G H College of Engineering and Management, Nagpur

(An Autonomous Institute affiliated to RTM Nagpur University Nagpur)

B. Tech First Year

Course Book 2024-25

Courses offered by
Applied Sciences & Humanities Board
(First Year Engineering Dept.)

Course Title: **Engineering Physics**										
Semester	I /II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd/ Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	BSC2	1 Hr.	1 Hr.	2 Hrs.	3	10	15	50	25	--
Course Code	23BTSHL101 AI/CS/DS/ CY/IT/EE/CE /ME/EC 23BTSHP101 AI/CS/DS/ CY/IT/EE/CE /ME/EC									
Teaching Mode	Offline	4 Hrs			Total	75			25	
Duration of ESE	2Hrs					100				

Course Objectives	Demonstration of the fundamentals of uniform and non-uniform electric and magnetic fields and working of related devices.
	Familiarization and demonstration of the concepts of laser and their applications.
	Explanation of working of various optoelectronic devices.
	Demonstration of the fundamentals of Quantum Mechanics and its related applications.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Identify the trajectories of electron in uniform Electric and Magnetic fields and operate related devices.
	CO2: Explain the working of Laser & use it for different applications
	CO3: Identify various optoelectronic devices and use them for various applications.
	CO4: Appraise the fundamental concepts, principles, theories, and terminology used in the Quantum Mechanics and solve related numericals.
	CO5: Demonstrate the knowledge of Physics involved in Quantum Computing.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	--	--	--	--	--	--	--	--	--	**1**
CO2	**3**	**2**	--	--	--	--	--	--	--	--	--	**1**
CO3	**3**	**2**	--	--	--	--	--	--	--	--	--	**1**
CO4	**3**	**2**	--	--	--	--	--	--	--	--	--	**1**
CO5	**3**	**1**	--	--	--	--	--	--	--	--	--	**1**

Course Contents:

Unit	Contents	Hours
I	**Electron Ballistics and Optics**: Trajectories of electron in uniform Electric and Magnetic field (Qualitative), Bethe's law, Electron Lens, Devices- Electron microscope (Theoretical), CRO.	6
II	**LASER:** Characteristics, Spatial and Temporal Coherence, Einstein Coefficient & its significance, Basic requirements of Laser, Components of laser, He-Ne, Semiconductor laser and Branch Specific applications, Pulse Laser Deposition	4
III	**Semiconductor Physics:** Band Theory of Solids, Hall Effect, and Optoelectronic Devices:-Types of optoelectronic devices, OLED, Photovoltaic Cell	5
IV	**Fundamentals of Quantum Physics:** Introduction to Quantum Mechanics, Dual nature of matter, phase velocity, synthesis of wave packet, group velocity,Heisenberg's Uncertainty Principle, Schrodinger's Mechanics, Equations, Operators, Particle in one dimensional box, tunneling.	6
V	**Applications of Quantum Physics:** Interaction of electron with matter, SEM, TEM, Quantum Computing: Physics involved in Quantum Computing: Reversibility, superposition, Quantum entanglement (Schrodinger's cat), Computations with Qubits. Quantum Logic Gates, Applications of Quantum Computing.	5

Text Books	1.	Fundamentals of Physics by David Halliday, Robert Resnick and Jerle Walker; John- Wiley and Sons, 2018, Eleventh Edition
	2.	Concepts of Modern Physics by Baiser et. al, Tata McGraw-Hill Education Pvt. Ltd, 2015, Twenty Ninth edition
	3.	Physics for Engineering, Dr. Bhavana P Butey, Oxford University Press, 2017, First Edition
EBooks	1.	https://www.phindia.com/Books/EBooks
Reference Books	1.	Quantum Mechanics by Leonard I Schiff, Tata McGraw-Hill Education Pvt. Ltd, 2014, Fourth Edition
	2.	Quantum Computation and Quantum Information, Michael A. Nielsen & Isaac L. Chua
	3.	Electronic Engineering Material and Devices by: John Allison (TMH),1971
Online TL Material	1.	https://nptel.ac.in/courses/104/104/104104085/

Sr. No.	Name of Experiments
1	Application of CRO: To measure the amplitude of AC voltage and determine unknown frequency using CRO
2	Application of CRO: Determination of phase difference between two AC signals.
3	Application of CRO: PN junction diode as a rectifier-Find efficiency & ripple factor by using CRO
4	Application of interference: Determination of diameter of thin wire using by measuring the width of the interference fringes produced by a wedge-shapedFilm.
5	Application of interference: Determination of radius of curvature of plano-convex lens by using Newton's rings.
6	Laser: Determination of Birefringence of double image prism.
	Laser: To determine (1) wavelength and (2) angular spread of He-Ne laser usingplane diffraction grating.
7	Determination of Hall Coefficient of an Extrinsic Semiconductor by arranging it in a Hall Effect. Experiment.
8	Determination of Band gap by four probe method.
9	Determination of Band gap of an Intrinsic semiconductor by using PN junction diode
10	Comparison of V-I characteristics of various diodes.
11	Application of Diode: Determination of Planks Constant by using LED of at least 4 different colours.

12	Application of diode: Voltage regulation by Zener diode.
13	Application of diode: Plot V-I & power curves of solar cells, and find maximum power point & efficiency.
14	Application of diode: To show the tunneling effect in tunnel diode using I-V Characteristics.
15	Quantum Mechanics: Use Scilab to solve Schrodinger equation for ground stateenergy and wave functions of various simple quantum mechanical one- dimensional potentials.

Course Title: **Environmental Chemistry**										
Semester	I/II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd/Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	BSC5	1 Hrs	NA.	2 Hrs.	2	10	15	50	25	--
Course Code	23BTSHL102 AI/CS/DS/ CY/IT/EE/CE/ME/ EC 23BTSHP102 AI/CS/DS/ CY/IT/EE/CE/ME/ EC									
Teaching Mode	Offline	3 Hrs			Total	75			25	
Duration of ESE	2 Hrs					100				

Course Objectives	Demonstrate various methods of water treatment for domestic and industrialpurpose.
	Explanation of different types of batteries and its commercial applications
	Demonstration and familiarization of impact of waste on environmentaldegradation.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Explain various methods of water treatment for domestic andindustrial use
	CO2: Differentiate various categories of waste and its disposal techniques
	CO3: Identify various batteries and recognize its commercial applications
	CO4: Classify the different types of Energy and its future scope
	CO5: Apply the knowledge of environmental pollution and degradation tosolve related problems

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**1**	--	--	--	--	--	**2**	--	--	--	--	**1**
CO2	**1**	--	--	--	--	--	**3**	--	--	--	--	**1**
CO3	**1**	--	--	--	--	--	**2**	--	--	--	--	**1**
CO4	**1**	--	--	--	--	--	**2**	--	--	--	--	**1**
CO5	**1**	--	--	--	--	--	**3**	--	--	--	--	**1**

Course Contents:

Unit	Contents	Hours
I	**Water Technology:** Purification of Domestic water, Boiler troubles (scale & sludge formation, caustic embrtillment), softening methods of industrial water (Lime-soda, Zeolite, & ion-exchange), Determination of hardness.	6
II	**Solid Waste Management and treatment Technology:** Solid waste and its Treatment: Collection, segregation, transportation and disposal. Different types of waste like e-waste, plastic waste, biomedical waste and Agriculture waste.	4
III	**Battery Technology:** Introduction to Battery, reversible and irreversible batteries. Examples: Dry cell, Lead-acid battery, Lithium-ion battery and fuel cell and applications.	4
IV	**Fuel Technology:** Solid Fuel: Characteristics, Significance of ultimate analysis of coal, concept of calorific value and its determination (GCV and NCV), Liquid Fuel: Fractional distillation of crude petroleum, Cracking of heavy oil, Gaseous fuel: composition, characteristics and applications.	4
V	**Pollution & its mitigation methods**: Causes, effects and controlling methods of air and water pollution.	4

Text Books	1.	Text Book of Engineering Chemistry, S S Dara, S Chand & company,2013, Eleventh Edition
	2.	Engineering Chemistry, Jain & Jain, Dhanpatrai&Dhanpatrai,2015,Sixteenth Edition
	3.	A Test Book of Environmental Chemistry & Pollution Control, S S Dara, S Chand & Co.,2006, Eleventh Edition
Reference Books	1.	Environmental Chemistry, B K Sharma and H. Kaur, Goel PublishingHouse, 2014, Fourteen Edition
	2.	Environmental Studies, R. Rajgopalan, Oxford Publication, 2016,Third Edition
E books	1.	Water purification, Alexandru Grumezescu, First edition https://www.elsevier.com/books/water-purification/grumezescu/978-0-12-804300-4
	2.	Solid waste management by Stephen Burnley, Willey publication, 2014 https://onlinelibrary.wiley.com/doi/book/10.1002/9781118863923
	3.	Air Pollution, S K Agarwal, APH Publishing, 2005 https://books.google.co.in/books/about/Air_Pollution.html?id=dJlxyyLX0 MoC

Online TL Material	1.	Introduction to Household Water Treatment and Safe Storage,https://www.coursera.org/learn/water-treatment/home/welcome
	2.	Electronic waste Management-Issues and challenges by Dr. Brajesh Kumar Dubey, http://nptel.ac.in/courses/120108005/
	3.	Integrated Waste Management for a Smart City ,https://onlinecourses.nptel.ac.in/noc19_ce31/course

Sr. No.	Name of Experiments / Case Studies
1	Physical parameters of water- Determination of PH, turbidity and conductivity of given water sample.
2	Chemical parameters of water- Determination of Hardness by Complexometric method and Alkalinity by Warders Method.
3	Demonstration on different types of cells and batteries.
4	Determination of Moisture present in given Solid waste
5	Case study on current scenario of region specific waste generation.
6	Determination of Proximate analysis of Solid fuel as Coal.
7	Determination of Acid value of Liquid fuel.
8	Demonstration on measuring air quality by using Air Quality Tester.
9	Determination of chloride ions from given water sample by Argentometric Method.
10	Determination of DO of given water sample by Iodometric titration.
11	Preparation of Biodiesel from edible oil.
12	Determination of saponification value of liquid fuel.

Course Title: **Matrices & Differential Calculus**										
Semester	I	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	BSC1	2 Hrs	1 Hrs	NA	3	10	15	50	NA	NA
Course Code	23BTSHL103 AI/CS/DS/ CY/IT/EE/CE/ ME/EC									
Teaching Mode	Offline	2 Hrs			Total	75			–	
Duration of ESE	2 Hrs.					75				

Course Objectives	To introduce concepts of matrices in the field of Engineering.
	To develop skills in student to solve engineering problems based onMatrices.
	To introduce concepts of Differential Calculus & Vector Calculus in the fieldof Engineering.
	To develop skills in students to solve applications based problems on Differential Calculus.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Understand and use the theory of Matrices to solve the system of linear equations and engineering problems in respective disciplines.
	CO2: Determine the Eigen values and Eigen vectors of a matrix and apply to various engineering problems in respective disciplines.
	CO3: Apply concepts of differentiation in solving engineering problems.
	CO4: Use applications of partial differentiation to solve various problems in engineering.
	CO5: Apply the Knowledge of vector differentiation to solve various problems in engineering.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**2**	--	**1**	--	--	--	--	--	--	**3**
CO2	**3**	**3**	**2**	--	**1**	--	--	--	--	--	--	**3**
CO3	**3**	**3**	**2**	--	**1**	--	--	--	--	--	--	**3**
CO4	**3**	**3**	**2**	--	**1**	--	--	--	--	--	--	**3**
CO5	**3**	**3**	**2**	--	**1**	--	--	--	--	--	--	**3**

Course Contents:

Unit	Contents	Hours
I	**Matrices:** Review of Matrix, Solution of simultaneous equations by Gauss Elimination method. Inverse of matrix by Partitioning method. Rank of matrix, Consistency for system of linear equations, Linear dependence.	8
II	**Characteristics equation, Eigen values and its properties.** Eigen vectors. Reduction to diagonal form, Cayley Hamilton theorem (statement & verification). Sylvester's theorem, Association of matrices with linear differential equations of second order with constant coefficient.	9
III	**Differential Calculus of single variable function:** Review of limits, continuity, differentiability and Mean value theorem. Successive differentiation, Leibnitz's Theorem, Taylor's series and Maclaurin series for single variable function, Curve Tracing	7
IV	**Differential Calculus of function of several variables:** Functions of several variables, First and higher order partial derivatives, Euler's theorem, Chain rules. Jacobian, Hessian matrix properties of Jacobian, Maxima and minima of function of two variables, Lagrange's method of undetermined multipliers.	8
V	**Vector Calculus:** Differentiation of vectors, Gradient of a scalar pointfunction, Directional derivatives. Divergence and Curl of vector point function. Solenoidal and Irrotational vector field.	7

Text Books	1.	Higher Engineering Mathematics: B. S. Grewal, Khanna Publishers, 2013, Forty Third Edition
	2.	Advanced Engineering Mathematics: Erwin Kreyszig John Wiley & Sons, 2013, Tenth Edition
Reference Books	1.	Advanced Engineering Mathematics: Jain, R.K. and Iyengar, S.R.K, Narosa Publishers; Alpha Science International, Ltd, 2007, Third Edition
	2.	Advanced Mathematics for Engineers and Scientists: Spiegel, M. R, McGraw-Hill, 2010, Second Edition
	3.	Linear Algebra A Geometric Approach , S Kumerson, Publisher: PHI Learning
	4.	Calculus and Analytic Geometry, George B Thomas, Jr Ross L Finney Pearson Publication
	5.	Calculus by James Stewart

Course Title: **Integral Calculus and Differential Equations**										
Semester	II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	BSC3	2 Hrs	1 Hrs	NA	3	10	15	50	NA	NA
Course Code	23BTSHL104 AI/CS/DS/ CY/IT/EE/EC									
Teaching Mode	Offline	3Hrs			Total	75			–	
Duration of ESE	2 Hrs.					75				

Course Objectives	To introduce the concepts of Integral calculus & Vector integration in thefield of Engineering.
	To develop skills in student to apply the concepts of integrals in variousengineering problems.
	To develop skills in student to solve problems of Ordinary DifferentialEquations and its applications in field of engineering.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Understand and use concept of integrals & solve engineeringproblems.
	CO2: Evaluate the multiple integrals using different techniques and applyit to solve engineering problems.
	CO3: Understand vector integration and its applications related to real lifeproblems.
	CO4: Solve first order, first degree & higher order differential equations.
	CO5: Form differential equations for simple engineering systems and findits solution.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**2**	--	**1**	--	--	--	--	--	--	**3**
CO2	**3**	**3**	**2**	--	**1**	--	--	--	--	--	--	**3**
CO3	**3**	**3**	**2**	--	**1**	--	--	--	--	--	--	**3**
CO4	**3**	**3**	**2**	--	**1**	--	--	--	--	--	--	**3**
CO5	**3**	**3**	**2**	--	**1**	--	--	--	--	--	--	**3**

Course Contents:

Unit	Contents	Hours
I	**Integral Calculus:** Review: Area, Volume, Length, Surface area using simple integration, Volume of Solid of Revolution, Improper Integrals, Differentiation under integral sign.	7
II	**Multiple Integral:** Double integral, Change of variables, Change of order of integration, Triple integral, Applications of multiple integral: Area, mass,volume.	8
III	**Vector Integration:** Line integral, Surface integral, Volume integral, Statement of Gauss theorem, Greens theorem and Stokes theorem and its applications.	8
IV	**Differential Equations:** Linear, Reducible to linear and exact differential equations of first order. Higher order linear differential equations with constant coefficients (Cases of CF & PI).	8
V	Method of variation of parameters, Cauchy's and Legendre homogeneous differential equations. Applications of Differentialequations.	8

Text Books	1.	Higher Engineering Mathematics: B. S. Grewal, Khanna Publishers, 2013,Forty Third
	2.	Advanced Engineering Mathematics: Erwin Kreyszig John Wiley & Sons,2013, Tenth Edition
	3	Differential equation with applications and historical notes, G. F Simmons
Reference Books	1.	Advanced Engineering Mathematics: Jain, R.K. and Iyengar, S.R.K,Narosa Publishers; Alpha Science International, Ltd, 2007, Third Edition
	2.	Differential equations, third edition, S L Ross, Wiley Publication.
	3.	Advanced Mathematics for Engineers and Scientists: Spiegel, M. R,McGraw-Hill, 2010, Second Edition
	4.	Calculus and Analytic Geometry, George B Thomas, Jr Ross L FinneyPearson Publication

Course Title: **Linear Algebra and Statistics**										
Semester	II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd/Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	BSC4	2 Hrs.	1 Hrs.	NA	3	10	15	50	NA	NA
CourseCode	23BTSHL105 AI/CS/DS/ CY/IT									
TeachingMode	Offline	3 Hrs			Total	75			_	
Duration ofESE	2 Hrs.					75				

Course Objectives	Analyze problems, recognize appropriate methods to find the solution.
	Apply principles from mathematics to solve applied problems in engineering.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Apply the concepts of least squares methods and linear regressionanalysis in engineering.
	CO2: Apply the knowledge of Random variables.
	CO3: Apply the knowledge of Probability distributions to solve engineering problems.
	CO4: Apply the concepts of Vector Spaces and Linear Transformation in engineering problems.
	CO5: Apply the concepts of Linear Algebra in programming languages.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**2**	--	**1**	--	--	--	--	--	--	**3**
CO2	**3**	**3**	**2**	--	**1**	--	--	--	--	--	--	**3**
CO3	**3**	**3**	**2**	--	**1**	--	--	--	--	--	--	**3**
CO4	**3**	**3**	**2**	--	**1**	--	--	--	--	--	--	**3**
CO5	**3**	**3**	**2**	--	**1**	--	--	--	--	--	--	**3**

Course Contents:

Unit	Contents	Hours
I	**Statistics:** Introduction to measures of central tendency, Curve fitting Least Square method, Correlation and Regression.	08
II	Random Variables, Distribution functions of continuous & discrete random variables, Mathematical expectations.	08
III	**Special probability distributions:** Binomial, Poisson's and Normal distributions.	06
IV	Vector space, Subspaces, Linear dependence and Independence, Bases and dimensions, Linear transformations, Rank Nullity theorem.	10
V	Four fundamental subspaces, Graphs, Networks, Incidence matrix. Eigenspaces, Diagonalization, Symmetric matrices, Singular Value Decomposition.	10

Text Books	1.	Linear Algebra and Matrix Analysis for Statistics, Chapman &Hall,CRC Texts in Statistical Science
	2.	Linear Algebra and Its Applications, Gilbert Strang, Cengage Learning,2006,Fourth
	3.	Linear Algebra , Schaum's Outline Series
	4.	Theory and Problems of Probability, Random Variables, and Random Processes, Hwei P. Hsu, Schaum's Outline series.
Reference Book	1.	Probability and Statistics by Rohatagi, Wiley Publication
	2	Introduction to Mathematical Statistics, Hogg & Craig, Fourth Edition. Macmillan Publishing Co., Inc. NEW YORK.
E Books	1.	https://faculty.atu.edu/mfinan/algebra2.pdf
	2.	https://sites.math.northwestern.edu/~len/LinAlg/
	3.	https://faculty.atu.edu/mfinan/LINENG.pdf

Course Title: **Differential Equations and Statistics**										
Semester	II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	BSC3	2 Hrs.	1 Hr.	-	3	10	15	50	NA	NA
Course Code	23BTSHL106 ME									
Teaching Mode	Offline	3 Hrs.			Total	75			----------	
Duration of ESE	2 Hrs					75				

Course Objectives	1. To introduce the concepts of Integral calculus in the field of Engineering.
	2. To develop skills in students to solve problems of Ordinary Differential Equations and its applications in field of engineering.
	3. To introduce concept of statistics.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Evaluate the multiple integrals using different techniques and apply it to solve engineering problems.
	CO2: Solve first order, first degree & higher order differential equations.
	CO3: Apply the knowledge of Numerical techniques to solve ordinary differential equations in engineering problems.
	CO4: Understand the solution techniques of linear Partial differential equations.
	CO5: Apply the concepts of least squares methods and linearregression analysis in engineering.

Mapping of Course Outcomes with Program Outcomes and Program SpecificOutcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**2**	**1**	-	**1**	-	-	-	-	-	-	-	**2**	**3**	**1**	**2**
CO2	**3**	**2**	-	**2**	-	-	-	-	-	-	-	**2**	**3**	**1**	**2**
CO3	**2**	**2**	-	**2**	-	-	-	-	-	-	-	**2**	**3**	**1**	**2**
CO4	**3**	**2**	-	-	**2**	-	-	-	-	-	-	**2**	**3**	**1**	**2**
CO5	**3**	**3**	-	-	**2**	-	-	-	-	-	-	**2**	**3**	**1**	**2**

Course Contents:

Unit	Contents	Hours
I	**Multiple Integral:** Double integral, Change of order of integration, Triple integral, Applications of multiple integral: Area, mass.	**7**
II	**Differential Equations**: Linear, Reducible to linear and exact differential equations of first order. Higher order linear differential equations with constant coefficients (Cases of CF & PI). Applications ofDifferential equations(First Order)	**7**
III	**Numerical Methods:** Solutions of algebraic and transcendental equations by False position method and Newton-Raphson method Numerical solution of ordinary differential equation by Taylor series method, Euler modified method, Runge -Kutta method of 4^{th} order. Solution of simultaneous linear equations by Gauss Seidel method	**6**
IV	**Partial differential Equations:** Partial differential equation of first order& first degree, Solution of Higher order Partial differential equations with constant coefficients.	**6**
V	**Statistics:** Introduction to measures of central tendency, Curve fittingLeast Square method, Correlation and Regression.	**6**

Text Books	1.	Higher Engineering Mathematics: B. S. Grewal, Khanna Publishers, 2013, Forty Third
	2.	Advanced Engineering Mathematics: Erwin Kreyszig John Wiley & Sons, 2013, Tenth Edition
	3.	Differential equation with applications and historical notes, G. FSimmons
	4.	Numerical Methods By R.K. Jain, S.R.K. Iyengar, New Age International Publications (2006) Ltd 4^{th} edition.
Reference Books	1.	Advanced Engineering Mathematics: Jain, R.K. and Iyengar, S.R.K,Narosa Publishers; Alpha Science International, Ltd, 2007, Third Edition
	2.	Differential equations, third edition ,S L Ross, Wiley Publication.
	3.	Advanced Mathematics for Engineers and Scientists: Spiegel, M. R, McGraw-Hill, 2010, Second Edition
	4.	Calculus and Analytic Geometry, George B Thomas, Jr Ross L Finney. Pearson Publication
	5.	Schaum's outline of Partial Differential Equations(Schaum's outline series)PAUL Duchateau, David W Zachmann-Mc Graw Hill
	6.	Introductory Methods of Numerical Analysis, S S Sastry, PHI Publications.

Course Title: **Integral Calculus and Differential Equations & Numerical Methods**										
Semester	II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	BSC3	2 Hrs.	1 Hr.	-	3	10	15	50	NA	NA
Course Code	23BTSHL107CE									
Teaching Mode	Offline	3 Hrs.			Total	75			---- --- ---- ---	
Duration of ESE	2.5 Hrs					75				

Course Objectives	1. To introduce the concepts of Integral calculus in the field of Engineering.
	2. To develop skills in students to solve problems of Ordinary Differential Equations and its applications in field of engineering.
	3. To introduce concept of statistics.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Evaluate the multiple integrals using different techniques and apply it to solve engineering problems.
	CO2: Solve first order, first degree & higher order differential equations.
	CO3: Apply the knowledge of Numerical techniques to solve ordinary differential equations in engineering problems.
	CO4: Understand the solution techniques of linear Partial differential equations.
	CO5: Apply the concepts of least squares methods and linear regression analysis in engineering.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	**2**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**1**	**2**
CO2	**3**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**1**	**2**
CO3	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**1**	**2**
CO4	**3**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**1**	**2**
CO5	**3**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**1**	**2**

Course Contents:

Unit	Contents	Hours
I	**Multiple Integral:** Double integral, Change of order of integration, Triple integral, Applications of multiple integral: Area, mass.	**7**
II	**Differential Equations**: Linear, Reducible to linear and exact differential equations of first order. Higher order linear differential equations with constant coefficients (Cases of CF & PI). Applications of Differential equations(First Order)	**7**
III	**Numerical Methods:** Solutions of algebraic and transcendental equations by False position method and Newton-Raphson method Numerical solution of ordinary differential equation by Taylor series method, Euler modified method, Runge -Kutta method of 4^{th} order. Solution of simultaneous linear equations by Gauss Seidel method	**6**
IV	**Partial differential Equations:** Partial differential equation of first order & first degree, Solution of Higher order Partial differential equations with constant coefficients.	**6**
V	**Statistics:** Introduction to measures of central tendency, Curve fitting Least Square method, Correlation and Regression.	**6**

Text Books	1.	Higher Engineering Mathematics: B. S. Grewal, Khanna Publishers, 2013, Forty Third
	2.	Advanced Engineering Mathematics: Erwin Kreyszig John Wiley & Sons, 2013, Tenth Edition
	3	Differential equation with applications and historical notes, G . F Simmons
	4	Numerical Methods By R.K. Jain, S.R.K. Iyengar, New Age International Publications (2006) Ltd 4^{th} edition.
Reference Books	1.	Advanced Engineering Mathematics: Jain, R.K. and Iyengar, S.R.K, Narosa Publishers; Alpha Science International, Ltd, 2007, Third Edition
	2.	Differential equations, third edition ,S L Ross, Wiley Publication.
	3.	Advanced Mathematics for Engineers and Scientists: Spiegel, M. R, McGraw-Hill, 2010, Second Edition
	4.	Calculus and Analytic Geometry, George B Thomas, Jr Ross L Finney. Pearson Publication
	5	Schaum's outline of Partial Differential Equations(Schaum's outline series)PAUL Duchateau, David W Zachmann-Mc Graw Hill
	6	Introductory Methods of Numerical Analysis, S S Sastry, PHI Publications.

