Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Syllabus for

S.Y.B. Tech.

Civil Engineering (Pattern 2023)

Department of Civil Engineering

Department of Civil Engineering

Vision:

To be a Leading Centre of Education in Civil Engineering through Holistic Development

Mission:

Develop competent Civil Engineers by imparting practical skills imbibed with ethics and societal values.

Provide holistic education empowering students to address real-world challenges in Civil Engineering.

Equip graduates with necessary knowledge and skills to pursue research, higher studies, entrepreneurship.

PROGRAM EDUCATIONAL OBJECTIVES

PEO 1: Graduates will have successful career in the field of Civil Engineering

PEO 2: Graduates will respond to growing demands of society through professional and ethical practices

PEO 3: Graduates will pursue lifelong learning including higher studies in the field of Civil Engineering

Department of Civil Engineering

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

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

Department of Civil Engineering

PROGRAM SPECIFIC OUTCOMES (PSO):

PSO1: Engineering graduates will be able to plan and execute the activities of construction projects

PSO2: Engineering graduates will be able to analyze and design components of Civil Engineering Systems.

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S.Y. B. TECH. (Civil Engineering) **SEMESTER III (PATTERN 2023)**

CourseCode	Course Name	Course Type	Teaching Scheme (Hrs/Week)			Assessment Scheme (100-mark scale)										Credits
			Theory	Lab	Tut	ISA						ESA			Total	
						HA	TW	SCE	PPT	GD	CIE	ESE	Prac Exam	OR	100	
CV21231	Fluid Mechanics	TH	3	2	-	10	20	20	-	-	-	40	-	10	100	4
CV21232	Geomatics Engineering	TH	3	2	-	10	20	20	-	-	-	40	-	10	100	4
CV21233	Concrete Technology	TH	2	2	-	10	20	20	-	-	-	40	-	10	100	3
MDM20234	Probability and Statistics	TH	2	-	-	20	-	20	-	-	20	40	-		100	2
EEM21236	Design thinking	TH	1	-	1	-	30	30	20	-	20	-	-		100	2
VEC21237	Universal Human Values	TH	2	-	-	-	-	-	20	-	10	-	-	20	50	2
CEP21238	Community Engagement Project	CE	-	4	-	-	50	-	-	-	-	-	-	-	50	2
	Open Elective-I	TH	2	-		20	-	20	-	-	20	40	-	-	100	2
CSOEUA21239A	Basics of UI /UX															
AIOEUA21239B	Data Ethics															
ETOEUA21239C	Sensor Technology															
MEOEUA21239D	Renewable Energy															
	Total		**15**	**10**	**1**	**70**	**140**	**130**	**40**	**-**	**70**	**200**	**-**	**50**	**700**	**21**

HOD

Dean Academics

Director

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Vishwakarma Institute of Information Technology, Pune-48
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S.Y. B. TECH. (Civil Engineering) SEMESTER IV (PATTERN 2023)

Course Code	Course Name	Course Type	Teaching Scheme (Hrs/Week)			Assessment Scheme (100-mark scale)										Credits
			Theory	Lab	Tut	ISA (40 Marks)					ESA (60 marks)				Total	
						HA	SCE	PPT	GD	CIE	ESE	PR Exam	OR	TW	100	
CV22231	Water Supply Engineering	TH	3	2	-	10	20	-	-	-	40	-	10	20	100	4
CV22232	Geotechnical Engineering	TH	3	2	-	10	20	-	-	-	40	-	10	20	100	4
CV22233	Structural Analysis	TH	2	2	-	10	20	-	-	-	40	-	10	20	100	3
MDM20235	Quality Standards and Practice	TH	2	-	-	20	20	-	-	20	40	-	-	-	100	2
AEC22236	Logical Reasoning and Quantitative aptitude	CE	2	-	-	-	-	-	-	-	-	-	-	50	50	2
EEM22237	Entrepreneurship Development	TH	2	-	-	-	20	-	-	10	-	-	-	20	50	2
VEC22238	Leadership and Ethical Decision Making	TH	1	-	1	-	20	-	-	10	-	-	-	20	50	2
	Open Elective	TH	2	-	-	20	20	-	-	20	40	-	-	-	100	2
CSOEUA22239A	Introduction to IOT															
AIOEUA22239B	Data Centric AI															
ETOEUA22239C	Introduction to Robotics and Applications															
MEOEUA22239D	Electric Vehicle															

CVOEUA22239E	Professional Practice, Law and Ethics															
M2	Mandatory Course	AU														
	Total		**17**	**6**	**1**	**70**	**140**	**-**	**-**	**60**	**200**		**30**	**150**	**650**	**21**

Open Elective-II

Computer, IT, CSE -SE, CSE-IOT	Introduction to IOT
AIDS, CSE AI-ML, CSE- AI, CSE-DS	Data Centric AI
E&TC	Introduction to Robotics and Applications
Mech	Electrical Vehicle
Civil	Processional Practice, Law and Ethics

Mandatory Course : Environmental Sciences, Indian Constitution, esence of Indian traditional knowledge

HOD

Dean Academics

Director

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Department of Civil Engineering

Fluid Mechanics (CV21231)

Teaching Scheme	Examination Scheme					
Credits: 3 Lectures: 3 hrs./ week Practical: 2 hrs./ week Tutorial: NA	HA	SCE	TW	OR	ESE	Total
	10	20	20	10	40	100

Prerequisite course(s):

Course Objective(s):

Course Outcomes:

Upon completion of the course, students will be able to

Course Contents:

Fluid properties; Pressure measurement; Hydrostatic forces on plane and curved surfaces; Buoyancy and equilibrium; Stability, metacentric height; Types of flow; Continuity; Energy and momentum equations; Velocity distribution and velocity coefficients, practical applications; Navier Stoke equation; Shear stress and pressure gradient; Flow through pipes, Hagen Poiseuille equation; Turbulence, Prandtl's mixing length, eddy viscosity; Darcy-Weisbach equation for flow through pipes, friction factor, Moody diagram, minor losses, pipes in series and parallel, equivalent length, pipe network analysis; Boundary layer concept, drag and lift, their coefficients, control of boundary layer; Unsteady flow. Dimensional analysis and similitude

Laboratory experiments:

Students should complete any 8-experiment mentioned below.

1. Measurement of surface tension in a given liquid
2. Determination of metacentric height.
3. Drawing of flow net by electrical analogy for flow below weir (with / without sheet pile)
4. Experimental verification of Bernoulli's theorem with reference to loss of energy
5. Calibration of Venturimeter
6. Study of laminar flow using Heleshaw's apparatus
7. Determination of friction factor for a given pipe
8. Flow around a Circular Cylinder

Text Books:

1. F.M. White, Fluid Mechanics, McGraw Hill, 1994
2. V.L. Streeter and E.B. Wylie, Fluid Mechanics, McGraw Hill, 1997
3. P.N. Modi and S.M. Seth, Hydraulics and Fluid Mechanics, Standard Book House, 1998

Reference books :

1. M.K. Goyal, Fluid Mechanics and Hydraulic Machines, PHI Learning Pvt. Ltd., 2015
2. K. S. Massey, Mechanics of Fluids, Van Nostrand Reinhold Co., 1979
3. J. Frabzini, Fluid Mechanics with Engineering Applications, McGraw Hill, 1997
4. J.H. Spurk, Fluid Mechanics - Problems and Solutions, Springer, 2003

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Department of Civil Engineering

Geomatics Engineering (CV21232)

Teaching Scheme	Examination Scheme					
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): NA Practical (P): 2 hrs./week	HA	SCE	TW	OR	ESE	Total
	10	20	20	10	40	100

Prerequisite course(s): Basic Surveying

Course Objective(s):

1. To impart knowledge about different methods of survey such as traversing, tachometry.
2. To impart knowledge about elements of different types of curves and surveying applications in setting out of curves, buildings, drainage lines, canals.
3. To understand principles of geodetic surveying and theory of errors and adjustments
4. To understand the basic concepts of SBPS, remote sensing and GIS
5. To understand photogrammetry concepts and fundamentals of Air photo Interpretation

Course Outcomes:

Upon completion of the course, students will be able to

1. **Perform** traversing using a Theodolite.
2. **Explain** triangulation method for geodetic survey and **determine** intervisibility of triangulation stations
3. **Determine** reduced level of points using Tacheometry and draw a contour map
4. **Design** and set out horizontal curve on ground.
5. **Compute** most probable values of angles in triangulation, considering plane and spherical angles
6. **Describe** classification, applications, flight planning in aerial photogrammetry and **determine** scale and relief displacement in vertical photograph
7. **Explain** fundamentals of segments, positioning methods, and errors in Space Based Positioning System
8. **Describe** concepts, physical fundamentals, and components of Remote Sensing
9. **Describe** objectives, components, limitations, and applications of Geographical Information System

Contents

Theodolite: Study of theodolite (vernier and micrometer), uses of theodolite. Fundamental axes of theodolite: permanent adjustments of a transit theodolite. (1 Lecture)

Traversing: computation of consecutive and independent co-ordinates, adjustment of closed traverse by transit rule and Bowditch's rule, Gale's traverse table. Checks, omitted measurements, area calculation by independent coordinates. (3 Lectures)

Geodetic Survey: Objective, Introduction to Triangulation, classification of Triangulation Systems, Triangulation figures, Concept of well-conditioned Triangle, selection of stations, intervisibility and height of stations. (2 Lectures)

Tachometry: application and limitations, principle of stadia tachometry, fixed hair method with vertical staff to determine horizontal distances and elevations of points. (4 Lectures)
Setting-Out Works - buildings, maintaining verticality of tall buildings, bridges, and tunnels. (2 Lectures)

