	PC-EE402.1	Understand different Number systems, Codes, Logic Gates, Boolean laws & theorems to simplify the Boolean functions to the minimum number of literals and the digital logic families..
		PC-EE402.2	Design different types of combinational and sequential logic circuits using Logic gates and Flip Flops respectively.
		PC-EE402.3	Understand the operation of different types ADC, DAC and memory system.
PC-EE403	Electrical and Electronics Measurement	PC-EE403.1	Explain basic measurement systems, analog meters, instrument transformers, energy meters, bridge, potentiometers, CROs, DSOs, sensors and transducers.
		PC-EE403.2	Apply the concept of measurement system for concluding about the pros and cons of the system
		PC-EE403.3	Evaluate the parameters associated with the instruments.
		PC-EE403.4	Use the measurement system for recording and controlling system variables.
		PC-EE403.5	Use the measurement system for data manipulation and analysis.
ES-ME401	Engineering Mechanics	ES-ME401.1	Explain the co-ordinate system, principle of three dimensional rotation, kinematics and kinetics of rigid bodies.
		ES-ME401.2	Elaborate the theory of general motion, bending moment, torsional motion and friction
		ES-ME401.3	Develop free body diagram of different arrangements.
		ES-ME401.4	Solve problems with the application of theories and principle of motion , friction and rigid bodies.
		ES-ME401.5	Analyze torsional motion and bending moment.
HM-HU402	Values and Ethics in Profession	HM-HU402.1	The students are able to see that verification on the basis of natural acceptance and experiential validation through living is the only way to verify right or wrong, and referring to any external source like text or instrument or any other person cannot enable them to verify with authenticity; it will only develop assumptions.
		HM-HU402.2	The students are able to grasp the right utilization of their knowledge in their streams of Technology/Engineering/ Management to ensure mutually enriching and recyclable productions systems
		HM-HU402.3	The students are able to see that lack of right understanding leading to lack of relationship is the major cause of problems in their family and not the lack of physical facilities in most of the cases, while they have given higher priority to earning of physical facilities in their life ignoring relationships and not being aware that right understanding is the most important requirement for any human being
PC-EE491	Electric Machine-I Lab	PC-EE491.1	Determine no load characteristics of separately excited generator and compound DC generator (short shunt).
		PC-EE491.2	Demonstrate load characteristics, speed control of a DC shunt motor and load characteristics of a DC series motor.

		PC-EE491.3	Demonstrate open-circuit and short-circuit tests of single phase transformer to determine the parameters, efficiency and polarity test, group connection of three phase transformer.
		PC-EE491.4	Demonstrate parallel operation, back to back test of the transformer
		PC-EE491.5	Determine parameters of three phase induction motor performing no load and blocked rotor test.
		PC-EE491.6	Study the performance of wound rotor induction motor under load.
PC-EE492	Digital Electronics Lab	PC-EE492.1	Validate the operation of code conversion circuit –BCD to Excess 3 & vice versa, 4 bit parity generator & comparator circuits.
		PC-EE492.2	Construct decoder , multiplexer, adder and subtractor circuits with appropriate instruments and precaution
		PC-EE492.3	Realize RS-JK and D flip flop, universal register with gates, multiplexer and flip-flops and asynchronous and synchronous up down counters.
		PC-EE492.4	Realize A/D and D/A converters circuits
PC-EE493	Electrical and Electronics Measurement Lab	PC-EE493.1	Observe the construction of basic measurement system instruments.
		PC-EE493.2	Calibration of AC energy single phase energy meter using dynamometer type wattmeter.
		PC-EE493.3	Measure resistance using Kelvin Double Bridge.
		PC-EE493.4	Analyze power in electrical systems using instrument transformer and poly-phase circuits.
		PC-EE493.5	Prepare at setup for frequency measurement using Wien's Bridge.
		PC-EE493.6	Measure inductance using Anderson Bridge & Hay's bridge
		PC-EE493.7	Measure capacitance using De- Sauty and Schering Bridge.
MC471	Environmental Science	MC471.1	Explain basic concepts, man, society & environment, their interrelationship, mathematics of population growth and associated problems, steady state conservation system.
		MC471.2	Demonstrate natural environmental hazards like flood, earthquake, landslide-causes, effects and control/management.
		MC471.3	Classify air pollution, water pollution, land pollution, noise pollution and their controls.
		MC471.4	Study Elements of ecology and environmental management.
PC-EE-501	Electric Machine-II	PC-EE-501.1	Describe the arrangement of winding of AC machines
		PC-EE-501.2	Explain the principle of operation of Induction machines, Synchronous machines and special machines.
		PC-EE-501.3	Solve numerical problems of Induction machines, Synchronous machines and Special machines.
		PC-EE-501.4	Estimate the parameters and efficiency of Induction machines and Synchronous machines.
		PC-EE-501.5	Determine the characteristics of Induction machines and Synchronous machines.
		PC-EE-501.6	Select appropriate methods for starting, braking and speed control of Induction machines
PC-EE502	Power System-I	PC-EE502.1	Explain the principle of generation of Electric power from different sources
		PC-EE502.2	Determine parameters of transmission lines and its performance.
		PC-EE502.3	Explain the principle of formation of corona and methods of its reduction
		PC-EE502.4	Conduct electrical tests on insulators.
		PC-EE502.5	Solve numerical problems related to overhead transmission line, cable, insulators and tariff
		PC-EE502.6	Analyze overhead transmission line based on short medium and long lines.
PC-EE503	Control System	PC-EE503.1	Develop mathematical model and compute transfer of linear system
		PC-EE503.2	Calculate peak time, rise time, settling time , steady state error of linear system in time response analysis.
		PC-EE503.3	Compute peak response, bandwidth, gain crossover, phase crossover , gain margin and phase margin of linear system in frequency response analysis
		PC-EE503.4	Explain stability analysis of linear system in time domain approach and frequency domain approach
		PC-EE503.5	Describe the effect of using controller and compensator to improve the system performances with given criterion.
		PC-EE503.6	Apply the knowledge of state variable techniques for analysis of linear systems.
OE-EE 501A	Microprocessor and Microcontroller	OE-EE 501A.1	Describe about the basic architecture and pin configuration of 8085, 8086 microprocessor.
		OE-EE 501A.2	Explain about Stack, sub routine and interrupt operation of 8085 microprocessor.
		OE-EE 501A.3	Solve different arithmetic and logical operation using Assembly language programming.
		OE-EE 501A.4	Explain about Memory and I/O interfacing with microprocessor and Microcontroller.
		OE-EE 501A.5	Describe the features of 8051 and PIC Microcontrollers and basic operations.
OE-EE 501B	Digital Signal Processing (DSP)	OE-EE 501B.1	Represent signals mathematically in continuous and discrete-time and in the frequency domain.
		OE-EE 501B.2	Analyze discrete-time systems using z-transform.
		OE-EE 501B.3	Explain the Discrete-Fourier Transform (DFT) and the FFT algorithms.
		OE-EE 501B.4	Design digital filters for various applications
		OE-EE 501B.5	Apply digital signal processing for the analysis of real-life signals
HM-HU 501	Economics for Engineers	HM-HU 501.1	Discuss fundamentals of economic analysis.
		HM-HU 501.2	Describe rate of return and profitability analysis, Present, Future, Annuity, Risk and return, BEP and Sensitivity Analysis, Bayesian joint probability and quantitative decision making, basic accounting system and balance sheet and P & L accounts etc.
		HM-HU 501.3	Apply decision making skills in terms of Economic, financial considerations in practice.
		HM-HU 501.4	Apply knowledge to take right financial decision at the right point in time in real world situation.
PC EE 591	Electric Machine II Lab	PC EE 591.1	Identify appropriate equipment and instruments for the experiment.
		PC EE 591.2	Test the instrument for application to the experiment
		PC EE 591.3	Construct circuits with appropriate instruments and safety precautions.

		PC EE 591.4	Validate different characteristics of single phase Induction motor, three phase Induction motor, Induction generator and synchronous motor , methods of speed control of Induction motors and parallel operation of the 3 phase Synchronous generator.
		PC EE 591.5	Work effectively in a team
PC-EE 592	Power System-I Lab	PC-EE 592.1	Identify appropriate equipment and instruments for the experiment.
		PC-EE 592.2	Test the instrument for application to the experiment
		PC-EE 592.3	Construct circuits with appropriate instruments and safety precautions.
		PC-EE 592.4	Validate different characteristics of transmission line.
		PC-EE 592.5	Determine earth resistance, dielectric strength of insulating oil, breakdown strength of solid insulating material and dielectric constant of transformer oil.
		PC-EE 592.6	Analyze an electrical transmission line circuit with the help of software.
		PC-EE 592.7	Work effectively in a team
PC-EE593	Control System Lab	PC-EE593.1	Use control system tool box, Simulink tool box in MATLAB for simulation of systems.
		PC-EE593.2	validate step response & impulse response analysis for Type-0, Type-1 & Type-2 system Using MATLAB & PSPICE.
		PC-EE593.3	Design lead, lag and lead-lag compensator for given system using MATLAB Simulink
		PC-EE593.4	Design PI, PD and PID controller for given system using MATLAB Simulink
		PC-EE593.5	Analyze state space model of given system using MATLAB
OE-EE 591A	Microprocessor and Microcontroller Lab	OE-EE 591A.1	Explain 8085 register level architecture and components of trainer kit.
		OE-EE 591A.2	Solve numerical problems by programming in 8085 trainer kit or simulator.
		OE-EE 591A.3	Use 8255 PPI on the trainer kit for IN/ OUT operation.
		OE-EE 591A.4	Interface ADC, Keyboard and Multi digit display with 8085 trainer kit
		OE-EE 591A.5	Solve arithmetic and logical problems using 8051 microcontroller trainer kit.
		OE-EE 591A.6	Demonstrate the interfacing of stepper motor with 8051 microcontroller.
OE-EE591B	Digital Signal Processing (DSP) Lab	OE-EE591B.1	Understand elementary signals/ waveforms and perform arithmetic operations on signals.
		OE-EE591B.2	Analyze frequency response of a given system and verify the properties using simulation.
		OE-EE591B.3	Implement FFT of given sequence and identify the reduction of computations using FFT.
		OE-EE591B.4	Design and Implement FIR and IIR filter for a given sequence
MC571	Aptitude Skill Development-I	MC571.1	Understand the basic concepts of QUANTITATIVE ABILITY
		MC571.2	Understand the basic concepts of LOGICAL REASONING Skills
		MC571.3	Understand the basic concepts of PROBABILITY.
		MC571.4	Acquire satisfactory competency in use of VERBAL REASONING
PW-EE581	Technical Seminar	PW-EE581.1	Prepare presentation on the any advance topic of Electrical Engineering.
		PW-EE581.2	Describe use of advanced tools and techniques encountered during the presentation.
		PW-EE581.3	Interact with audience during the presentation.
		PW-EE581.4	Prepare professional work reports and presentations.
PC-EE 601	Power Electronics	PC-EE 601.1	Differentiate different power electronic devices on the basis of construction and fundamental operations.
		PC-EE 601.2	Describe about different triggering, commutation and protection circuits suitable for different power electronic devices.
		PC-EE 601.3	Explain about the operation and application of different single phase, three phase power converters and DC to DC converters.
		PC-EE 601.4	Select an appropriate power semiconductor device for required converter application.
		PC-EE 601.5	Apply the above knowledge to predict the performance of a simple power electronic circuit
		PC-EE 601.6	Use different power electronic converters in commercial and industrial applications.
PC-EE-602	Power System-II	PC-EE-602.1	Represent power system components in line diagrams.
		PC-EE-602.2	Determine location of distribution substation
		PC-EE-602.3	Determine the performance of power system with the help of load flow studies.

		PC-EE-602.4	Analyze faults in Electrical systems.
		PC-EE-602.5	Determine the stability of Power system
		PC-EE-602.6	Explain principle of operation of different power system protection equipment
		PC-EE-602.7	Solve numerical problems related to representation, load flow, faults, stability and protection of power system.
PE-EE601A	Advanced Control system	PE-EE601A.1	Acquire knowledge of state space model and state feedback in modern control systems,
		PE-EE601A.2	Derive discrete-time mathematical models and perform stability analysis z domain
		PE-EE601A.3	Demonstrate non-linear system behavior by phase plane and describing function methods
		PE-EE601A.4	Perform the stability analysis nonlinear systems by Lyapunov method
		PE-EE601A.5	Design of state observers and output feedback controllers
PE-EE601C	Renewable and Non-conventional Energy	PE-EE601C.1	Explain the principle of conversion of solar energy, wind energy , biomass, Geothermal energy, Ocean energy and Hydrogen energy to other form of energy.
		PE-EE601C.2	Suggest location to set up wind mill and biogas generation plant
		PE-EE601C.3	Use Solar energy, Wind energy , Biomass, Geothermal energy, Ocean energy, Hydrogen energy and fuel cell for different applications.
		PE-EE601C.4	Explain the principle of operation of magneto hydrodynamic power generation
		PE-EE601C.5	Estimate conversion efficiency of fuel cell.
OE-CS601F	Data Structure and Algorithm	OE-CS601F.1	Understand the basic concepts of Data structures and complexity of algorithms.
		OE-CS601F.2	Comprehend the concepts of linear and nonlinear data structures and operations on them.
		OE-CS601F.3	Apply the knowledge of linear and nonlinear data structures in solving problems.
		OE-CS601F.4	Analyze complexity of different Sorting and Searching algorithms.
OE-EC601B	Computer Organization	OE-EC601B.1	Describe Computer hardware System, Instruction sets and Addressing Mode.
		OE-EC601B.2	Apply the knowledge of number system to perform different arithmetical operations.
		OE-EC601B.3	Design memory organization that uses banks for different word size operations.
		OE-EC601B.4	Compare different type of control units and I/O transfer techniques.
OE-EC601A	Analog and Digital Communication	OE-EC601A.1	Understand the need for modulation, representation of the modulated carrier wave in both analog and digital communication.
		OE-EC601A.2	Analyze the different types of analog and digital modulation techniques.
		OE-EC601A.3	Understand the basic concept of Sampling and analog to digital signal conversion techniques, concept of line coding and ISI.
		OE-EC601A.4	Analyze different career modulation techniques considering noise aspects
OE-EC601C	Electronic Devices	OE-EC601C.1	Describe semiconductor physics ,semiconductor types and carrier transport phenomena
		OE-EC601C.2	Describe working principle of various diodes, BJT, MOSFET, solar cell and opto electronic devices.
		OE-EC601C.3	Characterize diodes, BJT and MOSFETs.
		OE-EC601C.4	Apply the acquired knowledge for implementing these devices for further application.
		OE-EC601C.5	Calculate various device related parameters.
PC-EE 691	Power Electronics Lab	PC-EE 691.1	Demonstrate V-I characteristics of SCR and TRIAC.
		PC-EE 691.2	Differentiate between different gate triggering circuits for Thyristors
		PC-EE 691.3	Demonstrate the operation of different power electronic converter circuits.
		PC-EE 691.4	Design different power electronic converters by software simulation.
		PC-EE 691.5	Apply pulse width modulation techniques in power electronic converter.
PC-EE-692	Power System-II Lab	PC-EE-692.1	Identify appropriate equipment and instruments for the experiment
		PC-EE-692.2	Test the instrument for application to the equipment
		PC-EE-692.3	Construct circuits with appropriate instruments and safety precautions
		PC-EE-692.4	Validate the characteristics of under voltage relay, over current relay, earth fault relay, on load time delay relay, off load time delay relay, CT & PT
		PC-EE-692.5	Validate protection schemes of transformer, generator, motor & feeder
		PC-EE-692.6	Apply software tools to find bus voltage, currents and power flows throughout the electrical system
		PC-EE-692.7	Work effectively in a team
OE-CS691F	Data Structure and Algorithm Lab	OE-CS691F.1	Write the basic codes on linear Data structures and operations performed on it .
		OE-CS691F.2	Apply dynamic memory allocation concept to implement linear and nonlinear data structures.
		OE-CS691F.3	Apply the knowledge of linear data structures to solve expression conversion programs.
		OE-CS691F.4	Compare different Sorting and Searching techniques by writing menu driven programs.
OE-EC691B	Computer Organization Lab	OE-EC691B.1	Verify truth-table of different types of IC.
		OE-EC691B.2	Design different type of adder circuits.
		OE-EC691B.3	Design ALU by applying the knowledge of Combinational circuit.
		OE-EC691B.4	Design different circuits with RAM ICs and perform read-write operation.
HM-HU691	Soft Skill Development Lab	HM-HU691.1	Honing over all Communicative Competence
		HM-HU691.2	Develop Team Building and Leadership Quality
		HM-HU691.3	Deliver an enthusiastic and well-practiced presentation
		HM-HU691.4	Communicate with clarity and confidence thereby enhancing employability skills of the students.
PC-EE701	Electric Drives	PC-EC701.1	Explain the principle of operation of Electric Drive
		PC-EC701.2	Describe different methods of starting and braking of Electric Drive.
		PC-EC701.3	Apply knowledge of power electronic converter to operate different electric drives.
		PC-EC701.4	Control speed of DC, Induction and Synchronous motor drives.