<table>
<tr><td colspan="11">Course Title: Communication Skills</td></tr>
<tr><td rowspan="2">Semester</td><td rowspan="2">I/II</td><td colspan="4" rowspan="2">Teaching Scheme</td><td colspan="5">Evaluation Scheme</td></tr>
<tr><td colspan="3">Theory</td><td colspan="2">Practical</td></tr>
<tr><td>Term</td><td>Odd/ Even</td><td>Th</td><td>Tu</td><td>Pr</td><td>Credits</td><td>TAE</td><td>CAE</td><td>ESE</td><td>INT</td><td>EXT</td></tr>
<tr><td>Course Category</td><td>AEC1</td><td rowspan="2">1 Hr</td><td rowspan="2">--</td><td rowspan="2">2 Hrs.</td><td rowspan="2">2</td><td rowspan="2">10</td><td rowspan="2">15</td><td rowspan="2">--</td><td rowspan="2">25</td><td rowspan="2">--</td></tr>
<tr><td>Course Code</td><td>23BTSHL 108 AI/CS/DS/ CY/IT/EE/CE/M E/EC
23BTSHP 108 AI/CS/DS/ CY/IT/EE/CE/M E/EC</td></tr>
<tr><td>Teaching Mode</td><td>Offline</td><td colspan="3" rowspan="2">3 Hrs.</td><td rowspan="2">Total</td><td colspan="3">25</td><td colspan="2">25</td></tr>
<tr><td>Duration of ESE</td><td>NA</td><td colspan="5">50</td></tr>
<tr><td rowspan="5">Course Objectives</td><td colspan="10">To introduce the students on the importance of Communication Skills in Engineering</td></tr>
<tr><td colspan="10">To build up the Basic Communication Skills of the students through Listening, Speaking, Reading and Writing</td></tr>
<tr><td colspan="10">To carve the body language of the students on their effective presentation as and when required before audience.</td></tr>
<tr><td colspan="10">To augment the presentation skills of the students of their Technical Proficiency through effective PPTs</td></tr>
<tr><td colspan="10">To enhance the creativity of the students through activities like Creative Writing, Extempore</td></tr>
<tr><td rowspan="6">Course Outcome</td><td colspan="10">At the end of the course:-</td></tr>
<tr><td colspan="10">Students shall identify and comprehend the main ideas through Comprehensive and Critical Listening and respond appropriately to the questions using “Eyes-Mind-Ears” technique.</td></tr>
<tr><td colspan="10">Students shall be strongly opinionated, thoughtful and shall speak confidently on any given random topic (Extempore)</td></tr>
<tr><td colspan="10">Students shall predict main ideas from titles and visual aids by using Skimming and Scanning techniques of Reading Comprehension and Charts.</td></tr>
<tr><td colspan="10">Students shall organize and present their email and letter writing for college Correspondence in a coherent way.</td></tr>
<tr><td colspan="10">Students shall plan, organize and prepare an effective presentation by Implementing the audience centric delivery styles with appropriate visual aids.</td></tr>
</table>

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Program Outcomes											
	PO 1	PO2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	--	--	--	--	--	--	--	--	--	**3**	--	--
CO2	--	--	--	--	--	--	--	--	--	**3**	--	--
CO3	--	--	--	--	--	--	--	--	--	**3**	--	--
CO4	--	--	--	--	--	--	--	--	--	**3**	--	--
CO5	--	--	--	--	--	--	--	--	**3**	**3**	--	--

Course Contents

Unit	Contents	Hours
I	**Elevation to the Course:** Ice-Breaker: Self Introduction by Students online - Introduction to the course Briefing on the syllabus, learnings, outcome and Assessment Patterns - Pre-Training Module: Pre-Assessment on the Existing English Proficiency of the students	3
II	**Communication Skills and "YOU"** Introduction to English Communication skills and Cognizance in English -Self-Realization – Review on SWOC Analysis and self- Introspection SMART Goals- Preparation and presentation of Individual goal charts	3
III	**The Practical Approach to Basic Communication Skills through LSRW -*In par with Basic and Intermediate levels Academic English like IELTS, TOEFL, ESL*** **Listening Skills**: Comparison of Listening skills assessment at schools and listening skills from now on to improve communication skills/ The Key Elements and the focus towards distraction/ 3 P's of listening/ Comprehensive Listening: Understanding the message and the sound (Gap Fill Exercise/ Note/Form/Sentence Completion Exercise) Critical Listening: Evaluating the message and the sound (Short Answer Questions/Listen and Label)- Strategies to effective listening Skills: Practice series of Listening skills Exercises - **Speaking Skills**: Extempore Speaking/ Three Vital Components/ Techniques Involved to speak- Do's and Don'ts'/ Sample Videos of extempore presentations and review by students for self- Realization- **Reading Skills:** Reading Styles/Strategies to Reading/ Reading Comprehension (Exercise of Match the heading/Yes-No-Not Given/Read and Fill/- Reading Charts- Trends- Adverbs- Prepositions)	7
IV	**Formal Correspondence and Creative Content Framing** Introduction to formal Writing techniques- Difference between Formal and Informal Writing- Formats in Formal Mails and letters- Words and phrases to be avoided in Formal Correspondence- Email and Letter writing scenarios in College correspondence- **Creative Writing-** Skills exposed in Creative Writing- Types of Writing-Developing contents on a prompt- Creative Writing Practice	4

V	**Presentation skills for Engineers** Structure of Presentations-Use of aids like Power point- Do's and Don'ts of presentation-Types of presentation- Body Language during presentation- The practical execution of Presentation skills (Individual and Technical) along with review and feedback **Non-verbal Communication** Difference between Verbal and Non-verbal Communication-Physical Appearance-"Do Looks really Matter?"- Body Language - Tips for improving Non-verbal communication (Gesture/Posture/Facial Expression/Personal Appearance/ Eye contact)	3

Text Books	1.	Communication Book for Budding Professionals by Sindhu Panikar and Priyanka Sharma (Edition 2 - 2021)
E--Books	1.	Bridging the Soft Skills Gap, Bruce Tulgan
Reference Books	1.	Soft Skills for enhancing Employability (Connecting Campus to Corporate) , M S Rao
	2.	Communication Skills for Technical Students, Mr. Farahatulla
Online TL Material	1.	Online Lectures/Exercises/Assessment/Evaluation/Quizzes shall be made available with extended learning

Sr. No.	Name of Activities
1	**Listening Skills**: *Comprehensive Listening : Gap Fill Exercise/ Form, Note, Sentence Completion *Critical Listening : Short Answer Questions/ Listen and Label
2	**Speaking Skills**: *Extempore Speaking
3	**Reading Skills**: *Reading Comprehension: Match the headings/ Yes, No, Not Given Statement/ Read & Fill * Reading Charts
4	**Writing Skills:** * Formal Correspondence: Email and Letter writing for college Scenarios * Creative Writing with quotes, statements and a Picture prompt
5	**Presentation Skills :** *PPT designing Beginner level with Vision Board (Goal Setting) * Oral Presentation with Professional Body Language

Course Code	Course Name	Instructors	Institute	Duration	Platform	Link	Start Date
23BTSHL109 Branch	Indian Knowledge System (IKS): Concepts and Applications in Engineering	Prof. B. Mahadevan, Dr. Vinayak Rajat Bhat, Dr. R Venkata Raghavan	Indian Institute of Management Bangalore (IIMB), Chanakya University, Bangalore, Indian Institute of Technology Bhubanewar	10 weeks	Swayam	https://onlinecourses.swayam2.ac.in/imb23_mg53/preview	31 July 2023
23BTSHL110 Branch	Social History of Medicine in Colonial India	Prof. John Bosco Lourdusamy	IITM	8 weeks	NPTEL	https://onlinecourses.nptel.ac.in/n	21 Aug 2023
23BTSHL111 Branch	Modern Indian Architecture	Prof. P. S.Chani	IITR	8 weeks	NPTEL	https://onlinecourses.nptel.ac.in/noc23_ar14/preview	21 Aug 2023

Elective: Indian Knowledge System Course List (IKS)

Course Title: Indian Knowledge System (IKS): Concepts and Applications inEngineering										
Semester	I/II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd/ Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	IKS	2 Hr	--	--.	2	10	15	50	--	--
Course Code	23BTSHL109 AI/CS/DS/ CY/IT/EE/CE/ ME/EC									
Teaching Mode	Offline	2 Hrs.			Total	75				
Duration of ESE	NA					75				

Course Objectives	To make the students understand the rich heritage of our traditions
	To give the the students a platform to expose to the dynamic function in Indian knowledge system
	To enhance the knowledge of Sanskrit in getting to the roots of philosophical concepts.
	To inspire the students to learn and appreciate the origin and development of Indic thought and practices from ancient to current times.
	To give students insight of practices that will prepare one for the inner-journey to discover the Self

Course Outcomes	Students will be equipped with the scientific functions and methodology of Vedas.
	Student will learn and practice number system, mathematical calculations and Astronomy.
	Student will be able to understand ancient concepts and applications of Engineering Technology.
	Student will be able to understand Architecture heritage framework and classifications.
	Students will be able to gain command over Linguistic of Sanskrit.

CO PO Mapping

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	--	--	--	--	--	--	--	--	--	--	--	1
CO2	--	--	--	--	--	--	--	--	--	--	--	1
CO3	--	--	--	--	--	--	--	--	--	--	--	1
CO4	--	--	--	--	--	--	--	--	--	--	--	1
CO5	--	--	--	--	--	--	--	--	--	--	--	1

Course Syllabus

Indian Knowledge System (IKS): Concepts and Applications in Engineering

Duration :10 Weeks

Course layout

Week 0: Welcome to the course

Week 1: Indian Knowledge System – An Introduction

Week 2: The Vedic Corpus

Week 3: Number System and Units of Measurements

Week 4: Mathematics

Week 5: Astronomy

Week 6: Engineering and Technology: Metals and Metalworking

Week 7: Engineering and Technology: Other Applications

Week 8: Town Planning and Architecture

Week 9: Knowledge Framework and Classification

Week 10: Linguistics

Books and references

- **Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavana R.N. (2022),** "Introduction to Indian Knowledge System: Concepts and Applications", PHI Learning Private Ltd.Delhi.

Additional Readings:

- Pride of India: A Glimpse into India's Scientific Heritage, Samskrita Bharati,New Delhi.
- Sampad and Vijay (2011). "The Wonder that is Sanskrit", Sri AurobindoSociety, Puducherry.
- Bag, A.K. (1979). Mathematics in Ancient and Medieval India, Chaukhamba Orientalia, New Delhi.
- Datta, B. and Singh, A.N. (1962). History of Hindu Mathematics: Parts I and II, Asia Publishing House, Mumbai.
- Kak, S.C. (1987). "On Astronomy in Ancient India", Indian Journal of History ofScience, 22(3), pp. 205–221.
- Subbarayappa, B.V. and Sarma, K.V. (1985). Indian Astronomy: A Source Book, Nehru Centre, Mumbai.
- Bag, A.K. (1997). History of Technology in India, Vol. I, Indian NationalScience Academy, New Delhi.
- Acarya, P.K. (1996). Indian Architecture, Munshiram Manoharlal Publishers, New Delhi.
- Banerjea, P. (1916). Public Administration in Ancient India, Macmillan,London.
- Kapoor Kapil, Singh Avadhesh (2021). "Indian Knowledge Systems Vol – I &II", Indian Institute of Advanced Study, Shimla, H.P.

<table>
<tr><td colspan="11">Course Title: Indian Knowledge System (IKS): Social History of Medicine In Colonial India</td></tr>
<tr><td rowspan="2">Semester</td><td rowspan="2">I/II</td><td colspan="4" rowspan="2">Teaching Scheme</td><td colspan="5">Evaluation Scheme</td></tr>
<tr><td colspan="3">Theory</td><td colspan="2">Practical</td></tr>
<tr><td>Term</td><td>Odd/ Even</td><td>Th</td><td>Tu</td><td>Pr</td><td>Credits</td><td>TAE</td><td>CAE</td><td>ESE</td><td>INT</td><td>EXT</td></tr>
<tr><td>Course Category</td><td>IKS</td><td rowspan="2">2 Hrs</td><td rowspan="2">--</td><td rowspan="2">--</td><td rowspan="2">2</td><td rowspan="2">10</td><td rowspan="2">15</td><td rowspan="2">50</td><td rowspan="2">--</td><td rowspan="2">--</td></tr>
<tr><td>Course Code</td><td>23BTSHL110 AI/CS/DS/ CY/IT/EE/CE/ ME/EC</td></tr>
<tr><td>Teaching Mode</td><td>Offline</td><td colspan="3" rowspan="2">2 Hrs.</td><td rowspan="2">Total</td><td colspan="3">75</td><td colspan="2"></td></tr>
<tr><td>Duration of ESE</td><td>NA</td><td colspan="5">75</td></tr>
</table>

Duration :8 Weeks

Course layout

Week 1: Introduction: Significance of medicine in the colonial context - Colonial understandings of Indian landscape, diseases and causations - Initial attitudes towards indigenous systems — Concerns about survival and initial medical measures**Week 2:** The IMS (Indian Medical Service) - Medical Departments - Enclavism - Shifts in the discourses on race, climate and diseases - Hill stations and Sanatoria - Medical Education

Week 3: From White personnel's health to 'Native' and Public Health - Challenge of Epidemics (Smallpox, Malaria, Cholera, Plague), Sanitary Measures, Challenges of International Trade and Politics

Week 4: Local Response - Compliances and Resistances - Cultural challenges - Volunteer Associations – Role of media and local intelligentsia

Week 5: Tropical Paradigm - Tropical Diseases and Tropical Medicine; Medical Research – Emergence of Bacteriological and other Research Institutions – Malarial and other field surveys/researches - Vaccine Research and Production

Week 6: Colonial Medicine and Women – Zenana Missions, Lock Hospitals, Scientific Midwifery, Nursing, Women's Medical Institutions, Women's MedicalService (WMS).

Week 7: Non-State initiatives – Setting up of funds, dispensaries, hospitals and colleges through private philanthropy – Role of Missionaries

Week 8: Western versus Indigenous Systems – Revivalist movements - Professionalization of indigenous systems - Standardization of texts and drugs -Commercialization

Books and references

1. Arnold, David. 1993. Colonizing the Body: State Medicine and Epidemic Disease in Nineteenth-Century India. Berkeley: University of California Press.
2. Bala Poonam, ed. 2012. Contesting Colonial Authority: Medicine and IndigenousResponses in Nineteenth-and Twentieth-Century India. Lanham: Lexington Books.
3. Chakrabarti, Pratik. 2014. Medicine and Empire: 1600 - 1960. Basingstoke: Palgrave Macmillan.
4. Harrison, Mark. 1994. Public Health in British India: Anglo-Indian Preventive Medicine 1859 - 1914. Cambridge: Cambridge University Press.
5. Kumar, Anil. 1998. Medicine and the Raj: British Medical Policy in India, 1835- 1911. Walnut Creek: Altamira Press.

Course Title: **Indian Knowledge System (IKS): Modern Indian Architecture**										
Semester	I/II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd/ Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	IKS	2 Hr	--	---.	2	10	15	50	--	--
Course Code	23BTSHL111 AI/CS/DS/ CY/IT/EE/CE/ ME/EC									
Teaching Mode	Offline	2 Hrs.			Total	75				
Duration of ESE	NA					75				

Duration: 8 weeks

Course layout

Week 1: Introduction, Pre-Independence, Pre-Independence to Independence- Part1

Week 2: Pre-Independence to Independence- Part 2, Revivalism, The First Generation 1945 - 1970- Part 1 to 3

Week 3: The First Generation 1945 - 1970- Part 4 to 7, Impact of Western Architects: Le Corbusier- Part 1

Week 4: Impact of Western Architects: Le Corbusier- Part 2 to 4, Impact of Western Architects: Louis I. Kahn- Part 1 to 2

Week 5: Impact of Western Architects: Louis I. Kahn- Part 3 to 4, Impact of Western Architects: Walter Gropius, Introduction to Critical Regionalism, Critical Regionalism: Climate Responsive Perspective- Part 1

Week 6: Critical Regionalism: Climate Responsive Perspective- Part 2 to 4, Critical Regionalism: Other Contexts

Week 7: Structure in Modern Indian Architecture, Points-Blocks and High-Rises, Housing in India- Part 1

Week 8: Housing in India- Part 2, Women in Modern Indian Architecture, Search for a new Architecture

Books and references

- Beri, s. (2022). Spaces inspired by nature. Super book house.Bhatt, v., & scriver, p. (1990). After the masters. Mapin pub.
- Cantacuzino, s. (1984). Charles correa/essay by sherban cantacuzino. Concept media pte. Ltd.
- Droste, m. (2019). Bauhaus. Updated edition (updated ed.). Taschen.

- Gossel, p., & leuthauser, g. (2005). Architecture in the twentieth century (2nd us(slipcase, 2 vols) ed.). Taschen.
- Hitchcock, h.-r., & johnson, p. (1997). The international style. Ww norton & co.

- (2022). Contemporary houses by indian architects. Ia group.

- Lang, j. (2002). A concise history of modern architecture in india. Permanent black. Mehrotra, r. (2011). Architecture in india: since 1990. Hatje cantz.

Course Title: **Integrated Personality Development-I**												
Semester	I/II	**Teaching Scheme**				**Evaluation Scheme**						
						Theory			Practical			
Term	Odd	Theory	Tutorial	Practical	Credits	TAE	CAE	ESE	INT	EXT		
Course Category	CC1	-	-	4 Hrs	2	-	-	-	25	25		
Course Code	23BTSHP112Branch											
Teaching Mode	Offline	4Hours			Total	-			50			
Duration of ESE	NA					50						

Course Objectives	To provide students with a holistic value-based education that will enable them to be successful in their academic, professional, and social lives.
	To give the students the tools to develop effective habits, promote personal growth, and improve their well-being, stability, and productivity
	To allow students to establish a stronger connection with their family through critical thinking and development of qualities such as unity, forgiveness, empathy, and effective communication.
	To provide students with soft skills that complement their hard skills, making them more marketable when entering the workforce
	To inspire students to strive for a higher sense of character by learning from role models who have lived principled, disciplined, and value-based lives.

Course Outcome	Students will learn to visualize their future goals and will structure their lives through smart goals to give themselves direction and ultimately take them to where they want to go
	Students will explore the detrimental effects of addictions on one's health, personal life, and family life. They will learn how to take control of their life by becoming addiction free.
	Students will understand the importance and benefits that forgiveness plays in their personal and professional life. They will learn to apply this knowledge in realistic situations.
	Students will learn the six steps of teamwork and harmony that are essential for students' professional and daily life. Students will explore a new approach to leadership, through humility
	Students will learn to cope with current and future causes of stress. They will develop a variety of practical financial skills that prepare them to become financially stable throughout their future careers.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcome	**Program Outcomes and Program Specific Outcomes**														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**3**
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**3**
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**3**
C04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**3**
C05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**3**

Lecture No.	Content	Hours
1	**Remaking Yourself** - Restructuring Yourself	2
2	**Remaking Yourself** - Power of Habit	2
3	**Learning from Legends** - Tendulkar & Tata	2
4	**Facing Failures** - Failures are not Always Bad	2
5	**Remaking Yourself** - Being Addiction-Free	2
6	**Soft Skills** - Teamwork & Harmony	2
7	**Remaking Yourself** - Handling the Devil - social media	2
8	**From House to Home** - Forgive & Forget	2
9	**From House to Home** - Listening & Understanding	2
10	**Financial Wisdom** - Basics of Financial Planning	2
11	**Soft Skills** - Networking - Decision Making - Leadership	2
12	**Review Lecture** - Student Voice-1	2
Total		**24**

Topic	Reference Books
Restructuring Yourself/ Power of Habit/Being Addiction-Free/ Handlingthe Devil - social media	• Power of Habit, Charles Duhigg, Random House Trade Paperbacks, 2014 • The Seven Habits of Highly Effective People, Stephen Covey, Simon & Schuster, 2013 • Atomic Habits, James Clear, Random House, 2018
ssFailures are not AlwaysBad	• Born Again on the Mountain: A Story of Losing Everything and Finding It Back, Arunima Sinha, Penguin, 2014 • Failing Forward: Turning Mistakes into Stepping Stones for Success, John C. Maxwell, Thomas Nelson, 2007
Teamwork & Harmony/Networking - Decision Making - Leadership	• The 17 Indisputable Laws of Teamwork, John Maxwell, HarperCollins, 2013 • Predictably Irrational, Revised and Expanded Edition: The Hidden Forces That Shape Our Decisions, Harper Perennial, Dan Ariely, 2010
Basics of Financial Planning	• Rich Dad Poor Dad, Robert Kiyosaki, Plata Publishing, 2017 • The Intelligent Investor, Benjamin Graham, Harper Business, 2006
Forgive & Forget/ Listening and Understanding	"What Makes a Good Life? Lessons from the Longest Study on Happiness", R. Waldinger, Ted Talks, 2015

Course Title: **Manufacturing Science**										
Semester	II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Even	L	T	P	Credits	TAE	CAE	ESE	INT	EXT
Course Category	BSC 4	2	-	2	03	10	15	50	25	-
Course Code	23BTSHL114 ME 23BTSHP114 ME									
Teaching Mode	Offline	4 Hrs.			Total	75			25	
Duration of ESE	2 Hrs.					100				

Course Objectives	1. To identify the basic manufacturing processes.
	2. To understand the basics of joining processes.
	3. To illustrate the concepts of powder metallurgy.
Course Outcomes	Upon successful completion of this course, student shall be able to:
	CO 1. Choose casting processes for various applications.
	CO 2. Illustrate different forming processes.
	CO 3. Make use of various welding operations in engineering applications.
	CO 4. Explain different plastic processing methods.
	CO 5. Adapt powder metallurgy for strengthening.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	2	-	2	-	-	-	-	-	3	-	2
CO2	3	3	3	3	3	-	2	-	-	-	-	-	3	-	2
CO3	3	3	3	3	2	-	2	-	-	-	-	-	3	-	2
CO4	3	2	3	2	2	-	2	-	-	-	-	-	3	-	2
CO5	3	2	2	2	3	-	2	-	-	-	-	-	3	-	1

Course Contents:

Unit	Contents	Hours
I	**Casting Process:** Introduction, pattern making: types, materials used, pattern making allowances, color codes, core making: types of cores, classification of casting, casting processes (Investment, Die & Centrifugal), riser, runner.casting defects. Moulding: types of sand mould.	06
II	**Forming Processes:** Advantages and drawbacks, hot and cold rolling, wire drawing, forging, extrusion, embossing, etc., sheet metal working process & sheet metal operations.	06
III	**Joining Processes:** Introduction to welding processes, Types of welding. Arc welding (TIG, MIG, Submerged Arc, Metal arc), Gas Welding	06
IV	**Processing of Plastics:** Thermosetting and thermo plastics, General plastic processes: injection moulding, compression molding, transfer molding, blow molding.	06
V	**Powder Metallurgy:** Powder manufacture and conditioning, production of sintered structural components, cemented carbides, ceramics, sintered carbide cutting tools. Advanced topics	06

Text Books	1.	Manufacturing Technology (foundry Forming and Welding) by P.N. Rao, TMH education, Fourth edition, and 2006.
	2.	Workshop Technology (Volume I)', by Hajra Chaudhary, Media Promoters and Publishers, 2007.
	3.	Manufacturing Science by Ghosh and Malik Affiliated East-West Press Private Limited, 2010.
	4.	Manufacturing Engineering and Technology', by S. Kalpak Jain and S R Schmidt, Wesley.
E-Books	1.	Introduction to Basic manufacturing processes and Workshop Technology by Rajender Singh ,New Age International
	2.	Fundamentals of Modern Manufacturing, Materials, Processes, and systems by Mikel P. Groover, Fourth edition, John Wiley and Sons
Referenc eBooks	1.	Sheet metal forming processes and dies design by Vukota Boljavonic, Industrial Press, and New York.