Curves: horizontal and vertical curves (no numerical and derivations to be asked on vertical curves and reverse curves), different types and their applications, simple and compound circular curves, elements and setting out by linear methods such as radial and perpendicular offsets, offsets from long chord, successive bisection of chord and offsets from chords produced. Angular methods: Rankine's method of deflection angles (one and two theodolite methods). (Numerical on simple circular curves to be asked), Transition curves: necessity and types. (6 Lectures)

Theory of Errors and Triangulation Adjustment: Kinds of errors, Laws of weights, Determination of most probable values (MPV) of conditioned and independent quantities, Method of least squares, Indirect observations, Probable error and its determination, Distribution of error to the field measurements, Normal equation, Method of correlates. Station and figure adjustment of geodetic quadrilateral without central station. Spherical triangle, Calculations of spherical excess and sides of spherical triangle. (6 Lectures)

Aerial Photogrammetry: Objects, Classification- qualitative and quantitative photogrammetry Applications, comparison of map and aerial photograph, Vertical, Tilted and Oblique photographs, Scale of and Relief displacement in vertical photograph, Stereoscopic parallax and its measurement by parallax bar. Mirror stereoscope, Differential height from differential parallax. Ground control points (GCPs), Flight planning. (6 Lectures)

Introduction to Satellite based positioning systems (SBPS): SBPS systems - GPS, Glonoss, Galileo, Navic, Compass, etc. and their features, Segments of SBPS (Space, Control and User), their importance and role in SBPS, Positioning with SBPS - Absolute and Differential Methods, Use of SBPS in Surveying, SBPS Co-ordinates and heights, Different types of errors in SBPS Positioning. (1 Lecture)
Remote Sensing: Basic concepts in Remote Sensing, Basic Laws of electromagnetic radiation, Atmospheric effects on radiation, Interaction of EM energy with matter, Resolution in remote sensing, Satellite remote sensing. Space platforms for remote sensing. Image interpretation. Applications of remote sensing. Comparison between aerial photograph and satellite image. (2 Lectures)
Geographical Information System: Components (people, procedure, hardware, software & data) & functions (input, manipulation, management, query & analysis and visualization) of GIS. Coordinate systems and projections, Georeferencing, GIS data – spatial (Raster & vector) & aspatial data. Introduction to vector and raster data analysis such as network analysis, overlay analysis etc. for vector, DEM, Management of aspatial data. Applications of GIS in civil engineering. Limitations of GIS. (3 Lectures)

Practical Work:

List of practicals – (perform any 8):

1. Measurement of horizontal and vertical angles using 20" vernier Theodolite by repetition method.
2. Measurement of horizontal and vertical angles with 1" theodolite.
3. Finding horizontal and vertical distance using Tachometer.
4. Radial contouring: Plotting of contours from one station
5. Setting out a building from a given foundation plan (minimum six co-ordinates).
6. Setting out a circular curve by Rankine's method of deflection angles.
7. Practical based on measurement with total station (angles, distance, remote elevation
8. measurements, and remote distance measurements)

9. Determination of air base distance using mirror stereoscope.
10. Determination of difference in elevation by parallax bar.
11. Use of RS images and visual interpretation
12. Use of interface and tools in GIS software such as GRAM++ or QGIS or equivalent software.

Project: (perform any two)

1. Traversing: Plotting traverse and finding out its area using vernier/micrometer Theodolite
2. Adjustment of geodetic quadrilateral without central station by method of correlates.
3. Field survey (500 sq.m.) using GPS (Control as well as mapping).
4. Radial contouring: Plotting of contours from two stations minimum 60m to 100m apart.

Textbooks:

1. Dr. B.C. Punmia, Ashok K. Jain, Arun K. Jain, (2005) "Surveying Vol. I and Vol. II", Laxmi Publications Pvt Limited
2. N.N. Basak, (2014), "Surveying and Levelling", McGraw Hill Education
3. R. Subramanian, (2012) "Surveying and Levelling", Oxford University Press
4. T. P. Kanetkar and S. V. Kulkarni, (2010) "Surveying and Levelling Vol I and Vol. II", Vidyarthi Griha Prakashan.
5. Basudeb Bhatta (2011) "Remote Sensing and GIS", Oxford University Press

Reference Books:

1. J. Uren, W.F. Price, (2010), "Surveying for Engineers", Palgrave Macmillan
2. S.K. Duggal, (2013), "Surveying Vol. I and Vol. II", McGraw Hill Education
3. James McMurry Anderson, James M Anderson, Edward M Mikhail, (1998), "Surveying: Theory and Practice", McGraw-Hill Education
4. Russell C. Brinker, (2013), "The Surveying Handbook", Springer US
5. Peter A. Burrough, Christopher D. Lloyd, Rachel A. Mcdonnell (2015) "Principles of Geographical Information System"' Oxford University Press
6. Satheesh Gopi, R. Sathikumar, N. Madhu (2014) "Advanced Surveying -Total Station, GIS and Remote Sensing", Pearson Publication

Suggested Reading:

Bureau Gravimetries International (BGI)
International GPS Service for Geodynamics (IGS)
International Association of Geodesy (IAG)
International Federation of Surveyors (FIG)
Permanent Service for Mean Sea Level (PSMSL)
Commission X Global and Regional Geodetic Networks
www.nrsa.gov.in
www.iirs-nrsa.gov.in
www.surveyofindia.gov.in

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Department of Civil Engineering

Concrete Technology (CV21233)

Teaching Scheme	Examination Scheme					
Credits: 3 Lectures: 2 hrs./ week Practical: 2 hrs./ week Tutorial: NA	HA	SCE	TW	OR	ESE	Total
	10	20	20	10	40	100

Course Objectives:

1. Understand and gain fundamental knowledge of various ingredients of concrete including their properties.
2. Review and apply the QAQC norms as per standards in constriction practices.
3. Acquire the knowhow of special concretes and NDT methods for concrete.
4. Be cognizant of various technologies in concreting.
5. Be able to design concretes mixes using standards.
6. Acquire the knowledge of durability requirements of concrete and its maintenance.

Course Outcomes: After completion of the course the students will have an ability to:

1) **Identify** the materials used to make concrete; including their sources, production and properties.
2) **Assess** and practice standard tests relevant to the use and QAQC norms of fresh concrete and identify and select concrete handling equipment
3) **Assess** and practice standard tests relevant to the use and QAQC norms of Hardened Concrete and **Evaluate** the different types of special concretes and techniques.
4) **Design** concrete mix as per standard codes
5) **Examine** the durability requirements of concrete and **choose** suitable measures.

Unit I – Introduction to Concrete as a Construction Material

Cement – manufacture of Portland cement, basic chemistry of cement, hydration of cement, classification of cement, types of cement, tests on cement-field tests & laboratory tests Fly Ash: Classification of fly ash , properties of fly ash, tests on fly ash.
Aggregate and water – Different classifications, Fine aggregate, coarse aggregate , mechanical properties, physical properties, deleterious materials, soundness, alkali-aggregate reaction, sieve analysis: fineness tests on aggregates, artificial and recycled aggregate, mixing water, curing water, tests on water.
Admixtures – functions, classification, types: mineral and chemical, IS: specifications (9103 and 456), compatibility of admixtures.

Unit II – Properties, Production and Placement of Concrete

Fresh concrete: Workability – factors affecting workability, cohesion and segregation,Bleeding, Laitance, mixing, handling, placing and compaction of concrete, Influence of temperature, maturity rule
Introduction to concrete related equipments – Batching plants, hauling, pumps, Types of concrete mixers: Tilting, Non tilting and Reversible drum mixer, Types of vibrators **Tests of fresh concrete –** Workability by Slump cone, Compaction factor, Vee Bee consistometer and flow table test, Marsh cone test.

Unit III – Properties and tests on hardened concrete and Special Concretes

Hardened concrete and Its Testing – Strength of concrete, factors affecting strength, micro-cracking and stress-strain relationship, other strength properties, relation between tensile and compression strength, impact strength, abrasion resistance, elasticity and creep, shrinkage, and swelling. Compression test on cube and cylinder, flexural test, indirect tensile strength, core test. **Introduction to Nondestructive testing:** Rebound
hammer, Ultrasonic pulse velocity, Pullout test and Impact echo test, Rebar locator. **Special concreting**

techniques: pumping of concrete, under water concreting, ready mix concrete, roller compacted concrete Cold weather concreting, hot weather concreting.
Special concretes – Lightweight concrete, Cellular light weight concrete-Form concrete and autoclave C.L.C, polymer concrete, types of fibers, fiber reinforced Concrete, high density concrete, self-compacting concrete and applications. Ferrocement: Definition, Basic concepts in forming ferrocement composites.

Unit IV– Concrete Mix Design and Deterioration and repairs.

Concepts of Mix Design, Factors for proportioning of concrete. Factors to be considered, Statistical quality control, Laboratory trial mixes and guidelines to improve mix, methods of Mix Design for M25 and above grades by IS (10262:2019, IS456:2000) and DOE methods with and Without fly ash, Deterioration, and repairs of concrete.

Practical's:

List of Laboratory Assignments

The term work shall consist of a journal giving details of all the following experiments.

1. Fineness and standard consistency of cement.
2. Initial and final setting time and soundness of cement.
3. Compressive strength of cement.
4. Moisture content, silt content, and Specific gravity of fine aggregate
5. Fineness modulus by sieve analysis of fine aggregate.
6. Moisture content , water absorption, and Specific gravity of coarse aggregate
7. Density of coarse aggregate and Fine Aggregate.
8. Fineness modulus by sieve analysis and gradation of fine aggregates.
9. Workability of concrete by slump test, compaction factor, Vee Bee test, effect of admixture and retarders on setting time concrete.
10. Compressive strength test of concrete by crushing and Rebound hammer.
11. Indirect tensile strength and flexural strength of hardened concrete
12. Concrete mix design by IS code method and DOE method. Demonstration and application of concrete mix design software.
13. Site visit to RMC plant

Oral: Based on above syllabus and term work.

