Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third-Year B. Tech.
Course Code	
Course Name	Professional Elective 2: Remote Sensing and GIS
Desired Requisites:	Basics of Surveying

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	Introduce students the necessary knowledge and concepts in the field of RS and GIS and their civil engineering significance. To develop the sense of Applications of Spatial technology among civil engineering students.
2	Introduce the technique of interpreting, classifying and applying various RS and GIS data in Civil Engineering decision making.
3	Enable students in decision making to manage the Civil Engineering related spatial problems before preparing and implementing any civil engineering action plans.

Course Outcomes (CO)

After completion of the course students will able to

CO	Description	Blooms Taxonomy	
		Descriptor	Level
CO1	Identify and describe the fundamentals of Remote Sensing and Geographic Information Technologies.	Understanding	II
CO2	Demonstrate, and interpret spatial data to extract maximum information.	Analysing	IV
CO3	Implement Geospatial Applications in Various Domains.	Applying	III
CO4	Classify the remotely sensed data.	Evaluating	IV

Module	**Module Contents**	**Hours**
I	**Principles of Remote Sensing** Definition and principles of remote sensing, Electromagnetic spectrum and interaction with Earth's surface, Platforms and sensors used in remote sensing, Image acquisition and interpretation, Review on photogrammetry, Advantages of Remote sensing, Data formats and pre-processing techniques, errors in remote sensing data, Radiometric and geometric corrections	4
III	**Visual Image Interpretation** Types of Pictorial Data Products, Image interpretation strategy, Process of Image Interpretation, Interpretation of Aerial Photo, Three dimensional interpretation Method, Basic elements of Image Interpretation	4
IV	**Fundamentals Geographical Information System** Definition and principles of GIS, Components of a GIS (hardware, software, data, methods), Spatial data models (vector and raster), GIS Queries, Coordinate systems and map projections, GIS Architecture, Theoretical Models of GIS, GIS Categories	5
V	**Spatial Data Modelling** Stages of GIS Data Modelling, Graphic Representation of Spatial Data, Raster GIS Models, Vector GIS Models	4

VII	**Introduction of Global Positioning System** Satellite constellation, GPS signals and data, Geo-Positioning-Basic Concepts. Control Segment Discussion on NAVSTAR, GLONASS, GALLILEO, COMPASS, Coordinate Systems, Special Referencing system, Map Scale, Scale factors, Indian geodetic System, GNSS.	5
VIII	**Creation of Information System and its application** Land use and land cover mapping, Environmental monitoring and assessment, Urban planning and management, Natural resource management and conservation, Archaeology investigation, Agriculture management.	4

Text Books	
1	Reddy M. A., "Remote Sensing & Geographical Information System", BS Publications, Hyderabad.
2	Lillesand T. M. & Kiefer R., "Remote Sensing and Image Interpretation" , John Villey.
3	French, Gregory T. Understanding the GPS: An Introduction to the Global Positioning System: what it is and how it Works. United States: GeoResearch."

References	
1	Jensen J. R. "Remote Sensing & Digital Image Processing", Department of Geography University of South Carolina Columbia.
2	Panda B C, "Principles of Remote Sensing", Viva Books Private Limited.
3	Colvocoresses, Alden P.. Remote Sensing Platforms. United States, U.S. Geological Survey.

Useful Links	
1	https://www.youtube.com/watch?v=vJAQHA5XQWI&list=PL3MO67NH2XxLAFn3jc7gOhXLD9YFx-oew
2	https://www.youtube.com/watch?v=1zwg-siuvuc&list=PLp76zJxzEriMstHWJssWiczio7rtIAU6r

CO-PO Mapping

	Programme Outcomes (PO)												**PSPO**	
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3													
CO2				3										
CO3					2									

The strength of mapping: - 1: Low, 2: Medium, 3: High

Assessment

The assessment is based on MSE, ISE, and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of a teacher's assessment. The mode of assessment can be field visits, assignments, etc., and is expected to map at least one higher-order PO.