Reference Books	3.	Metal Shaping Processes by Vukota Boljavonic ,Industrial Press Inc., NewYork
	4.	'Workshop Technology Vol. I & II' , B.S. Raghuvanshi , Dhanpat RaiPublications, 2009
On line TL Material	1.	Manufacturing Process-1,Prof. Inderdeep Singh IIT Roorkee, nptel,https://nptel.ac.in/courses/112107145/
	2.	Manufacturing Process-2 Prof. A.B. Chattopadhyay IIT Kharagpur, nptel,https://nptel.ac.in/courses/112105126/
	3.	Metal Casting Prof. D.B. Karunakar IIT Roorkee, nptel,https://nptel.ac.in/courses/112107083

Sr. No.	**Name of Experiments / Mini Projects/ Case Studies**
1	Practical on pattern making
2	Practical on mould making
3	Practical on casting
4	Practical on arc welding
5	Practical on soldering
6	Mini Project/Fabricated model using Arc welding
7	Mini project/Fabricated model using patternmaking, moulding and casting.
Open Ended Experiments	
1	Practical on Gas Welding
Details of on line Laboratory Resource Material Instruction / Operating Manuals	
1.	Virtual Labs – Metal Forming Lab http://msvs-dei.vlabs.ac.in/msvs-dei/
2.	Virtual Labs – Fab Lab http://fab-coep.vlabs.ac.in/
3.	Virtual Labs – General purpose Production shop simulation lab http://gssl.iitk.ac.in/pssl/

Course Title: **Biomedical Engineering**										
Semester	I/II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd/Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	BSC5	2 Hrs.	--	2 Hrs.	3	10	15	50	25	-
Course Code	23BTSHL115 BRANCH 23BTSHP115 BRANCH									
Teaching Mode	Offline	4 Hrs.			Total	75			25	
Duration of ESE	2 Hrs					100				

Course Objectives	It helps students to understand importance of biological concepts in engineering fields.
	To understand application of engineering concepts in medical instrumentation.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Understand Human anatomy
	CO2: Able to apply appropriate biosensor
	CO3: Relate various applications of Biomedical instrumentation with safety standards.
	CO4: apply and suggest diamagnetic medical instruments
	CO5: Analyses and apply various biomedical diagnostic methods.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	PO 1	PO2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	-	2	2	-	-	-	-	-	2
CO2	2	2	2	-	3	2	-	-	-	-	-	3
CO3	3	2	2	-	3	2	-	-	-	-	-	3

Course Contents:

Unit	Contents	Hours
I	**Human Physiology and Anatomy:** Introduction to Human anatomy & Physiology, Nervous system, Cardiovascular system, Skeleton system	5
II	**Biosensors:** Generations of biosensors; Basic principle and instrumentation of different biosensors: electrochemical, optical, acoustic, piezoelectric ,and calorimetric biosensors;	5
III	**Biomedical Instrumentation**: Bio-electric Signals, Types of Electrodes, Electrodes for ECG, EMG, EEG,ECG Machine, B. P, Heart Rate, Heart Sound, Blood Flow Measurements.Electrocardiography,	5
IV	**Diagnostic Medical instruments:** X-ray, CT Scan, MRI, Ultrasonic Doppler Machine, Diathermy, Lasers in medical application, Pacemakers, Defibrillators, Biomedical Standards.	5
V	**Biomedical Applications:** Robotics in medical application, AI/ML for Medical applications, Case studies, Advance topics in biomedical Engineering.	5

Text Books	1.	Biomedical Instrumentation and Measurement, Cromwell, PHI.
	2.	Biomedical Instrumentation, R. S. Khandpur,
Reference Books	1.	Carr and Brown, “Biomedical Instrumentation”.
	2.	Webster, “Application and Design of Medical Instruments".
On line TL Material	1.	https://onlinecourses.nptel.ac.in/noc21_bt50/preview

Sr. No.	Name of Experiments / Mini Projects/ Case Studies
1	Study of Human Physiology by Skeleton model
2	Design and perform Heart Rate Detection System using Arduino
3	To study and measure the EEG signals
4	To study and measure the ECG signals
5	To study and measure the EMG signals
6	Mini project
7	Open Ended Experiments

Course Title: **Construction Material & Workshop Practices**										
Semester	I	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	BSC5	2 Hrs.	-	2 Hrs.	03	10	15	50	25	-
Course Code	23BTSHL116 CE 23BTSHL116 CE									
Teaching Mode	Offline	4 Hrs.			Total	75			25	
Duration of ESE	2.5 Hrs.					100				

Course Objectives	To identify the various elements of building and material.
	To describe methods and techniques used for various types of construction work.
	To define terminologies associated with Building & its Functional Facilities.
Course Outcomes	**CO1**: Define types of Foundation and basic requirements for building.
	CO2: Identify various components of construction of Building.
	CO3: Select appropriate material for building construction.
	CO4: Examine requirements in various construction related activities and their quality control.
	CO5: Select appropriate conventional as well as sustainable materials for Construction Work of building.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	--	--	3	3	--	3	--	--	--	--	2	3	--	1
CO2	3	--	--	3	3	--	3	--	--	--	--	2	3	--	1
CO3	3	--	--	3	3	--	3	--	--	--	--	2	3	--	1
CO4	3	--	--	3	3	--	3	--	--	--	--	2	3	--	1
CO5	3	--	--	3	3	--	3	--	--	--	--	2	3	--	1

Course Contents:

Unit	Contents	Hours
I	**Foundations:** Necessity and types of R.C.C. foundations, Detail of Deep foundation and precast foundation in general, Details shallow foundations.Bearing capacity of soils and its assessment.	8
II	**Brickwork:** Qualities of good bricks, classification of bricks tests on bricks as per as codes. Terms used in brickwork, commonly used types of bonds in brickwork such as header, stretcher, English and Flemish bonds, principles of construction. Reinforced brickwork, brick knogging. Parapets, copings, sills and corbels, brief introduction to cavity walls, load bearing and partition walls. Masonry construction using cement concrete blocks and clay walls, load bearing and partition walls. Masonry construction using cement concrete blocks and clay blocks. Precast construction: Introduction to method and materials. Precast elements like poles, cover, jallies, steps corbets, truss element etc.	8
III	**Stone Work:** Stones, cutting and dressing, selection of stones types of stone masonry, principles of construction joints in masonary. Lifting heavy stones, **Arches and Lintels:** Terminology in contraction, type's chajjas and canopies, precast Lintels & Arches. **Damp Proofing:** Causes and effect of dampness. Various methods of damp proofing Damp proofing in plinth protection, New Techniques of Damp proofing. Epoxy etc.	8
IV	**Floors and Roofs:** Floors: General Principals, types and method of construction, floors finished quality, testing floor tiles, synthetic & Ceramic Tiles. Roofs: Flat and pitches roofs, roof coverings, types AND their constructional features. Thermal Insulation **Stairs:** Types of stairs, functional design of stairs. **Doors and Windows:** Purpose materials of construction and types.	8
V	**Plastering and Pointing:** Necessity, types and methods **Temporary Timbering:** Centering and formwork shoring, underpinning and scaffolding. **Painting:** White washing, colour washing and distempering new materials & Techniques.	8

Text Books	1.	Dr. B. C. Punmia, Ashok Kr. Jain, Arun Kr. Jain, Building Construction, 11th Edition, Laxmi Publications (p) LTD, New Delhi, 2015
	2.	Chudley, R. Greeno (2006), Building Construction Handbook' (6), R. Butterworth-Heinemann
	3.	Building Construction by Rangwala Charotar Pub. House
E-Books	1.	http://gtuinfo.com/Subject/2110004/ECE/Elements_of_Civil_Engineering/Books
	2.	Concrete: Microstructure, Properties, and Materials, Fourth Edition

Reference Books	1.	S.C.Rangwala, Building Construction, 30th Edition, Charotar Publishing House, 2011
	2.	Gurcharan Singh, Building Construction & Material, 14 th Edition, Standard Book House, Rajsons Publication Pvt. LTD, 2011
	3.	Building Materials, P.C. Varghese, Prentice-Hall India, 2005
	4.	Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to materials used for Civil Engineering applications
Online NPTEL Material	1.	www.nptel.iitm.ac.in/iitDelhi (https://nptel.ac.in/courses/105/102/105102088/)

Sr. No.	Name of Experiments / Case Studies
1	To study the various construction Material
2	To Draw the Sign & Symbols of the various construction Material & Building Component
3	To Draw the Sketches of different types of Foundations
4	To Draw the Sketches of different types of bonds in Brickwork
5	To Draw the Sketches of different types of bonds in Stonework
6	To Draw the Sketches of different types of Lintels & Arches
7	To Draw the Sketches of different types of Doors & Windows
8	To Draw the Sketches of different types of Staircases
9	To Draw the Sketches of different types Roofs
10	To Draw the Sketches of different types Scaffolding.

Courses offered by Artificial Intelligence Board

Course Title: **Introduction to Artificial Intelligence and Machine Learning**										
Semester		Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	PCC1	1	--	2	2	10	15	50	25	--
Course Code	23BTAIL101 23BTAIP101									
Teaching Mode	Offline	3 Hrs.			Total	75			--	
Duration of ESE	2 Hrs.					100				

Course Objectives	1. Understand the fundamental concepts and principles of AI and ML, including their history, applications, and impact on society.
	2.Gain knowledge of different types of intelligent agents and their architectures, and develop an understanding of how agents can solve problems and make decisions
	3.Gain practical experience in implementing and applying supervised learning algorithms, such as linear regression, logistic regression
Course Outcomes	Up on successful completion of this course, student will be able to:
	CO1: Understand the basic concepts, principles, and goals of AI and ML.
	CO2: Identify and differentiate various AI techniques and their applications in real-world scenarios.
	CO3: Analyze problem spaces and formulate problems as computational tasks suitable for AI techniques.
	CO4: Develop programming skills to implement AI and ML algorithms using programming languages and frameworks commonly used in the field.
	CO5: Apply supervised learning algorithms, such as linear regression, logistic regression to solve classification and regression problems.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1		**3**												
CO2		**3**	**3**	**3**										
CO3		**3**	**3**	**3**										
CO4					**3**									**3**
CO5		**3**	**3**	**3**	**3**									**3**

Course Contents:

Unit	Contents	Hours
I	**Introduction to AI**: Definition and goals of AI, History and evolution of AI, Applications of AI in various domains, Ethical considerations in AI, Intelligent Agents - Agent-based systems, Agent architectures, Problem-solving agents	3
II	**Problem Solving:** Solving Problems by Searching: Problem Solving Agents, Searching for Solutions, Uninformed Search Strategies, Informed Search Strategies, Heuristic Functions, Local Search Algorithms and Optimization Problems, Local Search in Continuous Space,	4
III	**Introduction to Machine Learning:** Definition Machine Learning, Difference between machine learning and traditional programming, Evolution of machine Learning, Types: Supervised ML, Unsupervised,Reinforcement Learning, Types of Variable: Independent Variable, Dependent Variable, Understanding Data Types: Continuous and Categorical Variables, Data Pre-processing and Feature Engineering, Real Time Application of Machine Learning. **Supervised Learning Algorithms:** Linear Regression, Types: Simple Regression, Multiple Regression Assumption of Linear Regression,Overfitting and Underfitting, Bias and Variance Trade-off Evaluation Metrics of Linear Regression: SSE, SST, MSE, RMSE, R-Squred. Adj R-sq. **Unsupervised Learning Algorithms:** PCA & clustering.	7
IV	**Ethics in AI:** Introduction to ethical action, ethical reasoning approaches by AI, Ethical behavior levels. The Ethical Status of AI Systems, Ethical Benefits of AI, Legislation and Regulation.	2

Sr. No.	List of Experiments
1	Installation of Python and IDEs.
2	Loading different types of dataset, creating data frame and performing basic operations on data frame.
3	Introduction to Statistics for Exploratory Data Analysis – Description of data, Correlation, Covariance, Measures of Central Tendency etc.
4	Perform Data Cleaning and Feature scaling on given dataset.
5	Data Preparation using Scikit Learn - Splitting of dataset
6	Implement simple and multiple linear regression algorithm
7	Implement logistic regression
8	Implement Clustering
9	Data Visualization using matplotlib and seaborn
Open Ended Experiments / New Experiments	
1	Based on multiple features/variables perform Linear Regression. For example, based on a number of additional features like number of bedrooms, servant room, number of balconies, number of houses of years a house has been built – predict the price of a house.

Elective-I: Vocational and Skill Enhancement

Course Title: **Vocational and Skill Enhancement I (Data Visualization)**										
Semester	I	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	VSEC1	1	--	2 Hrs.	2	10	15	--	25	--
Course Code	23BTAIL102 23BTAIP102									
Teaching Mode	Offline	3 Hrs			Total	25			25	
Duration of ESE	--					50				

Course Objectives	1. To understand the role and necessity of Data Visualization. 2. To analyze and comprehend the various data in different charts. 3. To learn the applicability of the techniques in data visualization. 4. To use Advanced Data Cleaning and Transformation Tool in multidisciplinary environments.
Course Outcomes	Upon successful completion of this course, student will be able to: **CO1:** Apply appropriate Python Libraries to visualize a data. **CO2:** Create different charts for categorical data. **CO3:** Apply the knowledge to Selected appropriate Dataset and visualize it in different plot. **CO4:** Visualize a selected appropriate data by using Advanced Excel methods and Python Libraries. **CO5:** Use Advanced Data Cleaning and Transformation Tool in multidisciplinary environments.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	--	3	--	3	3	--	--	--	--	--	--	--	1	--
CO2	--	3	--	3	3	--	--	--	--	--	--	--	3	--
CO3	--	3	--	2	3	--	--	--	--	--	--	--	2	--
CO4	--	3		2	3	--	--	--	--	--	--	--	1	--
CO5	--	3	--	2	3	--	--	--	--		--	--	1	--

Course Contents:

Unit	Contents	Hours
I	Introduction of basic Python Library: What is data analysis and data transformation? How to Visualize Data with Python, Matplotlib & Seaborn, Matplotlib Pyplot , Matplotlib Plotting, Matplotlib Markers, Matplotlib Line, Line Styles, Line Color, Line Width, Matplotlib Labels and Title, Customize the X-axis in MatPlotLib. What is Seaborn, Installation of Seaborn Library ,Different categories of plot in Seaborn , Some basic plots using seaborn, Data Visualization with Seaborn Line Plot	4
II	Data Visualization Scatter Plots with a Trend Line, compare categorical data or display frequency distributions with data labels ,Histograms with Density Plots with Seaborn histplot , Add Outline or Edge Color to Histogram in Seaborn, Boxplot using Seaborn in Python, Grouping variables in Seaborn boxplot with different attributes., Coloring Boxplots with Palettes, Mean on Boxplot, Histograms **in MatPlotLib, Multiple Histograms in MatPlotLib,** Matplotlib Pie Charts, Labels.	4
III	Data Visualization: Using Advanced Excel Data Visualization in Excel, Power Pivot Table, Excel Power Query with customizable calculations and visualizations, data labels, Excel Power View and Data Model, Create Charts and Visualizations (line, data bar, column, tree map) charts by using Advanced Excel methods, Microsoft Power Map for Excel is a three-dimensional (3-D) data visualization tool, Clean Data in Excel, Excel's data tools like Text to Columns for importing data. Removing duplicates**.**	4

Text Books	1.	**Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython**
	2.	**Python Data Analytics: Data Analysis and Science using pandas, matplotlib and the Python Programming Language, Fabio Nelli**

	3	**Matplotlib for Python Developers: Effective techniques for data visualization with Python, 2nd E** Aldrin Yim, Claire Chung, Allen Yu
E-Books	1.	Mastering Python Data VisualizationBy Kirthi Raman · 2015
	2.	**Data Analysis with Excel , by Manisha Nigam.**
	3.	**Power Pivot and Power BI: The Excel User's Guide to DAX, Power Query, Power BI & Power Pivot in Excel 2010-2016 Paperback**
Online TL Material	1.	https://jovian.ai/aakashns/python-matplotlib-data-visualization
	2.	https://www.w3schools.com/python/matplotlib_plotting.asp
	3.	https://www.tutorialspoint.com/excel_power_view/excel_power_view_map_visualization.htm

Sr. No.	Experiment List	Mapping With CO
1	Implementation of basic Python Library Matplotlib or Seaborn to create line plots, which are useful for visualizing trends and patterns in data over time or across different categories.	CO1
2	Create bar charts using Matplotlib or Seaborn to compare categorical data or display frequency distributions with data labels.	CO2
3	Use a data visualization library such as Matplotlib or Seaborn to create a histogram and plot the histogram, ensuring appropriate labelling of the x-axis, y-axis, and title to data.	CO1, CO2
4	Apply the Plotly library to create a boxplot visualization for the sales data and Compare the central tendency (median) and variability (interquartile range) among the product categories to understand differences in sales performance.	CO1, CO3
5	Use the Plotly library to create a pie chart visualization.	CO1, CO2
6	Apply advanced Excel Method to visualize a large dataset into Power Pivot Table and Power Query with customizable calculations and visualizations.	CO1, CO4
7	Create dynamic and interactive charts using features like data labels, trendlines, secondary axes, and combination of (e.g .line, data bar, column, tree map) charts by using Advanced Excel methods.	CO2, CO4
8	Apply the Advanced Excel add-ins like Power View, Power Query, and Power Map to enhance data visualization capabilities and create interactive reports	CO3,CO4
9	Use Excel's data cleaning tools like Text to Columns, Flash Fill, or Power Query to prepare data for visualization by transforming and standardizing it.(Advanced Data Cleaning and Transformation Tool)	CO4,CO5
10	Open Ended Practical	CO4,CO5

	Implement t-distributed stochastic neighbor embedding (t-SNE) in Python with scikit-learn. Analyze the visualizations and derive meaningful insights. Identify key trends, patterns, or anomalies in customer behaviour, product performance, or sales trends using Python Library or Advanced Excel Methods.	

Text Books	1.	Stuart Russell and Peter Norvig. Artificial Intelligence: A Modern Approach, 3rd Edition, Prentice Hall, 2009
	2.	Ronald J. Brachman, Hector J. Levesque: Knowledge Representation and Reasoning, Morgan Kaufmann, 2004.
	3.	Deepak Khemani. A First Course in Artificial Intelligence, McGraw Hill Education (India), 2013.
	4.	Elaine Rich, Kevin Knight, Shivshankar Nair, Artificial Intelligence, McGraw Hill.
E-Books	1.	http://www.rinai.iitmandi.ac.in/RinAI_2017/Representation&Reasoning_in_Logic_module_1.pdf
	2.	Patrick Henry Winston. Artificial Intelligence, Addison-Wesley, 1992. https://courses.csail.mit.edu/6.034f/ai3/rest.pdf
Reference Books	1.	R. C. Schank and C. K. Riesbeck: Inside Computer Understanding: Five Programs Plus Miniatures, Lawrence Erlbaum, 1981.
	2.	Murray Shanahan: A Circumscriptive Calculus of Events. Artificial. Intelligence 77(2), pp. 249-284, 1995.
	3.	John F. Sowa: Conceptual Structures: Information Processing in Mind and Machine, Addison Wesley Publishing Company, Reading Massachusetts, 1984.
	4.	John F. Sowa: Knowledge Representation: Logical, Philosophical, and Computational Foundations, Brooks /Cole, Thomson Learning, 2000.
Online Material	1.	https://archive.nptel.ac.in/courses/106/106/106106140/

Course Title:	**Vocational and Skill Enhancement II (Elective –II) (Artificial Intelligence with Python)**									
Semester	II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	VSEC2	1	--	2 Hrs.	2	10	15	--	25	
Course Code	23BTAIL105 23BTAIP105									
Teaching Mode	Offline	3 Hrs			Total	25			25	
Duration of ESE	--					50				

Course Objectives	1. To Utilize programming tools like Python, NumPy Pandas & Matplotlib.
	2.Understand applying Calculus and linear algebra to applications
	3. Perform key techniques of neural networks, including gradient descent and Backpropagation.
	4.Gain practical experience in implementing and applying AI with Python
Course Outcomes	Up on successful completion of this course, student will be able to:
	CO1: Understand the basic concepts, principles, and goals of AI with Python
	CO2: Identify various Linear Algebra Essentials required for AI applications in real-world scenarios.
	CO3: Analyze various Calculus Essentials suitable for AI techniques and applications.
	CO4: Develop programming skills to implement AI applications in Real-world scenarios.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	**Program Outcomes**												
	PO 1	PO2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**1**	**3**	**2**	**1**	**1**									
CO2	**1**	**3**	**3**	**3**	**1**									
CO3	**1**	**3**	**3**	**3**	**2**									
CO4	**2**	**3**	**2**	**1**	**3**									**3**
CO5	**2**	**3**	**3**	**3**	**3**									**3**

Unit	Contents	Hours
I	**Introduction to AI with Python:** Anaconda to manage packages and environments for use with Python. Jupyter Notebooks to create documents combining code, text, images, and more. Basics of Numpy, Pandas, and Matplotlib. Basic concepts of various fields of artificial intelligence like Artificial Neural Networks, Natural Language Processing, Machine Learning, Deep Learning, and its implementation in Python.	**3**
II	**Linear Algebra Essentials:** Basics and need of the Linear Algebra as mathematical tool. Vectors, Matrix and linear equations, Eigenvalues and Eigenvector, Probability Distribution operations using python.	**3**
III	**Calculus Essentials :** Introduction: Need of calculus a powerful concept in mathematics. Derivates Through Geometry: as an important indicator in the world of machine learning. Chain Rule & Dot Product: to find the derivative of a composition of two or more functions, as a very important tool in training a neural network. Integration: the inverse of a derivative: the integral.	**3**
IV	**Introduction To Neural Networks:** Understanding architecture of neural networks. Implement gradient descent and back propagation in Python. **Calculus in Neural Networks:** Relation of neural networks to calculus through an explicit example.	**3**

Text Books	1.	Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython.
	2.	Stuart Russell and Peter Norvig. Artificial Intelligence: A Modern Approach,3rd Edition, Prentice Hall, 2009
	3	Deepak Khemani. A First Course in Artificial Intelligence, McGraw HillEducation (India), 2013.
Ebook	1.	Calculus for Machine Learning, Understanding the Language of Mathematics .Author Stefania Cristina, Mehreen Saeed.
	2.	Linear Algebra Coding with Python: Python's application for linear algebra .Author Hyun-Seok Son

Sr. No.	List of Experiments
1	Installing Jupyter Lab and use Numpy, Pandas & Matplotlib to choose appropriate plots for one and two variables based on the types of data you have for any AI application.
2	Implement any linear equations concept of linear Algebra using python.
3	Implement Eigenvalues and Eigenvectors in Python
4	Implement Probability Distribution in Python.
5	Implement dot product of two vectors in Python.
6	Implement gradient descent in Python.
7	Implement back propagation in Python illustrating applications of differentiations in neural networks.
8	Using Open AI to create your own environments for any problem

Computer Science and Engineering Board

Course Title: Computer Fundamentals and Troubleshooting										
Semester	II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	PCC1	1	NA	2	2	10	15	50	25	NA
Course Code	23BTCSL101 23BTCSP101									
Teaching Mode	Offline	3 Hr			Total	100				
Duration of ESE	2 Hr 30 Mins									

Course Objectives	1. Understand the basic computer hardware and system requirements.
	2. Make them to install Operating system and operate basic software utilities
	3. Realize the importance of basic networking technologies.
Course Outcomes	After successful completion of the course, students will be able to:
	CO1: Identify different hardware peripherals , components in a CPU and its functions.
	CO2: Understand the different computer networking devices and commands.
	CO2: Apply their knowledge for assembling and disassembling of computer
	CO3: Apply their knowledge to install operating system and application software.
	CO4: Analyze the internet-based services, cyber security and cyber laws.
	CO5: Determine hardware and software problem through hardware and software Troubleshooting

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes												PSOs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	--	--	2	1	--	--	1	--	--	3	1	--
CO2	1	2	--	--	2	1	2	--	1	--	--	3	3	--
CO3	1	2	--	--	1	1	--	--	1	--	--	3	2	--
CO4	--	2	--	2	3	--	--	3	1	--	--	3	3	--
CO5	1	2	--	--	2	1	--	--	1	--	--	3	2	--

Course Contents:

Unit	Contents	Hours
I	**UNIT-1: Introduction to Computer Hardware and Software:** Introduction to hardware peripherals like RAM, ROM, keyboard, Mouse, processors, etc. Generation of processors. Introduction to software. Types of software (MS office, VLC media player, Win rar), etc Working of SMPS. Study of various ports. Steps and precautions to assemble computer. Study of different types of Motherboards, Motherboard Configuration, Identifying Internal and External connectors, Types of data cables, Types of Processor	3
II	**UNIT-2: Assembly of Computer, Diagnostic and Troubleshooting of PC**: Steps and precautions to assemble PC,POST (Power on Self Test), identifying problems by Beep codes errors, checking power supply using Multi-meter, Replacement of components etc. CMOS, Study of BIOS Set-up- Advance set-up, Boot configuration, Boot Menu, Test Sequence, Error Messages, Troubleshooting Procedures and Preventative Maintenance, Troubleshooting Tools and Diagnostic software, device drivers	3
III	**UNIT-3: Computer Network Tools** Introduction to computer network. Study of various networking devices .Study of various topologies. Study of various computer networks and networkconfiguration commands.	3
IV	**UNIT-4: Operating System and Software Installations**: Introduction to operating system. Types of operating system (Windows and Linux).Window:- Evolution of operating system.Linux:- Evolution of operating system. Introduction to software. Types of software (open office, web browser, etc.)Case study of Installations step for operating system and application software. Formatting of Hard disk, Partitioning of Hard disk in different logical drives, Disk structure: Cylinders, heads, platters, tracks and sectors, Disk defragmentation, Disk clean up, Scan disk etc.	3
V	**UNIT-5: Internet & Cyber Security** Introduction and evolution of internet. Structure of Internet. Different Internet Study of various internet-based services like Email, Social network etc. Introduction to Cyber Security and Cyber Laws.	3

Text Books	1.	Hardware Bible by Winn L. Rosch
	2.	Hardware and Software of Personal Computers by Sanjay K. Bose
	3	IBM PC & Clones: Hardware Trouble Shooting and Maintenance by B.Govindarajalu, Tata McGraw Hill
	4	PC Systems, Installation and Maintenance, Second Edition by R. P. Beales
EBooks	1.	https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SBS1104.pdf
	2	http://uru.ac.in/uruonlinelibrary/Cloud_Computing/PC-hardware-a-beginners-guide.pdf
Reference Books	1	Fundamentals of Computers by V. Rajaraman
	2	Modern Computer Hardware Course by M Lotia, P Nair, P Lotia
	3	PC Upgrade & Repair Black Book by Ron Gilster

List of Practical

1	To identify the peripherals of a computer, components in a CPU and its functions.
2	Assembling and Disassembling of different parts of computers
3	To study of different kinds of network cable and network devices.
4	To connect and configure computer in LAN.
5	To execute of different Networking commands (like ping, ssh, ifconfig, scp, netstat, ipstat, nslookup, traceroute, telnet, host, ftp, arp, wget,route.)
6	Install MS windows operating system on the personal computer.
7	Install Linux operating system on the personal computer.
8	To detect and solve computer problem using Hardware Troubleshooting
9	To detect and solve computer problem using Software Troubleshooting
10	To explore and Analysis the Security Vulnerabilities for hacking a websites / Web Applications, E-commerce services, Web Browser, Antivirus installation, malware, configuring a firewall and cyber laws etc.
11	Open Ended: Email creation and usage, Creating digital Profile on LinkedIn.