IS Codes:

IS 456, IS 383, IS 9103, IS 10262 Latest revised editions.

Text books:

1. Concrete Technology by M. S. Shetty, S Chand, New Delhi-110055.
2. Concrete Technology by M. L. Gambhir, Tata McGraw-Hill.

Reference books:

1. Properties of concrete by A. M. Neville, Longman Publishers.
2. Concrete Technology by R.S. Varshney, Oxford and IBH.
3. Concrete technology by A. M. Neville, J.J. Brooks, Pearson.
4. Ferrocement Construction Manual by Dr. D. B. Divekar-1030, Shivaji Nagar, Model Colony, Pune.
5. Concrete Mix Design by A. P. Remideos, Himalaya Publishing House.
6. Learning from Failures: Deficiencies in Design, Construction and Service, R& D Center, 1987.

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Department of Civil Engineering

Probability & Statistics (MDM20234)

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Teaching Scheme	Examination Scheme						
Credits:4 Lecture (L): 2 hrs./week Practical (P): -- hr. Tutorial (T): 1 hr./wk	CIE	HA	SCE	ESE	PR/OR	TW	Total
	20	20	20	40	-	-	100

Prerequisite: Basics of Integration and differentiation, Concepts of set theory

Course objectives:

- Impart knowledge and develop the ability of students to systematically solve the problemsusing knowledge of probability, distributions.
- Develop the ability of students to carry out tests of hypothesis.
- Provide the basic concepts of regression and correlation to enable students interpret the correlation between variables and develop regression.

Course Outcomes:

Upon completion of the course, students will be able to

1. Solve basic problems arising in engineering that involve discrete and continuous probability distributions.
2. Interpret the given data and estimates the parameters.
3. Apply appropriate hypothesis test on given data
4. Interpret the correlation between variables and develop regression

Unit I– Probability Basics and distributions

Conditional andTotal Probabilities, Bayes theorem, Binomial, Poisson, Geometric distribution

Continuous Distribution: Normal, standard normal, uniform, exponential distribution

Unit II – Sampling Theory

Central limit theorem, Population and Sample, Statistical inference, Sampling with and without replacement, Population parameters, Sample statics, Sampling distributions, Sample mean, Sampling distribution of means, Sample variances, Sampling distribution of variances, Case where population variances is unknown, Unbiased estimates and efficient estimates, point estimate and Interval Estimates

Unit III – Test of hypothesis

Statistical hypothesis, Null and Alternate hypothesis, test of hypothesis and significance, Type I and Type II errors, Level of Significance, Tests involving the Normal distribution, One-Tailed and Two-Tailed tests, P value. Special tests of significance for large samples and small samples (F, chi-square, z, t- test), ANOVA

Unit IV – Correlation and regression

Introduction of correlation, correlation analysis, coefficient of correlation, probable error, regression, regression analysis, line of regression, standard error of estimate, Rank of correlation. single and multiple regression, linear regression, Curve fitting by method of least squares
Text Books:
1. Sheldon M. Ross, "Probability and Statistics for Engineers and Scientists", Fifth Edition, ELSEVIER Publication 2. Schaum's outline of "Probability and Statistics," Fourth Edition
Reference Books:
1. Johnson Richard A., Miller I., Freund J.E., (2016), "Probability and Statistics for Engineers",9th edition, PHI publications **2.** Rao G. S., (2018), "Probability and Statistics for Science and Engineering", 11th edition, Universities press publication – G Shankar Rao

Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

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Department of Civil Engineering

Design Thinking (EEM21236)

Teaching Scheme	Examination Scheme						
Credits:2 Lecture (L): 1 hrs./week Practical (P): -- hr. Tutorial (T): --1hr./week	CIE	PPT	SCE	ESE	PR/OR	TW	Total
	20	20	30	-	-	30	100

Prerequisite: Basics of Integration and differentiation, Concepts of set theory

Course objectives:

- To learn design thinking concepts and principles.
- To learn the different phases of design thinking.

Course Outcomes:

Upon completion of the course, students will be able to:

1. Understand(identify) the fundamentals of Design Thinking concepts, process and Principles.
2. Identify the methods to empathize and define the problem.
3. Apply the ideation techniques for problem solving.
4. Construct the prototype to evaluate a design

Unit I– Introduction

Introduction to Design Thinking, Design Thinking as a problem-solving tool, Principles of Design Thinking, Process of Design Thinking, Tools and techniques for Design Thinking process, Planning a Design Thinking project

Unit II – Empathize and Define

Search field determination, Problem clarification, understanding of the problem, Problem analysis, Reformulation of the problem, Observation Phase, Empathetic design, Tips for observing, Methods for Empathetic Design, Artifact Analysis, Behavioral Mapping and Tracking, Empathy Map,

Unit III – Idea Generation

Mastering the creative process, opening up sources of new ideas, Understanding the creative principles, factors for increasing creativity, Mind mapping, Generating ideas by brainstorming, Different brainstorming variation, Evaluation of ideas & Storytelling

Unit IV – Prototype

Prototype Phase - Lean Startup Method for Prototype Development, Visualization and presentation techniques, Ideas to presentable concepts, Storyboards, Developing mock-ups, models and prototypes

Text Books:

1. Design Thinking" , Gavin Ambrose, Paul Harris, AVA Publishing
2. "Handbook of Design Thinking - Tips & Tools for how to design thinking", Christian Mueller-Rotenberg.

3 "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation" by TimBrown

Reference Books:

1."Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", IdrisMootee, Wiley.

2."Designing for Growth: a design thinking tool kit for managers", Jeanne Liedtka and Tim Ogilvie

Bryan Lawson, "How designers think: The design process demystified", 2nd Edition, Butterworth Architecture

eBooks:

1. https://www.researchgate.net/publication/332869635_Case_Study the_Use_of_IBM_Design_Thinking_Methodology_in_Designing_User-Oriented_Learning_Environment_in_hebrew
2. https://www.design-thinking-association.org/explore-design-thinking-topics/design-thinking- case-studies
3. https://onlinecourses.nptel.ac.in/noc22_mg32/preview

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Department of Civil Engineering

Universal Human Values (VEC21237)

Teaching Scheme	Examination Scheme						
Credits:2 Lecture (L): 2 hrs./week Practical (P): -- hr. Tutorial (T): --hr./week	CIE	PPT	SCE	ESE	PR/OR	TW	Total
	10	20	-	-	20	-	50

Prerequisite: Basics of Integration and differentiation, Concepts of set theory

Course Objectives:

1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Course Outcomes:

Upon completion of the course, students will be able to:

1. Recognize the significance of human values and advocate a value-based approach to problem-solving
2. Commit to lead a life of responsibility by becoming aware of their individual reality
3. Apply understanding of human-human relationship in family and society to behave ethically and professionally
4. Demonstrate awareness and sensitivity towards nature/existence leading to ethical and sustainable solution to engineering problem

Unit I– Introduction to Value Education and Understanding the Human

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education.

Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations.

Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations

Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self.

Sample Practice Tasks -

1.Sharing about Oneself

2.Exploring Human Consciousness

3.Exploring Natural Acceptance

Unit II – Harmony in the Human Being, Family and Society

Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.
Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship.
'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship Understanding Harmony in the Society, Vision for the Universal Human Order.

Sample Practice Tasks -

5. Exploring Sources of Imagination in the Self
6. Exploring Harmony of Self with the Body
7. Exploring the Feeling of Trust
8. Exploring the Feeling of Respect

Unit III – Harmony in Nature/Existence and a Look at Professional Ethics

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature
Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence
Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct
A Basis for Humanistic Education, Humanistic Constitution and Universal
Human Order, Competence in Professional Ethics
Sample Practice Tasks -
9. Exploring Systems to fulfill Human Goal
10.Exploring the Four Orders of Nature
11.Exploring Co-existence in Existence
12.Exploring Ethical Human Conduct

Text Books

1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53

Reference Books:

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

e-Resourses:

1. https://fdp-si.aicte-india.org/UHVII.php
2. https://www.youtube.com/watch?v=NhFBzn5qKIM&list=PLWDeKF97v9SO8vvjC1KyqteziTbTjN1So

Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

Department of Civil Engineering

Basics of UI / UX: (CSOEUA21239A)

Teaching Scheme	Examination Scheme									
Credits: 2	HA	TW	SCE	PPT	GD	CIE	ESE	PR	OR	TOTAL
Lecture's/Week(L): 2 Hrs/week	20	-	20	-	-	20	40	-	-	100
Practical/Week(P):										
Tutorial/Week(T):										

Prerequisites: NIL

Course Objectives:

1. Gain a comprehensive understanding of the foundational principles of UI and UX design and recognize their significance in creating user-friendly digital experiences.
2. Develop the ability to conduct user-centered research, analyze user needs and behaviors, and translate findings into actionable insights that inform the design process.
3. Master fundamental design principles and tools to create visually appealing and user-friendly interfaces that enhance the overall user experience.
4. Understand the iterative nature of the UX design process, and learn how to effectively prototype, test, and iterate designs based on user feedback to optimize usability and functionality.

Course Outcomes:

After studying this course, students will be able to:

1. Analyze and evaluate existing digital interfaces based on UI/UX principles, identifying areas for improvement, and proposing design solutions to enhance user experience.
2. Gain the skills to plan, conduct, and report on user research activities, demonstrating the ability to gather and analyze qualitative and quantitative data to inform UX design decisions.
3. Produce high-fidelity UI mock-ups and prototypes using industry-standard design tools, showcasing their proficiency in applying design principles to create visually appealing and intuitive user interfaces.
4. Have developed a comprehensive understanding of the UX design process, including prototyping and iterative testing, and will be capable of applying these concepts to improve the usability and effectiveness of digital products and services.