ESE shall be on all modules with around 25-30% weightage on modules 1 to 3 and 70-75% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed, and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Prepared by	DAC/BoS Secretary	Head/BoS Chairman

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

A.Y. 2025-26 Onwards

Course Information	
Programme	B. Tech. Civil Engineering
Class, Semester	Third Year, Semester II
Course Code	
Course Name	Plastic and Electronic Waste Management
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	0 Hrs/week	30	20	50	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	To provide students with a comprehensive understanding of sources, types, and environmental and health impacts associated with plastic and e-waste, and the urgency of effective management.
2	To explore policy frameworks, regulations, and initiatives related to plastic and e-waste management, including extended producer responsibility (EPR) programs and circular economy approaches.
3	To acquaint students with the methods and challenges associated with their collection, recycling, and disposal.

Course Outcomes (CO)

CO	Description	Blooms Taxonomy	
		Descriptor	Level
CO1	Explain the sources, types, and generation patterns of plastic and e-waste environmental and health impacts of plastic and e-waste, and	Understand	II

	the need for sustainable management practices.		
CO2	Perceive policy frameworks, regulations, and initiatives related to plastic and e-waste management, and propose effective strategies for implementing extended producer responsibility (EPR) programs and promoting circular economy practices.	Understand	II
CO3	Identify generation patterns of plastic and e-waste, methods, challenges and opportunities in their collection, recycling, and disposal.	Analyse	IV

Module	Module Contents	Hours
I	**Introduction to Plastic and E-Waste Management** Understanding the environmental and health impacts of plastic and e-waste, Overview of the global plastic and e-waste crisis, Introduction to plastic and e- waste management approaches, Policies and regulations related to plastic and e- waste management	4
II	**Plastic Waste Management** Sources and types of plastic waste, Plastic waste collection methods and technologies, Sorting and segregation techniques for plastic waste, recycling of plastic by chemical and dissolution method, use of nanotechnology and AI in plastic waste management, use of plastic in roads, bricks and furniture	4

III	**E-Waste Generation and Sources** Sources of e-waste: consumer electronics, IT equipment, appliances, Understanding the composition and hazardous components of e-waste, E-waste generation trends and patterns, E-waste collection methods and systems.	4
IV	**E-Waste Recycling and Disposal** Recycling technologies for e-waste: dismantling, shredding, and separation, Hazardous substance management in e-waste recycling, Resource recovery from e-waste: precious metals, rare earth elements, E-waste disposal methods: landfilling, incineration, and their environmental impacts.	5
V	**Extended Producer Responsibility (EPR) and Policy Framework** Overview of Extended Producer Responsibility (EPR) programs, EPR policies and regulations for plastic and e-waste management, International and national initiatives to promote EPR, Case studies on successful EPR implementation.	5
VI	**Circular Economy and Sustainable Practices** Design for sustainability: eco-design and product life extension, Promoting repair, refurbishment, and resale of electronics, Circular economy approaches for plastic and e-waste management, Future trends and innovations in circular economy practices.	4
Textbooks		
1	Dr. Ramesha Chandrappa and Dr. Diganta B. Das "Solid Waste Management: Principles and Practice" , Springer, Publications.	
2	George Tchobanoglous Hilary Theisen Samual Vigil, “Integrated Solid Waste Management,” McGraw Hill publications, Indian edition.	
3	Murali Srinivasan Natamai Subramanian, “Plastics Waste Management: Processing and Disposal”, Wiley publications.	
References		
1	Kamila Pope, “Global Waste Management: Models for Tackling the International Waste Crisis”, Kogan Page publishing.	
2	Eric Williams, Klaus Hieronymi, Ramzy Kahhat, “E-waste Management From Waste to Resource”, Tayler and Francis.	

3	Trevor Letcher (Editor), “Plastic Waste and Recycling: Environmental Impact, Societal Issues, Prevention, and Solutions”, Academic Press Inc.
Useful Links	
1	https://www.youtube.com/watch?v=_r5rHyMHKEg&list=PL3MO67NH2XxJngITU5LDb2md2TX4Gqex-
2	https://www.youtube.com/watch?v=sF7NhoIp1C8&list=PL3MO67NH2XxJngITU5LDb2md2TX4Gqex-&index=11
3	https://www.youtube.com/watch?v=VjKRPOUMu-8&list=PLbRMhDVUMngcUlCNSaynDVY7T1XFaMFFy&index=5

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1						3	3							
CO2						3	3						1	
CO3						3	3						1	