Course Title: **COMPUTER PROGRAMMING**										
Semester	I/II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	Th	Tu	Pr	Credits	TAE	CAE	ESE	Int	Ext
Course Category	VSEC1	1 Hr.	NA	2 Hrs.	2	10	15	--	25	--
Course Code	23BTCSL102 23BTCSP102									
Teaching Mode	Offline	3 Hrs.			Total	25			25	
Duration of ESE	-					50				

Course Objectives	To introduce the basics of components of programming language and also develop logical thinking
	To implement concepts of mathematics into programming.
	To help students understand how to model real-world problems into the software and develop practical programming skills
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Design algorithms and flowcharts for solving Mathematical and Engineering Problems
	CO2: Apply the suitable Control structures to solve the given problem
	CO3: Investigate the problems and Identify the use of Pointers and Functions in it.
	CO4: Assess the programming structure and recommend the type of array to be useful to find a solution for applications.
	CO5: Synthesize various problems to develop logical thinking

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	--	3	--	--	--	--	--	--	--	--	--	--	2	--
CO2	--	--	3	--	--	--	--	--	--	--	--	--	1	--
CO3	--	--	--	3	--	--	--	--	--	--	--	--	2	--
CO4	--	--	3	--	--	--	--	--	--	--	--	--	2	--
CO5	--	--	3	--	--	--	--	--	--	--	--	--	2	--

Course Contents:

Unit	Contents	Hours
I	Introduction to Programming: Evolution, Programming Paradigms, Features, Algorithm, Flow charts, Data types, Operators	2
II	Control Statements: Decision Making Statements: if, if-else, nested if-else, switch, go-to. Loop Control Statements: while, do-while, for, break, continue	4
III	Arrays: Definition, Declarations, Initialization, Accessing, Types of Arrays:1D,2D	3
IV	Pointers: Definitions, Declarations, Applications Functions: Definitions, Declarations, Types, Calling, Function arguments: Call by Value, Call by Reference	3
V	Structure: Definition, Accessing Structure MembersUnion: Definition, Accessing Union Members Advance Topic: Advance programming concepts	3

Text Books	1.	Kernighan and Ritchie, C programming language Prentice Hall of India,
	2.	Balguruswamy, "Programming in ANSI C", Tata Mcgraw Hill Publishing
	3.	Kakde and Deshpande, "C and Data Structure", Charles River Media Publisher
	4.	Yashwant Kanetkar, Let's C, BPB Publishers
E--Books	1.	S. K. Srivastava, Deepali Srivastava, "C in Depth", BPB Publications
	2.	Bharat Kinariwal, Tep Dobry,"Programming in C ",University of Hawaii at Manoa Publisher
Reference Books	1.	Herbert Schildt, C: The Complete Reference, Mcgraw Hill Publishing
	2.	Expert C Programming, Deep C Secrets by Peter van der Linden.
On-line TL Material	1.	https://spoken-tutorial.org/tutorial-search/?search_foss=C+and+Cpp

Sr. No.	Name of Experiments
1	Implement syntax of C with algorithm and flowchart
2	Implement Data Types and Type casting
3	Implement the Branch control statements in C
4	Implement the Loop control statements in C
5	Implement the concept of Pointers using C
6	Implement the Functions in C
7	Implement recursive functions in C
8	Implement the Linear Array Operations.
9	Implement the Matrix Array Operations Array for addition and multiplication
10	Implement Structures in C
Open Ended Experiments	
1	Student Record Management System
2	Simple CPP
Details of on line Laboratory Resource Material Instruction / Operating Manuals	
1.	https://spoken-tutorial.org/tutorial-search/?search_foss=C+and+Cpp
2	https://cse02-iiith.vlabs.ac.in/

Course Title: **Foundation of Data Analytics**										
Semester	I/II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	Int	Ext
Course Category	VSEC2									
Course Code	23BTCSL105 23BTCSP105	1 Hr.	NA	2 Hrs.	2	10	15		25	
Teaching Mode	OFFLINE	3 Hrs			Total	25			25	
Duration of ESE	NA					50				

Course Objectives	To perform descriptive statistics on the given dataset
	To perform inferential statistics on the given dataset
	Apply linear regression and logistic regression and perform data visualization on the given dataset with Tableau.
Course Outcomes	**CO1**: Analyze the dataset and perform Descriptive Statistics
	CO2: Analyze the dataset and perform an Inferential Statistics
	CO3: Apply linear regression on the given dataset
	CO4: Apply the logistic regression on the given dataset
	CO5: Create an interactive data visualization

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes											
	PO 1	PO2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	--	--	--	--	--	--	--	--	--	2	--
CO2	3	--	--	--	--	--	--	--	--	--	2	--
CO3	--	--	3	--	--	--	--	--	--	--	3	--
CO4	--	--	3	--	--	--	--	--	--	--	3	--
CO5	--	--	--	--	3	--	--	--	--	--	--	3

Course Contents:

Unit	Contents	Hours
I	Buzzwords of Data Science, Info-graphic representation of terminologies, Difference between Analysis and Analytics, Applications	3
II	Descriptive Statistics: Population and Sample, Types of Data, Measurement Levels, Representation of categorical variables, Measures of Central Tendency (Mean, Median, Mode), Skewness, Variance, Standard Deviation, Coefficient ofVariation, Covariance, Correlation. Histogram Analysis.	3
III	Inferential Statistics: Distribution, Normal Distribution, Standard Normal Distribution, Central Limit Theorem, Standard Error, Estimators and Estimates, Confidence Interval, Students T Distribution, Margin of Error	3
IV	Linear Regression: Introduction to Regression, Simple and Multiple Linear Regression, Correlation vs. Regression, SST (Sum of Squares Total), SSR (Sum of Squares Regression), SSE (Sum of Squares Error) R-Square, Adjusted R-Squared. Multiple Linear Regression, Significance of p-value	3
V	Logistic Regression: Logistic regression, Logit vs logistic, Applications of logistic regression. Introduction to data visualization and various graphical ways of datarepresentation	3

Text Books	1.	The Art of Statistics: Learning from Data (Pelican Books), by David Spiegelhalter.
	2.	Principles of Statistics by M. G. Bulmer, Dover Publications Inc.
	3.	Statistics 101: From Data Analysis and Predictive Modeling to Measuring Distribution and Determining Probability, Your Essential Guide to Statistics By David Borman, Adams Media
E--Books	1.	An Introduction to the Science of Statistics: From Theory to Implementation, by Joseph C. Watkins https://www.math.arizona.edu/~jwatkins/statbook.pdf
	2.	Introduction to Statistics, by David M. Lane http://onlinestatbook.com/Online_Statistics_Education.pdf
Referenc E-Books	1.	Information Dashboard Design: Displaying Data for At-a-glance Monitoring by Stephen Few, Analytics Press
	2.	Beautiful Visualization, by Noah Iliinsky, Julie Steele Publisher(s): O'Reilly Media, Inc.ISBN: 9781449379865
On-line TL Material	1.	The Business Intelligence Analyst Course 2020 https://www.udemy.com/course/the-business-intelligence-analyst-course-2018/
	2.	The Data Science Course 2020: Complete Data Science Bootcamp https://www.udemy.com/course/the-data-science-course-complete-data-science-bootcamp/

Sr. No.	Name of Experiments
1	Apply pivot table of Excel to perform data analysis
2	Perform Descriptive statistics of given dataset using Data Analysis Toolbox of Excel
3	Perform the Histogram Analysis of given dataset using Data Analysis Toolbox of Excel
4	Perform Simple Linear Regression using Data Analysis Toolbox of Excel or with Python and Interpret the regression table
5	Perform Multiple Linear Regression using Data Analysis Toolbox of Excel or with Python and Interpret the regression table
6	Perform the Logistic Regression and given dataset and Interpret the regression table
7	Install Tableau, Understand User Interface, Dimensions, Measures, Pages, Filters,Marks and Show Me, Dataset Connections and Create a visualization
8	Various graphs in Tableau, Integration of Map and geo-locations, Creating Interactive Dashboard and Publishing your Dashboard to Tableau Public Site
9	Scatter Plots, Data Highlighter, Pages and Cards, Annotations Creating Story and publishing on Tableau Public
10	Given a case study: Perform Interactive Data Visualization with Tableau
Open Ended Experiments	
1	Perform Data Visualization with Microsoft Power BI
2	Perform Data Visualization with R

Courses of Information Technology Board

Course Title: **Problem Identification and Design Thinking**										
Semester	I/II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	PCC1	1	--	2	2	10	15	50	25	--
Course Code	23BTITL101 23BTITP101									
Teaching Mode	Offline	3Hrs			Total	75			25	
Duration of ESE	NA					100				

Course Objectives	Learn to illustrate the problem definition, significance of stakeholders and information gathering
	Conduct the brain storming to generate ideas and refining of ideas
	Select the potential ideas and design potential solution
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Identify the problem definition and stakeholders
	CO2:Analyzethegatheredinformationandidentifypotentialideas
	CO3: Design a suitable prototype and evolve it.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	--	3	--	--	--	--	--	--	--	--	--	--
CO2	--	--	--	3	--	--	--	--	--	--	--	--
CO3	--	--	3	--	--	--	--	--	--	--	--	--

Course Contents:

Unit	Contents	Hours
I	**Identify the Problem** (the reinforcement of tools used at the stages of empathy and definition) More tools for the user research, such as the profile, journey map, interview criteria, stakeholder map, and observation, are introduced. The keyword replacement is suggested to be used for the ideas and discussion.	3
II	**Define Problem and Propose Ideas** (the reinforcement of tools used at the stages of definition and ideation) The PEST and other research method are mentioned in this session to identify the trend of technology and society. Based on the analysis of the user research and technology and society trends, groups define problem, and state their POV.	3
III	**Prototype Design and Test** Considering the feasibility and profitability of demo in the process of designing prototype. The way of introducing and marketing the prototype or idea is important in the innovation process. During the test process, students are tested prototype to potential users or strangers in the campus. The feedbacks from test can be used to measure if the prototype meet the target or not and to iterate the prototype with the comments from users.	3
IV	**Introduction of Design Thinking** Awareness of the five stages of design thinking, Master the design thinking method and tools	3
V	**Implementation and Report Writing** Each group show their final projects and reports, Each group must summarize and review the projects and what will do for the next time.	3

Sr. No.	Name of Experiments
1	Define: Identify the problem definition and define it and identify the stakeholders. Enlist the constraints associated with Problem Definition and formulate the objectives.
2	Research: Conduct primary and secondary research in identified problem definition. Identify GAP and scope for improvement.
3	Information Gathering: Gather the information in the form of qualitative, quantitative and through surveys
4	Ideate:Performbrainstormingwhichcanleadstogenerationofpotentialideas
5	Refinement: Refine the ideas and increase the effectiveness
6	Prototype: Design a suitable prototype for ideas generated in Ideate Phase.
7	Selection: Identify the proposed design solution for implementation or developmentPhase
8	Implementation: Implement the solution or deliver the solution to stakeholders
9	Evolve: Identify what worked well and wherein the scope for improvement.
10	Report Writing: Write a detailed report for all the phases of design thinking.
	Open Ended Experiments
1	Define the Industry based problem and conduct the primary and secondary researchand information gathering
2	Ideate the potentials ideas and design a prototype for industry based problem.

Text Books	1.	Basics Design 08: Design Thinking, By: Gavin Ambrose, Paul Harris,AVA Publishing
	2.	Jeanne Liedtka and Tim Ogilvie Designing for Growth: A Design Thinking Tool Kit for Managers (Columbia UniversityPress,2011)
E-Books	1.	The Design Thinking: Guidebook by Mr. Lee Chong Hwa (Lead Facilitator)
Reference Books	1.	Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation(HarperBusiness,2009)

Course Title: **Programming for Problem Solving**										
Semester	I/II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd/Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	ESC3	3	--	2	4	10	15	50	25	--
CourseCode	23BTITL102 Branch 23BTITP102 Branch									
Teaching Mode	Online	5 Hrs			Total	75			25	
Durationof ESE	2 Hrs					100				

Course Objectives	This Course introduces basic idea of how to solve given problem.
	Focuses of paradigms of programming language.
	Aims at learning python as programming language.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Analyze and understand the behavior of fundamental programming constructs.
	CO2: Develop & Analyze Algorithms for solving problems.
	CO3: Demonstrate the knowledge of various concepts of Python Language.
	CO4: Demonstrate knowledge of advanced concepts of Python Programming
	CO5: Develop solutions using functions & recursion

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	--	3	--	--	--	--	--	--	--	--	--	--
CO2	--	--	3	--	--	--	--	--	--	--	--	--
CO3	--	3	--	--	--	--	--	--	--	--	--	--
CO4	--	--	--	3	--	--	--	--	--	--	--	--
CO5	--	--	3	--	3	--	--	--	--	--	--	--

Course Contents:

Unit	Contents	Hours
I	ALGORITHMIC PROBLEM SOLV ING: Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion).	8
II	DATA, EXPRESSIONS, STATEMENTS Python interpreter and interactive mode; values and types: int, float,Boolean, string, list and set; variables, expressions, statements, Tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments;	8
III	CONTROL FLOW,FUNCTIONS Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local andglobal scope, function composition, recursion; Strings: string slices,	8
IV	DICTIONARIES Dictionaries: Creating a Dictionary, Operations and Methods (Accessing Dictionary Elements, Modifying Dictionary Elements, Iterating Over a Dictionary) ; advanced list processing – list comprehension, Dictionary Manipulation Techniques ; Object Oriented Programming: Classes and objects- inheritance-polymorphism	8
V	FILE HANDLING & EXCEPTION HANDLING Overview of exception classes and Types: try, except, finally: File processing: reading and Writing files, Recent Trends in Python	8

Sr. No.	List of Experiment
1	Implementing if else in Python
2	Implementing loop in Python
3	Implementing Functions in Python
4	Implementing Set, Tuple & Dictionary in Python
5	Project Using Python Module 1: Algorithms, Expression, Variables & I/O
6	Module 2: Control Structures
7	Module 3: List, Strings, Tuples & Dictionary
8	Module 4: Functions
9	Module 5: Object Oriented Programming
10	Module 6: Expression Handling & File Handling

Text Books	1.	Python Programming using problem solving Approach, ReemaTheraja,2017, First Edition
	2.	A Byte of Python, C. H. Swaroop, Edition 2.1

Course Title: **Introduction to Linux**										
Semester	I/II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd/Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	VSEC1	1	--	2	2	10	15	--	25	--
CourseCode	23BTITL103 Branch 23BTITP103 Branch									
TeachingMode	Offline	3Hrs			Total	25			25	
Duration ofESE	NA					50				

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	--	3	--	--	--	--	--	--	--	--	--	--
CO2	--	--	--	3	--	--	--	--	--	--	--	--
CO3	--	--	3	--	--	--	--	--	--	--	--	--

Course Objectives	Understand the basics of Linux operating system
	Learn the basic commands in Linux
	Learn the security concepts in Linux
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Understand the basics of Linux operating system
	CO2:Understand the basic commands in Linux
	CO3: Illustrate the networking commands
	CO4: Illustrate the search for file (simple file matching)

Course Contents:

Unit	Contents	Hours
I	**Introduction to Linux Environment:**	3
	Introduction to Linux Operating System. Linux operating system and its key features. Difference between Linux and windows. Explore different Linux distributions and choose one for your experiments. Set up a Linux virtual machine or dual-boot system on your computer.	
II	**Linux Commands**	3
	Learn basic command-line operations such as listing files and directories, changing directories, and checking the current working directory. Practice using commands like ls, cd, pwd and man to navigate the file system and access command documentation	
III	**File and Directory Operations:**	3
	Introduction to files in Linux. Create, rename, and delete files and directories. Move and copy files and directories. Use commands like touch, mkdir, cat, grep, cp, mv, and rm to perform these operations. File Permissions:Understand the concept of file permissions in Linux. Use commands like chmod and chown to modify file permissions and ownership.	
IV	**Shell Scripting:**	3
	Introduction, shell responsibilities, pipes and input Redirection, output redirection, running a shell script, the shell as a programming language, shell meta characters, shell variables, command substitution, debugging shell scripts.Write simple shell scripts to automate tasks. Use variables, conditionals, loops, and functions in your scripts.	
V	**Process Management:**	3
	Understand the concept of processes in Linux. Use commands like ps, top, kill, and pgrep to manage processes. Practice starting, stopping, and monitoring processes. Use of fork() and other system call of process management in Linux	

Sr. No.	Name of Experiments
1	To study the introduction to Linux operating system and Install Ubuntu or Linux operating system.
2	To explore and implement command-line operation such as listing files and directories, changing directories, and checking the current working directory. ce using commands like ls, cd, pwd, and man to navigate the file system.
3	To understand the concept of file permissions in Linux. Use commands like chmod and chown to modify file permissions and ownership. Write shell script with different permission settings and observe their effects.
4	Write Shell script to create, rename, delete, move, copy files and directories. Use commands like touch, mkdir, cp, mv, and rm to perform these operations.
5	Write Shell script to create and edit text files using a command-line text editor like nano or vi. Learn basic text editing commands, such as saving, exiting, and searching for text within a file. Use commands like cat, echo, and grep.
6	Write a Shell Script that accepts a file name, starting and ending line numbers as arguments and displays all lines between the given line numbers.
7	To write C Programs using the following system calls of LINUX operating system fork, exec, getpid, exit, wait, close, stat, opendir, readdir.
8	a) Write a shell script to list all of the directory files in a directory b) Write a shell script to find factorial of a given number.
9	a) Write a script to count number of lines in a file that does not contain vowels b) write a script to find the no of characters ,words and lines in a file
10	Write simple shell scripts to automate tasks such as use variables, conditionals, loops, and functions in your scripts. Execute and test your scripts.

Text Books	1.	The Complete Reference Linux, sixth edition, by Richard Petersen
	2.	LINUX with operating system concept, by Richard Fox
E-Books	1.	https://doc.lagout.org/operating%20system%20/linux/Linux%20-%20The%20Complete%20Reference.pdf
Reference Books	1.	The Linux Command Line: A Complete Introduction, by William Shotts

Courses of Data Science Board

Course Title: **Introduction to Data Science**										
Semester	II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	C	1	--	2	2	10	15	50	25	--
Course	23BTDSL101 23BTDSP101									
Teaching Mode	Offline	5 Hrs			Total	75			25	
Duration of ESE	2 Hrs					100				

Unit	Contents	Hours
I	**Introduction to Data Science** Evolution of Data Science, Data Science Roles, Stages in a Data Science Project, Applications of Data Science in various fields and Data Security Issues	8
II	**Data Collection & Preprocessing** Data Collection Strategies, Data Pre-Processing Overview, Data Cleaning, DataIntegration and Transformation	7

List of Practical

Sr. No.	Name of Experiments
1	Study different types of data analytic techniques.
2	Perform descriptive analytics on a dataset using Python.
3	Perform diagnostic analytics on a dataset using Python.
4	Perform prescriptive analytics on a dataset using Python.
5	Perform Exploratory Data Analysis (EDA) on a dataset using Python.
6	Perform time series analysis on a dataset using Python.
7	Perform statistical analysis on a dataset using Python.
8	Open Ended Experiment: Demonstration of data analysis on virtual Lab.

Course Title: **Data Science Tools**										
Semester	I	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	VSEC-I	1	--	2	2	10	15	--	25	--
Course Code	23BTDSL102 23BTDSP102									
Teaching Mode	Offline	3 Hrs			Total	25			25	
						50				

Unit	Contents	Hours
I	Sources of Data Foundations for building Data Visualizations, Creating Your First visualization	3
II	Getting started with Tableau Software using Data file formats, connecting your Data to Tableau, creating basic charts (line, bar charts, Tree maps),Using the Show me panel. Tableau Calculations, Overview of SUM, AVR, and Aggregate features, Creating custom calculations and fields	6
III	Applying new data calculations to your visualizations, Formatting Visualizations, Formatting Tools and Menus, Formatting specific parts of the view. Editing and Formatting Axes, Manipulating Data in Tableau data, Pivoting Tableau data.	6

List of Practical

Sr. No.	Name of Experiments
1	Introduction to various Data Analysis Tools.
2	Graphical Analysis with EXCEL.
3	Visualization of Spreadsheet Models.
4	Create visualizations using Matplotlib. Visualize patterns and relationships in the data usingbar plot.
5	Introduction to Tableau and Aggregation Methods in Tableau.
6	Hierarchical and Topographical Data Visualizations in Tableau.
7	Demonstrate Histogram Plot using Tableau.
8	Open Ended Experiment : Demonstration of data analysis on virtual Lab

Course Title: **Programming in C**										
Semester	II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	VSEC2	1	--	2	2	10	15		25	-
Course Code	23BTDSL 105									
Teaching Mode	Offline	3			TOTAL	25			25	
						50				

Course Objectives	To learn basics of C programming language.
	To be able to develop logics to create programs/ applications in C.
Course Outcomes	CO1: Understand and trace the execution of programs written in C language.
	CO2:Apply logic to write programs that perform operations using Arrays, Pointers
	CO3:Design logic to write programs that perform operations using functions
	CO4: Develop logic to write programs that perform operations using file Management.
	CO5: Design logic to build small applications using basics of C language.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	**Program Outcomes and Program Specific Outcomes**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	2	3	2						2	2	1
CO2	2	3	3	2	2	2							2	1
CO3	2	3	3	1	2	3							2	1
CO4	2	3	3	3	2	2						2	2	1
CO5	2	3	3	3	2	3						3	2	1

Unit	Contents	Hours
I	**Introduction:** Introduction to Programming Language, Introduction to C Programming, Keywords & Identifiers, Constants, Variables, Input and Output Operations, Compilation and pre-processing, Data types: Different data types, Data types qualifier, modifiers, Memory representation, size and range, Operators: Operators (Arithmetic, Relational, Logical, Bitwise, Assignment & compound assignment, Increment & Decrement, Conditional), Operator types(unary, binary, ternary). Expressions, Order of expression (Precedence and associativity) Control structures: Decision Making and Branching (Simple IF Statement, IF…ELSE Statement, Nesting IF… ELSE Statement, ELSE IF Ladder), Selection control structure (Switch Statement). Loops: The WHILE Statement, The DO…WHILE Statement, The FOR Statement	6
II	**Array: Concept of Array & Pointers** Array Declaration, types of array(one and multiple dimension), Character Arrays and Strings, Subscript and pointer representation of array, Array of Pointers, Limitation of array, Pointers: Concept of Pointer (null pointer, wild pointer, dangling pointer, generic pointer), Pointer Expressions, Accessing the Address of a Variable, Declaring Pointer Variables, Initializations of Pointer Variable, Accessing a Variable through its Pointer, Applications of Pointers: Create a singly linked list, Insert element into an existing linked list 1 Delete element(s) from a linked list, Traverse a linked list	8
III	**Storage Class & Function** Storage class: Types (auto, register, static, extern), scope rules, declaration and definition. Function: Function & types (User defined function, library function) Function Definition, Declaration, Function Calls, Header file and library, Function Arguments, string handling function, Function recursion, Functions Returning Pointers, Pointers to Functions, Command line arguments, Application of pointer	8
IV	**Structure and Union & File Management** Defining, Declaring, Accessing, Initialization Structure, nested structure, self-referential structure, bit-field, Arrays of Structures, Structures and Functions, Unions, difference between structure and union, active data member, structure within union, Self-referential Structure, **File:** File Management in C, Defining and Opening a File, File opening modes(read, write, append), Closing a File, File operations, file and stream, Error Handling During I/O Operations, sequential and random access file	6
V	**Case Based Learning and Mini projects based upon above concepts.**	6

Text Books	Programming in ANSI C by E. Balguruswamy, Tata Mc-Graw Hill
	Programming With C, Schaum Series
Reference Books	The 'C' programming language by Kernighan and Ritchie, Prentice Hall
	Computer Programming in 'C' by V. Rajaraman , Prentice Hall
	Programming and Problem Solving by M. Sprankle, Pearson Education
	How to solve it by Computer by R.G. Dromey, Pearson Education
Online TL Material	http://www.stat.cmu.edu/~hseltman/Computer.html Online reference material on Computers and Programming from Carnegie Mellon University, Pittsburgh, USA
	http://www.princeton.edu/~achaney/tmve/wiki100k/docs/C_%28programming_language%29.html This site contains notes on C programming from Princeton University, USA. These are very useful for students who are learning C as their first programming Language.
	http://www.stat.cmu.edu/~hseltman/Computer.html Online reference material on Computers and Programming from Carnegie Mellon University, Pittsburgh, USA
	http://www.stat.cmu.edu/~hseltman/Computer.html Online reference material on Computers and Programming from Carnegie Mellon University, Pittsburgh, USA
	http://www.princeton.edu/~achaney/tmve/wiki100k/docs/C_%28programming_language%29.html This site contains notes on C programming from Princeton University, USA. These are very useful for students who are learning C as their first programming Language.

Sr. No.	Name of Experiments	PO	PSO
1	C Program Summation of a set of numbers, Sine function computation, Generation of the Fibonacci sequence, Finding the square root of a number	PO1,PO2,PO3,PO4,PO5	PSO1
2	C Program, the greatest common divisor of two integers, Generating prime numbers	PO1,PO2,PO3,PO4,PO5	PSO1
3	C Program for Arrays – single dimensional and multi-dimensional Strings as array of characters, string Library functions	PO1,PO2,PO3,PO4,PO5	PSO1
4	C Program for Solving problems using Arrays Finding the maximum number in a set, Array order reversal, Removal of duplicates from an ordered array, Selection sort, Bubble sort	PO1,PO2,PO3,PO4,PO5	PSO1
5	C Program to Find the Largest Element in an Array using Pointers	PO1,PO2,PO3,PO4,PO5	PSO1
6	C Program for Creation of singly linked list, Insert element into an existing linked list, Delete element from a linked list, Traverse a linked list	PO1,PO2,PO3,PO4,PO5	PSO1
7	C program: File handling – reading from file and writing into files using programs	PO1,PO2,PO3,PO4,PO5	PSO1
8	C Program to Merge/copy/variations contents of files into another file	PO1,PO2,PO3,PO4,PO5	PSO1
9	C Program for Game Development-TIC TACK TOE	PO1,PO2,PO3,PO4,PO5,PO9,PO12	PSO1,PSO2
10	C Program for Tower of Hanoi problem	PO1,PO2,PO3,PO4,PO5	PSO1,PSO2
Open Ended Experiments			
1	Travelling salesman problem implementation	PO1,PO2,PO3,PO4,PO12	PSO1,PSO2
2	Creation of advance Calculator	PO1,PO2,PO3,PO4,PO5,PO12	PSO1,PSO2
Details of on line Laboratory Resource Material Instruction / Operating Manuals			
1.	https://onlinecourses.nptel.ac.in/noc22_cs40/preview		
2.	https://www.coursera.org/specializations/c-programming		
3.	https://www.udemy.com/course/c-programming-for-beginners-/		

Courses of CSE-Cyber Security Board

Course Title: Introduction to Cyber Security										
Semester	I	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	PCC1	1	-	2	2	10	15	50	25	-
Course Code	23BTCYL101 23BTCYP101									
Teaching Mode	Offline	3Hrs			Total	75			25	
Duration of ESE	2 Hr					100				

Course Contents:

Unit	Contents	Hours
I	**Introduction to Cyber Space** History of Internet ,Cyber Crime, Information Security Introduction to cryptography Computer Ethics and Security Policies GDPR Privacy and concerns	3
II	**Browser selection according to the requirement and email security, password & wi-fi security** Guidelines to choose web browsers ,Securing web browser, Antivirus Email security ,Two-steps Authentication ,Password Manager ,Wi-Fi Security	6
III	Windows & smartphone security Networking Basic Security for User Account Password Smartphone Security Android/iOS Security.	6

List of Practical

Sr. No.	Name of Experiments
1	Study the use of network reconnaissance tools like WHOIS, dig, traceroute, nslookup to gather informationabout networks and domain registrars
2	Installation and demonstration of Wireshark Network Analyzer tool.
3	Trace the packets based on different filters using Wireshark.
4	Install and demonstrate the n-map tool.
5	Demonstrate the use of n-map tool for Port Scanning.
6	Install IDS (e.g. SNORT) and study the logs
7	Demonstrate the use of Wireshark network analyzer to sniff for router traffic.
8	Open Ended Experiment: To study Kerberos network authentication protocol.