Unit I : Introduction to UI/UX	**6 Hrs**

- Overview of UI/UX, importance, basic principles,
- Difference between UI and UX, industry applications

Unit II: User Research and Analysis	**6 Hrs**

- Understanding users, conducting user research, user personas,
- User stories, usability testing

Unit III: UI Design Principles and Tools	**6 Hrs**

- Fundamental design principles, UI elements and components,
- Introduction to design tools (e.g., Figma)

Unit IV: UX Design Process and Prototyping	**6 Hrs**

- UX design process, wireframing, prototyping, user testing, iteration

Textbooks:

1. Don't Make Me Think, by Steve Krug
2. The Design of Everyday Things, by Don Norman
3. Interaction Design: Beyond Human-Computer Interaction, by Jenny Preece, Helen Sharp, and Yvonne Rogers

Reference Books:

1. Lean UX: Designing Great Products with Agile Teams, by Jeff Gothelf and Josh Seiden
2. 100 Things Every Designer Needs to Know About People, by Susan Weinschenk
3. Designing Interfaces, by Jenifer Tidwell

Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

Department of Civil Engineering

IOEUA21239C: Data Ethics

Teaching Scheme	Examination Scheme									
Credits: 2	HA	TW	SCE	PPT	GD	CIE	ESE	PR	OR	TOTAL
Lecture's/Week(L): 2 Hrs/week	20	-	20	-	-	20	40	-	-	100
Practical/Week(P):										
Tutorial/Week(T):										

Prerequisites:	
•	Basics of Data Science
Course Objectives:	
•	To understand the fundamental concepts of Data Ethics.
•	To familiarize students with the concepts of Privacy and Confidentiality in relation with data ethics.
•	To introduce students with the concepts of Trust, Transparency and Algorithmic bias in relation with data ethics.
•	To understand how Data Governance is becoming more important.
Course Outcomes:	
	After completion of the course, student will be able to
1.	Describe the basic concepts related to Data Ethics.
2.	Explain Data Privacy in relation to Data Ethics.
3.	Illustrate Digital Trust, Transparency and Algorithmic bias.
4.	Determine the importance of Data Governance.

Unit I	**Introduction to Data Ethics**	**6-Hrs**
Definition and Importance of Data Ethics, Oops, we're all public ,Personal data becomes commercially valuable, Data driven business model, Data as payment, Good Data, Data at risk, What customer want, Teens want privacy, Demand for data control, Consumers are beginning to act, Pay for privacy,		

Principles of data ethics, Ethically significant harms and benefits of data ethics, Common ethical challenges for data practitioners and users.

Case Study: Aadhaar Data Breach
https://www.linkedin.com/pulse/aadhaar-data-breach-in-depth-analysis-one-indias-most-pervasive-iywzc/

Unit II:	**Data Privacy**	**6-Hrs**

Privacy charlatans, A new market for privacy tech, Privacy Embedded in Innovation, Privacy products are not new, Privacy by Design ,Privacy by Default, Differential privacy, Techniques of Data Anonymization and De-identification, Why is access important?, Providing access, Statistical disclosure control techniques, Non-tabular data, New challenges, Privacy Enhancing Technologies (PETs)

Case Study: COVID 19 Data breach
https://pib.gov.in/PressReleasePage.aspx?PRID=1931691

Unit III:	**Trust , Transparency and Algorithmic bias**	**6-Hrs**

What is digital trust? Why is digital trust important? , How to build digital trust? , Snowden effect, Trust is achieved in various ways, Privacy branding, Data Transparency: Importance, benefit and challenges.

Algorithmic Fairness and Bias: Introduction, Sources of bias, Sample bias, Label bias, Machine learning pipeline bias, Dealing with Bias, Choosing bias metrics, Mitigating Bias

Case Study: Marriott International Data Breach
https://hoteltechreport.com/news/marriott-data-breach

Unit IV:	**Data Governance**	**6-Hrs**

What is data Governance? What Data Governance Involves? Classification and Access Control, Why Data Governance is becoming more important, The Size of Data Is Growing, Examples of Data Governance in action, Use of data to make better decisions, New Regulations and Laws Around the

Treatment of Data, Why Data Governance Is Easier in the Public Cloud, Ingredients of Data Governance. **Privacy Regulations & Laws:** GDPR, DPDPA, COPPA, HIPPA, CCPA, PIPEDA, LGPD, POPI, PCI- DSS **Case Study:** How Airbnb used data literacy to promote data-driven decision-making https://atlan.com/data-governance-examples/		
Text Books:		
	1	Gry Hasselbalch, Pernille Tranberg Data Ethics - The New Competitive Advantage, PubliShare ,2016, 9788771920185, 8771920188
	2	Christoph Stückelberger and Pavan Duggal (Eds.) Data Ethics: Building Trust How Digital Technologies Can Serve Humanity, Globethics, 2023, 9782889315246, 288931524X
	3	Evren Eryurek, Uri Gilad, Valliappa Lakshmanan, Anita Kibunguchy, Jessi Ashdown Data Governance: The Definitive Guide: People, Processes, and Tools to Operationalize Data Trustworthiness, O'Reilly Media, Incorporated, 2021, 9781492063483, 1492063487
Reference Books:		
	1	Frauke Kreuter, Ian Foster, Julia Lane, Rayid Ghani, Ron S. Jarmin Big Data and Social Science Data Science Methods and Tools for Research and Practice CRC Press,2020, 9781000208634, 100020863X
Online Resources:		
	1	Introduction to Data Ethics https://www.scu.edu/media/ethics-center/technology-ethics/IntroToDataEthics.pdf
	2	Why digital trust matters? https://www.mckinsey.com/capabilities/quantumb1ack/our-insights/why-digital-trust-truly-matters
	3	Data ethics Tools- https://dataethics.ewtools/
	4	Privacy by Design The 7 Foundational Principles- https://privacy.ucsc.edu/resources/privacy-by-design---foundational-principles.pdf

Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

Department of Civil Engineering

Sensors Technology (ETOEUA21239C)

Teaching Scheme (Hrs/Week)			Assessment Scheme (100-mark scale)										Credits
			ISA						ESA			Total	
Theory	Lab	Tut	HA	TW	SCE	PPT	GD	CIE	ESE	Prac Exam	OR	100	
2	--	--	20	--	20	--	--	20	40	--	--	100	2

Prerequisite:

- Basic knowledge of electronics components and sensor
- Fundamental of Programming language

Course Objectives:

- To provide in depth knowledge in basic principles applied in sensors
- To Learn about different types of sensors and their applications in various fields. (like automotive, healthcare, environmental monitoring, industrial automation, and consumer electronics)
- To understand data acquisition systems and the integration of sensors into larger systems and networks
- To explore innovations such as IoT (Internet of Things) sensors, wearable sensors, and advanced MEMS (Micro-Electro-Mechanical Systems).

Course Outcomes: At the end of the course, students will be able to

1. Choose an appropriate sensor comparing different standards and guidelines to make sensitive measurements of physical parameters. (Understand level)
2. Use of microcontrollers with various sensors/wireless sensor network and actuators for design of application. (Apply level)
3. Select IoT protocols, Node MCUs and software (Analyze level)
4. Use of Senores and IoT in various Industrial and other applications (Apply level)

Course contents:

- Sensor fundamentals and characteristics: Sensor Classification, Performance and Types, Error Analysis characteristics, Type of Sensors: Optical Sources and Detectors, Strain, Force, Torque and Pressure sensors, Velocity and Acceleration sensors, Flow, Temperature and Acoustic sensors, Display Sensors.
- Smart Sensors/ IoT-Enabled Sensors: Sensors with integrated processing capabilities to perform complex functions and communicate autonomously. characteristics of wireless sensor nodes,
- IoT Protocols and standards, IoT protocol architecture, wireless technologies related to IoT, Role of microcontroller as gateway to interfacing sensors/ wireless sensors and actuators, Controlling Hardware, Controllers and Network Devices, Development Boards like Arduino, Raspberry Pi, Beagle Bone and various system software IOT platform.
- Case studies using sensors and IoT node MCUs: Industry, Smart Cities, Agriculture, Health and Lifestyle, Home Automation

Text Books:

1. Jacob Fraden, "Hand Book of Modern Sensors: physics, Designs and Applications", 2015, 3rd edition, Springer, New York.
2. Jon. S. Wilson, "Sensor Technology Hand Book", 2011, 1st edition, Elsevier, Netherland.
3. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, ISBN: 0: 0996025510, 13: 978-0996025515.
4. Jeeva Jose, "Internet of Things", ISBN-10 : 938617359X, Khanna Book Publishing, 2018.
5. Raj Kamal, Internet of Things: Architecture and Design Principle" , ISBN-13: 978-93-5260-522-4, McGraw Hill Education (India) 2017

Reference Books:

1. John G Webster, "Measurement, Instrumentation and sensor Handbook", 2017, 2nd edition, CRC Press, Florida.
2. Hakima Chouchi, "The Internet of Things Connecting Objects to the Web", ISBN 078 -1-84821-140-7, Wiley Publications.
3. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
4. The Internet of Things: From RFID to the Next-Generation Pervasive Networked Lu Yan, Yan Zhang, Laurence T. Yang, Huansheng Ning

Relevant MOOCs Course

1. NPTEL - Introduction to internet of things - Course (nptel.ac.in)
2. Coursera - An Introduction to Programming the Internet of Things (IOT) | Coursera

List of Assignments: (Students are instructed to use hardware and software online platforms for simulation and programming to implementing the following assignment)

Mode of Evaluation: CAT (Classroom Assessment Techniques), Digital Assignments, Quiz, Online course, Paper publication, Projects, Hackathon/Makeathon.