The strength of mapping :- 1: Low, 2: Medium, 3: High

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher’s assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Prepared by DAC/BoS Secretary Head/BoS Chairman

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26 Onwards

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Semester VI
Course Code	
Course Name	Professional Elective 1: Fundamentals of Air and Noise Pollution
Desired Requisites	Engineering Physics, Environmental Science

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs./week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 2			

Course Objectives

1	To describe sources and effects of air and noise pollution
2	To explain different techniques to control air and noise pollution
3	To demonstrate application of regulatory standards for air and noise pollution control

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	***Identify*** sources and ***Describe*** effects of air and noise pollution on human health, animals, and environment	Remember
CO2	***Explain*** the meteorological factors such as atmospheric composition, stability, and wind patterns associated with air pollution	Understand
CO3	***Demonstrate*** use of instrumentation to monitor level of air and noise pollutants in ambient atmosphere and compare measured values with respective regulatory standards	Apply

Module	Module Contents	Hrs
I	**Air Pollution: Introduction** Air pollution: Classification and sources of air pollutants; Effects of various air pollutants on man, animals, vegetation, and materials; Ambient air quality standards, and concept of Air Quality Index (AQI).	4
II	**Meteorology** Composition and structure of the atmosphere; Meteorological factors influencing air pollution; Atmospheric stability, Lapse rate, and Inversion; construction of Wind rose diagram, Plume behavior patterns	4
III	**Air Pollution Control Techniques** Operating principles for the control of Gaseous Pollutants: Absorption, Adsorption, Chemical Scrubbing, and Incineration; Control of Particulate Matter: Settling Chamber, Cyclone, Wet Collectors, Fabric filter, and Electrostatic precipitator.	5
IV	**Motor Vehicle Emissions** Automobile emissions; Emission standards and introduction to vehicular emission inventory, Various prevention and control measures, Status of vehicular air pollution in India.	4
V	**Noise Pollution** Introduction to Noise Pollution: Definition and sources of noise pollution; Measurement of noise, sound pressure level (SPL); Health and environmental effects of noise; Noise Pollution Control Techniques.	4
VI	**Air and Noise Pollution Monitoring, Legislation, and Case Studies** Air and Noise Pollution Monitoring Techniques and instrumentation; Air and Noise Pollution Legislation: National and international standards for air and noise pollution control; A Case study for air and noise pollution control in industry and public utility.	5

Textbooks	
1	S. K. Garg “Environmental Engineering” (Vol. II: Air and Noise Pollution), Khanna Publishers
2	R. K. Khitoliya “Environmental Engineering” Dhanpat Rai Publishing Company
3	P. Venugopala Rao “A Textbook of Environmental Engineering” Prentice Hall India
4	S. K. Agarwal “Noise Pollution: Theory and Control"
References	
1	Rao H.V.N. and Rao M. N., "Air Pollution", Tata McGraw Hill.
2	Cunniff PE, “Environmental Noise Pollution”, McGraw Hill, New York.
3	Central Pollution Control Board (CPCB) Publications Website: https://cpcb.nic.in
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc23_ce14/preview
2	https://www.youtube.com/watch?v=ToO0WOnFdq4

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2				2	2							
CO2		3			3	2								
CO3	3	2				3	2							

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher’s assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, student should obtain Min. 40% marks in (MSE+ISE+ESE) with individual passing i.e. Min. 40% marks in ESE as a separate head of passing

Prepared by	DAC/BoS Secretary	Head/BoS Chairman

Walchand College of Engineering, Sangli

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AY 2025-26 onwards

Course Information	
Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	
Course Name	River Engineering
Desired Requisites:	Open Chanel Hydraulics and Water Resources Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	0 Hrs/week	30	20	50	100
		Credits: 2			

Course Objectives	
1	To provide the student fundamentals of fluvial geomorphology
2	To understand concept of analysis of river flow hydraulics, hydraulic geometry and to design stable alluvial channels and fluvial design for river bank protection
3	To prepare the students for higher studies and research in the field of river engineering.