Course Title: **Principle of Information Security**										
Semester	II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	Skill Elective-II	1	-	2	1	10	15	--	25	--
Course Code	23BTCYL 105 23BTCYP 105									
Teaching Mode	Offline					25			25	
Duration of ESE	NA					50				

Course Objectives	1. To understand the basics of Ethical Hacking
	2. To understands basics of data security & threats
	3. To understand different hacking techniques
Course Outcomes	Up on successful completion of this course, student will be able to:
	CO1: To explain the principles of Ethical Hacking
	CO2: To explain the scientific principles of data security and threats
	CO3: To identify different hacking techniques
	CO4: To conduct the investigation process

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO3
CO1		2	1										2	1	
CO2		2	1										2	1	
CO3		1	3	1									2	1	
CO4		1	3	1									2	1	

Unit	Content	Hours
I	INTRODUCTION TO ETHICAL HACKING: Ethical Hacking Definition, difference between hacking and ethical hacking. Vulnerability, Attack Vector. Five stages of hacking	4
II	DATA SECURITY: Physical Security – Attacks and Protection, Steganography – Methods, Attacks and Measures, Cryptography – Methods and Types of Attacks,	3
III	System Hacking: Password cracking techniques, Key loggers, Escalating privileges, URL Hiding Files, Sniffers & SQL Injection: Active and passive sniffing	4
IV	Social Engineering: Phases of an attack, Common targets, Common sources of information. Web Servers and applications: Common attacks and flaws, Current tools.	3

Experiments:

Sr. No.	Name of Experiments
1	Introduction to Ethical Hacking. Understanding concepts of cyberspace, Cyber security & CIA triad in Ethical Hacking
2	Understanding & Exploring different types of attacks, difference between treats & vulnerabilities
3	Why Linux? Linux terminal including basic functionalities & CLI
4	Understanding Hacking Life Cycle. Exploring Reconnaissance
5	Basic terminology - SQL injections, VPN, proxy, VPS, and keyloggers
6	Configure and demonstrate use of vulnerability assessment tool
7	Strengthening Default Security Settings of Common Browsers
8	Demonstrating & Exploring Social Engineering attacks
9	Understanding cryptology & basic cipher implementation
10	To study the various Vulnerabilities tools

Text Books	1.	Ethical Hacking and Digital Forensics by Narayan Vikrama
E--Books	1.	Hacking: The Art of Exploitation, 2nd Edition - Zenk - Security
online TL Material	1.	https://onlinecourses.nptel.ac.in/noc22_cs13/preview
	2.	https://www.coursera.org/learn/hacking-patching
	3.	https://www.coursera.org/learn/digital-forensics-concepts
Vulnerabilities tools		NESSAS, be SECURE, Arachni etc

Courses of Civil Engineering Board

Course Title: **Engineering Mechanics**										
Semester	I/II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd/Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	ESC2	3 Hrs.	--	2 Hrs.	4	10	15	50	25	--
Course Code	23BTCEL101 23BTCEP101									
Teaching Mode	Offline	5 Hrs.			Total	75			25	
Duration of ESE	2.5 Hrs.					100				

Course Objectives	1. To describe and explain the conditions of rest or motion of the bodies underthe action of force and also to be familiar with the concept of simple lifting machine
	2. To illustrate the basic concepts of forces moments, couples in two dimensionalforce system & spatial force system.
	3. To practice and analyze the simple determinate structures like beam & trussand to understand the properties of plane geometric area.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO 1: Apply the fundamentals of two dimensional force systems for replacementinto equivalent force system
	CO 2: Demonstrate the basic concepts of free body diagrams for staticequilibrium for two dimensional force systems
	CO 3: Implement the concepts of Simple Lifting Machine and friction and to analyze the internal forces in the members of truss.
	CO 4: Employ the concepts of forces, moments, and couples in spatial force system
	CO 5: Apply the basic concepts of Centroid, Moment of inertia of lamina & Virtual Work

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	1	--	--	--	--	--	--	--	--	--	1
CO2	3	1	--	--	--	--	--	--	--	--	--	1
CO3	3	1	--	--	--	--	--	--	--	--	--	1
CO4	3	1	--	--	--	--	--	--	--	--	--	1
CO5	3	1	--	--	--	--	--	--	--	--	--	1

Course Contents:

Unit	Contents	Hours
I	**Fundamentals of Statics :** Definition of mechanics, Body, Rigid Body, Scalar quantities, Vector quantities, Representation of vector, Fundamental Units, Derived Units, Particle, Mass, Weight, Fundamental principles of mechanics, Newton's law of universal gravitation. **Equivalent Force System (2-D):** Concept of Force, Unit Newton force, System of force, Principle of transmissibility of force, Resolution and composition of coplanar force system, Resultant, Equilibrant, Law of parallelogram of force, Triangle law, Polygon law, Moment of force, Varignon's theorem, Couple and it's properties, Reduction of system of forces into a force couple system. Numericals on equivalent force involving co-planer force systems acting on body, Numericals on reduction of system of forces into a force couple system.	7
II	**Equilibrium of Two Dimensional Force System :** **Force System :** Concept of equilibrium, Principles of equilibrium, Equations of Equilibrium, Lami's theorem, Numericals on equilibrium involving co-planer force systems acting on body. **Beam:** Beam, Simply Supported Beam, Overhanging Beam, Beam reaction, Types of load acting over beam i.e. Concentrated load, Uniformly distribute load (UDL), Uniformly varying load (UVL), Types of support i.e. Simple support, Hinge support, Roller Support, Numericals on reaction of beam subjected to combination of loads	8
III	**Analysis of Truss *:*** Perfect Frame, Imperfect frame, Deficient frame, Redundent frame, Assumptions made in analysis of truss, Method of joints, Method of sections, Numericals on forces in the members of a truss. **Friction:** Definition of friction, Types of friction, Angle of repose, Coulombs laws of dry friction, Analysis of rigid bodies on rough inclined surfaces.	8
IV	**Spatial Force System (Three Dimensional Force System):** Component of force in a space, Resultant spatial force system, Force multiplier, Cartesian form of representation of vector, Unit vector, Position vector, Displacement Vector, Scalar product or Dot product, Vector product or Cross product, Length of common perpendicular between two non-intersecting vectors, Shortest distance, Moment of force about point, Moment of force about axis, Moment arm of force about point, Moment arm of force about axis, Resultant moment, Couple.	8

V	**Properties of Areas:** Centroid of plane areas, Moment of Inertia of composite lamina, Radius of gyration, Second moment of area, Product of inertia, Parallel axis theorem, Perpendicular axis theorem, Polar moment of inertia, Moment of inertia & product of inertia about new axes, Principal moment of inertia and principal axis direction by analytical method only. **Virtual Work :** Virtual Displacement, Definition of virtual work, Principles of virtual work, Virtual work method applied to beams, frames & mechanisms.	9

Text Books	1.	Engineering Mechanics - Statics & Dynamics by Author : K. Vijaya Reddy & J Suresh Kumar, B S Publication, 2010, Third Edition
	2.	Engineering Mechanics Statics and Dynamics, Rajasekaran S and Sankarasubramanian G, Vikas Publishing House Pvt. Ltd., 2005.
	3.	Engineering Mechanics, Bhavikatti, S.S, and Rajashekarappa, K.G., New Age International (P) Limited Publishers, 1998.
E-Books	1.	Textbook of Engineering Mechanics by R.K. Bansal Laxmi Publications, 2005
	2.	Engineering Mechanics A Textbook Of Applied Mechanics by S. Ramamrutham, Dhanpat Rai Publishing Company (P) Limited, 2008
Reference Books	1.	I. H. Shames, Engineering Mechanics: Statics and dynamics, PHI, 2002,Fourth Edition
	2.	F. P. Beer and E. R. Johnston, Vector Mechanics for Engineers, Vol I – Statics,Vol II – Dynamics, Tata McGraw Hill, 2011, Ninth Edition
	3.	R. C. Hibbler, Engineering Mechanics: Principles of Statics and Dynamics,Pearson Press, 2006

Sr. No.	Name of Experiments (Any Seven)
1	Familiarity (study) of simple lifting machines
2	Determination of velocity ratio, law of machine for “Single Purchase Crab Winch
3	Determination of velocity ratio, law of machine for “Double Purchase Crab Winch”.
4	Determination of velocity ratio, law of machine for “Differential Axle and Wheel”.
5	Determination of velocity ratio, law of machine for “Simple Screw Jack”.
6	Determination of reactions at the supports of simply supported beam
7	Determination of forces in the members of jib crane.
8	Determination of forces in the members of a shear leg apparatus
9	Determination of coefficient of friction of inclined planes
10	Determination of coefficient of coil friction.
11	Determination of mass moment of inertia of fly wheel
Open Ended Experiments	
1	To investigate effect on reaction forces produced at simply supported beam due to variation of position of single load.
2	To investigate effect on reaction forces produced at simply supported beam due to variation of position of multiple loads

Course Title: **Skill Enhancement Course -I (Computer Aided Drawing)**										
Semester	I	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	VSC1	1 Hr	--	2 Hrs.	2	10	15	--	25	--
Course Code	23BTCEL102 23BTCEP102									
Teaching Mode	Offline	3 Hrs.			Total	25			25	
Duration of ESE	-					50				

Course Objectives	To understand importance of Building drawing as an engineer's language
	To plan building as per owner's requirements and Building byelaws
	To develop drawings to scale with location site and block plan with AutoCAD software
Course Outcomes	**CO1**: Understand the various computer aided Drawing tools.
	CO2: Interpret the functions of building components and draw them free hand.
	CO3: Develop Single Line building drawing as per functional requirements.
	CO4: Evaluate the planning & drawing with appropriate scales using AutoCAD Software.
	CO5: Develop the Provisional drawing of a building as per bye-laws.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	-	3	-	3	-	-	3	-	-	-	3	2	3	-
CO2	3	-	3	-	3	-	-	3	-	-	-	3	2	3	-
CO3	3	-	3	-	3	-	-	3	-	-	-	3	2	3	-
CO4	3	-	3	-	3	-	-	3	-	-	-	3	2	3	-
CO5	3	-	3	-	3	-	-	3	-	-	-	3	2	3	-

Course Contents:

Unit	Contents	Hours
I	**Introduction of Drawing tools –** Introduction to various methods of Drawing, Its's significance, various drawing tools & software's. Introduction to 2D & 3D Drawings, Various software commands & their applications.	**5**
II	Design single line plan on Graph paper (line plans) based on various requirements for residential, public, education and industrial buildings.	**8**
III	**Auto CAD (Computer Aided Drafting)** a) Specifying Distance and coordinates. Polar coordinates, relative Cartesian coordinates. Interpreting curser modes and understanding prompt, choosing commands options , selecting objects, editing and grips. Setting up work area, measurement systems, scales factor mode as drafting tools. Symbols, blocks layers. Templates copying object, editing lines, changing length of object. Geometric construction of line and point parallel line, perpendicular lines, breaking lines, dividing lines, fillets, chambers, circles, tangent, arcs, curves through points, breaking polygons, solid shape ellipse.	**8**
IV	**Signs & Symbol :-** Hatch patterns boundary, adding text, Text formatting styles, size of text and scale of drawing, dimensions style, unit heights, locations, arrow style	**5**
V	**Method of Drawing:** Importance of Building drawing as Engineers language in construction & costing, Selection of scales for various drawings. Thickness of line Dimensioning, first angle and third angle method of projection, Abbreviations and conventional representations as per NBC, Free hand dimensioned sketches,stones of various building elements.	**6**

Text Books	1.	Shah and Kale, Building Drawing and Design, 2nd Edition, Tata McGraw, 2002
E-Books	1.	Advances in Landscape Architecture, Murat Ozyavuz (ed.) - InTech , 2013
	2.	Green Architecture: Advanced Technologies and Materials, Osman Attmann
Reference Books	1.	V. B. Sikka, Civil Engineering Drawing, 3rd Edition, S. K. Kataria & sons, 2003
	2.	George Omura, Mastering Autocad 1, 1st Edition, BPB Publications, New Delhi, 2004
Online TL Material	1.	https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-ar08
	2.	https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-ar09

List of Experiments

Sr. No.	Name of Experiments / Mini Projects/ Case Studies
1	One compulsory field visit and exercise given by teacher, free hand sketching of components and building plans and report submission.
2	Minimum 15 free hand self-explanatory dimensioned sketches of various building elements in sketchbook
3	Minimum 15 self-explanatory dimensioned sketches of various building elements on Auto-CAD
4	Drawing of single line plan of residential single storied building in sketchbook & on Auto-CAD
5	Drawing of single line plan of various types of Public building single storied building in sketchbook & on Auto-CAD
6	Single Line plans of multi-storied (2-storied) residential buildings in sketchbook
7	Single Line plans of multi-storied (2-storied) various types of buildings e.g. public / educational / industrial / hospital / community on graph papers (Four assignments) in sketchbook.
Details of on line Laboratory Resource Material Instruction / Operating Manuals	
1.	https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-ar16
2.	https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-ar14

Course Title: **Skill Enhancement Course -I (Design of Structure using Sketch Up)**										
Semester	I	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	VSEC	1 Hr.	-	2 Hrs.	2	10	15	-	25	-
Course Code	23BTCEL103 23BTCEP103									
Teaching Mode	Offline	3 Hrs.			Total	25			25	
Duration of ESE	-					50				

Course Objectives	To understand importance of Building drawing as an engineer's language
	To plan building as per owner's requirements and Building byelaws
	To develop drawings to scale with location site and block plan with AutoCAD software
Course Outcomes	**CO1**: Understand the various computer aided Drawing tools.
	CO2: Interpret the functions of building components and draw them free hand.
	CO3: Develop Single Line building drawing as per functional requirements.
	CO4: Evaluate the planning & drawing with appropriate scales using AutoCAD Software.
	CO5: Develop the Provisional drawing of a building as per bye-laws.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	-	3	-	3	-	-	3	-	-	-	3	2	3	-
CO2	3	-	3	-	3	-	-	3	-	-	-	3	2	3	-
CO3	3	-	3	-	3	-	-	3	-	-	-	3	2	3	-
CO4	3	-	3	-	3	-	-	3	-	-	-	3	2	3	-
CO5	3	-	3	-	3	-	-	3	-	-	-	3	2	3	-

List of Experiments-

Sr. No.	Name of Experiments / Mini Projects/ Case Studies
1	**INTRODUCTION-** Introduction of GOOGLE SKETCHUP ,Unit setup, Shortcut key, Default tray , Mouse Control
2	**TOOLS-BARS-**Camera Tool ,Construction Tool, Edit ,Getting Started ,Large Tool Set ,Layers ,Standard , Principal
3	**DRAWING TOOLS –** Shadows, Styles, Views, Sandbox
4	**3D PLAN DRAW-** Level setting and editing of door, window, and wall
5	**INTERIAL DRAWING -**Kitchen Draw ,Room designing
6	**FURNITURES -** Bed , Table , Chair
7	**3D WAREHOUSE-**Download Components – Importing, editing, placing.
8	**RENDERING -**Apply material, Rendering setup
Details of online Laboratory Resource Material Instruction / Operating Manuals	
1.	https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-ar16
2.	https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-ar14

Course Title: **Concrete Technology**										
Semester	II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	ESC3	3 Hrs.	--	2 Hrs.	4	10	15	50	25	--
Course Code	23BTCEL105 23BTCEP105									
Teaching Mode	offline	5 Hrs.			Total	75			25	
Duration of ESE	2 Hrs.					100				

Course Objectives	To understand the properties of concrete ingredients.
	To study the compressive, flexural, split strengths etc and other non-destructive tests.
	To learn mix design of concrete and its application in construction work.
Course Outcomes	**CO1:** Understand Properties of cement , aggregates and water use in concrete
	CO2: Evaluate the Mechanical properties of hardened concrete with destructive and non-destructive testing instrument.
	CO3: Analyze various additives & admixtures of concrete to get acquainted to concrete handling equipment and different Special concrete types
	CO4: Judge the durability requirements of concrete.
	CO5: Design concrete mixes as per IS codes

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	2	-	-	-	-	-	2	-	-	-	-	-	2	3	2
CO2	2	-	-	-	-	-	2	-	-	-	-	-	2	3	2
CO3	2	3	-	-	-	-	2	-	-	-	-	-	2	3	2
CO4	2	3	-	-	-	-	2	3	-	-	-	-	2	3	2
CO5	2	-	-	-	-	-	2	-	-	-	-	3	2	3	2

Course Contents:

Unit	Contents	Hours
I	**Cement**: Main constituents of cements, hydration of cement, water requirement. Physical properties. Types & test on Cement, field & laboratory tests. **Aggregates**: Classification and nomenclature, coarse and fine aggregate, normal weight (light and heavy weight aggregates). Aggregate characteristics and their significance in strength, workability, placement and compaction of concrete. Sampling, Particle shape and texture, Bond of aggregate, size & grading of aggregate strength of aggregate. Mechanical properties and laboratory tests– Specific gravity, bulk density, porosity, absorption of aggregate, moisture content of aggregate, bulking of sand abrasion test, impact value.	7
II	**Water**:-Water quality for mixing and curing, acceptable water, pH value, seawater chlorides content. Provisions in IS: 456-2000 **Fresh Concrete**: Batching, mechanical mixers, automatic batching and mixing plants. Efficiency of mixing, workability measurement- slump cone test, compacting factor test, flow table, Vee-Bee consisto meter, factor affecting workability, setting time, significance of W/C ratio, segregation, bleeding, voids and permeability. Placing of concrete, compaction, vibrators, methods of curing and temperature effects on curing.	10
III	**Strength of concrete**- Factors affecting compressive, tensile and flexural strengths, relation between compressive, flexural and tensile strength. **Destructive Testing of hardened concrete**: Compression strength test on cubes/ cylinder and their relation. Flexural strength of concrete, determination of tensile strength, indirect tension test. **Non Destructive Test (NDT)** – it's Significance, rebound hammer test, ultra sonic pulse velocity test, pullout test as per IS code provision.	8
IV	**Additives and admixtures**- Types of admixtures, byproducts – pozzolana, fly ash, silica fume, rice husk ash, metakaoline, G.G. blast furnace slag. Air entraining, water reducing, accelerators, retarders, plasticizers and super plasticizers. Fibers & it's types **Special concretes** – Lightweight concrete, fiber reinforced concrete, high density concrete, self-compacting concrete and applications.	8
V	**Mix Design**- Standard deviation, factors affecting mix properties, degree of quality control, design of mix by IS code method. **Durability of concrete**- Significance, water as an agent of deterioration, permeability of concrete, air sulphate attack and control, sea water attack, acid attack, efflorescence, resistance of corrosion, abrasion and cavitation's, process of rusting of steel. Study of different types supplementious material	7

Text Books	1.	M L Gambhir, Concrete Technology, 5th Edition, The McGraw-Hill Companies, 2013
	2.	Krishnaswamy, K.T., Kamasundara Rao, A, and Khandekar A.A., Concrete Technology",
	3.	A M Neville, Properties of concrete, 4th Edition, ELBS, London, 2012
E--Books	1.	IS 456-2000, IS 383-1970, IS 516-1959, IS 9103-1999, IS 10262-2009
	2.	M S Shetty, Concrete Technology, 5th Edition, S Chand & Co. Ltd., 2005

Referenc eBooks	1.	M S Shetty, Concrete Technology, 5th Edition, S Chand & Co. Ltd., 2005
	2.	Shanthakumar A. R., "Concrete Technology", Oxford University Press, 2007
	3	Concrete Technology by R.S. Varshney, Oxford and IBH.
Online TL Material	1.	Concrete Technology, Prof. Bhattacharjee B, Indian Institute of Technology - Delhi
	2.	Prof. Bhattacharjee B, Indian Institute of Technology - Delhi
	3.	Manu Santhanam, IIT Madras

Sr. No.	Name of Experiments / Mini Projects/ Case Studies
1	To determine Fineness of cement and Standard Consistency of Cement by Vicat's Apparatus
2	To determine initial and Final Setting time of given cement by Vicat's Apparatus and Soundness cement
3	To determine compressive strength of cement mortar cube.
4	To determine Moisture content, silt content, density and Specific gravity of fine aggregate by pycnometer method
5	To determine Fineness Modulus (FM) by sieve analysis of Fine Aggregate
6	To determine Moisture content, water absorption, density and Specific gravity of coarse aggregate coarse aggregate.
7	To determine Fineness Modulus (FM) by sieve analysis of coarse Aggregate
8	To determine the Workability of Concrete by Slump Test, Compaction Factor and Vee Bee test. Effect of admixture and retarders on setting time of concrete.
9	To determine the Workability of Flowable Concrete & Effect of admixture and retarders on setting time concrete.
10	To determine compressive strength by rebound hammer test and ultrasonic pulse velocity test.
11	To determine the Flexural Strength of Concrete
12	Concrete mix design by IS code method
Open Ended Experiments / New Experiments	
1	Mix Design of rapid hardening cement concrete and low heat cement concrete
2	Mix design of concrete for offshore structures
3	NDT evaluation of rigid pavement by core cutter method

Course Title: **Water Resources Engineering**										
Semester	II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	PCC1	2 Hrs.	-	-	2	10	15	50	-	-
Course Code	23BTCEL106									
Teaching Mode	Offline	2 Hrs.			Total	75			-	
Duration of ESE	2.5 Hrs.					75				

Course Objectives	To understand the hydrological cycle and its processes.
	To understand the infiltration characteristics of runoff.
	To characterize developing hydrograph.
Course Outcomes	**CO1**: Classify hydro-meteorological parameters & estimate abstractions from precipitation.
	CO2: Apply the mechanism of Evaporation, Transpiration and Evapotranspiration in real life situation
	CO3: Analyze rainfall-runoff models and development of hydrographs
	CO4: Examine statistical model and solve hydrologic flood routing models
	CO5: Investigate ground water hydrology and design of rainwater harvesting system.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	2	2	-	-	-	-	-	-	-	-	1	3	2	1
CO2	1	2	2	-	-	-	-	-	-	-	-	1	3	2	1
CO3	1	3	2	3	2	-	-	-	-	-	-	2	3	2	1
CO4	1	3	2	1	2	-	-	-	-	-	-	2	3	2	1
CO5	1	3	2	-	2	-	-	-	-	-	-	2	3	2	1

Course Contents:

Unit	Contents	Hours
I	**Introduction**: Hydrological Equations and brief description of its components. Importance of temperature, wind and humidity in hydrology. Earth and its atmosphere and importance. Definition, classifications, selection of site, density and adequacy of rain-gauge station.	6
II	**Infiltration:** Definition, mechanism, factors affecting. **Evaporation:** Definition, mechanism, factors affecting. **Transpiration:** Definition, mechanism, factors affecting.	10
III	**Run off:** Source components of run off, classification of streams, factors affecting. Estimation of discharge and Measurement methods. **Hydrographs:** Introduction: unit hydrographs. Base flow and base flow separation, S-Curve theories. Numerical on Infiltration, Evaporation, Transpiration, Runoff, Hydrographs.	8
IV	**Statistical methods:** Statistics in hydrological analysis. Probability and probability distribution. Analysis of time series, frequency analysis. Statistical analysis of the precipitation. **Floods:** Causes and effects, factors affecting, flood routing and flood forecasting & numerical.	8
V	**Geohydrology:** Introduction, occurrence and distribution, ground water exploration techniques, introduction to hydraulics of well, Numerical. Ground water quality, geomorphic and geologic control, Ground water province of India. **Ground water recharge:** Introduction, recharging methods, spreading methods. Recharge through rain water harvesting. Interlinking of rivers and catchment.	8

Text Books	1.	Subrahmanya, K., 2008, Engineering Hydrology, Tata McGraw Hill Pub. Co.,New Delhi.
EBooks	1.	Handbook of Applied Hydrology, Second Edition, By Vijay P. Singh, Ph.D., D.Sc., D. Eng. (Hon.), Ph.D. (Hon.), D. Sc. (Hon.), P.E., P.H., Hon. D. WRE, Academician (GFA)
Reference Books	1.	Dr. P. Jaya and Rami Reddy, Text book of hydrology, 3rd Edition, Laxmi Publication, 2007
	2.	R. K. Sharma and T. K. Sharma, Text book of hydrology and water resource engineering, 5th Edition, Dhanpat Rai Publications, 2007
on line NPTL Material	1.	https://nptel.ac.in/courses/105/101/105101002/
	2.	https://nptel.ac.in/courses/105/103/105103026/

Course Title: **Skill Enhancement Course -II (Architectural Planning & Drawing)_**										
Semester	II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	VSEC2	1 Hrs	--	2 Hrs	2	10	15	-	25	-
Course Code	23BTCEL107 23BTCEP107									
Teaching Mode	Offline	3 Hrs.			Total	25			25	
Duration of ESE	-					50				

Course Objectives	To understand importance of Building drawing as an engineers language
	To plan building as per owner's requirements and Building byelaws
	To develop drawings to scale with location site and block plan with AutoCAD software
Course Outcomes	**CO1**: Understand the principle of planning and provisions in Bylaws
	CO2: Interpret the functions of building components and draw them free hand
	CO3: Relate building drawing as per functional requirements
	CO4: Evaluate the planning & drawing with appropriate scales using AutoCAD software.
	CO5: Develop the submission drawing of a building as per bye-laws

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	-	3	-	3	-	-	3	-	-	-	3	2	3	-
CO2	3	-	3	-	3	-	-	3	-	-	-	3	2	3	-
CO3	3	-	3	-	3	-	-	3	-	-	-	3	2	3	-
CO4	3	-	3	-	3	-	-	3	-	-	-	3	2	3	-
CO5	3	-	3	-	3	-	-	3	-	-	-	3	2	3	-

Course Contents:

Unit	Contents	Hours
I	**Designing of Building-** Importance of drawing in Civil Engineering, Site requirements, zoning concept, Detailed Project Report and Building byelaws necessary documents. Climate and design consideration, orientation, recommendations of CBRI, General principles of planning with emphasis on functional planning. Graph paper design (line plans) based on various requirements for residential, public, education and industrial buildings.	**8**
II	**Auto CAD (Computer Aided Drafting)** a) Specifying Distance and coordinates. Polar coordinates, relative Cartesian coordinates. Interpreting curser modes and understanding prompt, choosing commands options, selecting objects, editing and grips. Setting up work area, measurement systems, scales factor mode as drafting tools. Symbols, blocks layers. Templates copying object, editing lines, changing length of object. Geometric construction of line and point parallel line, perpendicular lines, breaking lines, dividing lines, fillets, chambers, circles, tangent, arcs, curves through points, breaking polygons, solid shape ellipse.	**5**
III	Hatch patterns boundary, adding text, Text formatting styles, size of text and scale of drawing, dimensions style, unit heights, locations, arrow style Polyline, editing, creating splice curve, dividing in segments, filling in solid area, Printing and plotting drawing, output device paper size, orientation, control on scale and location.	**5**
IV	**Method of Drawing:** Importance of Building drawing as Engineers language in construction & costing, Selection of scales for various drawings. Thickness of line Dimensioning, first angle and third angle method of projection, Abbreviations and conventional representations as per NBC, Free hand dimensioned sketches, stones of various building elements. Developing working drawings to scale as per NBC from the givens sketch design and general specifications for terraced and pitched roofs in Auto-CAD,Developing submission drawings to scale with location site and block plan complete in Auto-CAD.	**8**
V	**Perspective Drawing:** Two point and Three Point perspective of Residential building including small elements of building such as plinth offset, chajjah projections etc.	**6**

Text Books	1.	Shah and Kale, Building Drawing and Design, 2nd Edition, Tata McGraw, 2002
E-Books	1.	Advances in Landscape Architecture, Murat Ozyavuz (ed.) - InTech , 2013
	2.	Green Architecture: Advanced Technologies and Materials, Osman Attmann
Reference Books	1.	V. B. Sikka, Civil Engineering Drawing, 3rd Edition, S. K. Kataria & sons, 2003
	2.	George Omura, Mastering Autocad 1, 1st Edition, BPB Publications, New Delhi, 2004
Online TL Material	1.	https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-ar08
	2.	https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-ar09