1. Study of different sensors: - temperature sensor, bio-sensor, IR sensor, chemical sensor (PH), gauge sensor, ultrasonic sensor etc.
2. Study of Raspberry Pi 4, Arduino board and Operating systems for the same. Understand the process of OS installation on the Raspberry Pi.
3. Understand the connection and configuration of GPIO and its use in programming. Write an application of the use of push switch and LEDs.
4. Write an application using Raspberry Pi/Arduino for traffic signal monitoring and control system.
5. Write an application using Raspberry Pi/Arduino for smart health monitoring system which records heart beat rate and temperature and also sends sms alerts if readings are beyond critical values.
6. Implement a weather monitoring system using humidity, temperature and raindrop sensor and Raspberry Pi/Arduino board.
7. Create a simple web interface for Raspberry-Pi/Beagle board to control the connected LEDs remotely through the interface.
8. Internet of things enabled real time water quality monitoring system

9. Implement smart home automation system. The system automates home appliances and control them over internet from anywhere.
10. Develop a Real time application like a smart home security. **Description**: When anyone comes at door the camera module automatically captures his image and sends a notification to the owner of the house on his mobile phone using GSM modem.

Renewable Energy (MEOEUA21239D)

Teaching scheme	Examination Scheme									
	ISA						ESA			Total
Credits: 2 Lectures (L): 2 hrs./week Tutorial (T): Practical (P):	HA	TW	SCE	PPT	GD	CIE	ESE	PR	OR	
	20		20			20	40			100

Prerequisite: Engineering Chemistry, Engineering Physics, Engineering Mathematics, Engineering Mechanics

Course objectives:

- To introduce renewable energy resources availability, potential and suitability as a substitute for conventional energy resources in future energy demand.

Course Outcomes:

Upon completion of the course, students will be able to

1. Understand energy generation, its consumption and opportunities to generate clean energy.
2. Comprehend the fundamental of solar energy conversion, operation and its applications.
3. Explain basic principles and operational features of wind turbine.
4. Illustrate the emerging green technologies – fuel cell and hydrogen energy systems.

Unit I– Introduction to Renewable energy

Fundamentals of Energy, Environmental aspects of energy, energy and sustainable development, Carbon footprint, Energy Audit for home.
Renewable Energy Scenario in India, prospects, perspectives and advantages of various renewable energy sources, Issues and Challenges for Growth of Renewable Energy in India

Unit II – Solar Energy

Solar Radiation Spectrum; Components of solar radiation -Beam, diffuse and global radiation, Solar radiation Measurements - Pyrheliometers, Pyrometer, Sunshine Recorder.
Classification of Solar Thermal systems, Concentrated solar power (CSP) systems- parabolic collectors, parabolic dish collector, Solar tower, Domestic water heating system
Solar PV cell types, operation and applications of solar photovoltaic system, Photovoltaic system for electric power generation, Solar Park

Unit III – Wind Energy

Wind energy potential and installation in India, Wind mechanism, Principle of wind energy conversion, wind data and site selection considerations, Wind velocity and power from wind, Lift and drag force
Basic components of wind energy conversion systems, small and large wind turbines; Horizontal and Vertical axis; Upwind and Downwind, One, Two and Three blades.
On-shore and off-shore wind power, issues occur while integrating wind energy with power grids.

Unit IV- Fuel cell and Hydrogen energy

Principle and operation of fuel cells, classification and types of fuel cells, potential applications, Fuel cell power plant, Present status and environmental effects

Hydrogen energy, Benefits of hydrogen energy, hydrogen production technologies
Hydrogen energy storage and delivery, applications of hydrogen energy, challenges associated with hydrogen energy, current status

Text Books:

1. G. D. Rai, 'Non-Conventional Energy Sources', Khanna Publisher
2. Tiwari G. N. 'Solar Energy: Fundamentals, design, modelling and Applications', Narosa, 2002
3. D P Kothari, K C Singal & Rakesh Ranjan, 'Renewable Energy Sources & Emerging Technologies', Prentice Hall India

Reference Books:

1. Kreith And Kreider, Solar Energy Handbook**,** McGraw Hill
2. Robert Gasch, 'Wind Power Plant Fundamentals, Design, Construction And Operations', Springer
3. Gary L Johnson, ' Wind Energy Systems', Prentice-Hall Inc., New Jersey
4. Mukund R Patel, ' Wind And Solar Power Systems: Design, Analysis and Operation, Second Edition', CRC Press
5. Goswami D. Y., Kreith F, Kreider J F, 'Principles of Solar Engineering', Taylor & Francis

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Semester IV

Water Supply Engineering (CV22231)

Teaching Scheme	**Examination Scheme**						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): NA Practical (P): 2 hr./week	HA	TW	SCE	ESE	PR/OR	TW	Total
	10	20	20	40	10	-	100

Course Objectives:
1. To understand the concept of water treatment process

Course Outcomes: At the end of the course the students will be able to:
1. Explain water supply system, characteristics of water and estimate water requirements.
2. Understand the conveyance of water by source works, material, and appurtenances.
3. Explain the process of aeration, coagulation, flocculation, sedimentation.
4. Analyze the process of filtration and disinfection
5. Explain advanced treatment systems through Membrane filtration, adsorption, Ion Exchange Process, and packaged drinking water plant
6. Explain the water distribution system, leakage, and maintenance.

Practical – Course Outcome
7. Determine chemical characteristics of water such as pH, alkanity, hardness, chloride, chlorine demand, iron or manganese, sulphate, fluoride, design of 1 MLD WTP by using excel or any software and site visit

Unit I - Water demand, quality, and quantity

Water supply system: Introduction, components Water demand: Usage and rates, governing factors, variation, estimation (present, intermediate, and ultimate) Water Quality: Physical, chemical, and biological parameters, IS 10500-2012, quantity of water required, population forecasting.

Unit II – Conveyance of water

Source works: Intake (types and location), types of river intake, jack well, pumping system, power and capacity of pump, conveyance system, forces acting, materials (Ductile Iron, Mild steel, and Plastic), laying of pipes, hydraulic analysis. Appurtenances: Valves type, thrust block concept.

Unit III – Water treatment (Aeration, mixing and settling)

Treatment: Philosophy, unit processes and operations Aeration: process, types of aerator, design of cascade aerator Coagulation: Physics and chemistry, practice, design of rapid mixer Flocculation: Theory, design of clariflocculator. Settling: Theory, types of settling tanks, design of rectangular and circular types sedimentation tank. Concept of for type 1 and 2 settling.

Unit IV– Water treatment (Filtration and disinfection)

Granular Filtration: Classification, theory of deep mono and dual bed filter, components of deep bed filter, clean filter bed head loss, filter operation, problems in filtration. Disinfection: Types, kinetics, chlorination, chemistry of chlorination, Chicks law, chlorine demand, chlorination practice, UV and Ozone disinfection

Unit V– Advanced water treatment

Membrane filtration: Types, basic concepts, applications. Adsorption: Introduction, basics of carbon adsorption. Ion Exchange: Theory and principal of softener, package drinking water plant concept, concept of 24x7 water supply and SCADA system.

Unit VI– Water distribution system and Operation-Maintenance

Water distribution: Methods, system configurations, hydraulic and functional requirements. Service reservoirs: Necessity, components, location, head, and capacity Leakage: Causes, detection and control Water quality in distribution: Causes of deterioration, Source trace, Water age, Nodal constituent concentration Operation and maintenance: Water supply system

List of practical – (Any Six of the following)

1. Determination of pH and alkanity from water.
2. Determination of Hardness from water.
3. Determination of chlorides from water.
4. Determination of optimum dose of alum.
5. Determination of chlorine dose and chlorine demand.
6. Determination of Iron or Manganese from water.
7. Determination of sulphate from water.
8. Determination of fluoride from water.
9. Design of 1MLD WTP in spread sheet or any software.
10. Site Visit on WTP describing Unit Operations in Water Treatment.

List of Assignments:

1. Study of Plumbing fixture and accessories.
2. Types of Intake Structures.
3. Automation in Water Supply.

Oral Exam based on Practical's

Text books:

1. S.K. Garg, Water Supply Engineering Vol. -1, Khanna Publication, New Delhi
2. B C Punmia, Environmental Engineering Vol. -1, Laxmi Publication, New Delhi

Reference books:

1.G.S. Birdi -, Water supply & Sanitary Engg. Laxmi publications (p) Ltd. New Delhi
2. Mark J., Water & waste Water technology. Hammer, Prentice – Hall of India, New Delhi
3. H.S. Paeavy& D.R. Rowe, Environmental Engineering. McGraw Hill Book Co. New Delhi
4. G.M. Fair & J.C. Geyer, 1968, Water & Waste Water Technology. New York, NY, John Wiley &Sons Incorporated,

Geotechnical Engineering (CV22232)

Teaching Scheme	**Examination Scheme**						
Credits: 4 Lecture (L): 3 hrs./week Tutorial (T): NA Practical (P): 2 hr./week	HA	TW	SCE	ESE	PR/OR	TW	Total
	10	20	20	40	10	-	100

Course Objectives:

1. To impart knowledge about the soil properties, classification, and its behavior under stress
2. To impart knowledge about the methods for measurements and determination of index and engineering properties of soil
3. To impart knowledge about the study the interaction between water and its effect on engineering behavior of soil

Course Outcomes: At the end of the course the students will be able to:

1. Classify the different types of soil/rock and define their index properties.
2. Explain permeability and seepage through soil and determine permeability of different types of soils.
3. Determine compaction properties and stress, and methods to determine stress distribution in the soils.
4. Calculate shear strength parameters of soil and explain methods to determine shear strength of soils.
5. Compute the lateral thrust due to backfill on the retaining walls.
6. Describe soil slopes and their failure modes and explain methods to determine strength of rocks.