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	*Explain* the fundamentals of fluvial geomorphology.	Understanding
CO2	*Apply* the knowledge of fundamental of analysis of river flow hydraulics, hydraulic geometry and design stable alluvial channels.	Applying, Analysing
CO3	*Design* of fluvial stable alluvial channels and river bank protection.	Evaluate

Module	**Module Contents**	**Hours**
I	Fluvial Geomorphology: Fluvial system, variables for alluvial rivers, regime concept, river classifications, thresholds of river morphology, hydraulic geometry, meander platform, geomorphic analysis of river channel responses.	4
II	Foundation of Fluvial Process: Hydraulics of flow in river channel, physical properties of sediments, scour criteria and scour-related problems, alluvial bed forms and flow resistance, sediment movements in Rivers, flow in curved channels.	5
III	Regime Rivers and Responses: Analytical basis for hydraulic geometry, design of stable alluvial channel,	5
IV	Analytical river morphology, plan geometry and processes of river meanders	4
V	Modeling of river channel changes: Mathematical model for erodible channels,	4

VI	Gradual breach morphology tidal responses of river and delta system, fluvial design of river bank protection	4

Textbooks	
1	Chang H. Howard, "Fluvial Processes in River Engineering", John Wiley & Sons1988.
2	Santosh Kumar, "River Engineering", Khanna Publishing House; 1st edition (30 September 2020)
3	K D Gupta, "River Engineering", Vayu Education Of India Edition, First Edition, 2014.
References	
1	Kumar D.S., "Practical River And Canal Engineering", Read Books, 2011.
2	US Army Corps of Engineers "Engineering and Design: River Hydraulics (Engineer Manual 1110-2-1416)", Khanna Publishers, New Delhi, 8th Edition, 1993.
Useful Links	
1	
2	
3	
4	

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2												1	1
CO2		3											2	2
CO3			3										3	2

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 2 and 60% weightage on modules 3 to 4.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing).

Walchand College of Engineering, Sangli

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AY 2025-26 onwards

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech. Civil, Sem. VI
Course Code	
Course Name	Program Elective-I: Structural Mechanics
Desired Requisites:	Solid Mechanics, Structural Analysis

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	To explain the concept of matrix methods of structural analysis.
2	To inculcate applications of flexibility and stiffness methods to solve indeterminate structures.
3	To illustrate the concept and applications of finite element method in structural engineering.

Course Outcomes (CO)

CO	Description	Blooms Taxonomy	
		Descriptor	Level
CO1	Restate the analysis equations in the form of matrix equations.	Understanding	2
CO2	Analyse indeterminate trusses, beams and frames applying flexibility method.	Analysing	4
CO3	Analyse indeterminate trusses, beams and frames applying stiffness method.	Analysing	4
CO4	Calculate the nodal displacements and member forces using finite element method.	Evaluating	5

Module	**Module Contents**	**Hours**
I	**Flexibility Method - Beams & Frames** Flexibility coefficient matrix, Compatibility conditions, Development of flexibility matrix equations, Analysis of indeterminate beams and rigid jointed frames using flexibility method.	5
II	**Flexibility Method - Trusses** Analysis of indeterminate trusses using flexibility method, Stresses due to lack of fit or error in length, Temperature stresses.	4
III	**Stiffness Method - Structure Approach** Stiffness coefficient matrix, Relation between flexibility and stiffness coefficient matrix, Development of stiffness matrix equations, Analysis of continuous beams and frames.	5

IV	**Stiffness Method - Element Approach: Beams & Frames** Formulation for element stiffness matrix for beam element andplane frame element, Local and global coordinates, Transformation of matrices, Analysis of continuous beams andframes using direct stiffness method.	4
V	**Stiffness Method - Element Approach: Trusses** Direct stiffness method - Element approach, Development of element stiffness matrix and nodal load vector for truss element, Analysis of trusses.	4
VI	**Finite Element Method** Introduction to finite element method, Basic concept, General procedure of finite element analysis, Discretization, nodes, element connectivity, displacement model, shape function, selection of order of polynomials, Development of element stiffness matrix and nodal load vector for bar element, Application to bar with constant cross section subjected to axial forces.	4

Text Books	
1	Gere, J. M. & Weaver, W., Matrix Analysis of Framed Structures, CBS Publishers and Distributor.
2	Godbole, P. N., Introduction to Finite Element Methods, I K International Publishing House Pvt. Ltd..
3	Reddy, C. S., Basic Structural Analysis, McGraw Hill Education.