List of Experiments-

Sr. No.	Name of Experiments / Mini Projects/ Case Studies
1	Drawing of Double line plan of residential single storied building on Auto-CAD
2	Working drawing of residential single storied building of terrace and pitched roofs with foundation plan of load bearing structure. (Two assignment)
3	Submission drawing of single storied residential building (framed structure) withaccess to terrace including with foundation plan, all details and statements as per the local bye-laws. (One assignment) on Auto-CAD
4	Submission drawing of 02 (G+1) storied residential building framed structure including with foundation plan, all details and statements as per the local bye laws. (One assignment) on Auto-CAD
5	Double Line plans of various types of buildings e.g. public / educational / industrial /hospital / community on Auto-CAD (Two assignments).
6	Two point perspective of the single Residential building neglecting small building elements. (Two assignment – pitched & terraced roof)
7	Three Point perspectives of the single Residential building neglecting small building elements. (Two assignment – pitched & terraced roof)
8	Working drawing of multistoried Public / Educational / Health / Community / Industrial building including structural details and layout of services. (Twoassignment) on Auto-CAD/ Sketch-up / 3-D Max / BIM
Details of online Laboratory Resource Material Instruction / Operating Manuals	
1.	https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-ar16
2.	https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-ar14

Course Title: **Skill Enhancement Course -II (Building Information Modeling Software)**										
Semester	**II**	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	VSEC2	1 Hr.	--	2 Hrs.	2	10	15	--	25	--
Course Code	23BTCEL108 23BTCEP108									
Teaching Mode	Offline	3 Hrs.			Total	25			25	
Duration of ESE	-					50				

Course Objectives	To understand importance of Building drawing as an engineer's language
	To plan building as per owner's requirements and Building byelaws
	To develop drawings to scale with location site and block plan with AutoCAD software
Course Outcomes	CO1: Understand the principle of planning and provisions in Bylaws
	CO2: Interpret the functions of building components and draw them free hand
	CO3: Relate building drawing as per functional requirements
	CO4: Evaluate the planning & drawing with appropriate scales using AutoCAD software.
	CO5: Develop the submission drawing of a building as per bye-laws

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	-	3	-	3	-	-	3	-	-	-	3	2	3	-
CO2	3	-	3	-	3	-	-	3	-	-	-	3	2	3	-
CO3	3	-	3	-	3	-	-	3	-	-	-	3	2	3	-
CO4	3	-	3	-	3	-	-	3	-	-	-	3	2	3	-
CO5	3	-	3	-	3	-	-	3	-	-	-	3	2	3	-

Course Contents:

Unit	Contents	Hours
1	**Introduction**:- To Revit Architecture- Exploring Gui & Workspace, Display Control (Zoom, Pan, Views, Undo, Redo),File Management (New Open, Save,Save As)	**5**
II	**Units Setting-** Project Browser–Plan Views, Top Views, 3D View, Level Setting, Build Tools – Wall Architecture(Wa), Trim, Modify Tool Trim/ Extend To Corner, Extend Single Element, Trim / Extend Multiple Elements, Annotate Tool – Aligned Dimension, Build Tools – Door (Dr) & Windows (Wn) Load, Family, Door Editing, Window Editing, Build Tools – Floor Architecture & Editing, Roof By Footprint & Editing, Column Architecture & Editing, Build Tools–Ceiling & Editing	**5**
III	**Modify Tools: -** Move, Copy, Offset, Align, Mirror Pick Axis, Mirror DrawAxis, Rotate, Split Element, Split With Gap, Pin, Unpin, Delete, Wall Join.	**5**
IV	**Circulation Tools:-** Railing & Editing, Ramp & Editing, Stairs & Types & Editing, Stair By Sketch	**5**
V	**Opening Tools**:- Edit Profile (Wall), Wall Opening, Attach & Detach Wall. Opening By Face, Vertical, Opening, Shaft Opening, Dormer, Join / Unjoin Roof.	**5**
VI	**Model Site:-** Topo surface, Sub region, Split, Surface, Merge Surfaces, and Site Component.	**5**

Text Books	1.	Shah and Kale, Building Drawing and Design, 2nd Edition, Tata McGraw, 2002
EBooks	1.	Advances in Landscape Architecture, Murat Ozyavuz (ed.) - InTech , 2013
	2.	Green Architecture: Advanced Technologies and Materials, Osman Attmann
Reference Books	1.	V. B. Sikka, Civil Engineering Drawing, 3rd Edition, S. K. Kataria & sons, 2003
	2.	George Omura, Mastering Autocad 1, 1st Edition, BPB Publications, New Delhi, 2004
Online TL Material	1.	https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-ar08
	2.	https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-ar09

Courses offered by Mechanical Engineering Board

Course Title: **Engineering Graphics**										
Semester	I	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd	L	T	P	Credits	TAE	CAE	ESE	INT	EXT
Course Category	ESC1/ESC2	2	--	4	4	10	15	50	25	--
Course Code	23BTMEL101 BRANCH 23BTMEP101 BRANCH									
Teaching Mode	Offline / AutoCAD	6 Hrs.			Total	75			25	
Duration of ESE	2 Hrs.					100				

Course Objectives	To familiarize with basic engineering graphics principles and standards of drafting.
	To equip with various techniques to create technical drawings.
	To get acquainted in sketching, manual drafting and computerized drafting appropriately.
Course Outcomes	Upon successful completion of this course, student shall be able to:
	CO1: Understand concepts of dimensioning, drawing conventions and theories of projection related to engineering graphics.
	CO2: Interpret the projection of planes.
	CO3: Predict solid geometry in different angles.
	CO4: Imagine section of solids in different angles.
	CO5: Create the geometric information of engineering objects into engineering drawing using drafting tools.

Course Outcomes	Program Outcomes											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	**3**	**1**	**2**	**1**	**3**	**1**	**1**	**-**	**1**	**3**	**2**	**3**
CO2	**3**	**2**	**2**	**2**	**3**	**2**	**1**	**-**	**2**	**3**	**2**	**3**
CO3	**3**	**2**	**2**	**2**	**3**	**2**	**1**	**-**	**2**	**2**	**2**	**2**
CO4	**3**	**2**	**3**	**2**	**3**	**2**	**1**	**-**	**2**	**3**	**3**	**2**
CO5	**3**	**1**	**2**	**1**	**3**	**1**	**1**	**-**	**1**	**3**	**2**	**3**

Course Contents:

Unit	Contents	Hours
I	**Theory of Projections** Theory, techniques, first and third angle projections, multi view drawing (from pictorial views), views in orthographic projections, Projection of points, Projection of straight lines inclined to both reference planes.	4
II	**Projection of Planes** Projection of plane figures such as triangle, quadrilateral, regular polygons circle, Plane inclined to both reference planes.	4
III	**Projection of Solids** Projections of solids such as Prisms, Pyramids, Cone, Cylinder with varying position of axes with ground line.	4
IV	**Sections of solids** Section of solid such as Prisms, Pyramids, Cone, Cylinder and introduction to development of surfaces.	6
V	**Orthographic Projection & Isometric Projection** Conversion of pictorial view of solid to orthographic views, conversion of orthographic views in to isometric views.	8

Text Books	1.	A text book of Engineering Drawing by N.D.Bhatt&V.K.Panchal, Revised Latest Edition 2016, Charotar Publishing House, Anand,Gujrat.
	2.	A text book of Engineering Drawing by N.S.Parthasarthy, Vela Murali, Revisededition, 2016, Oxford Publications.
	3.	A text Bok of Engineering Graphics using AUTO CAD by Sarkar, Rastogi and Kulkarni , 2nd edition, 2015,Tata McGraw Hills.
Online TL Material	1.	NPTEL https://nptel.ac.in/courses/105/104/105104148/
	2.	NPTEL https://nptel.ac.in/courses/112/103/112103019/
	3.	http://www.cadtutor.net/tutorials/autocad/drawing-objects.php

Sr. No.	Name of Experiments/Mini Projects/Case studies	Mode of conduction
1	Types of Lines, Dimensioning & Projection of Line	Manually (on half imperial drawing sheet)
2	Projection of Plane	Manually(on half imperial drawing sheet)
3	Projection of Solids	Manually(on half imperial drawing sheet)
4	Projection of Section of Solids	Manually(on half imperial drawing sheet)
5	Orthographic projection	Manually(on half imperial drawing sheet)
6	Isometric Views	To be drawn with AutoCAD

Course Title: **2 Wheelers Servicing & Maintenance (Skill Enhancement Elective-I)**										
Semester	I	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd	L	T	P	Credits	TAE	CAE	ESE	INT	EXT
Course Category	VSEC1	1	-	2	2	10	15	-	25	-
Course Code	23BTMEL102 23BTMEP102									
Teaching Mode	Offline	3 Hrs			Total	25			25	
Duration of ESE	--					50				

Course Objectives	Understand the major components of 2 Wheeler, current trends, and technology overview.
	Provide students the skills to detect various faults in 2 wheeler, analyze them and perform trouble shooting
Course Outcomes	Upon the successful completion of course, the student shall be able to:
	CO1: Make use of proper tools for the routine maintenance
	CO2: Identify various types of carburetor
	CO3: Demonstrate charging of battery
	CO4: Compare manual and automatic transmission system
	CO5: Solve various problem arising in 2 Wheeler.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS O 3
CO1	3	1	3	2	1	1	-	2	1	-	-	1	-	3	1
CO2	3	1	3	2	1	1	-	2	1	-	-	1	-	3	1
CO3	3	1	3	2	1	1	-	2	1	-	-	1	-	3	1
CO4	3	1	3	2	1	1	-	2	1	-	-	1	-	3	1
CO5	3	1	3	2	1	1	-	2	1	-	-	1	-	3	1

Course Contents:

Sr. No.	Content
1.	**Introduction of Safety Equipment and tools** Various types of safety equipment, its usage and importance, General tools and their uses, special purpose tools and its proper usage. Measuring tools and equipments.
2.	**Spark Plug** Types of spark plug, Construction and Spark plug, Condition of spark plug. Cleaning and testing of spark plug on machine. Part number significance.
3.	**Types of Batteries** Battery types- conventional, VRLA battery, battery charger – load testing, use of multi meter to check battery voltage, battery removal and charging procedure.
4.	**Carburetors** Various types of Carburetors, Requirement of Carburetors, Function of carburetors, principles of carburetors, system of carburetors. A/F ratio, cleaning of carburetors.
5.	**Air filters, Lubrication systems** Types of air filter, cleaning of air filter, lubrication system in engines, engine dismantling, engine assembly, inspection of various parts.
6.	**Automatic transmission** CVT Transmission Operation, Functions of CVT components, dismantling and assembly of CVT. Advantages and disadvantages of CVT.
7.	**Fuel Injectors.** Types of fuel injectors, requirement of fuel injectors
8.	**Electrical Circuits.** Basics of electricity, arious types of electric circuits such as starting circuits, lighting circuits, signaling circuits, ignition circuit and charging circuits

Text Books	1.	R.K. Rajput, A Textbook of Automobile Engineering, Lakshmi Publication, 2008
Referenc eBooks	1.	Kirpal Singh Automotive Engineers, vol.1 & vol.2, Standard publication.
	2.	Automotive Mechanics: Joseph Heitner Motor Vehicle Technology W.H. Crouse.
Online TL Material	1.	Fundamentals of Automotive Systems,Prof. C.S.Shankar Ram, IIT Madras https://archive.nptel.ac.in/courses/107/106/107106088/
	2.	The Automobile Fundamentals Certificate Course, DIYguru

Sr. No.	Name of Experiments
1	Demonstration of General and special tools.
2	Spark plug cleaning and testing
3	Testing and charging of Batteries
4	Dismantling and assembly of Carburetors
5	Cleaning of air filters, Engine disassembly.
6	Dismantling and assembly of CVT
7	Fuel injector testing and cleaning
8	Demonstration on various electric circuits

Course Title: **Digital Fabrication (Skill Enhancement Elective-I)**										
Semester	I	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd	L	T	P	Credits	TAE	CAE	ESE	INT	EXT
Course Category	VSEC 1	1	-	2	2	10	15	-	25	-
Course Code	23BTMEL103 23BTMEP103									
Teaching Mode	Offline	3 Hrs			Total	25			25	
Duration of ESE	-					50				

Course Objectives	1. To construct 2D model using CAD
	2. To construct 3D model using CAD
	3. To create 3D model using 3D printing
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Understand the principles of rapid prototyping and its applications in product development, including iterative design, testing, and refinement.
	CO2: Understand the fundamental principles of digital fabrication, including additive manufacturing, subtractive manufacturing, and computer numerical control (CNC) machining.
	CO3: Demonstrate proficiency in using digital design tools, such as computer-aided design (CAD) software, to create 3D models for fabrication.
	CO4: Utilize 3D printing technologies to transform digital designs into physical objects, considering factors such as resolution, material properties, and post-processing requirements.
	CO5: Analyze and troubleshoot common issues and errors that may arise duringthe digital fabrication process and apply appropriate solutions.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	3	2	1	-	2	-	3	1	2	2
CO2	3	2	2	1	2	1	2	-	2	1	3	3
CO3	3	2	3	2	3	3	2	-	2	3	3	3
CO4	2	2	2	2	2	2	2	-	2	2	2	2
CO5	3	3	3	3	3	3	3	-	3	3	3	3

Course Contents:

Week	Contents	Hours
I	**Introduction to Digital Fabrication** • Overview of digital fabrication and its applications • Historical background and evolution of digital fabrication • Introduction to CAD software and 3D modeling principles • Understanding the digital fabrication workflow	1
II	**Digital Fabrication Processes** • Additive manufacturing techniques: CNC, FDM, SLA, SLS, etc. • Comparison of different 3D printing and CNC • Strengths and limitations of each process	1
III	**3D Modeling Basics** • Introduction to CAD (Computer-Aided Design) software • Basic modeling techniques • Creating and editing 3D models	1
IV	**Advanced 3D Modeling** • Intermediate modeling techniques • Parametric design and constraints • Designing for 3D printing: considerations and best practices	1
V	**Preparing Models for Printing** • Preparing models for printing using slicing software • Optimizing designs for printing • Support structures and rafts	1
VI	**3D Printer and CNC Operation and Maintenance** • Printer components and their functions • Calibration and setup • Maintenance and troubleshooting common issues	1
VII	**Materials for 3D Printing and CNC** • Overview of different materials used in 3D printing • Properties and characteristics of various materials • Selecting the right material for specific applications	1
VIII	**Post-Processing and Finishing** • Removing support structures • Sanding, polishing, and painting 3D prints • Adding post-processing details and effects	1
IX	**Practical Applications of 3D Printing** • Case studies and examples of 3D printing in different industries • Customization and personalization • Rapid prototyping and small-scale production	1
X	**Project Work** • Hands-on project using 3D printing technology and CNC • Designing and printing a functional object • Presentation and evaluation of the project	1

Text Books	1.	The Role of Digital Fabrication in Today's Society Tandra Lea Tyler-Wood Source Title: Research Anthology on Makerspaces and 3D Printing in Education DOI: 10.4018/978-1-6684-6295-9.ch002
	2.	Fundamentals of Digital Manufacturing Science, Zude Zhou, Shane (Shengquan) Xie Dejun Chen ISSN 1860-5168 ISBN 978-0-85729-563-7 e-ISBN 978-0-85729-564-4 DOI 10.1007/978-0-85729-564-4 Springer London Dordrecht Heidelberg New York
Online NPTEL Material	1.	Rapid Manufacturing https://onlinecourses.nptel.ac.in/noc23_me82/preview
	2.	Metal Additive Manufacturing https://onlinecourses.nptel.ac.in/noc23_me92/preview

Sr. No.	List of Experiments
1	2 D Sketching on CATIA V5
2	3D Modeling on CATIA V5
3	Slicing and G code generation for 3D printing
4	Introduction to FDM 3D printing
5	Performance on FDM 3D printing
6	Introduction to SLA 3D printing
7	Performance on SLA 3D printing
8	Introduction to CNC
9	G code generation for CNC
10	Performance on CNC

Course Title: **Solar PV System (Skill Enhancement Elective-I)**										
Semester	I	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd	L	T	P	Credits	TAE	CAE	ESE	INT	EXT
Course Category	VSEC1	1	-	2	2	10	15	-	25	-
Course Code	23BTMEL104 23BTMEP104									
Teaching Mode	Offline	3 Hrs			Total	25			25	
Duration of ESE	-					50				

Course Objectives	1. To learn the features of Solar Photovoltaic (PV) system.
	2. To identify the components of Solar PV system.
	3. To design the Solar PV system for specific load.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1. Understand the fundamentals of solar radiations.
	CO2. Evaluate electric conversion efficiency of Solar cell / PV module.
	CO3. Identify the parameters effecting efficiency of Solar PV module.
	CO4. Understand the basics of batteries for PV system.
	CO5. Design Solar PV system for various applications.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	3	3	2	-	-	3	-	-	-	-	3
CO2	3	3	3	2	-	-	3	-	-	-	-	3
CO3	3	3	3	2	-	-	3	-	-	-	-	3
CO4	3	3	3	2	-	-	3	-	-	-	-	3
CO5	3	3	3	2	3	-	3	-	2	2	-	3

Unit	Contents	Hours
I	**Solar Radiation:** Renewable energy sources, Solar constant, Air mass, Solar radiations- beam and diffuse, Instruments to measure solar radiations.	3
II	**Solar Cell:** Electricity, Measurement of DC voltage and current, Solar cell and types, solar cell parameters - Short circuit current, Open circuit voltage, Maximum power point, Fill factor, Efficiency, Current-Voltage curve, Factors affecting electricity generated by a Solar cell.	3
III	**Solar Module / Arrays and Batteries:** Introduction - Solar PV Modules and arrays, ratings of PV Module, Cells in module, series and parallel combinations of module and	3
	estimation of total power.	
IV	**Batteries/ Inverters /Charge controller:** Batteries for Photovoltaic(PV) Systems, components, types ,standard parameters of a battery, Battery Storage Capacity, Depth of Discharge(DoD), Battery Efficiency. Power Converters and Their Efficiency, Types of Inverters, Specifications, Charge Controllers and types.	3
V	**Solar PV System Design:** Off-grid system, Load estimation, Determining the batteries size, Determine the PV modules size, Use of modern tools for PV system design.	3

Text Books	1.	G.N.Tiwari, Handbook of Solar Energy: Theory, Analysis and Applications, Springer Science+Business Media, Singapore, First Ed. 2016
	2.	JohnA.Duffie&WilliamA.Beckman,SolarEngineeringofThermalProcesses:Photovoltaics and Wind; John Wiley & Sons, Inc., Hoboken, New Jersey, Fifth Ed. 2020
E-Books	1.	Suneel Deambi, Photovoltaic System Design: Procedures, Tools and Applications; CRC Press, Boca Raton, 2016.
Reference Books	1.	Chetan Singh Solanki, Solar Photovoltaic Technology and Systems - A Manual for Technicians, Trainers and Engineers;PHI Learning Private Limited, Delhi, First Ed., 2013
	2.	Weidong Xiao, Photovoltaic Power System: Modeling, Design, and Control; John Wileyand Sons Ltd., First Ed. 2017

Sr. No.	List of Experiments
1.	Measurement of solar radiations using pyranometer in different conditions.
2.	To study construction and working of solar photovoltaic (PV) systems.
3.	To measure the DC voltage and current using multimeter.
4.	Demonstration of PV cell under solar simulator.
5.	To study the performance of PV module with varying radiation intensities.
6.	To study the effect of module temperature on performance of PV module.
7.	To study the series and parallel combination of PV modules.
8.	To study the effect of tilt angle and shading on the PV output
9.	To determine the connected load and their energy estimation for PV system design.
10.	Design of photovoltaic system for various applications.

Course Title: **Material Science and Workshop Practice**										
Semester	II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Even	L	T	P	Credits	TAE	CAE	ESE	INT	EXT
Course Category	ESC3	2	-	4	4	10	15	50	25	-
Course Code	23BTMEL105 23BTMEP105									
Teaching Mode	Offline	6 Hrs.			Total	75			25	
Duration of ESE	2 Hrs.					100				

Course Objectives	1. To provide the students with basic knowledge of materials science
	2. To distinguish between variety of materials based on their structure and properties
	3. To demonstrate in workshop for various operations
Course Outcomes	Upon the successful completion of course, the student shall be able to
	CO 1. Demonstrate in workshop for various operations
	CO 2. Know the different classes of materials used in engineering applications.
	CO 3. Distinguish between variety of materials based on their structure and properties
	CO 4. choose the right materials for specific applications
	CO 5. Select cutting tool based on the material and desirable properties.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	3	2	-	2	-	2	-	-	-	-	-	2	2	3
CO2	3	3	2	-	2	-	2	-	-	-	-	-	2	2	3
CO3	3	3	2	-	3	-	2	-	-	-	-	-	2	1	3
CO4	3	2	2	-	2	-	1	-	-	-	-	-	3	3	3
CO5	3	3	2	-	2	-	1	-	-	-	-	-	3	2	3

Course Contents:

Unit	Contents	Hours
I	**Workshop and Digital fabrication:** Workshop: Introduction to cutting tools, Methods of manufacturing processes – casting, forming, metal removal processes, joining processes, surfacefinishing processes, basic workshop processes – carpentry, fitting, handforging, machine forging, welding, cold and hot working of metals. Introduction to Digital fabrication: 3D printing, CNC machines	8
II	**Introduction to Material Science:** Properties of Materials, Structure of atoms, Description of materials science tetrahedron, Force - interatomic distance curve, Structure - description of unit cell and space lattices, Coordination number, APF for cubic and hexagonal close packed structures, Miller indices, Non crystalline structures properties of crystalline and amorphous structures, Crystal imperfections Significance of structure property correlations in all classes of engineering materials.	6
III	**Crystallography and Phase diagrams** – Solid solution, Hume Rothery rule, Time temperature cooling curve, construction of equilibrium diagram, Gibbs phase rule - Single component systems – Eutectic phase diagram – lever rule -Study of properties of phase diagrams - Phase transformation - Nucleation kinetics and growth, allotropy of iron, microstructure .	6
IV	**Mechanical properties** - Stress, Strain, Elastic properties – Deformation – elasticity – hardness – Rockwell, Brinell test, tensile test, impact test, Izod andCharpy test, non-destructive testing	6

Text Books	1.	"Introduction to Physical Metallurgy" by S. H. Avener ,McGraw Hill Publication,,2001.
	2.	'Nanostructured Materials and Nanotechnology', by Hari Singh Nalwa, Academic Press, 2002.
	3.	'Nanotechnology', by Mick Wilson et al, Overseas Press (India) Pvt. Ltd.,2005.
	4	'Workshop Technology' by S.K. Hajara Chuadhari, Media pramotors and publishers pvt ltd.
	5	'Workshop Technology' by B S Raghuvanshi, Dhanpatrai & Sons
E-Books	1.	Materials Engineering, http://home.iitk.ac.in/~anandh/E-book/phase2/
	2.	Crystal Structure; http://home.iitk.ac.in/~anandh/E-book/
	3.	Workshop practices, https://www.amazon.in/Mechanical-Experiments-Workshop-Practice-Sawhney-ebook/dp/B01JCYXLWS
Referenc eBooks	1.	Engineering Physical Metallurgy & Heat Treatment, Lakhtin Y.; 6th Ed; Mir Publishers, 1998.
	2.	Nanomaterials- Synthesis, Properties and Applications, Edited by A.S.Edelstein and R.C. Cammarata, Institute of Physics Publishing, London, 1998(paper back edition)
Online TL Material	3.	Manufacturing Processes and Materials: Exercises© 2010 Miltiadis A.Boboulos & Ventus Publishing.
	1.	Advanced machining Processes, Prof. Manas Das IIT Guwahati, nptel, https://nptel.ac.in/courses/112103202/
	2.	Introduction to Material Science and Engineering, Prof. Rajesh Prasad, IITDelhi, https://archive.nptel.ac.in/courses/113/102/113102080/

Sr. No.	Name of Experiments
1	Practical in Carpentry shop
2	Practical in welding shop
3	Practical in Fitting shop
4	Practical in Smithy shop
5	Hardness measurement and detailed study of Rockwell hardness testing machine.
6	Tensile Testing of Mild Steel using universal Testing machine
7	Impact testing of metallic material using Charpy / Izod test procedure
8	Detailed study of the optical microscope for metallographic examination.
9	Virtual Labs – Material response to Microstructure; http://mrmsmtbs-iitk.vlabs.ac.in/home%20page.html
10	3D Printing Practical

Course Title: **Sensors, Actuators and Measurement**										
Semester	II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Even	L	T	P	Credits	TAE	CAE	ESE	INT	EXT
Course Category	PCC1	1	-	2	2	10	15	50	25	-
Course Code	23BTMEL106 23BTMEP106									
Teaching Mode	Offline	3 Hrs.			Total	75			25	
Duration of ESE	2 Hrs.					100				

Course Objectives	1. To understand the basic concept of sensors, actuators, and measurement system, along with its functional element.
	2. To study the performance characteristics of measuring instruments
	3. To learn various measuring instruments and its applications.
Course Outcomes	Upon successful completion of this course, student shall be able to:
	CO 1. Relate the use of sensors, actuators, and measuring instruments in various applications and interpret the instrument characteristics.
	CO 2. Select a measuring instrument for strain and pressure measurement.
	CO 3. Illustrate the force, motion and flow measuring instrument.
	CO 4. Decide the temperature measuring instrument
	CO 5. Choose the proper measuring instruments for speed, vibration, humidity, and liquid level

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	2	-	1	-	-	1	3	2	3	-
CO2	3	1	1	1	3	2	-	1	-	-	1	3	2	3	-
CO3	3	1	1	1	3	2	-	1	-	-	1	3	2	3	-
CO4	3	1	1	1	3	2	-	1	-	-	1	3	2	3	-
CO5	3	1	1	1	3	2	-	1	-	-	1	3	2	3	-

Course Contents:

Unit	Contents	Hours
I	**Introduction of Sensor, Actuators , Measurement system, and General performance Characteristics:** Sensors, Basic requirements of a sensor, Classification of sensors, actuators, generalized measurement system, types ofmeasuring instruments, types of inputs, various methods of correction, Static characteristics, Dynamic characteristics, different types of errors,	3
II	**Strain Measurement & Pressure Measurement:** **Strain Measurement:** Types of strain gauges, strain gauge circuits, **Pressure Measurements:** Elastic transducers and force balance transducers, strain gauge pressure cell, High-pressure measurement, low-pressure Measurement.	3
III	**Force Measurement, Motion Measurement & Flow Measurement** **Force Measurement:** Pneumatic and hydraulic load cells, strain gauge load cells, piezoelectric load cells, torque measurement, types of dynamometers. **Motion measurements:** LVDT, capacitive, photoelectric & Inductive transducers. **Flow Measurements:** Rota meter, anemometer, turbine meter, electromagnetic flow meter.	3
IV	**Temperature measurement:** Liquid in glass thermometer, pressure thermometers, thermocouples, resistance thermometers,bimetallic thermometers, thermistors, radiation, optical pyrometer.	3
V	**Various Measurements:** Speed Measurement, different types of tachometers, Vibration Measurements, Humidity measurement, liquid level Measurements Advanced topic	3