		PC-EC701.5	Recommend drives for different industrial applications.
PE-EE701A	Advanced Power System	PE-EE701A.1	Students will be able to understand all aspects of advanced power system
		PE-EE701A.2	Students will be able to apply concepts of power system in real time applications
		PE-EE701A.3	Students will be able to execute critical problems related to power system
PE- EE701C	Sensors & Transducers	PE- EE701C.1	Explain the basic principle of operation of Transducers and Sensors.
		PE- EE701C.2	Distinguish different sensors and transducers
		PE- EE701C.3	Identify suitable transducer by comparing different industrial standards and procedures for measurement of physical parameters
		PE- EE701C.4	Estimate the performance of different transducers.
		PE- EE701C.5	Design real life electronics and instrumentation measurement systems.
		PE- EE701C.6	Apply smart sensors, bio-sensors, PLC and Internet of Things to different applications.
PE-EE702B	Power Generation and Economics	PE-EE702B.1	Explain the different terms e.g. load factor etc for economics of generation.
		PE-EE702B.2	Apply different types of tariff for electricity pricing.
		PE-EE702B.3	Optimize the operation of power system with unit commitment.
		PE-EE702B.4	Determine generation levels such that the total cost of generation becomes minimum for a defined level of load.
		PE-EE702B.5	Determine the state of the system given by the voltage magnitudes and phase angles at all buses
		PE-EE702B.6	Predict the power or energy needed to balance the supply and load demand at all the times.
PE-EE702C	Illumination Engineering	PE-EE702C.1	State & explain basic principle of Illumination & good lighting practices.
		PE-EE702C.2	Apply an appropriate measurement technique of artificial lighting for different specific purposes.
		PE-EE702C.3	Investigate on various types of artificial light sources (GLS, FTL, CFL, SV, MV, MH & LED) as well as can evaluate their performance in terms of their colour rendering and luminous efficacy.
		PE-EE702C.4	Prescribe (Design outline) appropriate illumination techniques for selected applications (Domestic, Official, Industrial, Arena & Street).
		PE-EE702C.5	Select as well as apply appropriate Luminaires for specific application.
PE-EE702D	Electrical and Hybrid Vehicle	PE-EE702D.1	Explain the principle of Electric traction.
		PE-EE702D.2	Describe suitable drive scheme for Hybrid Electric Vehicles depending on resources.
		PE-EE702D.3	Explain various drive train topologies for electric vehicles.
		PE-EE702D.4	Explain proper energy storage systems for vehicle applications.
		PE-EE702D.5	Apply different energy management strategies for hybrid vehicle.
OE-CS 701F	Data Base Management System	OE-CS 701F.1	Describe the fundamental concept of File System and DBMS Architecture.
		OE-CS 701F.2	Understand the concepts of different types of attribute, keys and Entity Relationship model.
		OE-CS 701F.3	Apply concepts of relational algebra, calculus and Structured Query language.
		OE-CS 701F.4	Apply concepts of functional dependency and normalization process to construct normalized database.
OE-IT 701E	Object Oriented Programming	OE-IT 701E.1	Identify classes, objects, members of a class and relationships among them, needed for a specific problem.
		OE-IT 701E.2	Demonstrate the concepts of polymorphism and inheritance.
		OE-IT 701E.3	Implement Java collection API as well as the java standard class library.
		OE-IT 701E.4	Implement error-handling techniques using exception handling.
		OE-IT 701E.5	Implement the concept of Multithreading and Applet programing.
HM- HU 703	Principles of Management	HM- HU 703.1	Explain the concept and approaches of Management.
		HM- HU 703.2	Demonstrate the roles, skills and functions of management.
		HM- HU 703.3	Diagnose and solve organizational problems.
		HM- HU 703.4	Apply different methods of Customer, Operation and Technology management.
PC-EE791	Electric Drives Laboratory	PC-EE791.1	Demonstrate starting method of rectifier fed DC drive.
		PC-EE791.2	Apply speed control method to different Electric drives in laboratory.
		PC-EE791.3	Design PWM inverter fed 3 phase induction motor drive using software simulation.
		PC-EE791.4	Design Full controlled rectifier fed DC motor drive using software simulation.
		PC-EE791.5	Demonstrate different braking operation of electric drive using software simulation.
OE- CS 791F	Database Management System Laboratory	OE- CS 791F.1	Apply the basic concepts of Database Systems and Applications.
		OE- CS 791F.2	Use the basics of SQL and construct queries using SQL in database creation and interaction.
		OE- CS 791F.3	Design a commercial relational database system (Oracle, MySQL) by writing SQL using the system.
		OE- CS 791F.4	Analyze and Select storage and recovery techniques of database system.
OE- IT 791E	Objective Oriented Programming Laboratory	OE- IT 791E.1	Develop and implement Java programs for simple applications that make use of classes, packages and interfaces.
		OE- IT 791E.2	Develop and implement Java programs with Array List, exception handling and multithreading.
		OE- IT 791E.3	Design applications using file processing, generic programming and event handling.
PW- EE 781	Electrical & Electronic Design Laboratory -I	PW- EE 781.1	Explain basic concept of measurement, noise in electronic system, sensor and signal conditioning circuits.
		PW- EE 781.2	Understand PC based data acquisition systems.
		PW- EE 781.3	Construct circuits with appropriate instruments and safety precautions.
		PW- EE 781.4	Design heating elements, power distribution system for small township and Electric machines.
		PW- EE 781.5	Design electronic hardware for speed of AC/DC motor.
PW- EE 782	Project Stage- I	PW- EE 782.1	Understand the content and techniques of the literature for project problem formulation.

		PW- EE 782.2	Analyze the model based on literature survey and plan for innovative thinking to inculcate skills for team work.
		PW- EE 782.3	Plan, design of Preliminary Model by Simulation or Experiment for building a prototype related to the topic.
		PW- EE 782.4	Represent project report and prepare presentation on the topic to demonstrate a prototype.
PW- EE 783	Industrial Training Evaluation	PW- EE 783.1	Explain the operation of actual tools for practices in industry by participating in an industrial project.
		PW- EE 783.2	Understand about industrial safety practices and work culture by observation and participation.
		PW- EE 783.3	Get knowledge from industry personnel by effective communication.
		PW- EE 783.4	Represent a work report and prepare effective technical presentation.
PE-EE 801A	Power Quality and Deregularation	PE-EE 801A.1	Analyze uncompensated Ac transmission line.
		PE-EE 801A.2	Explain working principle of FACTS.
		PE-EE 801A.3	Apply FACTS devices for power flow control and stability.
		PE-EE 801A.4	Apply compensation techniques using DSTATCOM.
PE-EE 801C	High Voltage Engineering	PE-EE 801C.1	Explain breakdown phenomenon of composite insulators.
		PE-EE 801C.2	Suggest methods for generation and measurement of high voltage and currents.
		PE-EE 801C.3	Determine the basic insulation level of substation equipment.
		PE-EE 801C.4	Apply methods for the over voltage phenomenon and insulation coordination in Electric power systems.
		PE-EE 801C.5	Test insulators bushings, isolators, circuit breakers, cables and power transformers.
		PE-EE 801C.6	Solve numerical problems of breakdown phenomena, generation and measurement of high voltage and currents, over voltage phenomena and high voltage testing.
PE-EE801D	HVDC Transmission	PE-EE 801D.1	Choose intelligently AC and DC transmission systems for the dedicated applications.
		PE-EE 801D.2	Identify the suitable two-level/multilevel configuration for high power converters.
		PE-EE 801D.3	Select the suitable protection method for various converter faults.
		PE-EE 801D.4	Identify suitable reactive power compensation method.
		PE-EE 801D.5	Decide the configuration for harmonic mitigation on both AC and DC sides.
		PE-EE 801D.6	Solve numerical problems related to converters, power flow analysis, reactive power control.
PE-EE802A	Utilization of Electric Power	PE-EE802A.1	Explain the fundamentals of illumination and different lighting schemes.
		PE-EE802A.2	Explain the fundamental of Electric heating and Welding.
		PE-EE802A.3	Design appropriate lighting, heating and welding techniques for specific applications.
		PE-EE802A.4	Explain the principle of different aspect of Electric traction and control of traction motor.
PE-EE802B	Process Control	PE-EE802B.1	Appreciate role of automation in industry.
		PE-EE802B.2	Describe the importance of sequential control and the role of PLC.
		PE-EE802B.3	Apply different control strategies and scheme to improve system performances and Tuning of P, PI and PID controller.
		PE-EE802B.4	Apply PLC in simple industrial problem using ladder diagram and logic diagram.
		PE-EE802B.5	Apply first order plus dead time (FOPDT) control using PID controller.
PE-EE 802C	Electrical Energy Conversion and Auditing	PE-EE 802C.1	Explain the basic of energy resources, energy security, energy conservation and pollution.
		PE-EE 802C.2	Quantify the energy conservation opportunities in different thermal systems.
		PE-EE 802C.3	Quantify the energy conservation opportunities in different electrical systems.
		PE-EE 802C.4	Identify the common energy conservation opportunities in different energy intensive industrial equipments.
		PE-EE 802C.5	Explain the methods of energy management and audit.
		PE-EE 802C.6	Analyze and report the outcome of energy audit.
OE-CS 801A	AI and Soft Computing	OE-CS 801A.1	Understand different searching techniques in the field of AI.
		OE-CS 801A.2	Comprehend Propositional Logic Concepts.
		OE-CS 801A.3	Understand Neural Network and Applications.
		OE-CS 801A.4	Discuss Fuzzy Logic and Applications.
		OE-CS 801A.5	Comprehend Genetic Algorithms and Applications.
OE-IT 801C	Internet of Things	OE-IT 801C.1	Explain the definition and usage of the term —Internet of Things in different contexts.
		OE-IT 801C.2	Explain the key components that make up an IoT system.
		OE-IT 801C.3	Differentiate between the levels of the IoT stack and be familiar with the key technologies and protocols employed at each layer of the stack.
		OE-IT 801C.4	Build and test a IoT system involving prototyping, programming and data analysis.
PW-EE 881	Electrical & Electronic Design Laboratory -II	PW-EE 881.1	construct circuits with appropriate instruments and safety precautions.
		PW-EE 881.2	Design air core grounding reactor, double circuit transmission line and electric machines.
		PW-EE 881.3	Do wiring and installation design of a multistoried residential building with lift and pump.
		PW-EE 881.4	Design electronic hardware for speed of AC/DC motor.
PW-EE 882	Project Stage- II	PW-EE 882.1	Understand the content and techniques of the literature for project problem formulation.
		PW-EE 882.2	Analyze the model based on literature survey and plan for innovative thinking to inculcate skills for team work.

		PW-EE 882.3	Plan, design of preliminary model by simulation or experiment for building a prototype related to the topic.
		PW-EE 882.4	Represent project report and prepare presentation on the topic to demonstrate a prototype.

Department Name: **Electronics and Communication Engineering**
Program Name: **B.Tech (ECE)**

Paper Code	Paper Name	CO No.	CO Statement
PC-EC301-	Electronic Devices	PC-EC301.1	Describe semiconductor physics, semiconductor types and carrier transport phenomena.
		PC-EC301.2	Describe working principle of various diodes, BJT, MOSFET, solar cell and opto electronic devices.
		PC-EC301.3	Characterize diodes, BJT and MOSFETs.
		PC-EC301.4	Apply the acquired knowledge for implementing these devices for further application.
		PC-EC301.5	Calculate various device related parameters.
PC-EC302-	Analog Electronic Circuit	PC-EC302.1	Explain the operation of simple circuits with transistor, op-amp, amplifiers, oscillators.
		PC-EC302.2	Design of simple circuits with op-amp, amplifiers and oscillators.
		PC-EC302.3	Solve simple design-based problems related to circuits using diodes, transistors and OPAMPs
		PC-EC302.4	Analyze simple circuits with transistor and OPAMPs
PC-EC303-	Signals and Systems	PC-EC303.1	Analyze different types of signals.
		PC-EC303.2	Represent continuous and discrete systems in time and frequency domain using different transforms
		PC-EC303.3	Investigate the stability of the systems
		PC-EC303.4	Sample and reconstruct signals
PC-EC304-	Network Theory	PC-EC304.1	Analyse basics of electrical circuits with node and mesh analysis methods.
		PC-EC304.2	Appreciate electrical network theorems.
		PC-EC304.3	Apply Laplace Transform for transient and steady state behaviour.
		PC-EC304.4	Analyze passive circuits using various network parameters.
		PC-EC304.5	Design different types of passive AC networks and filters
ES-CS391	Data Structure & Algorithm Lab.	ES-CS301.1	Analyze an algorithm to determine computational complexity.
		ES-CS301.2	Select and implement an appropriate technique to solve a given searching problem.
		ES-CS301.3	Implement the operation of stack, queue and linked list and analyze them to determine the computational complexity.
		ES-CS301.4	Implement different sorting algorithms and analyze their performance in terms of space and time complexities.
		ES-CS301.5	Implement and analyze the operation of different algorithms for trees and graphs.
BS-M304	Numerical Methods	BS-M304.1	Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to intractable mathematical problems
		BS-M304.2	Apply numerical methods to obtain approximate solutions to mathematical problems
		BS-M304.3	Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
		BS-M304.4	Analyse and evaluate the accuracy of common numerical methods
PC-EC391	Electronics Devices Lab	PC-EC391.1	Characterize BJT,MOSFET,LED.LDRetc
		PC-EC391.2	Experimentally determine device parameters
		PC-EC391.3	Design amplifier circuits, implement them practically & determine bandwidth from graph.
PC-EC392	Analog Electronic Circuit Lab	PC-EC392.1	Explain application and demonstrate diode as a clipper and clamper.
		PC-EC392.2	Experimentally determine efficiency and ripple factor of rectifiers
		PC-EC392.3	Design amplifier and oscillator circuits, implement them practically & determine parameters from graph or calculation.
		PC-EC392.4	Characterize practical OPAMP and apply it to operational and filter circuits
ES-CS391	Data Structure & Algorithm Lab.	ES-CS391.1	Implement arrays and matrices.
		ES-CS391.2	Implement searching and sorting techniques.
		ES-CS391.3	Implement stacks, queues and linked lists.
		ES-CS391.4	Traverse BST and AVL trees
		ES-CS391.5	Generate hash table using hash function and collision resolution methods.
BS-M394	Numerical Methods Laboratory	BS-M394.1	Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to intractable mathematical problems.
		BS-M394.2	Apply numerical methods to obtain approximate solutions to mathematical problems.
		BS-M394.3	Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations,and the solution of differential equations.
		BS-M394.4	Analyse and evaluate the accuracy of common numerical methods
MC371	Environmental studies	MC371.1	Explain basic concepts, man, society & environment, their interrelationship, mathematics of population growth and associated problems, steady state conservation system.
		MC371.2	Demonstrate natural environmental hazards like flood, earthquake, landslide- causes, effects and control/management.
		MC371.3	Classify air pollution, water pollution, land pollution, noise pollution and their controls
		MC371.4	Discuss elements of ecology and environmental management.

PC-EC401	Analog communication	PC-EC401.1	Describe the need for modulation and type of modulation
		PC-EC401.2	Compare between the different demodulation methods.
		PC-EC401.3	Apply the basic concepts of Multiplexing in time (TDM) and frequency (FDM).
		PC-EC401.4	State basic operation and application of Super heterodyne receiver.
		PC-EC401.5	Analyze the noise performance of different modulation technique
PC-EC402	Digital system Design	PC-EC402.1	Describe the different number system and their conversions.
		PC-EC402.2	Discuss the Venn diagram, logic gates, SOP, POS and K-Map for logic simplification.
		PC-EC403.3	Design and analyze the modular combinational circuits
		PC-EC404.4	Design and analyze sequential logic circuits.
		PC-EC405.5	Apply the combinational and sequential circuit understanding for the analyze of converter circuit and logic families.
PC-EC403	Microprocessor and microcontroller	PC-EC403.1	Apply a basic concept of digital fundamentals to Microprocessor based personal computer system
		PC-EC403.2	Identify the detailed s/w & h/w structure of the Microprocessor.
		PC-EC403.3	Illustrate the operation, interface and instructions of microprocessor and microcontroller
		PC-EC403.4	Apply the microprocessor and microcontroller understanding in a multidisciplinary environment
ES-CS401-	Operating System	ES-CS401	Recall and state introductory concepts of operating system
		ES-CS401	Apply and analyze process scheduling methods and deadlock handling schemes
		ES-CS401	Explain inter process communication
		ES-CS401	Describe, apply and analyze memory management and disk management procedures
BS-M402	Mathematics III	BS-M402.1	Explain the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment.
		BS-M402.2	Apply calculus of complex function for analysing complex field
		BS-M402.3	Explain the tools of Fourier transform to analyze engineering problems and apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines.
		BS-M402.4	Solve engineering problems using z transform and probability theory
BS-BIO-401	Biology	BS-BIO-401.1	State different engineering applications from biological perspective.
		BS-BIO-401.2	Classify biological systems and identify different organisms and microorganisms depending on their morphological, biochemical and ecological criterion.
		BS-BIO-401.3	Explain the concept of recessiveness and dominance during the passage of genetic material from parent to offspring and describe DNA as a genetic material in the molecular basis of information transfer
		BS-BIO-401.4	Discuss structures of different biomolecules starting from basic units and hence understand different biological processes at the reductionistic level
		BS-BIO-401.5	Describe protein structures and enzymology and also compare different mechanisms of enzyme action.
		BS-BIO-401.6	Describe energy transformation processes in biological systems
PC-EC491	Analog Communication Lab	PC-EC491.1	Explain concepts of carrier, modulating signal, modulated waveform
		PC-EC49.21	Apply the concept of VCO in FM generation
		PC-EC491.3	Apply the concept of signal to noise ratio in noise measurement
PC-EC492	Digital system Design Lab	PC-EC492.1	Identify the various digital ICs and explain their operation
		PC-EC492.2	Develop the concept of Boolean laws and digital system
		PC-EC492.3	Apply Boolean laws for the different combinational logic circuit design.
		PC-EC492.4	Design the different sequential logic circuits
PC-EC493	Microprocessor & Microcontroller Lab	PC-EC493.1	Illustrate & execute assembly language program using kit and simulator
		PC-EC493.2	Apply the interface of PPI to microprocessor and microcontroller
		PC-EC493.3	Design and implement applications based on microprocessor and microcontroller
HM-HU 491	Soft Skill Development lab	HM-HU 491.1	Hone overall communicative competence.
		HM-HU 491.2	Develop team building and leadership quality.
		HM-HU 491.3	Deliver an enthusiastic and well-practiced presentation
		HM-HU 491.4	Communicate with clarity and confidence thereby enhancing employability skills of the students
MC-472	Constitution of India	MC-472.1	Develop an understanding of the nation's constitution
		MC-472.2	Develop knowledge about the various levels of governance in the country.
PC-EC501	Electromagnetic Waves and Transmission lines	PC-EC501.1	Understand Characteristics of wave propagation in high frequency Transmission lines
		PC-EC501.2	Carryout Impedance Transformation in Transmission lines
		PC-EC501.3	Use Transmission line sections for realizing circuit elements
		PC-EC501.4	Characterize Uniform Plane Waves
		PC-EC501.5	Analyze wave propagation in metallic waveguides in modal form
		PC-EC501.6	Understand principle of Radiation and Radiation characteristics of Antenna
PC-EC502	Computer Architecture	PC-EC502.1	Describe different components of computer systems
		PC-EC502.2.	Explain different memory structures and mapping technique
		PC-EC502.3.	Describe parallel computation system
		PC-EC502.4	Develop simple functional units using VHDL/Verilog
		PC-EC502.5	Design and solve problems related to CPU architecture, memory management and pipelining
PC-EC503	Digital Communication & Stochastic Process	PC-EC503.1	Understand the concept of Stochastic Process in Communication System
		PC-EC503.2	Represent various signals in different mathematical forms
		PC-EC503.3	Analyze baseband transmission mode of digital data