References	
1	Cook, Robert D., Malkus, David S., Plesha, Michael E., and Witt, Robert J., Concepts and Applications of Finite Element Analysis‖; John Wiley and Sons.
2	McGuire, William, Gallaghar, Richard H. and Ziemian, Ronald D., Matrix Structural Analysis, John Wiley.
3	Meghare A. S.& Deshmukh S. K., Matrix Methods of Structural Analysis, Charotar Publishing House.

Useful Links	
1	https://archive.nptel.ac.in/courses/105/105/105105180/
2	https://onlinecourses.nptel.ac.in/noc20_me91/preview

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	**2**													**2**
CO2	**3**													**2**
CO3	**3**													**2**
CO4	**3**													**2**

The strength of mapping: - 1: Low, 2: Medium, 3: High

Assessment
The assessment is based on MSE, ISE, and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of a teacher's assessment. The mode of assessment can be field visits, assignments, etc., and is expected to map at least one higher-order PO. ESE shall be on all modules with around 25-30% weightage on modules 1 to 3 and 70-75% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed, and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing).

Prepared by Dr. D. S. Chavan	DAC/BoS Secretary	Head/BoS Chairman

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third-Year B. Tech.
Course Code	
Course Name	Professional Elective 1 - Airport Engineering
Desired Requisites:	Transportation Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	To give exposure to the airport construction and maintenance aspects of the airport and make them familiar with the components of the airport.
2	Impart the techniques of planning and designing the airport components like runways, taxiways, terminal building, hangars, etc., along with the drainage and traffic control methods.
3	To make conversant with various construction methods of airports.

Course Outcomes (CO)

CO	Description At the end of the course, students will be able to	Blooms Taxonomy	
		Descriptor	Level
CO1	Explain the fundamental concepts, history, classifications, and terminology related to airport engineering.	Understand / Apply	II & III
CO2	Explain and apply design considerations of the various components of airports.	Apply	III
CO3	Illustrate air traffic control systems, lighting, and marking requirements for runways, taxiways, and heliports.	Understand	II
CO4	Analyze airport drainage systems and propose mitigation measures for environmental impacts caused by airport operations.	Analyze / Apply	III & IV

Module	Module Contents	Hours
I	**Introduction to Airport Engineering** Introduction, History, Terminology, characteristics, airport classification, and organizations concerned with Airport Engineering, ACM & PCM ,components of aircraft, Role of civil engineering in airport planning and design.	5
II	**Airport Planning** Factors influencing site selection for airports, Land use planning and zoning regulations, Runway orientation and site-specific considerations, Safety considerations and clearance requirements, airport obstructions, layouts, and zoning laws.	5
III	**Airport Geometric Design of Runways, Taxiways** Designing: Runways, Runway classification, runway orientation, basic runway length, geometric design.Taxiways- layouts, geometric design, Waterways	4
IV	**Airport Terminal Buildings** **Terminal Buildings:** Site selection, facilities, aprons, gate positions. Hangars: Function, types, requirements.	4
V	**Air Traffic Control System** Air Traffic Control: VFR, IFR, visual aids, lighting and marking. Heliports: Characteristics, site selection, planning, size, obstructions, orientation, marking and lighting.	4

VI	**Airport Drainage and Environmental Considerations** Surface water management at airports, Drainage: Necessity, types, Environmental impacts of airports and mitigation measures.	4

Text Books	
1	G. Venkatappa Rao., "Airport Engineering", Tata McGraw-Hill
2	Khanna S. K. & Arora M. G., "Airport Planning and Design", Nem Chand and Brothers
3	Richard de Neufville, Amedeo Odoni, " Airport System: Planning, Design and Management", McGraw-Hill Education.