Unit – I Index Properties of Soil

Need for soil mechanics studies, Soil as an engineering material - Scope of Geotechnical engineering. Major soil deposits of India, Index properties of soil and rock, three phase soil system, Soil minerals, Soil structures, Weight volume relationship, Index properties of soil and rock.

Unit II – Permeability and Seepage

Soil water, permeability definition and necessity of its study, Darcy's law, factors affecting permeability. Laboratory measurement of permeability – Constant head method and Falling head method as per IS 2720. Field test for determination of permeability test as per IS. Permeability of stratified soil deposits. Seepage and Seepage Pressure, quicksand phenomenon, critical hydraulic gradient, General flow equation for 2-D flow (Laplace equation), Flow Net, properties and application, Flow Net construction for flow under sheet pile and earthen dam.

Unit III – Compaction and Stress Distribution

Introduction, Standard Proctor test, Modified Proctor test, zero air void line. Factors affecting compaction. Effect of compaction on soil properties. Field compaction methods and compaction equipment is for different types of soil, Field compaction control

Geostatic stress, Boussinesq's theory with assumptions for point load (with numerical), equations for circular load, line load and strip load, Pressure Distribution diagram on a horizontal and vertical plane, Pressure bulb and its significance. Westergaard's theory, equivalent point load method, Approximate stress distribution method.

Unit IV– Shear Strength of soil

Mohr's stress circle, Mohr-Coulomb failure theory. The effective stress principle- Total stress, effective stress and neutral stress / pore water pressure. Peak and Residual shear strength, factors affecting shear strength. Stress-strain behavior of sands and clays. Direct Shear test, Tri-axial compression test, Unconfined

Compression test, Vane Shear test. (Different drainage conditions for shear tests). Sensitivity and thixotropy of cohesive soils.

Unit V– Earth Pressure theory

Earth Pressure – Introduction, Rankine's state of Plastic Equilibrium in soils- Active and Passive states due to wall movement, Earth Pressure at rest. Rankine's Theory : Earth pressure on Retaining wall due to submerged backfill. Backfill with uniform surcharge, backfill with sloping surface, layered backfill. Coulomb's Wedge theory. Rebhann's and Culmann's graphical method of determination of earth pressure

Unit VI– Stability of slopes and strength of rocks

Classification and failure of slopes, Finite slope stability by Swedish circle method with slip circle and method of slices, Soil stabilization, its necessity and methods. Landslides- Causes and remedial measures. Rock quality designation, Rock mass classification, Laboratory methods to determine strength of rocks, Determination of Bearing capacity

List of Experiments: Any 8 + Sr. No 13 and 14 are compulsory.

1. Determination of water content and specific gravity ofsoil
2. Sieve analysis, particle size determination and IS classification as per I. S. Codes.
3. Determination of Consistency limits and their use in soil classification. as per I. S. Codes.
4. Field density test by a) Core cutter b) Sand Replacement
5. Determination of coefficient of permeability by a) constant head and b) variable head method.
6. Direct shear test.
7. Unconfined compression test.
8. Vane Shear test.
9. Standard Proctor test / Modified Proctor test.
10. Differential free swell test.
11. Demonstration of Tri-axial test
12. Swelling Pressure test
13. Any one of the following assignments-

a) Review of any field geotechnical investigation report.

b) Construction of pressure bulb by using any geotechnical engineering software.

14. Assignments on the following topics

a) Rebhann's and Cullman's graphical method for determination of earth pressure.

b) Solution of problems on shear strength parameters using graph.

Text books:

1. Punmia B. C, (2017), "Soil Mechanics and Foundation Engineering". Laxmi Publications.
2. Shashi K. Gulati and Manoj Datta (2018), "Geotechnical Engineering", Tata McGraw Hill.
3. Murthy, V. N. S., (2000), "Principles of Soil Mechanics and Foundation Engineering", UBS Publishers
4. Mukherjee, P. K. (2013), "A Text Book of Geology", World press Publishers.

Reference books:

1. Terzaghi and Peck (1996), "Soil mechanics and engineering Practice" John Wiley & Sons
2. Joseph. E. Bowles (2001),"Physical and Geotechnical Properties of Soils", International Students Edition
3. Das B. M. (2010), "Principles of Geotechnical Engineering", Cengage Learning

Structural Analysis (CV22233)

Teaching Scheme	**Examination Scheme**					
Credits: 3 Lecture (L): 2 hrs./week Tutorial (T): 0 hr./week Practical (P): 2 hrs./week	HA	TW	SCE	OR	ESE	Total
	10	20	20	10	40	100

Course Objectives:

- To prepare the students to analyze determinate beams and Arches
- To prepare the students to analyze Indeterminate beams and frames

Course Outcomes: Upon the completion of the course, students will be able to

1. Analyze the determinate beams using the concept of Influence Line Diagram
2. Analyze the three hinged arches
3. Analyze the indeterminate beams using Three Moment Theorem and Castigliano's II Theorem
4. Analyze the indeterminate beams and frames using Slope-Deflection Method, Moment Distribution Method, Flexibility Method and Stiffness Method

Unit I: Influence Line Diagram and Three Hinged Arches

Influence Line Diagram: Basic concepts, influence line diagram for reactions, shear and bending moment for simply supported and overhanging beams and Trusses Three Hinged Arches: Concept, analysis of parabolic and semicircular arch with supports at same and different levels. Horizontal thrust, radial shear and normal thrust for parabolic and semicircular arch.

Unit II: Three Moment Theorem and Castigliano's Second Theorem

Static and Kinematic redundancy of beams, trusses and frames. Clapeyron's Theorem of Three Moments, Application of the theorem to indeterminate beams with settlement of supports having static indeterminacy not more than 2. Castigliano's Second Theorem, Application of the theorem to indeterminate beams having static indeterminacy not more than 2.

Unit III: Slope Deflection Method and Moment Distribution Method

Introduction to Slope Deflection Method, sign conventions, fixed end moments, development of slope deflection equations, Application to indeterminate beams and non-sway frames having degree of Indeterminacy not more than 2.

Introduction to Moment Distribution Method, carry over moment, distribution factors, modification of stiffness for simple ends, Application to indeterminate beams and non-sway frames having degree of indeterminacy not more than 2.

Unit IV: Flexibility and Stiffness Method

Flexibility Method: Fundamental concepts, formulation of flexibility matrix, application to beams and sway and non-sway frames. (degree of Indeterminacy not more than 2)

Stiffness Method: Fundamental concepts, formulation of stiffness matrix, application to indeterminate beams and non-sway frames using member approach. (degree of Indeterminacy not more than 2)

Assignments for Tutorials

- Two Assignments on each unit

Text Books:

1. S.B. Junnerkar and H.J. Shah, (2015), "Mechanics of Structures-Vol II", Charotar Publishing House
2. B.C.Punmia, Ashok kumar Jain and Arun Kumar Jain, (2017), "Theory of Structures", Laxmi Publications (P) Ltd. 3
3. S.Ramamrutham and R. Narayan , (2017), "Theory of Structures", Dhanpat Rai Publishing Company
4. S.S.Bhavikatti (2018), "Structural Analysis-II", Vikas Publishing House Pvt. Ltd.

Reference Books:

1. Devdas Menon (2009), "Advanced Structural Analysis" Narosa Publishing House, Mumbai
2. R.C.Hibbler, (2017) , "Structural Analysis" , Pearson Publications
3. Dr. A.S.Meghre and S.K.Deshmukh, (2016), "Matrix Methods of Structural Analysis", Charotar Publishing House

Quality Standards and Practices (MDM22234)

Teaching scheme	Examination Scheme							
Credits: 2 Lectures (L): 2 hrs./week Tutorial (T): Practical (P):	H A	TW	SCE	CIE	ESE	PR	OR	Total
	20		20	20	40			100

Unit 1: Standards and the Standardization Process

Introduction to standards and standardization, Interoperability of standards, National Standards Body (NSB): Characteristics and governance, introduction to International Organization for Standardization (ISO), The International Electrotechnical Commission (IEC), Codex Alimentarius Commission (CAC), The International Organization of Legal Metrology (OIML), "Private" International Standards.

Unit 2: Quality Control and Quality Assurance

The evolution of quality concepts, quality control and quality assurance during a product's life cycle, benefits and costs of quality assurance, Costs of quality failure, quality systems, quality manual, quality organizational structure, statistical quality control tools, quality-control charts, sampling methods, investigating the causes of non-conformity, six-sigma approach to quality management, comparison between ISO 9000, and six-sigma

Unit 3: Quality Management Systems

The evolution of quality management, ISO 9000: Family (Series) of standards and its implementation, elements of ISO 9000, principles of quality management systems, internal audit, external audit, the surveillance or quality audit visit, assessment of quality-management systems, conformity assessment, Conformity Assessment Bodies (CABs).

Unit 4: Overview of Other Management Systems

ISO 14000, environmental management systems, overview of ISO 22000 standards on food safety management, standards on social responsibility, information security management, risk management, ISO standards on energy management

Reference books:

1. Standards and Quality by Anwar El-Tawil, World Scientific Publishing Co. Pte. Ltd
2. Quality and Standards in Electronics Raymond L. Tricker, Newnes An imprint of Butterworth-Heinemann Linacre House, Jordan Hill, Oxford OX2 8DP A division of Reed Educational and Professional Publishing Ltd.

Department of Civil Engineering
Logical Reasoning and Quantitative Aptitude (AEC22236)

Teaching scheme	**Examination Scheme**							
Credits: 2 Lectures (L): 2 hrs./week Tutorial (T): Practical (P):	H A	TW	SCE	CIE	ESE	PR	OR	Total
	-	50	-	-	-			50

Department of Civil Engineering

Entrepreneurship Development (EEM22237)

Teaching Scheme	Examination Scheme					
Credits: 2 Lecture (L): 2 hrs./week Tutorial (T): 0 hr./week Practical (P): 0 hrs./week	CIE	TW	SCE	OR	ESE	Total
	10	20	20			50

Course Objectives:

- To impart knowledge and skills needed to become a successful entrepreneur.
- To motivate young minds to set up their own venture and contribute to national economic development.