		PC-EC503.4	Analyze different career modulation techniques considering noise aspects.
PC-EC504	Digital Signal Processing	PC-EC504.1	Understand Signal and spectrum mathematically in discrete mode.
		PC-EC504.2	Analyze the response of an LSI system of different signals.
		Pc-EC504.3	Design of different types of digital filters for applications.
PE-EC-501-C	Power electronics	PE-EC-501C.1	Understand and apply the knowledge of device characteristics in power electronics domain.
		PE-EC-501C.2	Analyze the controlled rectifiers.
		PE-EC-501C.3	Perform Analysis of DC Choppers and Inverters.
		PE-EC-501C.4	Perform simple design of SMPS
PE-EC-501D	Scientific computing	PE-EC-501D.1	Explain the errors in numerical computations and floating point arithmetic.
		PE-EC-501D.2	Analyze the consistency of system of linear equations
		PE-EC-501-D.3	Solve the problems of eigen values and eigen vectors
		PE-EC-501-D.4	Analyze the efficiency of quadrature formulae
		PE-EC-501-D.5	Interpret data with least square method.
OE-EC-501A	Soft skill and interpersonal Communication	OE-EC-501A.1	Communicate better in different situation.
		OE-EC-501A.1	Develop leadership quality and resolve conflicts
		OE-EC-501A.1	Enhance life-skills for holistic development
MC571	Aptitude Skill Development-	MC571.1	Understand the basic concepts of QUANTITATIVE ABILITY.
		MC571.2	Understand the basic concepts of LOGICAL REASONING Skills .
		MC571.3	Understand the basic concepts of PROBABILITY.
		MC571.4	Acquire satisfactory competency in use of VERBAL REASONING
MC573	Essence of Indian Traditional Knowledge	MC573.1	Understand the concept of Traditional knowledge and its importance.
		MC573.2	Understand the need and importance of protecting traditional knowledge.
		MC573.3	Understand the various enactments related to the protection of traditional knowledg
		MC573.4	Understand the concepts of Intellectual property to protect the traditional knowledge
PC-EC591	Electromagnetic Waves and Transmission Line Laboratory	PC-EC591.1	Perform experiments and find different characterising parameters of transmission lines
		PC-EC591.2	Measure impedance of unknown load of transmission line.
		PC-EC591.3	Perform experiment to study radiation characteristics of different antennas and find different charactering parameters
PC-EC592	Computer Architecture Lab	PC-EC592.1	Explain different design styles in HDL
		PC-EC592.2	Design basic arithmetic circuits using VHDL/Verilo
		PC-EC592.3	Design basic combinational circuits using VHDL/Verilog
		PC-EC592.4	Design basic sequential circuits using VHDL/Verilog
		PC-EC592.5	Design ALU and memory using VHDL/Verilog
PC-EC593	Digital Communication Laboratory	PC-EC593.1	Demonstrate PAM, PCM, delta and adaptive delta modulation demodulation, line- coders: polar, unipolar, bipolar, NRZ, RZ and Manchester coding.
		PC-EC593.2	Demonstrate BPSK, BFSK, ASK, QPSK modulation demodulation schemes.
		PC-EC593.3	Generate 7-length and 15-length pseudo random noise sequence using shift register and apply it to coded communication.
		PC-EC593.4	Simulate the probability of symbol error rate for BPSK, BFSK modulation.
PC-EC593	Digital Signal Processing Laboratory	PC-EC593.1	Generate elementary signals/ waveforms and perform arithmetic operations on signals
		PC-EC593.2	Implement FFT of given sequence and identify the reduction of computations using FFT.
		PC-EC593.3	Plot frequency response of a given system and verify the properties of LTI system
PC-EC601	Control System and Instrumentation	PC-EC601.1	Understand basic knowledge of control system and illustrate mathematical representation of the real SISO & MIMO systems
		PC-EC601.2	Determine the system response to analyze the transient & steady state performance of the systems
		PC-EC601.3	Analyze the stability of system using different techniques .
		PC-EC601.4	Design some classical control system and perform stability analysis.
PC-EC602	Computer Network	PC-EC602.1	Understand basic idea of communication network and layered protocol architecture.
		PC-EC602.2	Understand different flow control and error control mechanisms and analyze the performance of different multiple access protocols
		PC-EC602.3	Understand internet addressing, routing techniques, process to process delivery,congestion control and design a subnet as per the requirement.
		PC-EC602.4	Apply different application layer protocols and modern communication technologies.
		PC-EC602.5	Understand the basic idea of cryptography and network security.
PE-EC-601A	Introduction to MEMS	PE-EC-601A.1	Appreciate the underlying working principles of MEMS and NEMS devices.
		PE-EC-601A.2	Understand the typical materials used for fabrication of micro systems
		PE-EC-601A.3	Understand the principles of standard micro fabrication techniques
		PE-EC-601A.4	Design and model MEMS devices.
PE-EC-601C	CMOS VLSI Design	PE-EC-601C.1	Apply MOS and CMOS circuit design techniques to different digital & analog circuits.
		PE-EC-601C.2	Design analog & digital CMOS circuits for specified applications
		PE-EC-601C.3	Explain VLSI design flow and study different fabrication process
PE-EC-601D	Information Theory and Coding	PE-EC-601D.1	Understand Information, Uncertainty, Entropy and channel capacity of AWGN channel
		PE-EC-601D.2	Analyze various source coding mechanism
		PE-EC-601D.3	Apply the knowledge of error control coding techniques to detect and correct the channel error.
OE-EE601A	Electronic Measurement & Measuring Instruments	OE-EE601A.1	Understand the basic concept of instrument characteristics
		OE-EE601A.2	Explain the process of different required Measuring Instruments
		OE-EE601A.3	Understand the operational technique of different Signal Analyzers.

		OE-EE601A.4	Understand the insight of the construction and working of different Transducers
		OE-EE601A.5	Understand and analyze the concept of Bridges and DAS
OE-IT601B	Object Oriented Programming	OE-IT601B.1	Recognize features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity
		OE-IT601B.2	Express basic techniques of writing programs using loops , methods and arrays in object oriented paradigm
		OE-IT601B.3	Apply the concepts of Encapsulation, Inheritance, Polymorphism in developing object oriented featured software.
		OE-IT601B.4	Design applications with an event-driven graphical user interface and using databases
		OE-IT601B.5	Practice efficient mapping of the real world interdisciplinary problems into object oriented programming methodologies.
HM-HU 601	Economics for Engineers	HM-HU 601.1	Describe the role of economics in the decision making process and perform calculations in regard to interest formulas
		HM-HU 601.2	Estimate the Present, annual and future worth comparisons for cash flows
		HM-HU 601.3	Calculate the rate of return, depreciation charges.
		HM-HU 601.4	Explain the importance of finance functions, financial ratios and solve related problems.
HM-HU602	Value and Ethics in Profession	HM-HU602.1	Understand the verification on the basis of natural acceptance and experiential validation through living is the only way to verify right or wrong, and referring to any external source like text or instrument
		HM-HU602.2	Apply the right utilization of their knowledge in their streams of Technology/Engineering/ Management to ensure mutually enriching and recyclable productions systems
		HM-HU602.3	Inculcate right understanding leading to lack of relationship as the major cause of problems in their family and not the lack of physical facilities
PW-EC681	Mini Project/ Electronic Design Workshop	PW-EC681.1	Identify a problem statement, analyze it after literature survey or from given conditions.
		PW-EC681.2	Design the prototype in order to solve the conceived problem
		PW-EC681.3	Implement and test the prototype in order to solve the conceived problem
MC671	Aptitude Skill Development- II	MC671.1	Be Prepared for Campus Placements and different Competitive Exams

PC-EC691	Control System and Instrumentation Lab	EC691.1	Use MATLAB Control System tool Box, MATLAB- SIMULINK tool box and pSpice
		EC691.2	Use the concepts of MATLAB to determine the step, impulse response for 1st and 2nd order system with increased system Type.
		EC691.3	Determine the time and frequency domain analysis with Root Locus, Bode Plot, Nyquist plot for different Type and order of system using MATLAB toolbox.
		EC691.4	Determine the compensator and controller actions using MATLAB/pSPICE
PC-EC692	Computer Network Lab	EC692.1	Design the structure of a LAN and the components required to install it.
		EC692.2	Configure NIC for multiple operating systems.
		EC692.3	Write programs in C for inter process communication using Pipe in Linux environment
		EC692.4	Write network programs in C using Socket in Linux environment.
OE-EE691A	Electronic Instrumentation and Measurement Lab	OE-EE691A.1	Explain the instrument characteristics
		OE-EE691A.2	Understand the clear knowledge about erro
		OE-EE691A.3	Execute the operation of different required measuring instrument.
		OE-EE691A.4	Understand the basic principle of operation of LVDT
		OE-EE691A.5	Understand the insight of construction and working of VCO or PLL
OE-IT691B	Object Oriented Programming lab	OE-IT691B.1	Use I/O to communicate with the user to populate variables and control program flow
		OE-IT691B.2	Write programs to solve the problems using the features of Object Oriented programming and java technology
		OE-IT691B.3	Develop applications with an event-driven graphical user interface using databases and networking concepts
		OE-IT691B.4	Practice efficient mapping of the real world interdisciplinary problems into object oriented programming methodologies.
PE-EC701A	Microwave Theory and Techniques	PE-EC701A.1	Analyze the Mathematical model of Microwave Transmission i.e. concept of Modes, Impedances.
		PE-EC701A.2	Characterize the Microwave systems using Scattering Parameters.
		PE-EC701A.3	Define the basic Principles and Characteristics of different Microwave Passive and Active Devices.
		PE-EC701A.4	Carryout design of Microwave Impedance matching networks, Filters, and Amplifiers.
		PE-EC701A.5	State the principles of measurement of various circuit parameters like power, frequency, impedance at microwave frequency range.
PE-EC 701B	Error Correcting Codes	PE-EC 701B .1	Explain Linear Block codes, Hamming Distance.
		PE-EC 701B .2	Design of simple cyclic encoder and Decoder circuits.
		PE-EC 701B .3	Generates Different types of convolution codes.
		PE-EC 701B .4	Analyze suitable coding mechanism for intelligent signal transmission.
PE-EC701C	Industrial Automation and Control	PE-EC701C.1	Understand the concept of automation, its terminology and basic communication protocol.
		PE-EC701C.2	Apply Relay logic for automation.
		PE-EC701C.3	Learn about PLC, its operation and application in automation.
		PE-EC701C.4	Analyze the industrial sensors, its terminology and how one can interface with PLC.
		PE-EC701C.5	Demonstrate Pneumatic system and its application in industry.
PE-EC702A	Embedded System	PE-EC702A.1	Describe about different embedded system and its purpose.
		PE-EC702A.2	Explain the different architecture required for an embedded system.
		PE-EC702A.3	Analyze the different components required for an embedded system.
		PE-EC702A.4	Apply the Program Modeling Concepts and Real time Operating system concepts for design of an simple er
PE-EC702B	Wireless Sensor Networks	PE-EC702B.1	Design wireless sensor networks for a given application.
		PE-EC702B.2	Understand and demonstrate emerging research areas in the field of sensor networks.
		PE-EC702B.3	Understand MAC protocols used for different communication standards used in WSN and implement i
		PE-EC702B.4	Explore new protocols for WSN.
PE-EC702C	Renewable Energy	PE-EC702C.1	Discuss the challenges and problems associated with the use of various energy sources, including fos
		PE-EC702C.2	Describe the basics of solar energy and use of solar energy for heating as well as photovoltaic generation.
		PE-EC702C.3	Identify Winds energy as alternate form of energy and to know how it can be tapped.
		PE-EC702C.4	Explain the principle of generation and use of different renewable energy sources such as ocean energy, hydel energy, geothermal energy, biomass energy, magneto hydrodynamics energy conversion etc.
OE-EE701A	Adaptive Signal Processing	OE-EE701A.1	Understand the non-linear control and the need and significance of changing the control parameters
		OE-EE701A.2	Mathematically represent the 'adaptability requirement'.
		OE-EE701A.3	Understand the mathematical treatment for the modeling and design of the signal processing systems.
OE-EE701C	Digital Image and Video Processing	OE-EE701C.1	Mathematically represent the various types of images and analyze them.
		OE-EE701C.2	Process an image for the enhancement of certain properties or for optimized use of the resources.
		OE-EE701C.3	Develop an algorithm for image compression and coding.
OE-CS701G	Neural Network and Fuzzy Logic Control	OE-CS701G.1	Comprehend the concepts of McCulloch-Pitts neuron and perceptron
		OE-CS701G.2	Describe structural and functional framework of ANN
		OE-CS701G.3	Comprehend ANN learning procedure and applications
		OE-CS701G.4	Discuss Fuzzy Logic control and applications
OE-CS701A	Big Data Analytics	OE-CS701A.1	Describe the concept of Big Data, Hadoop and HDFS.

		OE-CS701A.2	Describe the concept of Map Reduce, Hive, HBase, Pig, Sqoop and Impala.
		OE-CS701A.3	Demonstrate the concept of data transfer between HDFS, MySQL and Hive.
		OE-CS701A.4	Apply NoSQL for importing and exporting unstructured data.
OE-IT701F	Web Technology	OE-IT701F.1	Design good web pages using different tags, tables, forms, frames and style sheetssupported by HTML
		OE-IT701F.2	Implement, compile, test and run Java programs, comprising more than one class, to address a particular so
		OE-IT701F.3	Demonstrate the ability to employ various types of selection statements and iteration statements in a Java
		OE-IT701F.4	Be able to leverage the object-oriented features of Java language using abstract class and interface.
		OE-IT701F.5	Be able to handle errors in the program using exception handling techniques of Java.
		OE-IT701F.6	Design applets as per the requirements with event handling facility.
OE-CS701E	Cyber Security	OE-CS701E.1	Identify the cyber attacks of computer systems and network.
		OE-CS701E.2	Identify vulnerabilities critical to the information assets.
		OE-CS701E.3	Define the security controls sufficient to provide a required level of confidentiality, integrity and availabilit
OE-HU701A	Entrepreneurship	OE-HU701A.1	Develop some knowledge and skills needed to run a business.
		OE-HU701A.2	Prepare proposal and business plan independently.
		OE-HU701A.3	Understand the central and state government policies and regulations.
		OE-HU701A.4	Understand basics of venture capital, incubations and IT Startups.
HM-HU702	Principles of Management	HM-HU702.1	Explain the concept and approaches of Management.
		HM-HU702.2	Demonstrate the roles, skills and functions of management.
		HM-HU702.3	Diagnose and solve organizational problems.
		HM-HU702.4	Apply different methods of Customer, Operation and Technology management.
PW -EC781	Industrial Training	PW -EC781.1	Participate in the projects of industries during his or her industrial training.
		PW -EC781.2	Describe use of advanced tools and techniques encountered during industrial training and visit.
		PW -EC781.3	Interact with industrial personnel and follow engineering practices and discipline prescribed in industry.
		PW -EC781.4	Develop awareness about general workplace behavior and build interpersonal and team skills.
		PW -EC781.5	Prepare professional work reports and presentations.
PW-EC782	Project-I	PW-EC782 .1	Describe their project objective and state different research-oriented topics reviewed, related to their proj
		PW-EC782 .2	Formulate mathematical expressions/ design electronic circuits relevant to their project objective.
		PW-EC782 .3	Practically implement the designed circuits, apply different scientific software tools and techniques fo
		PW-EC782 .4	Report and present their work and function in collaboration with the team members.
PE-EC801A	Antennas and Propagation	PE-EC801A.1	Apply the knowledge of Maxwell's equation in solving the radiation fields of antenna.
		PE-EC801A.2	Define all the characterizing parameters of antenna.
		PE-EC801A.3	Analyze the fields of antenna array.
		PE-EC801A.4	Relate the basic principles and design considerations of Aperture and Microstrip antennas.
		PE-EC801A.5	Define the principles and mechanism of various Radio wave Propagation methods.
PE-EC801B	Fiber Optic Communication	PE-EC801B.1	Describe the principles of fiber-optic communication, the components and bandwidth advantages
		PE-EC801B.2	Discuss the properties of the optical fibers and optical components.
		PE-EC801B.3	Realize operation of lasers, LEDs, and detectors
		PE-EC801B.4	Analyze system performance of optical communication systems.
		PE-EC801B.5	Plan a point-to-point optical fiber communication link based on power budgeting and rise- time budgeting.
PE-EC801C	Satellite Communication	PE-EC801C .1	Visualize the architecture of satellite systems as a means of high speed, high range communication system.
		PE-EC801C .2	State various aspects related to satellite systems such as orbital equations, sub-systems in a satellite,
		PE-EC801C .3	Solve numerical problems related to orbital motion and design of link budget for the given paramet
PE-EC802A	Mixed Signal Design	PE-EC802A.1	Understand the concepts of Switched capacitor and Data Converter circuits.
		PE-EC802A.2	Apply the concepts for mixed signal MOS circuit.
		PE-EC802A.3	Analyze the signal to noise ratio and modeling of mixed signals.
		PE-EC802A.4	Design and analysis of engineering problems in the area of mixed-signal Design.
PE-EC802B	Mobile Communication and Network	PE-EC802B.1	Explain the basic cellular structure and frequency reuse concept.
		PE-EC802B.2	Explain fading effect and different atmospheric effects on mobile communication.
		PE-EC802B.3	Understand basic concept of frequency selective channel and different antenna requirements regarding mo
		PE-EC802B.4	Explain TDMA, FDMA, CDMA and digital modulation scheme like BPSK, QPSK etc.
		PE-EC802B.5	Understand basic operation principle of RAKE receiver, MRC receiver etc.
		PE-EC802B.6	Understand basic of GSM, EDGE, GPRS etc.
PE-EC802C	VLSI Design Automation	PE-EC802C.1	Discuss the concepts of VLSI design and methodology.
		PE-EC802C.2	Analyze the circuits for partitioning and placement.
		PE-EC802C.3	Apply the concept of floor-planning and routing for VLSI Circuits
		PE-EC802C.4	Illustrate and analyze VLSI Simulation and synthesis of circuits.
OE-IT801C	Internet of Things	OE-IT801C.1	Explain the definition and usage of the term —Internet of Things‖ in different contexts
		OE-IT801C.2	Explain the key components that make up an IoT system.
		OE-IT801C.3	Differentiate between the levels of the IoT stack and be familiar with the key technologies and protocols en
		OE-IT801C.4	Build and test a IoT system involving prototyping, programming and data analysis
OE-CS801B	Artificial Intelligence	OE-CS801B.1	Evaluate the basic concepts of AI
		OE-CS801B.2	Explain between heuristic and non-heuristic search techniques.
		OE-CS801B.3	Interpret Resolution and Probability based inference.
		OE-CS801B.4	Explain NLP, Learning and Expert System Architecture.
OE-HU801H	Organizational Behaviour	OE-HU801H.1	Demonstrate the applicability of the concept of organizational behavior to understand the behavior of peop
		OE-HU801H.2	Demonstrate the applicability of analyzing the complexities associated with management of inc
		OE-HU801H.3	Analyze the complexities associated with management of the group behavior in the organization

		OE-HU801H.4	Demonstrate how the organizational behavior can integrate in understanding the motivation (why) be
OE-M801A	Operations Research and Optimizing Technique	OE-M801A.1	Solve linear programming problems using appropriate techniques and optimization solvers, interpret the r
		OE-M801A.2	Determine optimal strategy for Minimization of Cost of shipping of products from source to Destination/ M
		OE-M801A.3	Optimize the allocation of resources to Demand points in the best possible way using various techniques ar
PW-EC881	Project-II	PW-EC881.1	Describe their project objective and state different research-oriented topics reviewed, related to their proje
		PW-EC881.2	Formulate mathematical expressions/ design electronic circuits relevant to their project objective.
		PW-EC881.3	Practically implement the designed circuits, apply different scientific software tools and techniques fo
		PW-EC881.4	Report and present their work and function in collaboration with the team members.
PW-EC882	Comprehensive Viva Voce	PW-EC882.1	Express themselves effectively.
		PW-EC882.2	Apply knowledge to tackle unknown questions.
		PW-EC882.3	Review literature to independently study unknown modern topic.