References	
1	Rangwala S.C. " Principals of Airport Engineering" Universities Press
2	Horonjeff R., McKelvey F., Sproule W., Young S., "Planning and Design of Airports",

Useful Links	
1	https://www.youtube.com/watch?v=bn2_NZkYQAo&list=PLvG1qort4KxZwu0l4mS2gW06-lrQW6M56

CO-PO Mapping

	Programme Outcomes (PO)												**PSPO**	
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2												1	
CO2	2	2	2		1								1	1
CO3	1	1											1	
CO4	2	1				2							1	

The strength of mapping: - 1: Low, 2: Medium, 3: High

Assessment

0. The assessment is based on MSE, ISE, and ESE.
1. MSE shall be typically on modules 1 to 3.
2. ISE shall be taken throughout the semester in the form of a teacher's assessment. The mode of assessment can be field visits, assignments, etc., and is expected to map at least one higher-order PO.
3. ESE shall be on all modules with around 25-30% weightage on modules 1 to 3 and 70-75% weightage on modules 4 to 6.
4. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed, and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Prepared by	DAC/BoS Secretary	Head/BoS Chairman

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26 onwards

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	
Course Name	Professional Elective 1: Advanced Concrete Technology
Desired Requisites:	Concrete Technology

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	To give exposure to in-depth knowledge of cement chemistry and the hydration of cement.
2	To provide conceptual know-how of admixtures used in concrete to improve the properties of concrete and develop skills to design concrete mixtures.
3	To make students conversant with durability issues of concrete and special types of concrete.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Description**	**Blooms Taxonomy**	
		Descriptor	**Level**
CO1	Apply the knowledge of cement chemistry and the hydration of cement.	Apply	III
CO2	Compare the properties of admixtures to decide their suitability depending on the construction industry requirements.	Analyze	III
CO3	Analyse the durability of issues of concrete and apply knowledge of special concretes.	Analyze	III
CO4	Design a special concrete mix according to the IS 10262: 2019 provisions.	Design	V

Module	**Module Contents**	**Hours**
I	**Cement** Clinkering reactions, Hydration Reactions & Chemistry of Cement paste, Setting of Cements, Heat of Hydration, Microstructure of hydrated cement paste.	5
II	**Chemical Admixtures** Specification, Functions, Classification and Working Principles. Chemical Admixtures: Plasticisers, Super-plasticiser, Accelerators, Retarders, Air entraining agents, Speciality Admixture, Compatibility of Admixtures	4
III	**Mineral Admixtures** Specification, Functions, and Classification. Mineral Admixtures: Fly ash, Silica Fume, Slag, Rice husk ash, Metakaolin Pozzolanic Reactivity of Mineral admixtures	4
IV	**Concrete Mix Design** Factors to be considered, Concrete mix design of High Strength Concrete and SCC by IS: 10262 (2019) method, Concept of Particle Packing density	5
V	**Durability of Concrete** Permeability and Pore Structure, Ionic Diffusion, Chemical Attack (Sulphate, Chloride, Acid, Carbonation), Physical Attack (freeze-thaw), Corrosion of reinforcement, Alkali-Aggregate Reaction	5

VI	**Special Concretes** Fibre reinforced concrete, Ultra-high strength concrete, Pervious Concrete, Recycled Aggregate Concrete.	3

Text Books	
1	Mehta P. K. and Paulo J. M. M, "Concrete – Microstructure, Properties and Material", McGraw Hill Professional 3rd Edition, 2009.
2	Neville A. M. and Brooks J. J., "Concrete Technology", Pearson Education Limited, 1987
3	Shetty M. S., "Concrete Technology", S. Chand & Company Ltd. New Delhi, 7th Edition, 2013.
References	
1	Neville A. M., "Properties of Concrete", Prentice Hall, 5th edition, 2012
2	Newman J., Choo B.S., Advanced Concrete Technology-Constituent Materials, Elsevier Ltd. 1st edition, 2003
3	Taylor H.F.W., Cement chemistry, Thomas Telford, 2nd edition, 1997
Useful Links	
1	https://www.digimat.in/nptel/courses/video/105102012/L01.html
2	https://www.digimat.in/nptel/courses/video/105104030/L01.html
3	https://www.digimat.in/nptel/courses/video/105106176/L01.html

CO-PO Mapping

COs	Programme Outcomes (PO)												PSPO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2						2						2	
CO2	2						1						2	
CO3	2		3		2							2	3	
CO4														

The strength of mapping: 1: Low, 2: Medium, 3: High

Assessment

15. The assessment is based on MSE, ISE and ESE.
16. MSE shall typically be on modules 1 to 3.
17. ISE shall be taken throughout the semester in the form of a teacher's assessment.
18. The mode of assessment can be field visits, assignments, Presentations, Complex Problems, etc. and is expected to map at least one higher-order PO.
19. ESE shall be on all modules, with around 25-30% weightage on modules 1 to 3 and 70-75% weightage on modules 4 to 6.
20. Min. 40% marks in (MSE+ISE+ESE) are needed, and Min. 40% marks in ESE (ESE shall be a separate head of passing) are needed to pass a theory course.