Course Outcomes: Upon the completion of the course, students will be able to:

1. Discern distinct entrepreneurial traits.
2. Know the parameters to assess opportunities and constraints for new business ideas.
3. Design strategies for successful implementation of innovative business ideas.
4. Write a business plan.

Unit I: Introduction to Entrepreneurship

Entrepreneurship Meaning- Characteristics- Functions- Traits- Types- Entrepreneur- Women Entrepreneurship- Rural Entrepreneurship- Role of Entrepreneurship in Economic Development – Factors affecting entrepreneurial growth.

Unit II: Institutional Support to Entrepreneurs

Entrepreneurship Development Program- Need- Objectives- Course Contents- Phases-Evaluation - DIC, NSIC, SIDO, KVIC, SIDC, Industrial Estates, NIESBUD, SIDBI, EDII- - Angel Investors- Incubators- STEP- Venture Capital.

Unit III: Government Initiatives for Startups

SAMRIDH Scheme, MSME Market Development Assistance (MDA), NIDHI Scheme (National Initiative for Development and Harnessing Innovations), Credit Linked Subsidy Scheme (CLCSS), Digital India GENESIS, MSME Sustainable (ZED) Certification, The Multiplier Grants Scheme (MGS), Startup Leadership Program (SLP), ASPIRE (A Scheme for Promotion of Innovation, Rural Industries and Entrepreneurship), Startup India Initiative, Startup India Seed Fund Scheme, Pradhan Mantri Mudhra Yojna, Atal Innovation Mission, Credit Guarantee Trust Fund, Venture Capital Assistance Scheme, The Standup India Scheme, Raw Material Assistance Scheme, Single Point Registration Scheme.

Unit IV: Business Plan and Legal Aspects

Development of Business Plan and starting venture- Registration Formalities- IPR- Incentives and Subsidies- Need for Incentives and Subsidies- Tax benefits for SSI Units- Sickness in Small Industries- Causes and Remedies and Revival.

Text Books:

1. Khanka SS - Entrepreneurial Development - S.Chand & Co. Ltd 2010.
2. Startup India Website: https://www.startupindia.gov.in/content/sih/en/government-schemes.html

Reference Books:

1. Gupta CB and Srinivasan NP - Entrepreneurship Development in India - S.Chand & Co. Ltd.
2. Robert D Hisrich et al - Entrepreneurship Development - Tata McGraw- Hill publishing company Ltd 2007.
3. Prasanna Chandra - Projects- Planning, Analysis, Financing, Implementation & Review - Tata McGraw- Hill publishing company Ltd 2006.

Department of Civil Engineering

Leadership and Ethical Decision Making (VEC22238)

Teaching Scheme	Examination Scheme					
Credits: 2 Lecture (L): 1 hrs./week Tutorial (T): 1 hr./week Practical (P): 0 hrs./week	CIE	TW	SCE	OR	ESE	Total
	10	20	20			50

Course Objectives:

- To develop an understanding of leadership principles and their application in engineering contexts.
- To equip students with ethical decision-making frameworks for resolving professional challenges.
- To foster critical thinking and teamwork skills through practical activities and case studies.

Course Outcomes: Upon the completion of the course, students will be able to:

1. Recognize different leadership styles and develop self-awareness about personal leadership traits.
2. Apply structured decision-making models to address ethical dilemmas.
3. Develop strategies for team collaboration and effective communication.
4. Integrate leadership and ethical principles in solving real-world challenges.

Unit I: Fundamentals of Leadership

Definition, characteristics, and styles of leadership, Leadership theories: Trait theory, Behavioral theory, Contingency theory, and Transformational leadership, Emotional intelligence and its role in leadership, Leadership in engineering and technology-driven organizations. (4 hours)

Unit II: Ethics and Professional Decision Making

Fundamentals of ethics: Core concepts and values, Professional codes of conduct in engineering, Ethical decision-making models (e.g., Four-Component Model, PLUS model), Resolving ethical dilemmas: Case studies in engineering and technology. (4 hours)

Unit III: Leadership and Ethics in Action

Building high-performing teams and collaborative skills, Diversity, equity, and inclusion in the workplace, Conflict resolution strategies and negotiation skills, Case studies on leadership challenges and ethical practices. (4 hours)

Textbooks:

1. Northouse, P. G. (2021). *Leadership: Theory and Practice* (9th ed.). Sage Publications.
2. Harris, C. E., Pritchard, M. S., & Rabins, M. J. (2019). *Engineering Ethics: Concepts and Cases* (6th ed.). Cengage Learning.

Reference Books:

1. Goleman, D. (2006). Emotional Intelligence: Why It Can Matter More Than IQ. Bantam Books.
2. Kidder, R. M. (2009). How Good People Make Tough Choices: Resolving the Dilemmas of Ethical Living. Harper.
3. Kouzes, J. M., & Posner, B. Z. (2017). The Leadership Challenge: How to Make Extraordinary Things Happen in Organizations (6th ed.). Wiley.
4. Martin, M. W., & Schinzinger R. (2017). Ethics in Engineering (5th ed.). McGraw-Hill Education.

Department of Civil Engineering

Introduction to IOT (CSOEUA22239A)

Teaching Scheme	Examination Scheme					
Credits: 2 Lecture (L): 2 hrs./week Tutorial (T): 0 hr./week Practical (P): 0 hrs./week	HA	CIE	SCE	OR	ESE	Total
	20	20	20		40	100

Course Objectives:

- Understand the core concepts, architecture, and components of IoT systems.
- Develop hands-on skills in IoT project design using Arduino and Raspberry Pi.
- Explore cloud integration, data analytics, and secure communication in IoT.
- Analyze real-world IoT applications, challenges, and emerging trends.

Course Outcomes: Upon the completion of the course, students will be able to:

1. Demonstrate a clear understanding of IoT architecture, components, and communication protocols.
2. Develop functional IoT prototypes using Arduino and Raspberry Pi for real-world applications.
3. Integrate IoT systems with cloud platforms to collect, analyze, and visualize data securely.
4. Evaluate IoT applications across industries and propose innovative solutions to emerging challenges.

Unit I: Fundamentals of IoT

Overview of IoT, Definition and Characteristics, IoT Architecture, Components of IoT: Things (devices and sensors), Communication technologies, Data processing and storage, Overview of protocols in IoT (MQTT, CoAP, HTTP). (6 hours)

Unit II: IoT Devices and Connectivity

IoT Sensors and Actuators: Types and functionalities, Interfacing sensors with devices, Connectivity and Communication: IoT networking technologies (Wi-Fi, Bluetooth, Zigbee, LoRa, 5G), Role of gateways in IoT networks, Challenges in IoT connectivity, Power management in IoT devices. (6 hours)

Unit III: IoT Data and Cloud Integration

Data Collection and Processing: Data types and formats in IoT, Data analytics in IoT
IoT and Cloud Computing: Cloud platforms for IoT (AWS IoT, Google Cloud IoT, Microsoft Azure IoT), Edge computing and its importance
Security and Privacy Challenges: Common vulnerabilities in IoT systems, best practices for securing IoT networks (6 hours)

Unit IV: IoT Applications and Future Trends

Key IoT Application Areas: Smart homes and cities, Industrial IoT (IIoT) and smart manufacturing, Healthcare and wearables, Agriculture, and environmental monitoring
Challenges and Opportunities in IoT Development, Emerging Trends: AI in IoT, Blockchain for IoT security, IoT in sustainability (6 hours)

List of Tentative Assignments:

1. LED Control Using Arduino
2. Temperature sensing using Arduino
3. PIR Motion Sensor using Raspberry Pi
4. Ultrasonic Sound sensor using Arduino/Raspberry Pi
5. IR sensor with Buzzer
6. Gas Sensor with Buzzer
7. Soil Moisture Sensor
8. DHT 11 Temperature and Humidity Sensor

Study Material

1. Lecture Notes:

- Lecture notes on IoT architecture, protocols, and applications.
- Practical examples and diagrams for hardware interfacing.

2. Online Tutorials and Documentation:
   - Arduino Documentation
   - Raspberry Pi Documentation
   - Tutorials on IoT protocols like MQTT, CoAP, and HTTP.
3. Open-source Platforms:
   - Use platforms like ThingSpeak, Firebase, and AWS IoT Core for cloud integration.
   - Provide examples and sample code for IoT data visualization.
4. Videos and Online Courses:
   - IoT-focused YouTube channels (e.g., "TechExplorations" or "Core Electronics").
   - Online courses from platforms like Coursera, edX, or Udemy.
5. Research Papers and Case Studies:
   - Explore IEEE papers on IoT trends, security, and applications.

Reference Books

1. "Internet of Things: A Hands-On Approach" by Arshdeep Bahga and Vijay Madisetti.
2. "Getting Started with the Internet of Things" by Cuno Pfister
3. "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things" by David Hanes et al.
4. "Mastering Arduino" by Jon Hoffman
5. "Learning Python with Raspberry Pi" by Alex Bradbury and Ben Everard
6. "Building the Internet of Things: Implement New Business Models, Disrupt Competitors, Transform Your Industry" by Maciej Kranz

Department of Civil Engineering

Data Centric AI (AIOEUA22239B)

Teaching Scheme	Examination Scheme					
Credits: 2 Lecture (L): 2 hrs./week Tutorial (T): 0 hr./week Practical (P): 0 hrs./week	HA	CIE	SCE	OR	ESE	Total
	20	20	20		40	100

Prerequisites:
- Programming Paradigm and Methodology (ADUA12234)
- Calculus (BS10232)
- Fundamentals of Data Science (ADUA12236)

Course Objectives:
- To Compare Model-Centric and Data-Centric AI, promote paradigm shift.
- To use suitable Learning Techniques in AI as per problem
- To use data acquisition, data pre-processing techniques
- To use data deployment and model deployment methods.