Department Name: **Electronics and Communication Engineering**
Program Name: **B.Tech (EC-VLSI Design)**

Paper Code	Paper Name	CO No.	CO Statement
PC-EC302	Analog Electronic Circuits	PC-EC302.1	Explain the operation of simple circuits with transistor, op-amp, amplifiers, oscillators.
		PC-EC302.2	Design of simple circuits with op-amp, amplifiers and oscillators.
		PC-EC302.3	Solve simple design-based problems related to circuits using diodes, transistors and OPAMPs
		PC-EC302.4	Analyze simple circuits with transistor and OPAMPs
PC-EC303	Signals and Systems	PC-EC303.1	Analyze different types of signals.
		PC-EC303.2	Represent continuous and discrete systems in time and frequency domain using different transforms
		PC-EC303.3	Investigate the stability of the systems
		PC-EC303.4	Sample and reconstruct signals
PC-EC304	Network Theory	PC-EC304.1	Understand of basic electrical circuit with nodal and mesh analysis
		PC-EC304.2	Appreciate different network theorems
		PC-EC304.3	Apply Laplace transform for transient and steady state behavior
		PC-EC304.4	Analyze passive circuits using various network parameters
		PC-EC304.5	Design different types of passive AC networks and filters
ES-CS301	Data Structure and algorithm	ES-CS301.1	Analyze an algorithm to determine the computational complexity.
		ES-CS301.2	Select and implement an appropriate technique to solve a given searching problem.
		ES-CS301.3	Implement the operation of stack, queue and linked list and analyze them to determine the computational complexity.
		ES-CS301.4	Implement different sorting algorithms and analyze their performance in terms of space and time complexities.
		ES-CS301.5	Implement and analyze the operation of different algorithms for trees and graphs.
ES-CS302	Discrete Mathematics	ES-CS302.1	Express a logic sentence in terms of predicates, quantifiers, and logical connectives
		ES-CS302.2	Derive the solution for a given problem using deductive logic and prove the solution based on logical inference
		ES-CS302.3	Classify its algebraic structure for a given a mathematical problem
		ES-CS302.4	Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra
		ES-CS302.5	Develop the given problem as graph networks and solve with techniques of graph theory
PC-EC394	Network Theory Lab	PC-EC394.1	Analyze amplitude and phase spectrum of different signals.
		PC-EC394.2	Verify the network theorems. construct circuits with appropriate instruments and safety precautions
		PC-EC394.3	Apply the hardware knowledge for verification of circuits and systems
		PC-EC394.4	Apply the modern tools for study of different transformation and circuits .
BS-M304	Numerical Methods	BS-M304.1	Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to intractable mathematical problems
		BS-M304.2	Apply numerical methods to obtain approximate solutions to mathematical problems
		BS-M304.3	Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
		BS-M304.4	Analyse and evaluate the accuracy of common numerical methods
PC-EC392	Analog Electonic Circuits Lab	PC-EC392.1	Explain application and demonstrate diode as a clipper and clamper.
		PC-EC392.2	Experimentally determine efficiency and ripple factor of rectifiers
		PC-EC392.3	Design amplifier and oscillator circuits, implement them practically & determine parameters from graph or calculation.
		PC-EC392.4	Characterize practical OPAMP and apply it to operational and filter circuits
ES-CS391	Data Structure Lab.	ES-CS391.1	Handle arrays and matrices.
		ES-CS391.2	Implement searching and sorting techniques.

		ES-CS391.3	Implement stacks, queues and linked lists.
		ES-CS391.4	Create and traverse BST and AVL trees
		ES-CS391.5	Generate hash table using hash function and collision resolution methods.
BS-M394	Numerical Methods Lab	BS-M494.1	Apply programming concepts to solve the interpolation problems.
		BS-M494.2	Apply programming concepts to solve the numerical integration problems.
		BS-M494.3	Apply programming concepts to solve the transcendental equation
		BS-M494.4	Apply programming concepts to solve the boundary value problems of ordinary differential equation
		BS-M494.5	Apply programming concepts to fit the curve numerically & central tendancy
		BS-M494.6	Apply programming concepts to solve the system of linear eqautions
MC371	Environmental Sciences	MC371.1	Explain basic concepts, man, society & environment, their interrelationship, mathematics of population growth and associated problems, steady state conservation system.
		MC371.2	Demonstrate natural environmental hazards like flood, earthquake, landslide- causes, effects and control/management.
		MC371.3	Classify air pollution, water pollution, land pollution, noise pollution and their controls
		MC371.4	Discuss elements of ecology and environmental management.
PC-EC(V)401	Analog and Digital Communication	PC-EC(V)401.1	Understand the need for modulation, representation of the modulated carrier wave in both analog and digital communication.
		PC-EC(V)401.2	Identify the different types of analog and digital modulation technique, identify the modulating and carrier frequencies, and decide the type of generation method to be adopted.
		PC-EC(V)401.3	Understand the basic concept of Sampling and analog signal to digital signal conversion techniques, concepts of Digital transmission, concept of line coding and ISI
		PC-EC(V)401.4	Analyze different career modulation techniques considering noise aspects
		PC-EC(V)401.5	Illustrate the constellation diagram for different digital modulation technique.
PC-EC402	Digital system Design	PC-EC402.1	Describe the different number system and their conversions.
		PC-EC402.2	Discuss the Venn diagram, logic gates, SOP, POS and K-Map for logic simplification.
		PC-EC402.3	Design and analyze the modular combinational circuits
		PC-EC402.4	Design and analyze sequential logic circuits.
		PC-EC402.5	Apply the combinational and sequential circuit understanding for the analyze of converter circuit and logic families.
PC-EC403	Microprocessor and microcontroller	PC-EC403.1	Apply a basic concept of digital fundamentals to Microprocessor based personal computer system
		PC-EC403.2	Identify the detailed s/w & h/w structure of the Microprocessor.
		PC-EC403.3	Illustrate the operation, interface and instructions of microprocessor and microcontroller
		PC-EC403.4	Apply the microprocessor and microcontroller understanding in a multidisciplinary environment
PC-EC(V)402	Control System	PC-EC(V)402 .1	State basic knowledge of control system and illustrate mathematical representation of the real SISO & MIMO systems
		PC-EC(V)402 .2	Determine the system response to analyze the transient & steady state performance of the systems
		PC-EC(V)402 .3	Perform stability analysis of system using different technique
		PC-EC(V)402 .4	Design some classical control system
OE- EC(V)401B	Object Oriented Programming	OE- EC(V)401B.1	Recognize features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity
		OE- EC(V)401B.2	Express basic techniques of writing programs using loops , methods and arrays in object oriented paradigm
		OE- EC(V)401B.3	Apply the concepts of Encapsulation, Inheritance, Polymorphism in developing object oriented featured software.
		OE- EC(V)401B.4	Design applications with an event-driven graphical user interface and using databases
		OE- EC(V)401B.5	Practice efficient mapping of the real world interdisciplinary problems into object oriented programming methodologies.
BS-BIO-401	Biology	BS-BIO-401.1	State different engineering applications from biological perspective.
		BS-BIO-401.2	Classify biological systems and identify different organisms and microorganisms depending on their morphological, biochemical and ecological criterion.
		BS-BIO-401.3	Explain the concept of recessiveness and dominance during the passage of genetic material from parent to offspring and describe DNA as a genetic material in the molecular basis of information transfer
		BS-BIO-401.4	Discuss structures of different biomolecules starting from basic units and hence understand different biological processes at the reductionistic level
		BS-BIO-401.5	Describe protein structures and enzymology and also compare different mechanisms of enzyme action.

		BS-BIO-401.6	Describe energy transformation processes in biological systems
PC-EC(V)491	Analog and Digital Communication Lab	PC-EC491(V).1	Grow the knowledge about carrier, modulating signal, modulated waveform
		PC-EC491(V).2	Apply the concept of VCO in FM generation
		PC-EC491(V).3	Apply the concept of signal to noise ratio in noise measurement
		PC-EC491(V).4	Acquire skill to analyze and implement analogue to digital converters like PCM, DM, ADM
PC-EC492	Digital system Design Lab	PC-EC492.1	Identify the various digital ICs and explain their operation
		PC-EC492.2	Develop the concept of Boolean laws and digital system
		PC-EC492.3	Apply Boolean laws for the different combinational logic circuit design.
		PC-EC492.4	Design the different sequential logic circuits
PC-EC493	Microprocessor & Microcontroller Lab	PC-EC493.1	Illustrate & execute assembly language program using kit and simulator
		PC-EC493.2	Apply the interface of PPI to microprocessor and microcontroller
		PC-EC493.3	Design and implement applications based on microprocessor and microcontroller
OE- EC(V)491B	Object Oriented Programming Laboratory	OE- EC(V)491B.1	Use I/O to communicate with the user to populate variables and control program flow
		OE- EC(V)491B.2	Write programs to solve the problems using the features of Object Oriented programming and java technology
		OE- EC(V)491B.3	Develop applications with an event-driven graphical user interface using databases and networking concepts
		OE- EC(V)491B.4	Practice efficient mapping of the real world interdisciplinary problems into object oriented programming methodologies.
HM-HU 491	Soft Skill Development lab	HM-HU 491.1	Honing overall communicative competence.
		HM-HU 491.2	Develop team building and leadership quality.
		HM-HU 491.3	Deliver an enthusiastic and well-practiced presentation
		HM-HU 491.4	Communicate with clarity and confidence thereby enhancing employability skills of the students
MC-472	Constitution of India	MC-472.1	Understanding the constitution of India.
		MC-472.2	Understanding the various levels of governance in the country.
PC-EC501	Electromagnetic Waves and Transmission lines	PC-EC501.1	Understand Characteristics of wave propagation in high frequency Transmission lines
		PC-EC501.2	Carryout Impedance Transformation in Transmission lines
		PC-EC501.3	Use Transmission line sections for realizing circuit elements
		PC-EC501.4	Characterize Uniform Plane Waves
		PC-EC501.5	Analyze wave propagation in metallic waveguides in modal form
		PC-EC501.6	Understand principle of Radiation and Radiation characteristics of Antenna

PC-EC(V)502	Computer Architecture	PC-EC(V)502.1	Describe different components of computer systems
		PC-EC(V)502.2.	Explain different memory structures and mapping technique
		PC-EC(V)502.3.	Describe parallel computation system
		PC-EC(V)502.4	Develop simple functional units using VHDL/Verilog
		PC-EC502(V).5	Design and solve problems related to CPU architecture, memory management and pipelining
PC-EC(V)501	Analog VLSI Circuits	PC-EC(V)501.1	Understand the MOS fundamentals, small signal models , MOSFET based circuits and layouts
		PC-EC(V)501.2	Analyze analog circuits such as Differential Amplifier, OP-AMP, Current sources and current sink circuits, Current mirrors, and Biasing circuits.
		PC-EC(V)501.3	Design of High performance CMOS OPAMP and MOS Comparator
		PC-EC(V)501.4	Apply the MOS fundamentals for mixed mode circuits such as Comparator, ADCs, DACs, Switch Capacitor Filters
PC-EC504	Digital Signal Processing	PC-EC504.1	Understand Signal and spectrum mathematically in discrete mode.
		PC-EC504.2	Analyze the response of an LSI system of different signals.
		Pc-EC504.3	Design of different types of digital filters for applications.
PE-EC(V)501A	Microelectronics and Optoelectronic Devices	PE-EC(V)501A.1	Understand the band structures of various types of semiconductors and choice of materials for different microelectronic and optoelectronic devices
		PE-EC(V)501A.2	Learn many of the core problems involved with MOSFET technology, and the problems encountered in the continuing push on scaling and miniaturization.
		PE-EC(V)501A.3	Understand the various types of optical sources, characteristics and their applications
		PE-EC(V)501A.4	Understand the various types of optical detectors and modulators, characteristics and their applications.
		PE-EC(V)501A.5	Design system using microelectronic and optoelectronic devices for various applications and analyze their performance.
HM-HU502	Value and Ethics in Profession	HM-HU502.1	Understand the verification on the basis of natural acceptance and experiential validation through living is the only way to verify right or wrong, and referring to any external source like text or instrument
		HM-HU502.2	Apply the right utilization of their knowledge in their streams of Technology/Engineering/ Management to ensure mutually enriching and recyclable productions systems
		HM-HU502.3	Inculcate right understanding leading to lack of relationship as the major cause of problems in their family and not the lack of physical facilities
MC571	Aptitude Skill Development-I	MC571.1	Understand the basic concepts of QUANTITATIVE ABILITY.
		MC571.2	Understand the basic concepts of LOGICAL REASONING Skills .
		MC571.3	Understand the basic concepts of PROBABILITY.
		MC571.4	Acquire satisfactory competency in use of VERBAL REASONING
MC573	Essence of Indian Traditional Knowledge	MC573.1	Understand the concept of Traditional knowledge and its importance.
		MC573.2	Understand the need and importance of protecting traditional knowledge.
		MC573.3	Understand the various enactments related to the protection of traditional knowledg
		MC573.4	Understand the concepts of Intellectual property to protect the traditional knowledge
PC-EC591	Electromagnetic Waves and Transmission Line Laboratory	PC-EC591.1	Understand handling of test benches using Gunn and Klystron sources
		PC-EC591.2	Measure the Guide wavelength, cutoff wavelength in waveguide
		PC-EC591.3	Measure unknown impedance using shift in minima technique
		PC-EC591.4	Measure the HPBW, Directivity of Dipole and Folded Dipole Antenna
		PC-EC591.5	Measure the HPBW, Directivity and Gain of Pyramidal Horn Antenna
PC-EC592	Computer Architecture Lab	PC-EC592.1	Explain different design styles in HDL
		PC-EC592.2	Design basic arithmetic circuits using VHDL/Verilo
		PC-EC592.3	Design basic combinational circuits using VHDL/Verilog
		PC-EC592.4	Design basic sequential circuits using VHDL/Verilog
		PC-EC592.5	Design ALU and memory using VHDL/Verilog
PC-EC(V)591	Analog VLSI Circuits Lab	PC-EC(V)591.1	Understanding the SPICE tools
		PC-EC(V)591.2	Analyze the characteristics of Analog VLSI circuits and sub circuits
		PC-EC(V)591.3	Design the Analog VLSI circuits and sub circuits
		PC-EC(V)591.4	Implement the layout of MOS and its allied circuits
PC-EC594	Digital Signal Processing Laboratory	PC-EC593.1	Understand elementary signals/ waveforms and perform arithmetic operations on signals.
		PC-EC593.2	Implement FFT of given sequence and identify the reduction of computations using FFT.
		PC-EC593.3	Analyze frequency response of a given system and verify the properties of LTI system.
		PC-EC593.4	Design and Implement FIR and IIR filter for a given sequence

PC-EC(V)601	Microelectronics Fabrication	PC-EC601.1	Understand the necessities of clean room in microelectronics fabrication
		PC-EC(V)601.2	Describe different common fabrication steps used in microelectronics fabrication and their importance
		PC-EC(V)601.3	Demonstrate different steps involved in basic CMOS manufacturing procedure starting from bare silicon wafer
		PC-EC(V)601.4	Understand the importance of IC packaging, assembly and testing
PE-EC(V)601A	Computer Network	PC-EC(V)601.1	Understand basic idea of communication network and layered protocol architecture.
		PC-EC602.2	Understand different flow control and error control mechanisms and analyze the performance of different multiple access protocols
		PC-EC602.3	Understand internet addressing, routing techniques, process to process delivery,congestion control and design a subnet as per the requirement.
		PC-EC602.4	Apply different application layer protocols and modern communication technologies.
		PC-EC602.5	Understand the basic idea of cryptography and network security.
PC-EC(V)602	Digital VLSI	PC-EC(V)602.1	Understand the MOS and CMOS Invertor Circuits
		PC-EC(V)602.2	Analyze digital circuits using CMOS Logic gates
		PC-EC(V)602.3	Design of combinational and sequential logic circuits using CMOS
		PC-EC(V)602.4	Apply the MOS logic circuits for Dynamic Logic Circuits and Semiconductor Memories
PE-EC(V)602A	Sensors and Transducers	PE-EC(V)602A.1	Understand Characteristics and choice of transducer
		PE-EC(V)602A.2	Understand basic principles and applications of resistive and reactive transducers.
		PE-EC(V)602A.3	Analyze the self generating sensors i.e thermocouple, piezoelectric sensors
		PE-EC(V)602A.4	Understand basic principles of thickness, level and vacuum measurement
		PE-EC(V)602A.5	Analyze the signal conditioning circuits of resistive and reactive transducers
		PE-EC(V)602A.6	Understand basics of Instrument buses for VLSI testing
OE-IT601A	Machine Learning	OE-IT601A.1	Explain different supervised Learning Techniques
		OE-IT601A.2	Identify the difference between Linear and Non Linear Models
		OE-IT601A.3	Understand different unsupervised learning techniques.
		OE-IT601A.4	Understand the concept of model estimation and deep learning techniques
PC-EC(V)692	Digital VLSI Lab	PC-EC(V)692.1	Understanding the hardware design language (HDL).
		PC-EC(V)692.2	Design of the Combinational circuit using hardware description language or tools and validate its functionality
		PC-EC(V)692.3	Design of the Sequential circuit using hardware description language or tools and validate its functionality
		PC-EC(V)692.4	Design and implement on a FPGA board
OE-CS691B	Machine Learning Lab	OE-IT691A.1	Implement different classification and clustering algorithm
		OE-IT691A.2	Understand and implement decision tree .
		OE-IT691A.3	Implement Deep Learning Techniques.
PW-EC(V)681	Mini Project	PW-EC(V)681.1	Identify a problem statement, analyze it after literature survey or from given conditions
		PW-EC(V)681.2	Design the prototype in order to solve the conceived problem
		PW-EC(V)681.3	Implement and test the prototype in order to solve the conceived problem
MC671	Aptitude Skill Development- II	MC671.1	Prepared for Campus Placements and different Competitive Exams
PC-EC692	Computer Network Lab	EC692.1	Design the structure of a LAN and the components required to install it.
		EC692.2	Configure NIC for multiple operating systems.
		EC692.3	Write programs in C for inter process communication using Pipe in Linux environment
		EC692.4	Write network programs in C using Socket in Linux environment.