Text Books	1.	Erenest O. Doebeling, 'Measurement Systems', McGraw Hill, 2nd edition 2014
	2.	T.G. Beckwith & N.L. Bulk, 'Mechanical Measurements', Addison Werlly, 3rd edition 2012.
	3.	D.S. Kumar, 'Mechanical Measurement & Control', Metropolitan Book Company, 4th edition 2014.
E-Books	1.	D. V. S. MURTY, 'Transducers and Instrumentation', PHI Learning Pvt. Ltd.,2nd Edition, 2010.
	2	Erenest O. Doebeling, 'Measurement Systems', McGraw Hill, 2nd edition 2014
Reference Books	1.	J.P. Holman, 'Experimental Methods for Engineers', McGraw Hill, 2nd edition 2013.
	2.	Nakra Choudhari, 'Instrumental Measurement & Analysis', Tata McGraw Hill, 3rd edition 2011.
	3.	Ramgan, Sharma & Mani, 'Instrumentation', Tata McGraw Hill, 3rd edition 2013
	4.	Collette & Hope, 'Engineering Measurement', ELBS, 2nd edition 2010.
Online TL Material	1.	Mechanical Measurements and Metrology, Prof. S.P. Venkateshan, IIT Madras nptel, https://nptel.ac.in/courses/112106138/
	2.	Principles of Mechanical Measurement, Prof. R. Raman, IIT Madras, nptel, https://nptel.ac.in/courses/112106140/

Sr. No.	Name of Experiments / Mini Projects/ Case Studies
1	Assembling and details of components of Bourdon Tube Pressure Gauge
2	To determine the sensitivity, linearity, best fit line and error analysis of Bourdontube pressure gauge with dead weight tester.
3	To determine the sensitivity, linearity ,best fit line and error analysis of LVDT
4	To determine the sensitivity, linearity ,best fit line and error analysis of LDR
5	To determine linearity time constant and error analysis in temperature measurementwith the help of Thermocouple
6	Measurement of moisture content and psychometric properties by hygrometer
7	Speed Measurement by magnetic pick up and photoelectric pick up and comparisonwith results of tachometer
8	To determine the sensitivity, linearity ,best fit line &error analysis of Strain Gauge
Open Ended Experiments	
1	Measurement of air mass flow rate and psychometric properties by hot wireanemometer
Details of on line Laboratory Resource Material Instruction / Operating Manuals	
1.	https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=351&cnt=1

Course Title: **Design Thinking (Skill Enhancement Elective-II)**										
Semester	II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Even	L	T	P	Credits	TAE	CAE	ESE	INT	EXT
Course Category	VSEC2	1	-	2	2	10	15	-	25	-
Course Code	23BTMEL107 23BTMEP107									
Teaching Mode	Offline	3 Hrs.			Total	25			25	
Duration of ESE	--					50				

Course Objectives	1. To understand various stages of design inorder to develop a prototype.
	2. To understand surface finishing operation.
Course Outcomes	Upon the successful completion of course, the student shall be able to
	CO 1. Identify various stages of Design
	CO 2. Relate ideas to produce creative solutions
	CO 3. Translate idea to generate solution
	CO 4. Develop prototype by applying all skill

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	2	2	3	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	2	3	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	1	2	-	-	-	-	-	-	-	-	3	-	-
CO4	3	2	1	2	-	-	-	-	-	-	-	-	3	-	-
CO5	3	2	1	2	-	-	-	-	-	-	-	-	3	-	-

Course Contents:

Unit	Contents	Hours
I	**Stages of thinking** The Design Process: Stage 1 – Define, Stage 2 – Research, Stage 3 – Ideate, Stage 4 – Prototype, Stage 5 – Select, Stage 6 – Implement, Stage 7 – Learn	4
II	**Idea generation** Basic design directions, Themes of thinking, Inspiration and references, Brainstorming, Value, Inclusion, Sketching, Presenting ideas	4
III	**Refinement** Thinking in images, Thinking in signs, Appropriation, Humor, Personification, Visual metaphors, Modification, Thinking in words, Words and language, Type 'faces', Thinking in shapes, Thinking in proportions, Thinking in color.	4
IV	**Prototyping** Developing designs, 'Types' of prototype, Vocabulary **Implementation** Format, Materials, Finishing, Media, Scale, Series/Continuity	4

Text Books	1.	Gavin Ambrose, Paul Harris, "Basics Design - 8: Design Thinking", illustrated, reprint, AVA Publishing, 2010
	2.	Christian Müller-Roterberg, "Handbook of Design Thinking", Kindle Direct Publishing ISBN: 978-1790435371, November 2018
Referenc eBooks	1.	Design Thinking and Innovation for Grade 6 by CBSC
Online TL Material	1.	Design Thinking - A Primer, IIT Madras, Dr. Ashwin Mahalingam, Prof. Bala Ramadurai
	2.	Understanding Design Thinking and People Centred Design By Prof. Jhumkee Iyengar | IIT Kanpur

Sr. No.	Name of Experiments
1	Study of various cases of size and shape
2	Idea generation
3	Concept development
4	Preparation of model
5	Study of various material
6	Study of asthetic look and color
7	Preparation of prototype
8	Innovative product development

Course Title: **3 D Printing (Skill Enhancement Elective-II)**										
Semester	II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Even	L	T	P	Credits	TAE	CAE	ESE	INT	EXT
Course Category	VSEC 2	1	-	2	2	10	15	-	25	-
Course Code	23BTMEL108 23BTMEP108									
Teaching Mode	Offline	3 Hrs			Total	25			25	
Duration of ESE	-					50				

Course Objectives	1. Understand the fundamentals of 3D printing
	2. Develop proficiency in 3D modeling
	3. Gain practical knowledge of 3D printer operation
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO 1. Gain a comprehensive understanding of the principles, processes, and techniques involved in 3D printing
	CO 2. Develop skills in 3D modeling software to create and design 3D printable models.
	CO 3. Have practical experience operating 3D printers.
	CO 4. Learn about different materials used in 3D printing, their properties, and their suitability for various applications.
	CO 5. Familiarized with post-processing techniques for 3D printed objects.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	3	2	1	-	2	-	3	-	-	-
CO2	3	2	2	1	2	1	2	-	2	-	-	-
CO3	3	2	3	2	3	3	2	-	2	-	-	-
CO4	2	2	2	2	2	2	2	-	2	-	-	-
CO5	3	3	3	3	3	3	3	-	3	-	-	-

Course Contents:

Module	Contents	Hours
I	**Introduction to 3D Printing** • Overview of 3D printing technologies • History and current applications of 3D printing • Introduction to 3D modeling software	2
II	**3D Modeling for 3D Printing** • Basics of 3D modeling • Design considerations for 3D printing • Creating 3D models using CAD software	2
III	**Preparing 3D Models for Printing** • Introduction to slicing software • Importing and manipulating 3D models • Configuring print settings	2
IV	**3D Printing Materials** • Overview of common 3D printing materials • Properties and characteristics of different materials • Selecting the right material for a specific application	2
V	**Operating 3D Printers** • Components of a 3D printer • Setting up and calibrating a 3D printer • Troubleshooting common issues	2
VI	**Advanced 3D Printing Techniques** • Multi-material printing • Support structures and rafts • Post-processing techniques (sanding, painting, etc.)	2
VII	**Project Work** • Design and print a complex 3D object • Iterative design process • Presentation and evaluation of final projects	1

Text Books	1.	The Role of Digital Fabrication in Today's Society Tandra Lea Tyler-Wood Source Title: Research Anthology on Makerspaces and 3D Printing in Education DOI: 10.4018/978-1-6684-6295-9.ch002
	2.	Fundamentals of Digital Manufacturing Science, Zude Zhou, Shane (Shengquan) Xie Dejun Chen ISSN 1860-5168 ISBN 978-0-85729-563-7 e-ISBN 978-0-85729-564-4 DOI 10.1007/978-0-85729-564-4 Springer London Dordrecht Heidelberg New York
Online NPTEL Material	1.	Rapid Manufacturing https://onlinecourses.nptel.ac.in/noc23_me82/preview
	2.	Metal Additive Manufacturing https://onlinecourses.nptel.ac.in/noc23_me92/preview

Sr. No.	Name of Experiments / Mini Project
1	**Basic 3D Printing Setup:** Learn how to set up and calibrate a 3D printer, including leveling the build plate and loading filament.
2	**Designing for 3D Printing:** Explore various design principles and software tools (such as CATIA, Tinkercad) to create 3D printable models. Learn about properwall thickness, support structures, and other considerations.
3	**Printing with Different Materials**: Experiment with different types of filaments, such as PLA, ABS, PETG, or TPU, to understand their characteristics and printing requirements.
4	**Optimizing Print Settings:** Master the settings in your slicing software to achieve high-quality prints. Learn about layer height, print speed, infill density, and other parameters that affect the final result.
5	**Troubleshooting Print Issues:** Identify and solve common problems that may occur during the printing process, such as warping, stringing, or layer shifting.
6	**Post-Processing Techniques:** Explore techniques to enhance and finish 3D printed objects, including sanding, painting, smoothing, or adding surface finishes.
7	**Prototyping:** Use 3D printing to quickly iterate and prototype new product designs or engineering concepts.
8	Introduction to SLA 3D printing

Course Title: **Refrigeration and Air Conditioning Systems (Skill Enhancement Elective-II)**										
Semester	II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Even	L	T	P	Credits	TAE	CAE	ESE	INT	EXT
Course Category	VSEC2	1	-	2	2	10	15	-	25	-
Course Code	23BTMEL109 23BTMEP109									
Teaching Mode	Offline	3 Hrs.			Total	25			25	
Duration of ESE	2 Hrs.					50				

Course Objectives	1. To learn fundamental principles of refrigeration and air conditioning, along with refrigerant properties.
	2. To understand the different technologies of refrigeration and air conditioning.
Course Outcomes	Upon the successful completion of course, the student shall be able to
	CO 1. Demonstrate basic of refrigeration & air conditioning and express the importance of eco-friendly refrigerants.
	CO 2. Apply concepts of psychrometry

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	3	3	2	-	-	-	-	3	3	-
CO2	3	3	3	3	-	3	3	-	-	-	-	-	3	3	-

Course Contents:

Unit	Contents	Hours
I	**Introduction to Refrigeration, Refrigerants, and Vapour Refrigeration Systems:** **Applications:** Applications in domestic refrigerators, domestic air conditioners, automotive air conditioners, evaporative coolers, water coolers, commercial refrigeration- dairy, cold storage, ice plant, commercial air conditioning-multiplex, hospitals. **Refrigerants: C**lassification of refrigerants, designation of refrigerants, desirable properties of refrigerants, environmental issues, ozone depletion and global warming, ODP, GWP & LCCP, Montreal, Kyoto protocol, and Kigali amendment, **Vapour compression systems:** Working of simple vapour compression system, T-s and P-h diagram, COP, EER, SEER, IPLV, NPLV, **Vapour Absorption systems:** Introduction, working of simple vapour absorption system (VAS), desirable properties of binary mixture (aqua-ammonia), actual VAS, Li-Br absorption system, three fluid system (Electrolux refrigeration), applications of VAS, comparison between VCC and VAC.	8
II	**Psychrometry, Air conditioning system:** **Psychrometry:** basic psychrometry and processes, BPF of coil, ADP, adiabatic mixing of two air streams, SHF, RSHF, GSHF, ESHF. factors contributing to cooling load, numerical based on load analysis. **Human comfort**: thermodynamics of human body, comfort and comfort chart, factors affecting human comfort, concept of infiltration and ventilation, indoor air quality requirements. **Air conditioning systems:** working of summer, winter and all year-round ac systems, all air system, all water system, air water system, variable refrigerant flow and variable air volume systems, unitary and central air conditioning.	8

Text Books	1.	C.P. Arora, Refrigeration & Air conditioning, Tata McGraw Hill Publication, 3rd Edition, 2016.
	2.	Dr. Manohar Prasad, Refrigeration & Air conditioning, New Age International Publication, 3rd Edition, 2017.
E-Books	1.	S. N. Sapali, Refrigeration and Air Conditioning, PHI Learning, 2nd Edition, 2013
	2.	R S Khurmi, J K Gupta Textbook of Refrigeration and Air Conditioning, S. Chand Limited, 3rd edition 2008
Reference Books	1.	R J Dosset & T J Horan, Principles of Refrigeration, Prentice Hall, 3rd Edition, 2016.
	2.	Ramesh Chandra Arora, Refrigeration and Air conditioning, PHI Learning Pvt. Ltd., 1st Edition, 2010.
	3.	W. F. Stockers and J. W. Jones, Refrigeration and Air conditioning, McGraw Hill International, 2nd Edition, 1982.
Online TL Material	1.	Refrigeration And Air-Conditioning, Prof. Ravi Kumar, IIT Roorkee, Swayam https://archive.nptel.ac.in/noc23_me132

Sr. No	List of Practical: Conduct any eight practicals.
1.	Test on vapour compression test rig and its performance.
2.	Test on a desert cooler to evaluate its performance.
3.	Test on vapour absorption refrigeration test rig for its performance.
4.	Test on vortex tube refrigeration system to determine its performance.
5.	To perform trial on thermoelectric refrigeration system to determine COP.
6.	To perform trial on adiabatic demagnetization refrigeration system.
7.	Test on ice plant test rig for its performance.
8.	Test on air conditioning test rig for its performance.
9.	To perform trial on thermoacoustic refrigeration system (Open Ended).
10.	To perform trail on vapour compression test ring with magnet (Open Ended).

Course Title: **Basic Electrical Engineering**										
Semester	II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Even	L	T	P	Credits	TAE	CAE	ESE	INT	EXT
Course Category	ESC1	3	-	2	4	10	15	50	25	-
Course Code	23BTEEL101 23BTEEP101									
Teaching Mode	Offline	5 Hrs.			Total	75			25	
Duration of ESE	2 Hrs.					100				

Course Objectives	To prepare students to understand Different types of Circuit Elements.
	To make aware about basic principles of operations of electrical machines.
	To train students to know about energy audit, Management and Safety.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Remenber fundamentals of Electric Circuits.
	CO2: Understand the basic quantities of a magnetic circuit
	CO3: Identify different configurations of A.C. Circuits.
	CO4: Compare A.C machines and DC Machines.
	CO5: Estimate Energy Audit for Energy Management and Safety.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	PO 1	PO2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	**3**	--	--	--	--	--	--	--	--	--	--	--
CO2	**3**	--	--	--	--	--	--	--	--	--	--	--
CO3	**3**	--	--	--	--	--	--	--	--	--	--	--
CO4	**3**	--	--	--	--	--	--	--	--	--	--	--
CO5	**3**	--	--	--	--	--	--	--	--	--	--	--

Course Contents:

Unit	Contents	Hours
I	**Unit-I:- Fundamentals of Electric Circuits** Ohms Law, types of sources (Current & Voltage), Ideal and Practical Sources (Independent Sources only), Source Conversion. Superposition theorem with DC source. Circuit element resistance, series & parallel combination of resistances, Kirchhoff's Laws (KVL, KCL).	7
II	**Unit – II:- Magnetic Circuits** Types of Magnetic Materials, flux, flux density, flux intensity, MMF, reluctance, permanence, permeability, analogous electric circuit, concept of leakage flux and fringing, B-H curve, phenomena of magnetic hysteresis.	7
III	**Unit III:- A. C. Circuits** Generation of single phase voltage, average and RMS value for sinusoidal waveform,phasor representation of sinusoidal electrical quantities, RLC circuit with excitation,reactance, impedance, power and energy in AC circuit, series AC circuit, concept and importance of power factor.	7
IV	**Unit V Introduction to Electrical Machines** Working principle of Single phase transformer, DC machines (DC Generator& Motor), AC Machines.	5
V	**Unit V:- Energy Audit & Safety Instruments** Need and types of energy audit. Energy management, understanding energy costs, Necessity of equipment earthing, Fuses, MCB, ELCB, Isolator (Elementary concepts only), Introduction to House Wiring.	4

Text Books	1.	Basic Electrical and Electronics Engineering, S K Bhattacharya, Pearson, 2nd Edition.
	2.	Basic Electrical Engineering, H. Cotton, C B S, 2005, Seventh Edition
	3.	Engineering Circuit analysis, William Hayt, Tata McGraw Hill
E--Books	1.	Fundamentals of Electrical Engineering by Don Johnson, Connexions, 2010
	2.	Fundamentals of Electrical Engineering and Electronics,Tony R. Kuphaldt.
Reference Books	1.	Introduction to Electrical Engineering, Naidu, Kamakshaia, Tata McGraw Hill, 2000, Third Edition
	2.	Electrical and Electronics Technology, Hughes, Pearson, Eleventh Edition
	3.	Laboratory courses in Electrical Engg., S G Tarnekar, P K Kharbanda, S B Bodkhe, S D Naik, S. Chand & Co., 2010, Second Edition
Online TL Material	1.	https://nptel.ac.in/courses/108/108/108108076/
	2.	https://nptel.ac.in/courses/108/108/108108076/
	3.	https://nptel.ac.in/courses/108/108/108108076/

List of Practical / Experiment

Sr. No.	Name of Experiments
1	Overview of Lab Equipment & Safety Precaution.
2	To Verify Superposition Theorem.
3	To Verify Kirchhoff's Voltage Law.
4	To Determine Active and Reactive power of Choke coil.
5	To Plot B-H curve of Magnetic Circuit.
6	Study of phase relationship in R-L-C parallel network by computer simulation using P-Sim Software.
7	To Determine transformation ratio of transformer.
8	Case Study on Energy Audit
Open Ended Experiments / New Experiments	
1	To compare normal capacitor with super-capacitor, Various Types of Capacitor.
2	To study resonance circuit using software
3	Circuit designing, Testing & Validation of Electrical Circuits
Details of Online Laboratory Resource Material Instruction / Operating Manuals	
1.	Virtual Lab

Course Title: **Skill Enhancement Elective– I** **(Solar Photo Voltaic and its application)**										
Semester	IV	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	VSEC1	1	-	2	2	10	15	-	25	--
Course Code	23BTEEL102 23BTEEP102									
Teaching Mode	Conventional	3 Hrs			Total	25			25	
Duration of ESE	NA					50				

Course Objectives	**Students will learn to**
	Understand the fundamentals of energy conversion in solar photovoltaics
	Understanding various technologies in structures of solar photovoltaic cells
	Developing the skills in basic calculations in solar PV systems design
Course Outcomes	**Students will be able to**
	CO1: Understand various aspects of Solar Photovoltaic cell
	CO2: Understand Solar Photovoltaic energy conversion and utilization
	CO3: Understand and classify equipments in radiation measurement
	CO4: Understand use of various equipments associated with safety measures
	CO5: Understand the application of Solar PV system in various electricity consumers

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	3	--	--	2	3	--	--	--	1	3	1	1	3
CO2	3	2	3	--	--	2	3	--	--	--	1	3	1	1	3
CO3	3	2	3	--	--	2	3	--	--	--	1	3	1	1	3
CO4	3	2	3	--	--	2	3	--	--	--	1	3	1	1	3
CO5	3	2	3	--	--	2	3	--	--	--	1	3	1	1	3

Course Contents:

Unit	Contents	Hours
I	**Solar Photovoltaic and Its Applications:** Introduction to Solar PV technology, Principle of Energy conversion, Solar cell Characteristics, Series and Parallel connections of PV module – concept of Module and Array, various types Battery energy storage technologies, Inverters – standalone and grid connected, MPPT tracking systems, understanding On Grid and Off-grid PV systems, introduction to Net metering and its aspects**,** Introduction to charge controllers - its role and functions, financial incentives provided by utility on solar PV installationsand related policies, Estimation of losses & system yield calculation, Off-grid PV system design & component sizing for various types of electricity consumers, PV array design requirements as per IEC 62548, introduction System protection and safety equipments, Economics of PV Systems and payback period calculations, Operation and maintenance of PV systems, PV system installation & commissioning, application of solar PV systems for various types of electricity consumers	20

Sr. No.	List of Experiments
1	To study the overview of Solar Laboratory
2	To study 172.5 kW Solar PV system installed at Shradhha park campus
3	To study of Mono and polycrystalline structures of solar PV cell
4	To Study various battery energy storage systems associated with solar PV systems
5	To Study net metering system for Grid connected Solar PV system
6	To plot V-I characteristics for solar PV cell
7	To Study various safety instruments required during solar PV system installation
8	To study monthly electricity bills of GHRIET campus to understand monthly financial incentives offered by utility systems

Text Books	1.	1. Solar Photovoltaics: Fundamentals, Technologies And Applications, BookAuthor: Dr. Chetan Singh Solanki, Publisher- PHI learning
	2.	2. The Solar Electricity Handbook - 2017 Edition, by Michael Boxwell
E--Books	1.	https://kashanu.ac.ir/Files/Content/Handbook.pdf
Referenc eBooks	1.	SOLAR PHOTOVOLTAIC TECHNOLOGY AND SYSTEMS: A Manual for Technicians, Trainers and Engineers, by Dr. Chetan Singh Solanki, Publisher- PHIlearning
	2.	Solar Energy: The physics and engineering of photovoltaic conversion, technologies and systems Kindle Edition by Arno Smet
Online TL Material	1.	NPTEL Courses 1) https://nptel.ac.in/courses/115107116 2) https://nptel.ac.in/courses/103103206 3) https://nptel.ac.in/courses/115103123

Course Title: **Skill Enhancement Elective– I Energy Conservation & Audit**										
Semester	I	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	VSEC1	1	-	2 Hrs.	2	10	15	-	25	--
Course Code	23BTEEL103 23BTEEP103									
Teaching Mode	Offline	3 Hrs			Total	25			25	
Duration of ESE	NA					50				

Course Objectives	The subject aims at basic components
	To give understanding on current energy scenario
	To expose students to the function and application Energy Management
	To use appropriate experimentation techniques to evaluate energy efficiency in electrical system
Course Outcomes	**Upon successful completion of this course, student will be able to:**
	• Understand the current energy scenario and importance of energy conservation.
	• Understand the concepts of energy management.
	• Understand the methods of improving energy efficiency in different electrical systems.
	• Understand the concepts of different energy efficient devices.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	1	2	2	3	--	3	3	2	3	1
CO2	3	3	1	2	2	3	--	3	3	2	3	1
CO3	3	3	1	2	2	3	--	3	3	2	3	1
CO4	3	3	1	2	2	3	--	3	3	2	3	1
CO5	3	3	1	2	2	3	--	3	3	2	3	1

Course Contents:

Unit	Contents	Hours
I	**Energy Scenario** Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long termenergy scenario,. Energy Conservation Act-2001 and its features.	5 Hrs
II	**Basics of Energy and its various forms** Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.	5 Hrs
III	**Energy Management & Audit** Definition, energy audit, need, types of energy audit. Energy management (audit) approach understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material andenergy balance diagrams.	5Hrs
IV	**Energy Efficiency in Electrical Systems** Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses. Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors	5 Hrs

Text Books	1.	Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects (available online)
	2.	Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-3, Electrical Utilities (available online)
	3.	S. C. Tripathy, "Utilization of Electrical Energy and Conservation", McGraw Hill, 1991.
Reference Books	1.	. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org)

Course Title: **Advanced Electrical Technology**										
Semester	I/II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd/ Even	Th	Tu	P r	Credits	TAE	CAE	ESE	INT	EXT
Course Category	PCC1	**2**	--	--.	2	10	15	50	--	--
Course Code	23BTEEL105									
Teaching Mode	Offline	2 Hrs			Total	75				
Duration of ESE	2Hrs					75				

Course Objectives	To prepare students to understand Different types of poly phase circuit
	To make aware about basic principles of operations of transformer and machines
	To train students about the Electrical power system.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Understand different aspects of transformer.
	CO2: Describe the polyphase circuit.
	CO3: Analyze the performance of AC Motor.
	CO4: Identify different types of DC Machines.
	CO5: Highlight the overview of Electrical Power System.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	PO 1	PO2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	**2**	**3**	--	--	--	--	--	--	--	--	--	--
CO2	**2**	**3**	--	--	--	--	--	--	--	--	--	--
CO3	**2**	**3**	--	--	--	--	--	--	--	--	--	--
CO4	**2**	**3**	--	--	--	--	--	--	--	--	--	--
CO5	**2**	**3**	--	--	--	--	--	--	--	--	--	--

Course Contents:

Unit	Contents	Hours
I	**Unit I : Single Phase Transformers.** Basic principle, construction, phasor diagram for transformer under no load condition, Transformer on load, EMF equation Phasor diagrams, Equivalent circuit, Losses, Efficiency, Regulation, Open-circuit & short-circuit test,Applications.	10
II	**Unit II : Polyphase Circuits** Principal of Generation of three phase voltage, Phase sequence, Star & DeltaConnected three phase system, Voltage, Current & Power relations for Balanced three phase system.	6
III	**Unit III : AC Motors** Three phase Induction motor Construction, and principle of rotating field, synchronous speed, Rotor current, torque and slip.	8
IV	**Unit IV : DC Machines** Introduction to DC Machines, construction, EMF equation, classification, self-excitation of D.C. shunt generators.	8
V	**Unit V: Introduction to Electrical Power System** Introduction to Power Generation (Thermal, Hydro, Nuclear, Wind, and Solar) with block schematic presentation only. Single line diagram for Generation, Transmission & Distribution through different voltage levels.	8

Text Books	1.	Basic Electrical and Electronics Engineering, S K Bhattacharya, Pearson, 2nd Edition.
	2.	Electrical Power System, C L Wadhwa, New Age International Publishers.
	3.	Basic Electrical Engineering, D C Kulkshreshtha, McGraw Hill, 2012
E--Books	1.	Fundamentals of Electrical Engineering by Don Johnson, Connexions, 2010
	2.	Principles of Power System, V K Mehta, S Chand.
Reference Books	1.	Introduction to Electrical Engineering, Naidu, Kamakshaia, Tata McGraw Hill, 2000, Third Edition
	2.	Electrical and Electronics Technology, Hughes, Pearson, Eleventh Edition
	3.	Laboratory courses in Electrical Engg., S G Tarnekar, P K Kharbanda, S B Bodkhe, S D Naik, S. Chand & Co., 2010, Second Edition
Online TL Material	1.	https://nptel.ac.in/courses/108/108/108108076/
	2.	https://nptel.ac.in/courses/108/108/108108076/
	3.	https://nptel.ac.in/courses/108/108/108108076/

Sr. No.	Name of Experiments
1	Overview of Electrical Power System.
2	To find Line & phase quantities in Three Phase star Connected balanced Load.
3	To find the efficiency and regulation of a single phase transformer by OC and SC Test.
4	To Determine the speed and torque of DC Motor by using MATLAB.
5	Introduction to Power World Simulator Software for Power Flow.
6	To Observe the speed reversal of three phase Induction motor.
7	To find Line & phase quantities in Three Phase Delta Connected balanced Load.
8	To Study Staircase Wiring.
Open Ended Experiments / New Experiments	
1	To study and observe the performance of 33/11 kV distribution substation
2	To Study different Protective Devices
Details of Online Laboratory Resource Material Instruction / Operating Manuals	
1.	Virtual Lab