Course Outcomes: Upon the completion of the course, students will be able to:
1. Analyze model-centric issues, justify shift to data-centric approach.
2. Discuss Learning techniques in AI
3. Explain data acquisition, data pre-processing, data augmentation techniques.
4. Discuss data deployment and model deployment methods.

Unit I: Introduction to Data-centric AI

Introduction to Model Centric AI: Model-centric trends in AI world, Types of Learning techniques in AI, Problems in Model Centric AI, Need for Paradigm Shift. Introduction to Data Centric AI: Phases of Data Centric AI, Data Acquisition, Data Labelling, Data Crowdsourcing, Data Pre-processing, Data Cleaning, Data annotation, Data Augmentation, Data Deployment

Case Studies:

- Building a predictive model to forecast student enrolment in a university program.
- Creating a recommendation system for course selection based on students' academic records and interests (6 hours)

Unit II: Fundamentals of Data Acquisition, Data Pre-processing, and Data Augmentation

Data Acquisition: Sources of Data, Processes to acquire data, Authenticity of Data acquired, Data Storage and Retrieval, Data Integration and Aggregation, Data Fusion and Multi-Modal Data Analysis, Data Integration and Standardization in Multi-Source Data Acquisition Data Pre- processing: Need for Data Pre-processing, Data Cleaning, Data Labelling, Data annotation, Tools, and Techniques for Data Labelling for Large Data

Data Augmentation: Introduction to Data Augmentation, Need for Data Augmentation, Relationship between AI Model score and Data Augmentation, Trade-off for Data Augmentation

Case Studies:

- Collecting and analyzing social media data to understand student sentiment towards online learning
- Cleaning and standardizing a large dataset of student demographic and academic records for analysis
- Augmenting images of mathematical equations to improve accuracy of a handwriting recognition model for grading students' papers (6 hours)

Unit III: Machine Learning Fundamentals for Data-Centric AI

Supervised Learning: Regression and classification algorithms, Model evaluation and selection, Unsupervised Learning: Clustering algorithms, Dimensionality reduction techniques, Semi- supervised and Self-supervised Learning: Strategies for utilizing unlabeled data, Self-supervised learning

frameworks, Reinforcement Learning: Basics of reinforcement learning, Application of reinforcement learning in data-centric AI, Model Performance Metrics, Confusion Metrics.
Case Study: Study Applications of Each Learning Technique and apply to new problems appropriate learning technique with justification for it. (6 hours)

Unit IV: Data Deployment and Model Deployment

Data Deployment: Technical Debt in Software Development and AI, Data Accuracy, Statistical Significance of Data for Quality Training, Deplorable Data, Understanding the importance of deploying data, Overview of the data deployment process, Challenges and considerations in data deployment, Data Storage Solutions, Data Governance and Compliance, Data Versioning and Reproducibility, Data Security and Access Control
Model Deployment: Overview of model deployment process, Challenges in model deployment, Introduction to Docker and containerization, Docker file and Docker image creation, Deployment Platforms and Services: Cloud deployment platforms, Serverless deployment options (e.g., AWS Lambda, Google Cloud Functions), Model deployment services (e.g., TensorFlow Serving, Sage Maker, Azure ML), Version control for machine learning models, Automated testing and validation Monitoring and Maintenance, Security and Scalability. (6 hours)

Text Books:

1. "Data Centric Artificial Intelligence: A Beginner's Guide", Parikshit N. Mahalle, Gitanjali R. Shinde, Yashwant S. Ingle, Namrata N. Wasatkar, Springer Singapore, 978-981-99-6353-9
2. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville, MIT Press, 2016, 978-0-262-03561-3

Reference Books:

1. "Pattern Recognition and Machine Learning" , Christopher M. Bishop, Springer New York, NY, 978-0-387-31073-2
2. "Data Science from Scratch: First Principles with Python" by Joel Grus(for Unit III and IV)

Online Resources:

https://dcai.csail.mit.edu/
https://landing.ai/data-centric-ai/

Department of Civil Engineering

Introduction to Robotics and Applications (ETOEUA22239C)

Teaching Scheme	Examination Scheme					
Credits: 2 Lecture (L): 2 hrs./week Tutorial (T): 0 hr./week Practical (P): 0 hrs./week	HA	CIE	SCE	OR	ESE	Total
	20	20	20		40	100

Prerequisites:
- Digital Electronics, Basics of Microprocessors
- Basic Programming Language C, Python
- Basic Electronics Fundamental

Course Objectives:
- To understand the basics of robotic system.
- To justify the use of sensors and actuators in robotic system.
- To study various hardware and software tools for developing robotic applications
- To develop small application-based assignment using robotic system.

Course Outcomes: Upon the completion of the course, students will be able to:
1. Explain and classify the type of robotic system.
2. Explain and classify the type of robotic architecture with its component.
3. Design the robotic drive for industrial robotic application.
4. Demonstrate simulation and programming for various robotic case studies.

Unit I: Introduction to Robotic System (6 Hrs)

Brief History, Basic Concepts of Robotics such as Definition , Three laws, Elements of Robotic Systems i.e. Robot anatomy, DOF, Misunderstood devices etc., Classification of Robotic systems on the basis of various parameters such as work volume, type of drive, etc., Associated parameters i.e. resolution, accuracy, repeatability, dexterity, compliance, RCC device etc., Introduction to Principles & Strategies of Automation, Types & Levels of Automations, Need of automation, Industrial applications of robot

Unit II: Sensors and Actuators for Robotics (6 Hrs)

Sensors for Robots - Types of Sensors used in Robotics, Classification and applications of sensors, Characteristics of sensing devices, Selections of sensors. Need for sensors and vision system in the working and control of a robot. Actuators hydraulic, pneumatic, and electrical, actuators selection while designing a robot system

Unit III: Drives and Control for Robotics: (6 Hrs)

Essential components-Drive for Hydraulic and Pneumatic actuators, H-bridge drives for Dc motor Overload over current and stall detection methods, example of a micro-controller/microprocessor-based robot Controller

Unit IV: Advance Robotics (6 Hrs)

Introduction, Image acquisition, Illumination Techniques, Image conversion, Cameras, sensors, Camera and system interface, Framebuffers and Grabbers, Image processing, low level & high level machine vision systems

Text Books:
1. S. K. Saha, Introduction to Robotics 2e, TATA McGraw Hills Education (2014)
2. Asitava Ghoshal, Robotics: Fundamental concepts and analysis, Oxford University Press (2006).
3. Dilip Kumar Pratihar, Fundamentals of Robotics, Narosa Publishing House, (2019).
4. K. Mittal, I. J. Nagrath, Robotics and Control, TATA McGraw Hill Publishing Co Ltd, New Delhi (2003).

Reference Books:
1. S. B. Niku, Introduction to Robotics – Analysis, Control, Applications, 3rd edition, John Wiley &

Sons Ltd., (2020)
2. J. Angeles, Fundamentals of Robotic Mechanical Systems Theory Methods and Algorithms, Springer (1997).
3. R. D. Klafter, Thomas A. Chmielewski, and Mechael Negin, Robotic Engineering

I . Project Based Learning Mini Project/Seminar (SCE)

Implementation of Simulation and real-world implementation of specific robotic application.

Department of Civil Engineering
Electric Vehicle (MEOEUA22239D)

Teaching Scheme	**Examination Scheme**					
Credits: 2 Lecture (L): 2 hrs./week Tutorial (T): 0 hr./week Practical (P): 0 hrs./week	HA	CIE	SCE	OR	ESE	Total
	20	20	20		40	100

Prerequisites:

Course Objectives:

- To understand the comprehensive overview of Electric Vehicles.

Course Outcomes: Upon the completion of the course, students will be able to:

1. Understand the importance of electrical vehicle and its performance.
2. Describe battery storage unit.
3. Analyze different types of electric motor for selecting in electric vehicle and electric drive train.
4. Apply different drive cycles to model and identify the advancement in Electric Vehicles.

Unit I- Introduction to Electric Vehicles

Automobile history and development of electric vehicles, vehicle layout, Chassis types, constructional details of Frames, introduction to Suspension System and Brakes, Basics of Steering System, Types of Tiers, social and environmental importance of electric vehicles, EV Technology, Significance of e-Vehicle. Types of electric vehicles and its components, overview of Tesla Car

Unit II- Battery Storage Unit

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Basics – Battery Types, Battery-Lead acid batteries, lithium batteries, Nickel-Metal Hydride Batteries, Introduction to BMS, Fuel Cell based energy storage, Hybridization of different energy storage devices.

Unit III- Electric Motors and Drive Train

Introduction to motors, AC and DC Motors Types used in electric vehicles-Three Phase AC Induction Motors, Permanent Magnet Synchronous Motor (PMSM), DC Series Motor, Brushless DC Motor, Switched Reluctance Motors (SRM), Electric Vehicle (EV) Configurations, introduction to various electric drive-train topologies, differential, clutch, regenerative braking

Unit IV– Advancement in e-vehicles and Drive cycle

Integration of IoT in e-vehicle, Wireless sensor networks need for IoT, Intelligent Transport Systems, Degradation and disposal of batteries, modes of fast and efficient charging, Safety rules and regulations Power Train Drive Cycles, New York City Cycle (NYCC), Japanese (JP-10-15), Extra Urban Driving Cycle (EUDC), Federal Test Procedure (FTP-75), New European Driving Cycle (NEDC)

Text Books:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
2. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

Reference Books:

1. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
2. Sandeep Dhameja, "Electric Vehicle Battery Systems", Newnes, 2000.