Department Name: **Information Technology**
Program Name: **B.Tech (I.T.)**

Paper Code	Paper Name	CO No.	CO Statement
ES-EC303	Analog and Digital Electronics	ESEC303.1	Understand basic electronics simple Circuit.
		ESEC303.2	Understand the Boolean arithmetic and its application in Digital design.
		ESEC303.3	Understand, analyze and design various combinational and sequential.
PC-IT301	Data Structure and Algorithms	PC-IT301.1	Understand and apply the concept of stack, queue and linked list operations
		PC-IT301.2	Discuss the computational efficiency of the principal algorithms for sorting,
		PC-IT301.3	Understand and apply the knowledge of tree and graphs concepts
		PC-IT301.4	Choose an appropriate data structure for a particular problem
PC-IT302	Computer Organization and Architecture	PC-IT 302.1	Understand basic computer organization, micro-operations and design of hypothetical arithmetic logic unit.
		PC-IT 302.2	Understand various data representations, CPU functioning and computer arithmetic
		PC-IT 302.3	Understand various methods and techniques of memory organization and I/O operations

BS-M301	Mathematics-III	BS-M301.1	Learn the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment
		BS-M301.2	Understand the basic ideas of statistics with different characterisation of a univariate and bivariate data set
		BS-M301.3	Apply statistical tools for analysing data samples.
		BS-M301.4	Learn the tools of Fourier transform to analyze engineering problems and apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines.
HM-HU301	Introduction to Industrial Management	HM-HU301.1	Acquire fundamental knowledge of Industrial and Operations Management.
		HM-HU301.2	Prepare Production and Project Planning by CPM and PERT techniques.
		HM-HU301.3	Learn Material Management and Inventory Management Models.
ES-EC393	Analog and Digital Electronics Lab	ES-EC393.1	Apply the practical knowledge of basic electronics simple Circuit
		ES-EC393.2	To implement & design combinational and sequential circuit
PC-IT391	Data Structure and Algorithms Lab	PC-IT391.1	Design and analyze the time and space efficiency of the data structure.
		PC-IT391.2	Identity the appropriate data structure for given problem.
		PC-IT391.3	Have practical knowledge on the application of data structures.
PC-IT392	Computer Organization and Architecture Lab	PC-IT 392.1	Design, implement, and debug digital hardware systems.
		PC-IT 392.2	Understand digital logic specification methods and the compilation process that transforms these into logic networks.
		PC-IT 392.3	Understand the design of the various functional units of digital computers
PC-IT393	IT Workshop (Sci. Lab/MATLAB/Python/R)	PC-IT393.1	Understand the details of Scripting languages
		PC-IT393.2	Design real life problems and think creatively about solutions
		PC-IT393.3	Develop Solutions for advanced applications using R/Matlab/Python
ES-IT401	Discrete Mathematics	ES-IT401.1	Express a logic sentence in terms of predicates, quantifiers, and logical connectives
		ES-IT401.2	Derive the solution for a given problem using deductive logic and prove the solution based on logical inference
		ES-IT401.3	Classify its algebraic structure for a given a mathematical problem
		ES-IT401.4	Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra
		ES-IT401.5	Develop the given problem as graph networks and solve with techniques of graph theory
PC-IT401	Database Management System	PC-IT401.1	Explain the terms related to Database Design and Management
		PC-IT401.2	Construct and normalized conceptual database model
		PC-IT401.3	Understand database concept, structure and the issues related to database performance
PC-IT402	Design and Analysis of Algorithms	PC-IT402.1	For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms
		PC-IT402.2	Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms
		PC-IT402.3	Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation
		PC-IT402.4	Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it
		PC-IT402.5	Develop the dynamic programming algorithms, and analyze it to determine its computational complexity
		PC-IT402.6	For a given model engineering problem model it using graph and write the corresponding algorithm to solve the problems
		PC-IT402.7	Explain the ways to analyze randomized algorithms (expected running time, probability of error)
		PC-IT402.8	Explain what an approximation algorithm is. Compute the approximation factor of an approximation algorithm (PTAS and FPTAS)
PC-IT403	Formal Language and Automata Theory	PC-IT403.1	Write a formal notation for strings, languages and machines.
		PC-IT403.2	Design finite automata to accept a set of strings of a language.
		PC-IT403.3	For a given language determine whether the given language is regular or not.
		PC-IT403.4	Design context free grammars to generate strings of context free language.
		PC-IT403.5	Determine equivalence of languages accepted by Push Down Automata and languages generated by context free grammars
		PC-IT403.6	Write the hierarchy of formal languages, grammars and machines.
		PC-IT403.7	Distinguish between computability and non-computability and Decidability and undecidability
BS-M404	Numerical Methods	BS-M404.1	Calculate different types of error involved in Engineering problems and learn to apply numerical methods to find approximate solutions for them.
		BS-M404.2	Interpolate different polynomials using numerical techniques
		BS-M404.3	Derive numerical methods for integration and apply them for solving otherwise intractable Engineering problems
		BS-M404.4	To solve system of linear equations and to learn the concept of root finding for nonlinear equations
		BS-M304.5	To solve ordinary differential equation numerically
		BS-M404.6	Use various statistical tools to solve Engineering problems numerically
BS-BIO401	Biology	BS-BIO401.1	State different engineering applications from biological perspective
		BS-BIO401.2	Classify biological systems and identify different organisms and microorganisms depending on their morphological, biochemical and ecological criterion.

		BS-BIO401.3	Explain the concept of recessiveness and dominance during the passage of genetic material from parent to offspring and describe DNA as a genetic material in the molecular basis of information transfer
		BS-BIO401.4	Discuss structures of different biomolecules starting from basic units and hence understand different biological processes at the reductionistic level.
		BS-BIO401.5	Describe protein structures and enzymology and also compare different mechanisms of enzyme action.
		BS-BIO401.6	Describe energy transformation processes in biological systems.
PC-IT491	Database Management System Lab	PC-IT491.1	Design and implement a database schema for a given problem-domain
		PC-IT491.2	Create and maintain tables using PL/SQL
		PC-IT491.3	Populate and query a database
PC-IT492	Design and Analysis of Algorithms Lab	PC-IT492.1	Analysing and formulating a computing problem and to propose step by step solution
		PC-IT492.2	Computing efficiency of the proposed solution in terms of time complexity, space complexity, computational overheads
		PC-IT492.3	Gather knowledge about various types of algorithm and ability to apply the knoledge to solve various computing problem efficiently
BS-M494	Numerical Methods Lab	BS-M494.1	Apply programming concepts to solve the interpolation problems.
		BS-M494.2	Apply programming concepts to solve the numerical integration problems.
		BS-M494.3	Apply programming concepts to solve the transcendental equation
		BS-M494.4	Apply programming concepts to solve the boundary value problems of ordinary differential equation
		BS-M494.5	Apply programming concepts to fit the curve numerically & central tendancy
		BS-M494.6	Apply programming concepts to solve the system of linear eqautions
MC471	Environmental Sciences	MC471.1	Explain basic concepts, man, society & environment, their interrelationship, mathematics of population growth and associated problems, steady state conservation system.
		MC471.2	Demonstrate natural environmental hazards like flood, earthquake, landslide-causes, effects and control/management.
		MC471.3	Classify air pollution, water pollution, land pollution, noise pollution and their controls.
		MC471.4	Study Elements of ecology and environmental management.
PC-IT501	Compiler Design	PC-IT501.1	Understand given grammar specification, develop the lexical analyzer.
		PC-IT501.2	Design a given parser specification design top-down and bottom-up parsers.
		PC-IT501.3	Develop syntax directed translation schemes.
		PC-IT501.4	Develop algorithms to generate code for a target machine.
PC-IT502	Operating Systems	PC-IT502.1	Apply the knowledge of basic concepts of operating system
		PC-IT502.2	Apply concepts of memory management including virtual memory, and disk management system, file management and multithreading
		PC-IT502.3	Apply concepts to protection and security mechanisms
PC- IT503	Object Oriented Programming	PC-IT503.1	Specify simple abstract data types and design implementations, using abstraction functions to document them
		PC-IT503.2	Recognize features of object-oriented design such as encapsulation, polymorphism, inheritance and composition of systems based on object identity
		PC-IT503.3	Name and apply some common object-oriented design patterns and give examples of their use
		PC-IT503.4	Design applications with an event-driven graphical user interface
HM-HU501	Economics for Engineers	HM-HU501.1	Discuss fundamentals of economic analysis.
		HM-HU501.2	Describe rate of return and profitability analysis, quantitative decision making by economic analysis including basic accounting system such as P & L accounts and balance sheet.
		HM-HU501.3	Apply decision making skills in terms of Economic, financial considerations in practice.
PE-IT501B	Machine Learning	PE-IT501B.1	Understand the methods involved in generating models from data
		PE-IT501B.2	Understand a wide variety of learning algorithms
		PE-IT501B.3	Understand how to evaluate models generated from data
		PE-IT501B.4	Optimize the models learned and report on the expected accuracy that can be achieved when applying the models to solve the problems
		PE-IT501B.5	Apply the machine learning algorithms to solve various real-world problems
PC-IT591	Compiler Design Lab	PC-IT591.1	Be exposed to compiler writing tools.
		PC-IT591.2	Learn to implement the different Phases of compiler.
		PC-IT591.3	Be familiar with control flow and data flow analysis.
		PC-IT591.4	Learn simple optimization techniques.
PC-IT592	Operating Systems Lab	PC-IT 593.1	Apply the practical knowledge of the different types functions and structures of UNIX OS
		PC-IT 593.2	Apply the necessary knowledge of various process management concepts like scheduling synchronization etc
		PC-IT 593.3	Apply the necessary knowledge and skills for developing and debugging C and other programs in UNIX environment
PC-IT593	Object Oriented Programming Lab	PC-IT593.1	Ability to implement class and object using JAVA
		PC-IT593.2	Ability to reuse already written code in a program through inheritance
		PC-IT593.3	Ability to implement the concept of polymorphism using JAVA
		PC-IT593.4	Ability to handle special features namely exception, multithreaded programming, graphics and applet

HM-HU591	Soft Skill Development Lab	HM-HU591.9	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
		HM-HU591.10	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.
		HM-HU591.12	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.
PW-IT581	Project-I	PW-IT581.1	Work as a team member
		PW-IT581.2	Prepare a report in the standard format
		PW-IT581.3	Ready for Seminar Presentation before any standard body
MC571	Aptitude Skill Development-I	MC571.1	Understand the basic concepts of QUANTITATIVE ABILITY.
		MC571.2	Understand the basic concepts of LOGICAL REASONING Skills.
		MC571.3	Understand the basic concepts of PROBABILITY.
		MC571.4	Acquire satisfactory competency in use of VERBAL REASONING
MC572	Constitution of India	MC572.1	Understand the emergence and evolution of Indian Constitution.
		MC572.2	Analyse Panchayati Raj institutions as a medium of decentralization of administration
		MC572.3	Understand and Evaluate the Indian Political scenario amidst the emerging challenges
PC-IT601	Software Engineering	PC-IT601.1	Identify software process model and main aspects of software engineering.
		PC-IT601.2	Explain the role of project management including planning, scheduling, cost estimation, risk management, etc
		PC-IT601.3	Design software test cases and study software in object oriented paradigm using UML diagram.
PC-IT602	Computer Networks	PC-IT602.1	Familiarize with the basic protocols of computer networks, and how they can be used to assist in network design and implementation.
		PC-IT602.2	Identify the different types of network devices and their functions within a network.
		PC-IT602.3	Solve network administration problems by applying Computer Networking Concepts
PE-IT601B	Data Analytics and Big Data	PE-IT601B.1	Learn the importance of proper data analysis in decision making using Python.
		PE-IT601B.2	Identify Big Data and its Business Implications.
		PE-IT601B.3	Understand the components of Hadoop and Hadoop Eco-System
		PE-IT601B.4	Access and Process Data on Distributed File System
		PE-IT601B.5	Develop Big Data Solutions using Hadoop Eco System
PE-IT602A	Artificial Intelligence	PE-IT602A.1	Understand how an intelligent agent works
		PE-IT602A.2	Learn specific data structure for this field
		PE-IT602A.3	Understand the application of logic and concept of probability in reasoning
		PE-IT602A.4	Understand the importance of learning
		PE-IT602A.5	Have idea about Expert System
OE-CS601H	E-Commerce and ERP	OE-CS601H.1	Identify the various technologies used in e-commerce, and become familiar with important business, legal, security and ethical issues.
		OE-CS601H.2	Explain the key components of Electronic Commerce such as e-marketplace, EDI, supply chain and Collaborative Commerce, customer relationship management, EC security and ePayment schemes
		OE-CS601H.3	Describe the contemporary ecommerce concepts, terminologies, the processes and management decisions that are involved in launching, operating and managing business activity on the World Wide Web.
		OE-CS601H.4	Use the application software skills such as database creation, web page designing etc. to solve the real world business problems
PC-IT691	Software Engineering Lab	PC-IT691.1	Prepare Requirement document (SRS), Project management plan in standard format.
		PC-IT691.2	Scheduling a project using an appropriate Software Engineering methodology & Estimate project size using Function point (FP)/Use case point.
		PC-IT691.3	Design UML diagram, Test Script/Test Plan for a small component of the proposed project and generate Test result.
PC-IT692	Computer Networks Lab	PC-IT692.1	Explain basic protocols of computer networks.
		PC-IT692.2	Identify the different types of network devices and their functions within a network.
		PC-IT692.3	Solve network administration problems by applying Computer Networking Concepts.
PE-IT691B	Data Analytics and Big Data Lab	PE-IT691B.1	Use Python to analyze data and provide useful information for decision making.
		PE-IT691B.2	Set up single and multi-node Hadoop Clusters
		PE-IT691B.3	Apply Map Reduce technique for various algorithms
		PE-IT691B.4	Design new algorithms that use Map Reduce to apply on Unstructured and structured data.
		PE-IT691B.5	Represent NoSQL data.
		PE-IT691B.6	Use Big Data Databases : Hbase/Hive/Pig
PW-IT681	Project-II	PW-IT681.1	Work as a team member
		PW-IT681.2	Prepare a report in the standard format
		PW-IT681.3	Perform Seminar Presentation before any standard body
MC671	Aptitude Skill Development -II	MC671.1	Prepared for Campus Placements and different Competitive Exams
PE-IT701A	Internet Technology	PE-IT701A.1	Understand the knowledge of basic internet concepts in the web designing.
		PE-IT701A.2	Apply the knowledge of different components in web technology and to know about web servers.
		PE-IT701A.3	Understand security knowledge to the internet domain.
PE-IT701B	Quantum Computing	PE-IT701B .1	Relate vectors to physical states of system and matrices to operators.
		PE-IT701B .2	Examine the application of various quantum gates on qubit.

		PE-IT701B .3	Discover the power of parallel computing using quantum algorithms.
		PE-IT701B .4	Construct simple quantum circuits by IBM's Qiskit.
PE-IT701C	Cloud Computing	PE-IT701C.1	Analyze the necessity of service oriented computing
		PE-IT701C.2	Explain the cloud architecture and its management
		PE-IT701C.3	Analyze the importance of securing the services
		PE-IT701C.4	Know how the current organizations providing the cloud services
PE-IT702A	Multimedia Technology	PE-IT702A.1	Understand the concepts, principles and theories of Multimedia Applications and Virtual environments.
		PE-IT702A.2	Demonstrate knowledge and understanding the various aspects and issues involved with development and deployment of multimedia system.
		PE-IT702A.3	Analyze and solve problems related to their expertise in Multimedia Applications and Virtual Environments.
		PE-IT702A.4	Demonstrate their ability to extend their basic knowledge to encompass new principles and practice.
PE-IT702B	Soft Computing	PE-IT702B.1	Understand various types of Soft Computing Techniques.
		PE-IT702B.2	Apply the concept of Fuzzy Logic, Various fuzzy systems and their functions.
		PE-IT702B.3	Apply the concept of Neural Networks, architecture, functions and various algorithms involved.
		PE-IT702B.4	Apply Genetic algorithms, its applications and advances.
PE-IT 702C	Ad-Hoc and Sensor Networks	PE-IT 702C.1	Understand the basic concepts of Ad-hoc and Sensor networks.
		PE-IT 702C.2	Apply the knowledge of various architecture of Ad-hoc and Sensor networks.
		PE-IT 702C.3	Apply the concepts of protection and security of Ad-hoc and Sensor networks.
		PE-IT 702C.4	Understand the different Network Platforms and Tools.
PE-IT702D	Information and Coding Theory	PE-IT702D.1	Apply their knowledge to source coding and channel coding
		PE-IT702D.2	Apply their knowledge about linear codes for error correction
		PE-IT702D.3	Apply their knowledge of cyclic codes and BCH codes to different application
		PE-IT702D.4	Apply their idea about different convolutional codes for coding and decoding
PE-IT702E	Human Computer Interaction	PE-IT702E.1	Understand the context of building human computer interaction system.
		PE-IT702E.2	Adopt different techniques to design an interactive system.
		PE-IT702E.3	Analyse different guiding principles in developing synergistic cognitive system.
		PE-IT702E.4	Understand communication interfaces used in human computer interactive system.
		PE-IT702E.5	Understand design methods in web interface.
		PE-IT702E.6	Apply methods to formulate support systems for implementing interactive system.
PE-IT702F	Block Chain and its Applications	PE-IT702F.1	Describe the basic concepts of Blockchain and distributed Ledger Technology.
		PE-IT702F.2	Interpret the knowledge of the Bitcoin network, nodes, keys, wallets and transactions
		PE-IT702F.3	Implement smart contracts in Ethereum using different development frameworks.
		PE-IT702F.4	Analyse the Blockchain decentralized applications in a structure manner.
OE-HU701B	Human Resource Development and Organizational Behavior	OE-HU701B.1	Explain the basic concepts of organizational behavior and motivation.
		OE-HU701B.2	Explain the essential concepts of organizational conflicts, resolution of conflicts through negotiation, change management and organizational development.
		OE-HU701B.3	Summarize the concepts of HRD, its role and importance in the success of organization
		OE-HU701B.4	Describe the various aspects of HR, to deal effectively with people resourcing and talent management and HR functions in an organization.
OE-HU701C	Introduction to Philosophical Thoughts	OE-HU701C.1	Explain the Vedic theism and Upanisadic conception of Atman& Brahman
		OE-HU701C.2	Acquire thorough knowledge about Carvaka, Jainism and Buddhism
		OE-HU701C.3	Apply the knowledge of Nyaya & Liberation
OE-CS701H	Remote Sensing and GIS	OE-CS701H.1	Describe the principles of aerial and satellite remote sensing, Able to comprehend the energy interactions with earth surface features, spectral properties of water bodies .
		OE-CS701H.2	Define the basic concept of GIS and its applications, know different types of data representation in GIS
		OE-CS701H.3	Illustrate spatial and non spatial data features in GIS and understand the map projections and coordinates systems
		OE-CS701H.4	Apply knowledge of GIS and understand the integration of Remote Sensing and GIS.
HM-HU703	Project Management and Entrepreneurship	HM-HU703.1	Identify the type of entrepreneur and the steps involved in an entrepreneurial venture.
		HM-HU703.2	Explain the role of project management including planning, scheduling, cost estimation, risk management, etc
		HM-HU703.3	Describe various steps involved in starting a venture and to explore marketing methods & new trends in entrepreneurship.
		HM-HU703.4	Demonstrate Entrepreneurial skills and management function of a company.
PW-IT781	Project-III	PW-IT781.1	Evaluate the problem statement based on factors like industry/Research trends, Challenges and potential.
		PW-IT781.2	Understand uniqueness and creativity of the approach
		PW-IT781.3	Implement the idea effectively by considering factors like user interface, technology platform, data sources
		PW-IT781.4	Create clear, concise, and well-structured reports that effectively communicate information and adhere to professional standards.
		PW-IT781.5	Develop the ability to work efficiently, punctually as a team member or leader to achieve common goals.
PE-IT801A	Mobile Computing	PE-IT801A.1	Apply the basic concepts of Mobile computing