Course Title: **Vocational & Skill Enhancement Elective-II**

Foundation of Electric Vehicle and Renewable Energy

Semester	II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	VSEC2	1 Hrs	-	2	2	10	15 -		25	--
Course Code	23BEEL106 23BEEP106									
Teaching Mode	Conventional	3 Hrs			Total	25			25	
Duration of ESE	NA					50				

Course Objectives	1. Develop a comprehensive understanding of electric vehicles.
	2. Gain knowledge of the various subsystems that constitute an electric vehicle powertrain.
	3. Acquire a foundational understanding of renewable energy sources.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: To understand the current state and future potential of EVs in the country.
	CO2: To identify the different components of an EV.
	CO3: To ensure a comprehensive understanding of energy storage in electric vehicles.
	CO4: To understand PV cell and module technologies.
	CO5: To familiarize students with the basics of renewable generation.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	PO 1	PO2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	**3**	**2**	**-**	1	--	--	--	--	--	--	--	**2**
CO2	**3**	**2**	**-**	1	--	--	--	--	--	--	--	**2**
CO3	**3**	**2**	**-**	1	--	--	--	--	--	--	--	**2**
CO4	**3**	**2**	**-**	1	--	--	--	--	--	--	--	**2**
CO5	3	**2**	**-**	1	--	--	--	--	--	--	--	**2**

Course Contents:

Unit	Contents	Hours
I	**Unit I :- Basics of Electric Vehicle** Introduction to Energy Scenario in India, history of EV, Overview of Electric Vehicles in India, Vehicle Subsystems (block Diagram): EV Power-train, types of Electric Vehicles and their power sources.	8
II	**Unit II :- Components of Electric Vehicles** Fundamentals of EV Battery Pack, Basics of Lithium ion batteries and its safety, Fundamentals of EV Motors, Controllers and Accessories.	8
III	**Unit III :-Battery Charging and Infrastructure** Battery Charger, Battery discharging Profile, Basics of Regenerative Braking, Future trends in EV.	6
IV	**Unit IV :- PV System** Solar Energy: Basics and Concepts, PV Cell and Module, Standard specifications of Solar Module. IV and PV characteristics of Solar Panel, PV Charge Controller, Basic Block Diagram of PV system.	8
V	**Unit V:- Renewable Energy Sources** Wind energy in India, Basics of Wind Energy Generation, Wind Turbine Technology and components, Biomass, Hydro energy types and characterization.	10

Text Books	1.	Chan, C. C., and K. T. Chau. Modern electric vehicle technology. Vol. 47.Oxford University Press on Demand, 2001.
	2.	Solanki, Chetan Singh. Solar photovoltaics: fundamentals, technologies and applications. Phi learning pvt. Ltd., 2015.
	3.	Rai, G. D., and C. D. Rai. Non-conventional energy sources. Khanna, 1992.
E--Books	1.	Husain, Iqbal. Electric and hybrid vehicles: design fundamentals. CRC press, 2021.
	2.	Nelson, Vaughn C., and Kenneth L. Starcher. Introduction to renewable energy. CRC press, 2015.
Referenc eBooks	1.	Larminie, James, and John Lowry. Electric vehicle technology explained.John Wiley & Sons, 2012.
	2.	Ehsani, Mehrdad, Yimin Gao, and Ali Emadi. Modern electric, hybrid electric, and fuel cell vehicles: fundamentals, theory, and design. No. 10482.CRC press, 2003.
	3.	Kalogirou, Soteris A. Solar energy engineering: processes and systems.Academic press, 2013.
Online TL Material	1.	https://onlinecourses.nptel.ac.in/noc21_ee112/preview
	2.	https://onlinecourses.nptel.ac.in/noc23_ee01/preview
	3.	https://onlinecourses.nptel.ac.in/noc22_ch27/preview

List of Experiments

Sr. No.	Name of Experiments
1	Overview of Electric Vehicles (EV)
2	Study of various component of EV
3	Study of Series and Parallel combination of Batteries
4	Study of No Load characteristics of EV
5	Overview of Solar Systems.
6	IV characteristics of PV Module
7	Overview of Wind Energy
8	Study of component of Hydro energy generation
Open Ended Experiments / New Experiments	
1	Study of Wireless charging of EV
Details of Online Laboratory Resource Material Instruction / Operating Manuals	
1.	Study of various characteristics of Motor

Course Title: Vocational & Skill Enhancement Elective-II (Simulation of Electric Circuit)										
Semester	I	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	SEE1	1	0	2	2	10	15	0	25	--
Course Code	23BEEL107 23BEEP107									
Teaching Mode	Offline	3 Hrs.			Total	25			25	
Duration of ESE	NA					50				

Course Objectives	To impart practical knowledge of Electrical and Electronics Simulation and Analysis using Mathematical computing languages such as MATLAB and/or SCILAB.
	To Solve, Simulate and Analyze basic Electrical Circuits and Applications by writing Ohm's law, KCL and KVL Mathematical Equations and Programs.
	To develop hands on working experience with reference to Solve, Simulate and Analyze Electrical & Electronics Circuits using MATLAB or SCI LAB environments.
Course Outcomes	CO1: Apply the knowledge of Basic Network in solving and verifying various Network Theorems.
	CO2: Analyze the coupling circuits.
	CO3: Analyze the resonant Frequency and Draw the Locus Diagrams of RL and RC Circuits.
	CO4: Analyze the Transient behavior and Harmonic Content of RLC Circuits.
	CO5: Calculate the Time Response and Form Factor of a signal.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3	--	--	--	--	--	--	--	--	--	--	--
CO2	3	--	--	--	--	--	--	--	--	--	--	--
CO3	3	--	--	--	--	--	--	--	--	--	--	--
CO4	3	--	--	--	--	--	--	--	--	--	--	--
CO5	3	--	--	--	--	--	--	--	--	--	--	--

Course Contents:

Unit	Contents	Hours
I	**Introduction to MATLAB** Introduction to MATLAB LAB; features, applications and software versions,STARTING and QUITTING, MATLAB DESKTOP DESKTOP TOOLS; Command Window, Command History, Launch Pad, HelpBrowser, Current Directory Browser, Workspace Browser, Editor/ Debugger GETTING STARTED MATLAB; Using it as a calculator, Creating variables, Overwriting variable, Error messages, Making corrections, Controlling the hierarchy of operations or precedence, Controlling the appearance of floating point number, Managing the workspace Keeping track of your work session, Entering multiple statements per line, Getting help MATHEMATICAL FUNCTIONS; Examples BASIC PLOTTING; Creating simpleplots, Adding titles, axis labels, and annotations, Multiple data sets in one plot, Specifying line styles and colors, Copy/Paste Figures, Saving Figures WORKING WITH MATRICES; Introduction, Matrix generation ARRAY OPERATIONS; Matrix arithmetic operations, Array arithmetic operations SOLVING LINEAR EQUATIONS; Matrix inverse, Matrix functions INTRODUCTION TO PROGRAMMING IN MATLAB INTRODUCTION, M-FILE SCRIPTS; Examples, Script side-effects M-FILE FUNCTIONS; Anatomy ofa M-File function, Input and output arguments, INPUT/OUTPUT COMMANDS .	7
II	**Circuit design in MATLAB** KIRCHHOFF'S laws , RL and RC Series Circuit,Series and Parallel resonance RLC circuits, THEVENIN's & NORTON's Theorems. Verification of Superposition & Reciprocity Theorems analysis and verification using MATLAB	15
III	**Circuit Analysis by** using PSIM simulation software Simulation of DC Circuits, DC Transient response, Mesh Analysis, Nodal Analysis	8

Text Books	1	Introduction to Programming with Matlab by J. Michael Fitzpatrick and John D. Crocetti,Department of Electrical Engineering and Computer Science, School of Engineering, Vanderbilt University, Nashville, TN, 2000-2011.
Reference Books	1	Introduction to Matlab: Application to Electrical Engineering by HoussemRafik El Hana Bouchekara
	2	A Matlab Tutorial by Dr. L. Doyle and Dr. A. Kokaram
Online TL Material	1	http://in.mathworks.com/

List of Experiments

Sr. No.	Name of Experiments
1	Introduction to MATLAB LAB; features, applications and software versions, STARTING and QUITTING, MATLAB DESKTOP
2	MATLAB; Using it as a calculator
3	BASIC PLOTTING; Creating simple plots, Adding titles, axis labels, and annotations, Multiple data sets in one plot, Specifying line styles and colors, Copy/Paste Figures, Saving Figures
4	WORKING WITH MATRICES; Introduction, Matrix generation
5	ARRAY OPERATIONS; Matrix arithmetic operations, Array arithmetic operations
6	SOLVING LINEAR EQUATIONS; Matrix inverse, Matrix functions
7	Simulation of DC Circuits,
8	DC Transient response, Mesh Analysis, Nodal Analysis

Courses of Electronics and Telecommunication Board

Course Title: **Digital Logic Design**										
Semester	I	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD/ EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	ESC2	3 Hrs.	--	2 Hrs.	4	10	15	50	25	--
Course Code	23BTECL101 23BTECP101									
Teaching Mode	Offline	5 Hrs.			Total	75			25	
Duration of ESE	2 Hrs.					100				

Course Objectives	To understand number systems, codes and their conversions.
	To demonstrate various Digital ICs and their applications.
	To design digital circuits to solve engineering problems and applications.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Solve the problems on Number system codes and their conversions.
	CO2: Identify Digital IC and implement in the circuits.
	CO3: Create, design and simulate canonical logic forms
	CO4: Demonstrate the application of combinational and sequential logic circuits.
	CO5: Demonstrate the application of state machine

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	**Program Outcomes**											
	PO 1	PO2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	**3**	**3**	**3**	**2**	--	--	--	--	--	--	**1**	--
CO2	**3**	**3**	**3**	**2**	--	--	--	--	--	--	**1**	--
CO3	**3**	**3**	**3**	**2**	--	--	--	--	--	--	**1**	--
CO4	**3**	**3**	**3**	**2**	--	--	--	--	--	--	**1**	--
CO5	**3**	**3**	**3**	**2**	--	--	--	--	--	--	**1**	--

Course Contents:

Unit	Contents	Hours
I	**Number Systems** Decimal, binary, octal, hexadecimal number system and conversion, binary weighted& non-weighted codes & code conversion, signed numbers, 1s , 2s & 9s complement codes, Binary arithmetic	8
II	**Boolean Algebra& Logic Gates:** Boolean laws, truth tables, associative and distributive properties, De-Morgan's theorems, realization of switching functions using logic gates. Logic families: TTL, ECL, CMOS, Switching equations, canonical logic forms, sum of product & product of sums,	8
III	**Combinational Logic & Combinational Circuits:** simplification of expressions using Karnaugh maps, mixed logic combinational circuits, multiple output functions, Introduction to combinational circuits, code conversions, decoder, encoder, priority encoder, multiplexers & De-multiplexer, Basic Arithmetic Circuits.	8
IV	**Sequential Logic & Circuits:** Latch, flip-flops, clocked and edge triggered flip-flops, timing specifications, asynchronous and synchronous counters counter design, Registers, types of registers. Analysis of simple synchronous sequential circuits, Introduction to Memories.	8
V	**Finite State Machine:** Introduction to Mealy and Moore circuits, State machine design, Advanced Topics based on Course.	8

Text Books	1.	Digital Electronics, R P Jain, McGraw Hill, 2017, Second Edition
	2.	Digital Logic and Computer Design, Morris Mano, PHI , 2017, Review Second Edition
	3.	Digital Logic Design (Floyd: Digital Fundamentals With VHDL 10 / E)
Reference Books	1.	Digital Electronic Principles, Malvino, PHI 2011-13, Seventh Edition
Online TL Material	1.	https://nptel.ac.in/courses/117/105/117105080/

List of Experiments

Sr. No.	Name of Experiments
1	To study basic gates and verify their truth tables
3	To realize Basic gates (AND,OR,NOT) From Universal Gates(NAND & NOR)
3	To Design adder, subtractor circuit using a 4-bit adder IC
4	To study about full adder & verify its truth table
5	To design and implement encoder and decoder
6	To design and implement multiplexer and demultiplexer
7	To design and construct basic flip-flops
8	To design and construct of Synchronous Counter
	Open Ended Experiments
1	To verify the truth table of one bit and two bit Comparators using logic Gates
2	To design a 4 bit Binary to Gray code Converter, bit Gray to Binary code Converter, 3 bit Binary to Excess-3 code Converter.
3	Design of real time application using K-Map
	Details of Online Laboratory Resource Material Instruction / Operating Manuals
1.	Virtual Laboratory

Course Title: Vocational & Skill Enhancement Elective-I **Introduction to Drones**										
Semester	I/II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd/ Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	VSEC	1	--	2 Hrs.	2	10	15	--	25	--
Course Code	23BTECL102 23BTECP102									
Teaching Mode	Offline	3 Hrs			Total	25			25	
Duration of ESE	NA					50				

Course Objectives	1. Be able to describe common components of drone
	2. Be able to define concepts related to drone
	3. Be able to design the application oriented drone
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO 1. Recognize and describe the role of drone in present, past and future society
	CO 2. Comprehend basic components of drone.
	CO 3. Explain the impact of various payloads of drone.
	CO 4. Interpret the aspects of legal issues
	CO 5. Implement and design application oriented drone.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	PO 1	PO2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	1	2	2	3	--	3	3	2	3	1
CO2	3	3	1	2	2	3	--	3	3	2	3	1
CO3	3	3	1	2	2	3	--	3	3	2	3	1
CO4	3	3	1	2	2	3	--	3	3	2	3	1
CO5	3	3	1	2	2	3	--	3	3	2	3	1

Course Contents:

Unit	Contents	Hours
I	**Introduction to Drone Technology:** Types of Drones and Their Technical Characteristics, Main Existing Drone Types, Level of Autonomy, Size and Weight, Differences in Energy Source, Widely Used Drone models,	4
II	**Assembly of Drone:** Parts of a Drone, Motor, Propellers, Flight Controllers, Electronic Speed Controllers, Safe Assembly of Drone and Drone air Flight for aerial Photos. Battery management systems	4
III	**Impact of Payloads:** Types of Payloads and their application sensors, other payloads and frequency spectrum issues.	4
IV	**Legal Aspects:** Legal issues on the use of frequency spectrum and electronic equipment, surveillance and compliance. Flight zones	4
V	**Case studies:** Future Developments in Drone Technology. Advance topic	4

Text Books	1.	The future of Drone Use Opportunities and Threats from Ethical & Legal Perspectives -Prof Bart Custer's , Center for Law and Digital Technologies, Leiden Law School, Leiden University, The Netherlands, October 2016,T.M.C. ASSER PRESS, ISBN: 978-94-6265-131-9
	2.	Drones (The Ultimate Guide): How they work, learning to fly, how to fly, building your own drone, buying a drone, how to shoot photos -Publisher: Create Space Independent Publishing Platform; Large Print edition (May 30, 2017) Ben Rupert (Author)
E--Books	1.	Quad copters and Drones: A Beginner's Guide to Successfully Flying and Choosing the Right Drone -Create space Independent Pub (25 June 2015) Mark Smith (Author)
Reference Books	1.	Build a Drone: A Step-by-Step Guide to Designing, Constructing, and Flying Your Very Own Drone Barry Davies
	2.	Drones: An Illustrated Guide to the Unmanned Aircraft that are Filling our Skies

List of Experiments

Sr. No.	Name of Experiments / Mini Project
1	Experimental study of customized drone components interfacing
2	Study of mAH battery capacity with flight time calculation and battery connection
3	Study of type of motors and ESC with connection in adopter
4	Experimental study of propeller blade rotation CC & CCL & it's role in control
5	Installation of Pluto X controller App & it's setting
6	Study of throttle control in quad copter and its controlling
7	Experimental study of role of yaw control in quad copter
8	Experimental study of role of roll control in balancing
9	Experimental study of role of pitch control in quad copter balance and its control
10	Study of sensor board X breakout and sensor interfacing to quad copter
Open Ended Experiments / New Experiments	
1	Chuck to ARM
2	Open Sesame: Drone take-off due to change in ambient pressure
3	Turn the Drone upright from it's flipped position
Details of Online Laboratory Resource Material Instruction / Operating Manuals	
1.	Cygnus software
2.	Pluto X operating manuals
3.	Transmitter & Receiver console

Course Title: Sensor and Instrumentation										
Semester	II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	EVEN	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	PCC1	2	-	-	2	10	15	50	-	-
Course Code	UNECL103									
Teaching Mode	Offline	2 Hrs			2	75				
Duration of ESE	2 Hrs					75				

Course Objectives	1. To gain knowledge about the measuring instruments, sensors & actuator.
	2.To able to calibrate and testing of different Sensors
	3.To able to understand different sensors & actuators
Course Outcomes	Up on successful completion of this course, student will be able to:
	CO1: Understand basic analysis of instrumentation system
	CO2: Understand working of different sensors
	CO3: Design sensor based real time applications
	CO4: Analyze and use the functions of various instrumentation systems to design different applications.
	CO5: Interpret fundamental and some special knowledge in process automation in industries.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2	3	2	3	3					2	1	3		3
CO2		2	3	2	3	3					2	1	3		3
CO3		2	3	2	3	3					2	1	3		3
CO4		2	3	2	3	3					2	1	3		3
CO5		2	3	2	3	3					2	1	3		3

Course Contents:

Unit	Contents	Hours
I	**Instrumentation system**: Types of transducers, Digital and Analog mode of operation, static and dynamic characteristics and performance of instruments. Statistical treatment of measurement of errors, Combination of errors.	6
II	**Different Sensors & Transducers:** Resistive, Inductive & Capacitive Transducers. Potentiometer, strain gauge, LVDT, piezoelectric transducer, Temperature Sensors, Motion Sensors, Pressure sensors, Flow sensors, pH measurement	6
III	**Smart Sensors:** Digital transducers, Smart sensors, Fiber optic transducer, Image sensors, IC sensor, MEMS sensor, Advance Sensors.	6
IV	**Data Acquisition & Calibration:** Instrumentation amplifier & Signal conditioning, Techniques for grounding & shielding, Industry Standard Bus architecture. Calibration techniques.	6
V	**Actuators:** Pneumatic and Hydraulic control valves. solid state switches, Motor control techniques, Cases studies in Healthcare and Robotics, Advance topics and Case studies	6

Text Books	1.	Measurement system, application and design: E.D.doeblin, McGraw Hill Kogalcusha
	2.	Electrical & Electronic Measurements and Instrumentation: A.K. Sawhney
	3.	Instrumentation, measurement and feed back : B.E.Jones, McGraw hills
E--Books	1.	Electronic Instrumentation and Measurements Book by David A. Bell
	2.	Measurement, Instrumentation, and Sensors Handbook, Second Edition Electromagnetic, Optical, Radiation, Chemical, and Biomedical Measurement By John G. Webster, Halit Eren
Reference Books	1.	Sensors and Transducers: Patranabis D, Prentice Hall of India
	2.	Bus Architecture Manuals.
On line TL Material	1.	https://nptel.ac.in/courses/108/105/108105064/
	2.	http://www.nptelvideos.in/2012/11/industrial-instrumentation.html

Course Title: **Internet of Things and Its applications**										
Semester	II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	A	01 Hr	-	02 Hrs.	02	10	15	-	25	-
Course Code	23BTECL107 23BTECP107									
Teaching Mode	Offline	03 Hrs.			Total	25			25	
Duration of ESE	NA					50				

Course Objectives	To enable students to understand scope of Internet of things in Industry
	To introduce the concept of Internet of things
	To develop and apply Advance method for Implementation of Internet of Things
Course Outcomes	**CO1**:To understand the basics of IoT
	CO2: Analyze various IoT sensors and its technology
	CO3: Recognize and describe the role of Arduino board
	CO4: To understand the Controlling of Hardware with Arduino board
	CO5: Design and development of IoT application with the use of different Technology.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	PO 1	PO2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	**3**	**1**	**3**	**1**	**1**							**3**
CO2	**3**	**1**	**3**	**1**	**1**				**2**			**3**
CO3	**3**	**2**	**3**	**2**	**3**				**2**			**3**
CO4	**3**	**3**	**3**	**2**	**3**	**2**			**2**			**3**
CO5	**3**	**3**	**3**	**2**	**3**	**3**			**3**		**2**	**3**

Course Contents:

Unit	Contents	Hours
I	**Basics of IoT** Definition of "Internet of Things", impact of IoT on society, History of IOT, How IOT works, IOT Applications, Characteristics of IoT, Challenges of IoT, Advantages of IoT, Disadvantages IOT	4
II	**IoT sensors** Various IOT Sensors: Infrared (IR) sensor , Moisture sensors, Light sensors, Water level sensors, Proximity sensors, Gas sensors , Distance Measurement with ultrasonic sensor	4
III	**Arduino board** Introduction to Arduino board, Introduction to IDE software ,interfacing sensors to Arduino board.	4
IV	**Controlling Hardware**- Connecting LED, Buzzer, Controlling servo motor, sensors	4
V	**IOT use cases and applications** Smart homes, wearables, smart city, smart grid, industrial internet, connected health, smart retail, smart farming	4

Text Books	1.	Samuel Greengard ,The Internet of Things‖ by Samuel Greengard
	2.	Klaus Schwab ,The Fourth Industrial Revolution‖ by Klaus Schwab Author:
	3.	Cuno Pfister Author: Cuno Pfister ,Getting started with Internet of Things
EBooks	1.	IoT and Smart Building Data – by Senseware.
	2.	SkyHook, Everything You Need to Know About LPWAN Location
Reference Books	1.	Cuno Pfister, Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud (Make: Projects) 2018
	2.	Adrian McEwen , Designing the Internet of Things Kindle Edition

Sr. No.	Name of Experiments
1	Study the fundamental of IOT and components.
2	Familiarization with Arduino software
3	To interface LED/Buzzer with Arduino and write a program to turn ON LED for 1 sec after every 2 seconds
4	To interface DHT11 sensor with Arduino and write a program to print temperature and humidity readings
5	Design and interface water level indicator
6	To interface motor using relay with Arduino and write a program to turn ON motor
7	Measure the Distance Using Ultrasonic Sensor and Make Led Blink Using Arduino
8	To design and develop IOT based agriculture monitoring system
9	Advanced burglar alarm security system with the help of PIR sensor
10	To perform programming for control Home appliances using Arduino with Tinkercad.
11	To interface Digital sensor (IR) with Arduino and write a program to turn ON LED at sensor detection.
Open Ended Experiment	
12	Mini Project

Course Title: **Basic Electronics**										
Semester	I/II	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	Odd/Even	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	ESC	3 Hrs.	--	2 Hrs.	4	10	15	50	25	--
Course Code	23BTECL109EE 23BTECP109EE									
Teaching Mode	Offline	5Hrs.			Total	75			25	
Duration of ESE	2 Hrs.					100				

Course Objectives	To give understanding on how current flows through semiconductor devices and relating this phenomena to the characteristics and operation devices.
	To expose students to the function and application of the diodes, bipolar junction,field effect and CMOS transistors in electronic circuits.
	To demonstrate various Digital ICs and their applications.
	To use appropriate experimentation techniques to evaluate circuit performance.
Course Outcomes	Upon successful completion of this course, student will be able to:
	CO1: Relate operation of diodes and their role in design of various electronic applications.
	CO2: Develop the capability to analyze and design circuits using bipolar transistors.
	CO3: Design and analyze Build the concepts of feedback and apply the concepts for improvement of performance of amplifier and oscillator
	CO4: Solve the problems on Number system codes and their conversions.
	CO5: Demonstrate the application of combinational and sequential logic circuits.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	3	2	3	-	-	-	-	-	-	2
CO2	3	3	3	2	3	-	-	-	-	-	-	2
CO3	3	3	3	2	3	-	-	-	-	-	-	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2
CO5	3	3	3	3	3	-	-	-	-	-	-	2

Course Contents:

Unit	Contents	Hours
I	**Semiconductor Devices:** PN junction diode review, Half and full wave rectifiers, Zener Diode, Varactor Diode, Tunnel Diodes,	8
II	**BJT Circuits** BJT transistors- structure, Operations & characteristics, voltages and currents equations, CE, CB, CC configurations, Early Effect, Introduction to Feedback Amplifiers,	8
III	**Amplifiers & Oscillators** Classification A, B, AB, C, Efficiency, Classification of Oscillators, Design of RC, LC and Crystal Oscillators.	8
IV	**Number Systems & Boolean Algebra** Decimal, binary, octal, hexadecimal number system and conversion, Boolean laws,, De-Morgan's theorems, Logic Gates , K Maps	8
V	**Combinational & Sequential Circuits:** Introduction to combinational circuits, decoder, encoder, multiplexers & De-multiplexer, flip-flops, Registers	8

Text Books	1.	Electronics Devices and Circuits, S. Salivahanan, N Suresh Kumar, Tata McGraw-Hill 2008, Third Edition
	2.	Integrated Electronics, Jacob Millman, Tata McGraw-Hill, 2009, Second Edition
	3.	Electronics devices and Circuits and Theory, Robert L. Boylestad, Louis Nashelsky, Pearson India, 2009, Tenth Edition
	4	Digital Electronics, R P Jain, McGraw Hill, 2017, Second Edition
E--Books	1.	Electronics Devices and Circuits, S. Salivahanan
	2.	Solid State Electronic Devices, Ben G.Streetman & Sanjiv Kumar Banerjee,6th Edition
Reference Books	1.	Electronic Devices & Circuits, Sanjiv Gupta
	2.	Microelectronics Circuits, A S Sedra & K C Smith, Oxford University Press, 2013, Seventh Edition
	3.	Electronics Devices and Circuits, Nagrath I J, PHI Learning Pvt. Ltd, 2009,Third Edition.
Online TL Material	1.	Virtual Lab, Electronic Devices & Circuits, IIT Bombay http://vlabs.iitb.ac.in/vlab/electrical/index.html

*: Every practical will be performed on Bread Board

Sr. No.	Name of Experiments / Mini Projects
0	Study of different electronic components
1	Observe and draw V-I Characteristics of PN Diode & LED Diode.
2	Observe and draw the V-I characteristics and Regulation characteristics of a Zener diode.
3	Obtain ripple factor of Half Wave/Full wave Rectifier circuit with & without filter
4	Draw the input and output characteristics of transistor connected in CE/CB/CC any one Configuration
5	Design bipolar junction transistor as a switch
6	Design of Voltage Divider Bias for BJT.
7	Design Audio oscillator using BJT
8	Design Radio Oscillator using BJT
9	Design Oscillator for Laptop./ Mobile
10	Design of Class B push pull power amplifier and observe cross over distortion
11	Draw the Drain and Transfer characteristics of a given FET in CS Configuration.
12	Draw the Drain and Transfer characteristics of a given MOSFET in CS Configuration.
Open Ended Experiments	
1	Design Zener regulator circuits for Processor Motherboard.
2	Design of Simple analog application circuits.
3	Minor Project