		PE-IT801A.2	Apply the knowledge of various architecture in Mobile computing
		PE-IT801A.3	Apply the concepts of protection and security mechanisms
PE-IT801B	Cryptography and Network Security	PE-IT801B.1	Describe information security concepts and techniques.
		PE-IT801B.2	Explain Cryptographic Algorithms.
		PE-IT801B.3	Explain Internet Security Protocols & Firewall.
PE-IT801C	Natural Language Processing	PE-IT801C.1	Describe the fundamental concepts and techniques of natural language processing.
		PE-IT801C.2	Distinguish among the various techniques of NLP, taking into account the assumptions, strengths, and weaknesses of each.
		PE-IT801C.3	Use appropriate descriptions, visualizations, and statistics to communicate the problems and their solutions.
		PE-IT801C.4	Analyze large volume text data generated from a range of real-world applications.
PE-IT801D	Embedded System with IOT	PE-IT801D.1	Implement an architectural design for IoT for specified requirement
		PE-IT801D.2	Solve the given societal challenge using IoT
		PE-IT801D.3	Choose between available technologies and devices for stated IoT challenge
PE-IT 801E	Image Processing	PE-IT 801E.1	Explain the main concepts and key technologies of Image Processing
		PE-IT 801E.2	Apply different Image processing algorithms in Real Time cases.
		PE-IT 801E.3	Compare various Image Processing techniques.
PE-IT801F	Augmented Reality and Virtual Reality	PE-IT801F.1	Define and describe a typical VR application.
		PE-IT801F.2	Define and describe the principles of VR and AR built systems.
		PE-IT801F.3	Identify, examine and critically acclaim a software or a design that reflects fundamental techniques for the design and deployment of VR experiences.
		PE-IT801F.4	Explain the concepts of motion and tracking in a typical VR system.
OE-CS801F	Cyber Law & Ethics	OE-CS801F.1	Describe Cyber Space, Cyber Crime, Information Technology & Services.
		OE-CS801F.2	List and discuss various forms of Cyber Crimes
		OE-CS801F.3	Explain Cyber Crime at Global and Indian Perspective.
		OE-CS801F.4	Describe the ways of precaution and prevention of Cyber Crime as well as Human Rights
OE-CS801D	Bioinformatics	OE-CS801D.1	Demonstrate different biological databases and tools.
		OE-CS801D.2	Apply algorithms for searching the biological databases
		OE-CS801D.3	Determine gene and protein secondary structure.
		OE-CS801D.4	Categorize sequence alignment methods.
OE-ME801D	Robotics	OE-ME801D.1	Demonstrate knowledge of industrial robots, characteristics, end effectors and actuators
		OE-ME801D.2	Solve robot dynamics problems, generate joint trajectory for path planning
		OE-ME801D.3	Describe working principle of various sensors and program different operations.
		OE-ME801D.4	Describe the applications of robots in industry.
OE-CS801E	Computational Biology	OE-CS801E.1	Analyze the DNA content, identify protein binding patterns, compare sequences, and discover variation within genomes.
		OE-CS801E.2	Formulate your own sequence analysis problem, implement a solution, and be able to present your findings
		OE-CS801E.3	Formulate the types of biological questions which can be investigated using computers, and what limitations computational methods impose to get applied to biological domain
OE-HU801F	Introduction to Business Analytics	OE-HU801F.1	Know the concept of domain knowledge of various technologies and its application to facilitates managerial decision /MIS.
		OE-HU801F.2	Explain the concept of Enhance capabilities for innovative use of I.T.
		OE-HU801F.3	Explain the concept of global platform for data retrieval/process among different business cultures of the world.
		OE-HU801F.4	Know the of ethics and prevention of fraud through technology, theft of data etc.
		OE-HU801F.5	Know the concept of Encourage cross functional collaboration to enhance efficiency and productivity.
OE-HU801C	Economic Policies in India	OE-HU801C.1	Understand the Demographic Features, Poverty and Inequality and evaluate the role of fiscal and monetary policies is bringing about economic stability
		OE-HU801C.2	Evaluate the role of financial institutions in India.
		OE-HU801C.3	Analyse the role of different sectors in the economy.
OE-M801A	Operations Research and Optimizing Technique	OE-M801A.1	Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained.
		OE-M801A.2	Determine optimal strategy for Minimization of Cost of shipping of products from source to Destination/ Maximization of profits of shipping products using various methods, Finding initial basic feasible and optimal solution of the Transportation problems
		OE-M801A.3	Optimize the allocation of resources to Demand points in the best possible way using various techniques and minimize the cost or time of completion of number of jobs by number of persons
		OE-M801A.4	Analyse competitive real-world phenomena using concepts from game theory. Analyse pure and mixed strategy games
		OE-M801A.5	Formulate Network models for service and manufacturing systems, and apply operations research techniques and algorithms to solve these Network problems
PW- IT881	Project-IV	PW- IT881.1	Evaluate the problem statement based on factors like industry/Research trends, Challenges and potential.
		PW- IT881.2	Understand uniqueness and creativity of the approach
		PW- IT881.3	Implement the idea effectively by considering factors like user interface, technology platform, data sources

		PW- IT881.4	Create clear, concise, and well-structured reports that effectively communicate information and adhere to professional standards.
		PW- IT881.5	Develop the ability to work efficiently, punctually as a team member or leader to achieve common goals.

Department Name: **Information Technology**
Program Name: **B.Tech (AI & ML)**

Paper Code	Paper Name	CO No.	CO Statement
ES-EC303	Analog and Digital Electronics	ES-EC303.1	Understand basic electronics simple Circuit.
		ES-EC303.2	Understand the Boolean arithmetic and its application in Digital design.
		ES-EC 303.3	Understand, analyze and design various combinational and sequential.
PC-IT301	Data Structure and Algorithms	PC-IT301.1	Understand and apply the concept of stack, queue and linked list operations
		PC-IT301.2	Discuss the computational efficiency of the principal algorithms for sorting,
		PC-IT301.3	Understand and apply the knowledge of tree and graphs concepts
		PC-IT301.4	Choose an appropriate data structure for a particular problem
PC-IT302	Computer Organization and Architecture	PC-IT 302.1	Understand basic computer organization, micro-operations and design of hypothetical arithmetic logic unit.
		PC-IT 302.2	Understand various data representations, CPU functioning and computer arithmetic
		PC-IT 302.3	Understand various methods and techniques of memory organization and I/O operations
BS-AIML301	Linear Algebra	BS-AIML301.1	Apply the concept of Orthogonalization in inner product spaces for understanding Physical problem
		BS-AIML301.2	Use the concept of Linear Transformation to real life problem
HM-HU301	Introduction to Industrial Management	HM-HU 301.1	Interpret given organization structure, culture, climate and major provisions of factory acts and laws.
		HM-HU 301.2	Explain material requirement planning, store keeping procedure and PPC functions.
		HM-HU 301.3	Plot and analyze inventory control models and techniques.
		HM-HU 301.4	Prepare and analyze CPM and PERT for given activities.
ES-EC393	Analog and Digital Electronics Lab	ES-EC393.1	Apply the practical knowledge of basic electronics simple Circuit
		ES-EC393.2	To implement & design combinational and sequential circuit
PC-IT391	Data Structure and Algorithms Lab	PC-IT391.1	Design and analyze the time and space efficiency of the data structure.
		PC-IT391.2	Identity the appropriate data structure for given problem.
		PC-IT391.3	Have practical knowledge on the application of data structures.
PC-IT392	Computer Organization and Architecture Lab	PC-IT 392.1	Design, implement, and debug digital hardware systems.
		PC-IT 392.2	Understand digital logic specification methods and the compilation process that transforms these into logic networks.
		PC-IT 392.3	Understand the design of the various functional units of digital computers
PC-IT393	IT Workshop	PC-IT393.1	Understand the details of Scripting languages
		PC-IT393.2	Design real life problems and think creatively about solutions
		PC-IT393.3	Develop Solutions for advanced applications using R/Matlab/Python
ES-IT401	Discrete Mathematics	ES-IT401.1	Express a logic sentence in terms of predicates, quantifiers, and logical connectives
		ES-IT401.2	Derive the solution for a given problem using deductive logic and prove the solution based on logical inference
		ES-IT401.3	Classify its algebraic structure for a given a mathematical problem
		ES-IT401.4	Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra
		ES-IT401.5	Develop the given problem as graph networks and solve with techniques of graph theory
PC-IT402	Design and Analysis of Algorithms	PC-IT402.1	For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms
		PC-IT402.2	Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms
		PC-IT402.3	Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation
		PC-IT402.4	Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it
		PC-IT402.5	Develop the dynamic programming algorithms, and analyze it to determine its computational complexity
		PC-IT402.6	For a given model engineering problem model it using graph and write the corresponding algorithm to solve the problems
		PC-IT402.7	Explain the ways to analyze randomized algorithms (expected running time, probability of error)
		PC-IT402.8	Explain what an approximation algorithm is. Compute the approximation factor of an approximation algorithm (PTAS and FPTAS)
PC-AIML401	Artificial Intelligence	PC-AIML401.1	Understand how an intelligent agent works
		PC-AIML401.2	Learn specific data structure for this field
		PC-AIML401.3	Understand the application of logic and concept of probability in reasoning
		PC-AIML401.4	Understand the importance of learning
		PC-AIML401.5	Have idea about Expert System
PC-AIML402	Machine Learning Foundations	PC-AIML402.1	Understand the methods involved in generating models from data

		PC-AIML402.2	Understand a wide variety of learning algorithms
		PC-AIML402.3	Understand how to evaluate models generated from data
		PC-AIML402.4	Optimize the models learned and report on the expected accuracy that can be achieved when applying the models
		PC-AIML402.5	Apply the machine learning algorithms to solve various real-world problems
BS-BIO401	Biology	BS-BIO401.1	State different engineering applications from biological perspective.
		BS-BIO401.2	Classify biological systems and identify different organisms and microorganisms depending on their morphological, biochemical and ecological criterion.
		BS-BIO401.3	Explain the concept of recessiveness and dominance during the passage of genetic material from parent to offspring and describe DNA as a genetic material in the molecular basis of information transfer.
		BS-BIO401.4	Discuss structures of different biomolecules starting from basic units and hence understand different biological processes at the reductionistic level.
		BS-BIO401.5	Describe protein structures and enzymology and also compare different mechanisms of enzyme action.
		BS-BIO401.6	Describe energy transformation processes in biological systems.
PC-IT492	Design and Analysis of Algorithms Lab	PC-IT492.1	Analysing and formulating a computing problem and to propose step by step solution
		PC-IT492.2	Computing efficiency of the proposed solution in terms of time complexity, space complexity, computational overheads
		PC-IT492.3	Gather knowledge about various types of algorithm and ability to apply the knoledge to solve various computing problem efficiently
PC-AIML491	Artificial Intelligence Lab	PC-AIML491.1	Write progammes in Prologue (LISP / PYTHON can be used)
		PC-AIML491.2	Learn how the well-known algorithms of AI can be implemented in programmes
		PC-AIML491.3	Get idea how some famous artificial intelligent system works
PC-AIML492	Advanced Computing Lab	PC-AIML492.1	Understand the methods involved in generating models from data
		PC-AIML492.2	Understand a wide variety of learning algorithms
		PC-AIML492.3	Apply the machine learning algorithms to solve various real-world problems
MC471	Environmental Sciences	MC471.1	Explain basic concepts, man, society & environment, their interrelationship, mathematics of population growth and associated problems, steady state conservation system.
		MC471.2	Demonstrate natural environmental hazards like flood, earthquake, landslide-causes, effects and control/management.
		MC471.3	Classify air pollution, water pollution, land pollution, noise pollution and their controls.
		MC471.4	Study Elements of ecology and environmental management.
BS-M501	Probability and Statistics	BS-M501.1	Learn the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment.
		BS-M501.2	Understand the basic ideas of statistics with different characterisation of a univariate and bivariate data set.
		BS-M501.3	Apply statistical tools for analysing data samples and drawing inference on a given data set.
PC-AIML501	Database Management System	PC-AIML501.1	Explain the terms related to Database Design and Management.
		PC-AIML501.2	Construct and normalized conceptual database model.
		PC-AIML501.3	Explain the database concept, structure and the issues related to database performance.
PC-AIML502	Data Science	PC-AIML502.1	Explain the basic concepts of data and machine learning.
		PC-AIML502.2	Identify visual representation of data.
		PC-AIML502.3	Explain the concept about supervised Learning,Regression analysis & network Analysis.
PE-AIML501A	Object Oriented Programming	PE-AIML501A.1	Specify simple abstract data types and design implementations, using abstraction functions to document them.
		PE-AIML501A.2	Recognize features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity
		PE-AIML501A.3	Apply some common object-oriented design patterns and give examples of their use
		PE-AIML501A.4	Design applications with an event-driven graphical user interface
PE-AIML501B	Operating Systems	PE-AIML501B.1	Apply the knowledge of basic concepts of operating system.
		PE-AIML501B.2	Apply concepts of memory management including virtual memory, and disk management system, file management and multithreading
		PE-AIML501B.3	Apply concepts to protection and security mechanisms
PE-AIML501C	Image Processing	PE-AIML501C.1	Explain the main concepts and key technologies of Image Processing
		PE-AIML501C.2	Apply different Image processing algorithms in Real Time cases.
		PE-AIML501C.3	Compare various Image Processing techniques.
PE-AIML501D	Statistical Programming	PE-AIML501D.1	List motivation for learning a programming language
		PE-AIML501D.2	Explain how data is analysed and visualized using statistic functions
		PE-AIML501D.3	Use data-sets to create testable hypotheses and identify appropriate statistical tests.
OE-EC501D	Mobile Computing	OE-EC501D.1	Apply the basic concepts of Mobile computing
		OE-EC501D.2	Apply the knowledge of various architecture in Mobile computing
		OE-EC501D.3	Apply the concepts of protection and security mechanisms
OE-CS501B	Neural Network	OE-CS501B.1	Explain the use of neural nets for soft computing problems
		OE-CS501B.2	Apply the concept of the application areas of neural networks
		OE-CS501B.3	Design &Develop neural network models applications
OE-CS501C	Pattern Recognition	OE-CS501C.1	Explain the concept of a pattern and the basic approach to the development of pattern recognition and

			machine intelligence algorithms
		OE-CS501C.2	Know the basic methods of feature extraction and feature evaluation.
		OE-CS501C.3	Differentiate between supervised and unsupervised classification problem
OE-CS501D	Graph Algorithm	OE-CS501D.1	Use algorithms to explore graphs
		OE-CS501D.2	Compute shortest distance
		OE-CS501D.3	Compute min spanning tree
		OE-CS501D.4	Compute connected components
HM-HU 501	Economics for Engineers	HM-HU 501.1	Discuss fundamentals of economic analysis.
		HM-HU 501.2	Describe rate of return and profitability analysis, Present, Future, Annuity, Risk and return, BEP and Sensitivity Analysis, Bayesian joint probability and quantitative decision making, basic accounting system and balance sheet and P & L accounts etc.
		HM-HU 501.3	Apply decision making skills in terms of Economic, financial considerations in practice.
		HM-HU 501.4	Apply knowledge to take right financial decision at the right point in time in real world situation.
PC-AIML591	Database Management System Lab	PC-AIML591.1	Design and implement a database schema for a given problem-domain
		PC-AIML591.2	Create and maintain tables using PL/SQL
		PC-AIML591.3	Populate and query a database.
PC-AIML592	Data Science Lab	PC-AIML592.1	Demonstrate the concept of Data Science with Python Data Science Tool & IDE
		PC-AIML592.2	Describe the statistics, data preparation, Exploratory Data Analysis
		PC-AIML592.3	Explain the concept of Supervised Learning, Regression analysis & network Analysis
PE-AIML591A	Object Oriented Programming Lab	PE-AIML591A.1	Specify simple abstract data types and design implementations, using abstraction functions to document them.
		PE-AIML591A.2	Recognize features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity
		PE-AIML591A.3	Apply some common object-oriented design patterns and give examples of their use
		PE-AIML591A.4	Design applications with an event-driven graphical user interface
PE-AIML591B	Operating Systems Lab	PE-AIML591B.1	Apply the practical knowledge of the different functions types and structures of Unix OS.
		PE-AIML591B.2	Apply the necessary knowledge various process management concepts like scheduling, synchronization etc.
		PE-AIML591B.3	Apply the necessary knowledge and skills for developing and debugging C and other programs in UNIX environment.
PE-AIML591C	Image Processing Lab	PE-AIML591C.1	Analyze images in the frequency domain using various transforms
		PE-AIML591C.2	Develop image processing application
		PE-AIML591C.3	Apply different techniques employed for the enhancement of images.
PE-AIML591D	Statistical Programming Lab	PE-AIML591D.1	Explain different R Data Structures.
		PE-AIML591D.2	Apply programming logic using R Packages.
		PE-AIML591D.3	Analyze the datasets using R programming capabilities.
PW-AIML581	Project-I	PW-AIML581.1	Work as a team member.
		PW-AIML581.2	Prepare a report in the standard format.
		PW-AIML581.3	Present Seminar before any standard body.
HM-HU 591	Soft Skill Development Lab	HM-HU 591.1	Honing over all Communicative Competence.
		HM-HU 591.2	Develop Team Building and Leadership Quality.
		HM-HU 591.3	Deliver an enthusiastic and well-practiced presentation
		HM-HU 591.4	Communicate with clarity and confidence thereby enhancing employability skills of the students.
MC571	Aptitude Skill Development-I	MC571.1	Understand the basic concepts of QUANTITATIVE ABILITY.
		MC571.2	Understand the basic concepts of LOGICAL REASONING Skills.
		MC571.3	Understand the basic concepts of PROBABILITY.
		MC571.4	Acquire satisfactory competency in use of VERBAL REASONING
MC572	Constitution of India	MC572.1	Gain an understanding of the constitution of India.
		MC572.2	Become aware of the various levels of governance in the country.
PC-AIML601	Advanced Machine Learning	PC-AIML601.1	Present the design and evaluation of a machine learning algorithm, describing the design processes and evaluation
		PC-AIML601.2	Explain the nature of the statistical foundations of designing or adapting learning algorithms
		PC-AIML601.3	Explain the variance and bias trade-off in machine learning algorithms
		PC-AIML601.4	Demonstrate knowledge of the introduced machine learning models and the relative strengths and weaknesses of each and their most appropriate uses
		PC-AIML601.5	Demonstrate knowledge of methods to analyse machine learning algorithms
PC-AIML602	Soft Computing	PC-AIML602.1	Know Artificial Intelligence, various types & characteristics of production systems.
		PC-AIML602.2	Explain the concept of Neural Networks, architecture, functions and various algorithms involved.
		PC-AIML602.3	Explain the concept of Fuzzy Logic, Various fuzzy systems and their functions.
		PC-AIML602.4	Know Genetic algorithms, its applications and advances.
		PC-AIML602.5	Explain the unified and exact mathematical basis to some extent as well as the general principles of various soft computing techniques.
PE-AIML601A	Computer Networks	PE-AIML601A.1	Identify different types of network devices and their functions within a network.
		PE-AIML601A.2	Explain basic protocols of computer networks, and how they can be used for network design and implementation.
		PE-AIML601A.3	Solve network administration problems by applying the Computer Networking concept

PE-AIML601B	Data Visualization	PE-AIML601B.1	Create visualizations from data
		PE-AIML601B.2	Explain a better understanding of data from visualizations
		PE-AIML601B.3	Explain the trends in data from visualizations
PE-AIML601C	Deep Learning	PE-AIML601C.1	Explain the role of Deep learning in Machine Learning Applications.
		PE-AIML601C.2	Demonstrate the use of TensorFlow/Keras in Deep Learning Applications.
		PE-AIML601C.3	Design and implement Deep Learning Applications.
		PE-AIML601C.4	Analyze Different Deep Learning Models in Image Related Projects.
		PE-AIML601C.5	Design and implement Convolutional Neural Networks.
		PE-AIML601C.6	Apply Deep Learning in NLP and Image Processing.
PE-AIML601D	Advanced Algorithm	PE-AIML601D.1	Analyze the complexity/performance of different algorithms.
		PE-AIML601D.2	Determine the appropriate data structure for solving a particular set of problems.
		PE-AIML601D.3	Categorize the different problems in various classes according to their complexity.
		PE-AIML601D.4	Apply the knowledge of recent activities in the field of the advanced data structure.
OE-CS601C	Big Data	OE-CS601C.1	Describe big data and use cases from selected business domains
		OE-CS601C.2	Explain NoSQL big data management
		OE-CS601C.3	Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics.
OE-M601A	Operations Research and Optimizing Technique	OE-M601A.1	Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained.
		OE-M601A.2	Determine optimal strategy for Minimization of Cost of shipping of products from source to Destination/ Maximization of profits of shipping products using various methods, Finding initial basic feasible and optimal solution of the Transportation problems
		OE-M601A.3	Optimize the allocation of resources to Demand points in the best possible way using various techniques and minimize the cost or time of completion of number of jobs by number of persons
		OE-M601A.4	Analyse competitive real-world phenomena using concepts from game theory. Analyse pure and mixed strategy games
		OE-M601A.5	Formulate Network models for service and manufacturing systems, and apply operations research techniques and algorithms to solve these Network problems
OE-CS601G	Distributed System	OE-CS601G.1	Explain the concept of Distributed Systems.
		OE-CS601G.2	Explain the various synchronization issues and global state for distributed systems.
		OE-CS601G.3	Explain the Mutual Exclusion and Deadlock Detection algorithms in distributed systems.
		OE-CS601G.4	Describe the agreement protocols and fault tolerance mechanisms in distributed systems.
		OE-CS601G.5	Describe the features of peer to peer and distributed shared memory systems
OE-CS601I	Game Theory	OE-CS601I.1	Apply various types of non-cooperative game theory concepts
		OE-CS601I.2	Apply various types of cooperative game theory concepts.
		OE-CS601I.3	Apply various mechanism design concepts including auctions.
		OE-CS601I.4	Design robust and efficient solutions (mechanisms, algorithms, protocols) that would work for agents that are rational and intelligent in interdisciplinary domains.
		OE-CS601I.5	Model real-world situations such as social media marketing, social analytics, cloud computing issues, wireless networks etc using game theory.
OE-CS601K	Multimedia Technology	OE-CS601K.1	Demonstrate knowledge and understanding of the concepts, principles and theories of Multimedia Applications and Virtual environments
		OE-CS601K.2	Demonstrate knowledge and understanding of the current issues involved with development and deployment of multimedia system
		OE-CS601K.3	Analyze and solve problems related to their expertise in Multimedia Applications and Virtual Environments.
		OE-CS601K.4	Demonstrate their ability to extend their basic knowledge to encompass new principles and practice
		OE-CS601K.5	Demonstrate their computing, technical and theoretical skills by developing a substantial Multimedia application.
		OE-CS601K.6	Plan, conduct and report on the development of an Multimedia Application
OE-CS601J	Human Computer Interaction	OE-CS601J.1	Differentiate between various software vulnerabilities.
		OE-CS601J.2	Develop software process vulnerabilities for an organization.
		OE-CS601J.3	Monitor resources consumption in a software.
		OE-CS601J.4	Interrelate security and software development process.
OE-CS601D	Cloud Computing	OE-CS601D.1	Analyze the necessity of service oriented computing
		OE-CS601D.2	Explain the cloud architecture and its management
		OE-CS601D.3	Analyze the importance of securing the services
		OE-CS601D.4	Know how the current organizations providing the cloud services
OE-CS601E	Cryptography and Network Security	OE-CS601E.1	Describe information security concepts and techniques.
		OE-CS601E.2	ExplainCryptographic Algorithms.
		OE-CS601E.3	Explain Internet Security Protocols&Firewall.
PC-AIML691	Advanced Machine Learning Lab	PC-AIML691.1	Develop statistical model by understanding the nature of the problem
		PC-AIML691.2	Implement the knowledge of designing and analysing machine learning algorithms
		PC-AIML691.3	Developdifferent machine learning based model to solve real life problems
PC-AIML692	Soft Computing Lab	PC-AIML692.1	Know the concept of Artificial Intelligence, Various types of production systems, characteristics of production systems.
		PC-AIML692.2	Explain the concept of Neural Networks, architecture, functions and various algorithms involved.
		PC-AIML692.3	Know the concept of Fuzzy Logic, Various fuzzy systems and their functions.

		PC-AIML692.4	Explain the concept of Genetic algorithms, its applications and advances.
		PC-AIML692.5	Know the concept of unified and exact mathematical basis to some extent as well as the general principles of various soft computing techniques.
PE-AIML691A	Computer Networks Lab	PE-AIML691A.1	Explain basic protocols of computer networks.
		PE-AIML691A.2	Identify the different types of network devices and their functions within a network.
		PE-AIML691A.3	Solve network administration problems by applying Computer Networking Concepts.
PE-AIML691B	Data Visualization Lab	PE-AIML691B.1	Explain the details of data interpretation skills using statistics
		PE-AIML691B.2	Solve the Data analysis job from visualizations
		PE-AIML691B.3	Create Visualization from any kind of data
PE-AIML691C	Deep Learning Lab	PE-AIML691C.1	Demonstrate the role of Deep learning in Machine Learning Applications.
		PE-AIML691C.2	Use of TensorFlow/Keras in Deep Learning Applications.
		PE-AIML691C.3	Design and implement Deep Learning Applications.
		PE-AIML691C.4	Analyse Different Deep Learning Models in Image Related Projects.
		PE-AIML691C.5	Design and implement Convolutional Neural Networks.
		PE-AIML691C.6	Apply Deep Learning in NLP and Image Processing.
PE-AIML691D	Advanced Algorithm Lab	PE-AIML691D.1	Analyze the complexity/performance of different algorithms.
		PE-AIML691D.2	Determine the appropriate data structure for solving a particular set of problems.
		PE-AIML691D.3	Categorize the different problems in various classes according to their complexity.
		PE-AIML691D.4	Apply the knowledge of recent activities in the field of the advanced data structure.
PW-AIML681	Project-II	PW-AIML681.1	Work as a team member
		PW-AIML681.2	Prepare a report in the standard format
		PW-AIML681.3	Perform Seminar Presentation before any standard body
MC671	Aptitude Skill Course-II	MC671.1	Prepared for Campus Placements and different Competitive Exams

Department Name: **Mechanical Engineering**
Program Name: **B.Tech (ME)**

Paper Code	Paper Name	CO No.	CO Statement
BS-M303	Mathematics-III	BS-M303.1	Learn the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment.
		BS-M303.2	To apply statistical methods for analysing experimental data.
		BS-M303.3	Apply statistical tools for analysing complex field.
		BS-M303.4	Students will be able to solve field problems in engineering involving PDEs.
BS-BIO301	Biology	BS-BIO301.1	State different engineering applications from biological perspective.
		BS-BIO301.2	Classify biological systems and identify different organisms and microorganisms depending on their morphological, biochemical and ecological criterion.
		BS-BIO301.3	Explain the concept of recessiveness and dominance during the passage of genetic material from parent to offspring and describe DNA as a genetic material in the molecular basis of information transfer.
		BS-BIO301.4	Discuss structures of different biomolecules starting from basic units and hence understand different biological processes at the reductionistic level.
		BS-BIO301.5	Describe protein structures and enzymology and also compare different mechanisms of enzyme action.
		BS-BIO301.6	Describe energy transformation processes in biological systems.
ES-ME301	Materials Engineering	ES-ME301.1	Student will be able to identify crystal structures for various materials and understand the defects in such structures.
		ES-ME301.2	Categorize different material imperfections and apply this knowledge to explain failures.
		ES-ME301.3	Know about the concept of iron-carbon equilibrium diagram & phase diagrams and understand the basic terminologies associated with metallurgy. Construction and identification of phase diagrams and reactions.
		ES-ME301.4	Describe about different types of heat treatment methods to tailor the properties of Fe-C alloys.
		ES-ME301.5	Understand how to tailor material properties of ferrous and non-ferrous alloys.
ES-ME302	Engineering Mechanics	ES-ME302.1	Describe different types of forces and their effect on rigid bodies.
		ES-ME302.2	Employ basic laws of vector algebra.
		ES-ME302.3	Analyze system of forces and condition of equilibrium.
		ES-ME302.4	Recognize laws of friction and solve problems related to it, basic concepts of center of gravity and moment of inertia.
		ES-ME302.5	Identify laws of dynamics and solve related problems.
		ES-ME302.6	Solve simple truss problems and study of virtual work.
PC-ME301	Thermodynamics	PC-ME301.1	After completing this course, the students will be able to apply energy balance to systems and control volumes, in situations involving heat and work interactions.
		PC-ME301.2	Students can evaluate changes in thermodynamic properties of substances.
		PC-ME301.3	The students will be able to evaluate the performance of energy conversion devices.
		PC-ME301.4	The students will be able to differentiate between high grade and low grade energies.
PC-ME302	Basic Manufacturing Processes	PC-ME302.1	To understand the different conventional manufacturing methods employed for making different products.
		PC-ME302.2	Familiarize with different forming processes like rolling, forging, extrusion & their specific applications.

		PC-ME302.3	Learn about powder metallurgy process.
		PC-ME302.4	Know about different solid and liquid state joining processes.
PC-ME391	Basic Manufacturing Processes Lab	PC-ME391.1	Understand the idea for selecting materials for patterns. Types and allowances of patterns used in casting and analyze the components of moulds.
		PC-ME391.2	Understand the application of arc and gas welding in industries.
		PC-ME391.3	Know how casting, drilling, shaping, milling are done and demonstrate primary working skills on lathe.
		PC-ME391.4	To know and implement different safety precautions to be taken during manufacturing processes.
BS-M404	Numerical Methods	BS-M404.1	Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.
		BS-M404.2	Apply numerical methods to obtain approximate solutions to mathematical problems.
		BS-M404.3	Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
		BS-M404.4	Analyse and evaluate the accuracy of common numerical methods.
PC-ME401	Applied Thermodynamics	PC-ME401.1	After completing this course, the students will get a good understanding of various practical power cycles and heat pump cycles.
		PC-ME401.2	They will be able to analyze energy conversion in various thermal devices such as combustors, air coolers, nozzles, diffusers, steam turbines and reciprocating compressors.
		PC-ME401.3	They will be able to understand phenomena occurring in high speed compressible flows.
PC-ME402	Fluid Mechanics & Fluid Machines	PC-ME402.1	Upon completion of this course, students will be able to mathematically analyze simple flow situations.
		PC-ME402.2	They will be able to evaluate the performance of pumps and turbines.
PC-ME403	Strength of Materials	PC-ME403.1	Solve problems related to the theory of elasticity, concepts of stress and strain, strength and stiffness, deformations and displacements, strain energy, torsion and springs.
		PC-ME403.2	Analyze Mohr's circle for an arbitrary two dimensional stress/strain state for combined loading conditions and stresses in thin walled pressure vessels.
		PC-ME403.3	Identify and formulate structural problem and solve using a range of analytical methods and determination of internal actions in statically determinate structures and draw internal action diagrams like Shear Force (SFD) and Bending Moment Diagrams (BMD) for these structures.
		PC-ME403.4	Solve deflection of statically determinate and indeterminate beams due to bending moment by different methods.
		PC-ME403.5	Predict behaviour of the solid bodies subjected to certain types of loading and theories related to columns and struts.
PC-ME404	Metrology & Instrumentation	PC-ME404.1	Understand the working of linear and angular measuring instruments.
		PC-ME404.2	Know the fundamentals of limits and limit gauges, various methods for measurement of screw thread and surface roughness parameters and the working of optical measuring instruments.
		PC-ME404.3	Acquire an overview of mechanical measurement systems and principle of instruments for motion and dimension measurement.
		PC-ME404.4	Get basic idea about working principle and applications of devices for measurement of force and torque; strain and stress and temperature.
MC471	Environmental Science	MC471.1	Learn the importance of environment by gaining knowledge of real time experience.
PC-ME491	Metrology and Instrumentation Lab	PC-ME491.1	Demonstrate the use of instruments for measuring linear (internal and external), angular dimensions.
		PC-ME491.2	Formulate some unknown quantity or parameter of engineering interest.
		PC-ME491.3	Evaluate the surface quality of a given specimen which is important in all kind of manufacturing.
		PC-ME491.4	Measure different variables of a component.
PC-ME492	Machine Drawing-I	PC-ME492.1	Understand the symbolic operations utilized in Engineering sector and able to design components in AUTOCAD software.
PC-ME501	Heat Transfer	PC-ME501.1	After completing the course,the studentswill be able to formulate and analyze a heat transfer problem involving any of the three modes of heat transfer.
		PC-ME501.2	The students will be able to obtain exact solutions for the temperature variation using analytical methods where possible or employ approximate methods or empirical correlations to evaluate the rate of heat transfer.
		PC-ME501.3	The students will be able to design devices such as heat exchangers and also estimate the insulation needed to reduce heat losses where necessary.
PC-ME502	Solid Mechanics	PC-ME502.1	Upon completion of this course, students will be able understand the deformation behavior of solids under different types of loading and obtain mathematical solutions for simple geometries.
PC-ME503	Kinematics and Theory of Machines	PC-ME503.1	Understand the principles of kinematic pairs, chains and mechanisms.
		PC-ME503.2	Analyze different mechanisms for position, velocity and acceleration analysis.
		PC-ME503.3	Apply the principles of inertia force and inertia torque in reciprocating engines.
		PC-ME503.4	Apply principles of cam and gear mechanisms for a given motion or a given input/output motion or force relationship.
		PC-ME503.5	Apply principles of flywheel and governors for controlling fluctuation of energy and speed of engines for making effective mechanical systems.
		PC-ME503.6	Establish models for balancing and vibratory response in mechanical systems.
HM-HU502	Effective Technical Communication	HM-HU502.1	Understand the dynamics of Verbal and Non Verbal aspects of technical communication.
		HM-HU502.2	Practice multi-step writing process to plan, draft, and revise reports, correspondence, and presentations.

		HM-HU502.3	Illustrate and examine the knowledge of ethical aspects of engineering.
		HM-HU502.4	Demonstrate and explain social and professional etiquettes.
		HM-HU502.5	Plan self-development and practice self-assessment to function on multi-disciplinary teams.
MC571	Aptitude Skill Development-I	MC571.1	Understand the basic concepts of QUANTITATIVE ABILITY.
		MC571.2	To be familiar with the basic concepts of LOGICAL REASONING Skills.
		MC571.3	To be familiar with the basic concepts of PROBABILITY.
		MC571.4	Acquire knowledge in VERBAL REASONING and VOCABULARY.
PC-ME591	Mechanical Engineering Laboratory-I (Thermal)	PC-ME591.1	The students who have undergone the course will be able to measure various properties of fluidsand characterize the performance of fluid/thermal machinery.
PC-ME592	Machine Drawing-II	PC-ME592.1	Understand and apply the knowledge of machine drawing as a system of Communication in which ideas are expressed clearly and all information fully conveyed.
		PC-ME592.2	To understand the design a system, component or process to meet desired needs within, realistic constraints such as manufacturability, economic, environmental, safety & sustainability etc., to represent a part drawing and assembly drawings.
		PC-ME592.3	To identify, formulates, analyzes and solve Engineering Problems in Optimum time.
PW-ME581	Project-I	PW-ME581.1	Students will be able to gather some exposure on some projects, may be designing some innovative ideas, fabricating and/or demonstrating an innovative machine or product, etc.
PC-ME601	Manufacturing Technology	PC-ME601.1	To describe machines and related tools for manufacturing various components.
		PC-ME601.2	To understand the relationship between process and system in manufacturing domain.
		PC-ME601.3	To experiment on CNC machine tools.
		PC-ME601.4	To demonstrate rapid prototyping methods.
PC-ME602	Design of Machine Elements	PC-ME602.1	List processes, methods of design of machine elements, and identify failure modes for mechanical parts.
		PC-ME602.2	Explain functions, working principles, and design of cotter, knuckle and welded joints.
		PC-ME602.3	Design and analysis of shafts, couplings, belt drives, chain drives, screws and springs.
		PC-ME602.4	Formulate and design problems on clutches and brakes.
		PC-ME602.5	Apply principles of gear design to spur, helical, bevel and worm gears.
		PC-ME602.6	Analyze and design sliding and rolling contact bearings.
HM-HU601	Operations Research	HM-HU601.1	Apply linear programming tools for optimal utilization of resources in various types of industries.
		HM-HU601.2	Solve transportation and assignment problems to minimize cost and understand.
		HM-HU601.3	Apply PERT/CPM for project scheduling and resource allocation in an optimal way.
		HM-HU601.4	Understand the basic elements of a Queuing model.
		HM-HU601.5	Make decisions under certainty, uncertainty and conflicting situations.
PE-ME601A	Internal combustion Engines and Gas Turbines	PE-ME601A.1	Develop concepts of IC engines along with its working principles.
		PE-ME601A.2	Describe the combustion phenomenon in SI and CI engines.
		PE-ME601A.3	Evaluate the performance of IC engines and the importance of alternate fuels.
		PE-ME601A.4	Classify the essential components of gas turbine along with its performance improving methods.
		PE-ME601A.5	Illustrate the working principle of different types of Jet propulsive engines and Rockets.
PE-ME602B	Refrigeration and Air Conditioning	PE-ME602B.1	Know about the systems of Refrigeration, Air-Conditioning and Ventilation.
		PE-ME602B.2	Learn about different components of these systems.
		PE-ME602B.3	Know about designing a Refrigeration and Air-Conditioning system.
MC672	Constitution of India	MC672.1	Have general knowledge and legal literacy and thereby to take up competitive examinations.
		MC672.2	Understand state and central policies, fundamental duties.
		MC672.3	Understand Electoral Process, special provisions.
		MC672.4	Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.
		MC672.5	Understand Engineering ethics and responsibilities of Engineers.
		MC672.6	Understand Engineering Integrity & Reliability.
MC671	Aptitude Skill Development-II	MC671.1	Understand the basic concepts of QUANTITATIVE ABILITY.
		MC671.2	Understand the basic concepts of LOGICAL REASONING Skills.
		MC671.3	Understand the basic concepts of PROBABILITY.
		MC671.4	Acquire satisfactory competency in use of VERBAL REASONING.
PC-ME691	Mechanical Engineering Laboratory-II (Design)	PC-ME691.1	Understand the measurement of mechanical properties and deformation behaviour of materials.
		PC-ME691.2	Characterize the kinematic and dynamic behavior of mechanical system.
HM-HU691	Soft skill Development Lab	HM-HU691.1	Effectively communicate through verbal/oral communication and improve the listening skills.
		HM-HU691.2	Write precise briefs or reports and technical documents.
		HM-HU691.3	Actively participate in group discussion / meetings / interviews and prepare & deliver presentations.
		HM-HU691.4	Become more effective individual through goal/target setting, self motivation and practicing creative thinking.
		HM-HU691.5	Function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality.
PW-ME681	Project-II	PW-ME681.1	Students will be able to gather some exposure on some projects and participate in technical event/ competition to fabricate and demonstrate an innovative machine or product, etc.
PC-ME701	Advanced Manufacturing Technology	PC-ME701.1	To understand non- traditional machining processes and the effect of process parameters.
		PC-ME701.2	To differentiate the various non-traditional machining processes.
		PC-ME701.3	To demonstrate micromachining technology.
PE-ME701A	Automobile Engineering	PE-ME701A.1	Understand the basic lay-out of an automobile.

		PE-ME701A.2	Explain the operation of engine cooling, lubrication, ignition, electrical and air conditioning systems.
		PE-ME701A.3	Illustrate the principles of transmission, suspension, steering and braking systems.
		PE-ME701A.4	Demonstrate automotive electronics.
		PE-ME701A.5	Study latest developments in automobiles.
PE-ME702C	Advanced Welding Technology	PE-ME702C.1	To familiarize different types of welding processes.
		PE-ME702C.2	To familiarize the basic mechanism behind weld joint and influencing factors.
		PE-ME702C.3	To impart the knowledge different tests to judge soundness of the weld joint.
OE-AUE701A	Industrial Engineering	OE-AUE701A.1	Understand the concepts of Industrial Engineering.
		OE-AUE701A.2	Explain production systems and their characteristics.
		OE-AUE701A.3	Understand the role of productivity in streamlining a production system.
		OE-AUE701A.4	Describe different aspects of work system design and facilities design pertinent to manufacturing industries.
		OE-AUE701A.5	Apply forecasting and scheduling techniques to production systems.
		OE-AUE701A.6	Apply the inventory management tools in managing inventory.
HM-HU701	Economics for Engineers	HM-HU701.1	EXPLAIN principles of decision making in fixed and variable cost, life cycle cost, estimating models, improvement and learning curve.
		HM-HU701.2	ANALYZE economic conditions viz. inflation, deflation, economic criterion and present worth.
		HM-HU701.3	ANALYZE cash flow, rate of return, cost ratio, and break even analysis.
		HM-HU701.4	UNDERSTAND depreciation, types of property, tax regulation and capital allowance.
		HM-HU701.5	DESCRIBE inflation, price change, types of index and use of price index.
		HM-HU701.6	UNDERSTAND accounting, balance sheet, income statement, cost accounting, direct and Indirect cost.
PW-ME781	Project-III	PW-ME781.1	Build Exposure to research and development.
		PW-ME781.2	Implement innovative ideas for social benefit.
		PW-ME781.3	Develop Algorithms and programs using various software tools.
		PW-ME781.4	Develop prototypes and manage projects in multidisciplinary environments for industrial, social and sustainable developments.
		PW-ME781.5	Solve the industrial problems by applying ethical principles for sustainable development of society.
		PW-ME781.6	Publish and present research papers in National/International journals conferences.
PC-ME791	Mechanical Engineering Laboratory III (Manufacturing)	PC-ME791.1	Will be able to Study cutting forces in machining processes.
		PC-ME791.2	Will be able to test the quality of weld and moulding sands.
		PC-ME791.3	Will be able to develop a practical understanding of advanced manufacturing processes.
		PC-ME791.4	Will be able to understand the working of a robot and its programming.
		PC-ME791.5	Will be able to identify and rectify defects in parts and manufacturing processes related problems.
OE-AUE801A	Total Quality Management	OE-AUE801A.1	Understand quality management philosophies, techniques, and frameworks.
		OE-AUE801A.2	Apply tools and techniques of TQM in manufacturing and service sectors.
		OE-AUE801A.3	Understand the implications of quality management standards and systems.
PE-ME802B	Power Plant Engineering	PE-ME802B.1	Understand functions of the various components of power plant.
		PE-ME802B.2	Illustrate the working of nuclear, thermal and gas based power plants.
		PE-ME802B.3	Evaluate the design layout and working of hydroelectric power plants.
		PE-ME802B.4	Estimate the feasibility and its implications on power generating units.
OE-AUE801C	Analysis and Performance of Fluid Machines	OE-AUE801C.1	The students will know about the dimensional analysis for fluid machinery.
		OE-AUE801C.2	The students will learn about different heads, losses and efficiencies for pumps, fans and turbines.
		OE-AUE801C.3	The students will know about the Interaction of pumps and Turbines and systems.
		OE-AUE801C.4	The students will know about the Performance characteristics of pumps and turbines.
		OE-AUE801C.5	The students will learn about Cavitation: NPSH, Thoma's cavitation parameter and suction specific speed.
		OE-AUE801C.6	The students will know about the Analysis of flow through propellers and windmills and jet propulsion.
PE-ME801B	Energy conservation and Management	PE-ME801B.1	Understand principles of energy management and its influence on environment.
		PE-ME801B.2	Comprehend methods of energy production for improved utilization.
		PE-ME801B.3	Improve the performance of thermal systems using of energy management principles.
		PE-ME801B.4	Analyse the methods of energy conservation for air conditioning, heat recovery and thermal energy storage systems.
		PE-ME801B.5	Prepare energy audit report of energy consumption for industries.
PW-ME881	Project-IV	PW-ME881.1	Identify real world problems considering societal and environmental contexts for sustainable development.
		PW-ME881.2	Explain design methodologies and implementing it by communicating effectively individually or in a team.
		PW-ME881.3	Design advanced programming techniques which will enhance the life-long learning ability of an individual.

		PW-ME881.4	Develop presentation, report writing skills, cost effective project management and publications in national and international arena.

CO List for PG

Department Name: Electronics and Communication Engineering
Program Name: M.Tech (ECE-Comm)

Paper Code	Paper Name	CO No.	CO Statement
PC-MCE 101	Advance Communucation Network	PC-MCE101.1	Understand advanced concepts in Communication Networking.
		PC-MCE101.1	Design and develop protocols for Communication Networks.
		PC-MCE101.1	Understand the mechanisms in Quality of Service in networking.
		PC-MCE101.1	Optimize the Network Design.
PC-MCE 102	Wireless and Mobile Communication	PC-MCE102.1	Design appropriate mobile communication systems.
		PC-MCE102.2	Apply frequency-reuse concept in mobile communications, and to analyze its effects on interference, system capacity, handoff techniques
		PC-MCE102.3	Distinguish various multiple-access techniques for mobile communications e.g. DMA,TDMA, CDMA, and their advantages and disadvantages.
		PC-MCE102.4	Analyze path loss and interference for wireless telephony and their influences on a mobile communication system's performance.
		PC-MCE102.5	Analyze and design CDMA system functioning with knowledge of forward and reverse channel details, advantages and disadvantages of using the technology.
		PC-MCE102.6	Understanding upcoming technologies like 3G, 4G etc.
PC-MCE 202B	MIMO SYSTEM	PC-MCE202B.1	Understand channel modeling and propagation, MIMO Capacity, space-time coding, MIMO receivers, MIMO for multi-carrier systems (e.g. MIMO-OFDM), multi-user communications, multi-user MIMO.
		PC-MCE202B.2	Understand cooperative and coordinated multi-cell MIMO, introduction to MIMO in 4G (LTE, LTE-Advanced, WiMAX).
		PC-MCE202B.3	Perform Mathematical modeling and analysis of MIMO systems.
PC-MCE 202	Advnced Digital Signals Processing	PC-MCE202.1	To understand theory of different filters and algorithms.
		PC-MCE202.2	To understand theory of multirate DSP, solve numerical problems and write algorithms.
		PC-MCE202.3	To understand theory of prediction and solution of normal equations.
		PC-MCE202.4	To know applications of DSP at block level.
PE-MCE102B	RF and Microwave Circuit Design	PE-MCE102B.1	Understand the behaviour of RF passive components and model active components.
		PE-MCE102B.2	Perform transmission line analysis.
		PE-MCE102B.3	Demonstrate use of Smith Chart for high frequency circuit design.
		PE-MCE102B.4	Justify the choice/selection of components from the design aspects.
PC-MCE201	Antennas and Radiating Systems	PC-MCE201.1	Compute the far field distance, radiation pattern and gain of an antenna for given current distribution.
		PC-MCE201.2	Estimate the input impedance, efficiency and ease of match for antennas.
		PC-MCE201.3	Compute the array factor for an array of identical antennas.
		PC-MCE201.4	Design antennas and antenna arrays for various desired radiation pattern characteristics.
PE-MCE101B	Optical Networks	PE-MCE101B.1	Describe semiconductor physics, semiconductor types and carrier transport phenomena.
		PE-MCE101B.2	Describe working principle of various diodes, BJT, MOSFET, solar cell and opto electronic devices.
MC-MCE171	Research Methodology and IPR	MC-MCE171.1	Understand research problem formulation.
		MC-MCE171.2	Analyze research related information.
		MC-MCE171.3	Follow research ethics.
		MC-MCE171.4	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
		MC-MCE171.5	Understand that when IPR would take such important place in growth of individuals and nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general and engineering in particular.
		MC-MCE171.6	Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.
PC- MCE191	Advanced Communication Networks Laboratory	PC- MCE191.1	Identify the different types of network devices and their functions within a network.
		PC- MCE191.2	Understand and build the skills of sub-netting and routing mechanisms.
		PC- MCE191.3	Understand basic protocols of computer networks, and how they can be used to assist in network design and implementation.
PC-MCE192	Wireless and Mobile Communication Laboratory	PC-MCE192.1	Understanding Cellular concepts, GSM and CDMA networks.
		PC-MCE192.2	To study GSM handset by experimentation and fault insertion techniques.
		PC-MCE192.3	Understating of 3G communication system by means of various AT commands usage in GSM.
		PC-MCE192.4	Understanding CDMA concept using DSSS kit.
PW-MCE171A	English for Research Paper Writing	PW-MCE171A.1	Understand that how to improve your writing skills and level of readability
		PW-MCE171A.2	Learn about what to write in each section.
		PW-MCE171A.3	Understand the skills needed when writing a Title.
		PW-MCE171A.4	Ensure the good quality of paper at very first-time submission.
PC-MCE291	Antennas and Radiating Systems Lab	PC-MCE291.1	Determine specifications, design, construct and test antenna.
		PC-MCE291.2	Explore and use tools for designing, analysing and testing antennas. These tools include Antenna design and analysis software, network analysers, spectrum analysers, and antenna pattern measurement techniques.

PC-MCE292	Advanced Digital Signal Processing lab	PC-MCE292.1	Design different digital filters in software.
		PC-MCE292.2	Apply various transforms in time and frequency domain.
		PC-MCE292.3	Perform decimation and interpolation.
PW-MCE271C	Constitution of India	PW-MCE271C.1	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
		PW-MCE271C.2	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
		PW-MCE271C.3	Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
		PW-MCE271C.3.4	Discuss the passage of the Hindu Code Bill of 1956.
PW-MCE281	Mini Project with Seminar	PW-MCE281.1	Understand of Contemporary/emerging technology for various process and systems
		PW-MCE281.2	Share knowledge effectively in oral and written form and formulate documents
		OE-MCE 301C.1	Develop domain Knowledge about the various feasibility analysis – Market, Technical, Financial and Economic
		OE-MCE 301C.2	Develop ethe knowledge and skills required to be successful in applying project management
		OE-MCE 301C.3	Understand the techniques for project planning, scheduling and Execution control
PW-MCE 481	Dissertation-II	PW-MCE 481.1	Identify the technical problems invarious reported works through literature survey
		PW-MCE 481.2	Apply the knowledge of communication or interdisciplinary technique in the proposed work
		PW-MCE 481.3	Design the proposed work by using mathematical or software tool
		PW-MCE 481.4	Illustrates the proposed work through experimental results and findings

Department Name: **Management Science & Humanities**
Program Name: **MBA**

Paper Code	Paper Name	CO No.	CO Statement
MBA 401	Entrepreneurship Development	MBA 401.1	Students will gain knowledge and skills needed to run a busines
		MBA 401.2	Students will be able to write business plan on their own
		MBA 401.3	Students will understand the central and state government policies and regulations
		MBA 401.4	Students will understand venture capital, incubation and IT startups
MBA-FM 402	Financial Derivatives and Risk Management	MBA-FM 402.1	To have a brief concept on Risk Management using Forward and Futures.
		MBA-FM 402.2	To familiarise the Risk Management Measurementusing Options and Swaps
MBA-FM 403	Managing Banks and Financial Institutions	MBA-FM 403.1	Evaluate the performance of Banking Institutions and their contribution to the growth of Indian Corporate Sector
		MBA-FM 403.2	To have a Bird's view of the Indian Financial System and in the context of Global Indian Banking System.
		MBA-FM 403.3	To get an insight into the constitutions, structure, objectives and working of the Banking Institutions in India
MBA-FM 404	International Finance	MBA-FM 404.1	To describe the structure of the global financial system, the functions and main elements
		MBA-FM 404.2	To describe the basics of the global financial system stability.
		MBA-FM 404.3	To study the history of the global financial system regulation
		MBA-FM 404.4	To name the world financial institutions, its functions and structure.
MBA-FM 405	Financial Modelling	MBA-FM 405.1	Ability to understand the financial modeling in excel, understanding advanced features of excel database functions in excel, creating charts, using forms and control tool box.
		MBA-FM 405.2	Understand the finance functions present in excel by creating dynamic models.
		MBA-FM 405.3	Create an awareness for students about the present scenario of manager and sensitivity analysis features.
		MBA-FM 405.4	Examine different statistical distributions used in simulation generating random numbers that follow a particular distribution, building models in finance using simulation
MBA-BA 402	Data Analytics using Big Data	MBA-BA 402.1	Learn the importance of proper data analysis in decision making using Python
		MBA-BA 402.2	Identify Big Data and its Business Implications.
		MBA-BA 402.3	Understand the components of Hadoop and Hadoop Eco-System
		MBA-BA 402.4	Develop Big Data Solutions using Hadoop Eco Syste
MBA-BA 403	Multivariate Data Analysis	MBA-BA 403.1	Understand underlying theory for the analysis of multivariate data.
		MBA-BA 403.2	Able to choose appropriate procedures for multivariate analysis.
		MBA-BA 403.3	Use the R/ Splus/ SAS/ MATLAB/ Python language to carry out analyses. And Interpret the output of such analyses.
MBA-BA 404	Data Visualization using Business Intelligence Tools	MBA-BA 404.1	Apply suitable design principles in the creation of presentations and visualizations
		MBA-BA 404.2	Select appropriate data visualization techniques for given particular requirements imposed by the data
		MBA-BA 404.3	Present data with visual representations for any kind of target audience, task, and data
		MBA-BA 404.4	Create multiple versions of digital visualizations using Excel, R and Tableau

MBA-BA 405	Business Forecasting & Time Series Analysis	MBA-BA 405.1	Identify, collect, and organize relevant data useful for forecasting
		MBA-BA 405.2	Identify the appropriate forecasting methods (regression, time series, smoothing, etc.) for any given data.
		MBA-BA 405.3	Forecast using regression
		MBA-BA 405.4	Interpret the results and write a basic report useful for management for decision making
MBA-MM 402	Retail Management	MBA-MM 402.1	Clarify the concept and related terms in retailing.
		MBA-MM 402.2	Comprehend the ways retailers use marketing tools and techniques to interact with their customers.
		MBA-MM 402.3	Understand various formats of retail in the industry
		MBA-MM 402.4	Recognize and understand the operations-oriented policies, methods, and procedures used by successful retailers in today's global economy
MBA-MM 403	Rural and Agri-marketing	MBA-MM 403.1	Understand the scope, growth, importance of rural marketing and rural environment.
		MBA-MM 403.2	Identify the classification of rural consumer based upon the economic status and rural consumer behavior.
		MBA-MM 403.3	Examine the rural marketing segmentation, the significance and problems of regulated markets.
		MBA-MM 403.4	Analyze classification of markets and the role of regulated markets on marketing of agricultural products.
		MBA-MM 403.5	Discuss the role of media in rural marketing and the main problems in rural communication.
MBA-MM 404	Digital Marketing and E-business	MBA-MM 404.1	Develop a digital marketing plan that will address common marketing challenges.
		MBA-MM 404.2	Articulate the value of integrated marketing campaigns across SEO, Paid Search, Social, Mobile, Email, Display Media.
		MBA-MM 404.3	Recognize Key Performance Indicators tied to any digital marketing program.
		MBA-MM 404.4	Improve Return on Investment for any digital marketing program.
		MBA-MM 404.5	Launch a new, or evolve an existing, career path in Digital Marketing.
MBA-MM 405	B2B Marketing	MBA-MM 405.1	Understand and identify opportunities in B2B Markets, marketing mix, philosophy and value chain and identify the current trend and changes in Business Marketing
		MBA-MM 405.2	Identify the Organizational buying process and Buyer-seller relationship and Study on the customer relationship management and acquiring right customers.
		MBA-MM 405.3	Analyze the segmenting of business market study the segmentation process and study the product life cycle and technology adoption life cycle
		MBA-MM 405.4	Learn about the formation of business model Study about the strategic planning and Familiarize with the business marketing channels (Direct and Indirect Channels)
MBA-HR 402	Strategic HRM	MBA-HR 402.1	Integrate HR with the business strategy
		MBA-HR 402.2	Develop competency to enhance employee development
		MBA-HR 402.3	Gain rational ability to manage performance strategically
		MBA-HR 402.4	Develop competency to implement global HR practices.
		MBA-HR 402.5	Comprehensively understand the evolving role of HR in the context of global workforce landscape and the role as a strategic business partner.
MBA-HR 403	International HRM	MBA-HR 403.1	Discuss and infer significance of the strategic issues, opportunities and challenges in international HRM in volatile business environment.
		MBA-HR 403.2	Illustrate and categorize the skills required in diagnosing international HRM issues critically and analytically, and evaluating various alternative approaches.
		MBA-HR 403.3	Evaluate different strategies required for dealing with the cross cultural situation based on the understanding of external factors.
		MBA-HR 403.4	Analyze the social value considerations and suggest ways to ensure an ethical management of international HRM.
MBA-HR 404	Organizational Change and Development	MBA-HR 404.1	Gaining knowledge about organizational development process.
		MBA-HR 404.2	How to change and develop organizations.
		MBA-HR 404.3	Better understanding of the change management model.
		MBA-HR 404.4	Skills needed to develop an action plan for the development process.
		MBA-HR 404.5	Describe what an effective employee training and development program should look like
MBA-HR 405	Human Capital Management and HR Audit	MBA-HR 405.1	Demonstrate knowledge in examining the adequacy and appropriateness of the HRD systems, structures, styles, culture, and competencies.
		MBA-HR 405.2	Evaluate the current issues and trends in HR Audit globally.
		MBA-HR 405.3	Critical evaluation of whether HR processes are adequate, legal and ethical.
		MBA-HR 405.4	Engage in constant observation and continuous interaction and intervention to improve the organization's policies, procedures and practices.