Prepared by	DAC/BoS Secretary	Head/BoS Chairman

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Course Information	
Programme	B. Tech. (Mechanical Engineering)
Class, Semester	
Course Code	
Course Name	Introduction to Turbomachinery
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hr/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	--	30	20	50	100
		Credits:3			

Course Objectives	
1	Recall and define the different classifications of turbomachinery and their fundamental working principles
2	Understand the key performance parameters that influence the efficiency of turbomachinery.
3	Apply knowledge of turbomachinery selection criteria to analyze case studies and recommend suitable machinery for specific applications

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Understand the performance characteristics of various turbomachinery using relevant parameters and efficiency metrics	I	Understanding
CO2	Evaluate and select appropriate turbomachinery for specific applications considering operating conditions and design requirements	V	Evaluate
CO3	Analyze the applications of turbomachinery in different industries and explain their impact on those industries	III	Applying
CO4	Analyze and critically evaluate the design principles and working classifications of different turbomachinery	IV	Analyzing

Module	**Module Contents**	**Hours**
I	**Introduction and Classification of Turbomachinery**: fundamental concepts of turbomachinery, classification of turbomachinery based on working fluid (gas or liquid) and flow direction (axial, radial, mixed). Energy transfer mechanisms in different types of turbomachines through simple diagrams and applications.	6
II	**Performance Parameters and Efficiency of Turbomachinery:** key performance parameters of turbomachinery, fundamental relationships between these parameters using basic thermodynamics principles. Different	7

	types of efficiencies (isentropic, mechanical, overall) and their significance in evaluating turbomachinery performance.	
III	**Applications of Turbomachinery in Various Industries:** diverse applications of turbomachinery in various sectors, including: Power generation (steam turbines, gas turbines), Propulsion (aircraft jet engines, ship propellers), Process industries (pumps for various fluids, compressors for refrigeration and chemical processing). Specific requirements and types of turbomachinery used in each application.	6
IV	**Selection Criteria for Turbomachinery**: Crucial factors considered during the selection of turbomachinery for specific applications. Importance of flow rate, head/pressure requirements, desired efficiency, and operating conditions (temperature, pressure range). Discuss selection methodologies and tools used for choosing the most appropriate turbomachinery for a given application.	6
V	**Introduction to Non-Dimensional Parameters and Similarity Laws in Turbomachinery:** concept of non-dimensional parameters in turbomachinery analysis (e.g., Reynolds number, Euler number, specific speed) for performance comparison. The application of similarity laws (e.g., Buckingham Pi theorem) for predicting the performance of similar turbomachinery designs. Benefits of using non-dimensional parameters and similarity laws in scaling and design optimization of turbomachines	7
VI	**Case Studies: Selection of Turbomachinery for Specific Applications:** Apply the acquired knowledge through case studies involving the selection of turbomachinery for specific industrial applications. Utilize selection criteria and tools learned previously to select the most suitable turbomachinery for each case study.	6
Textbooks		
1	Principles of Turbomachinery" by R.K. Turton	
2	Turbomachinery: Basic Theory and Applications" by Earl Logan Jr.	
References		
	Centrifugal and Axial Flow Pumps: Theory, Design, and Application" by A.J. Stepanoff	
	Fluid Mechanics and Thermodynamics of Turbomachinery" by S.L. Dixon and Cesare Hall	
	Turbomachinery: Design and Theory" by Rama S.R. Gorla and Aijaz A. Khan	
Useful Links		
	https://www.youtube.com/watch?v=ocVzrn4DLj8&list=PLbMVogVj5nJQQp3QLuzbcHrt0XncZZTiE	
	https://www.youtube.com/watch?v=4mg8c6k3bCY	

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Course Information

Programme	B. Tech. (Mechanical Engineering)
Class, Semester	
Course Code	
Course Name	Design Principles of Turbomachinery
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hr/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	--	30	20	50	100
		Credits:3			

Course Objectives

1	**Explain** the fundamental design principles of axial and centrifugal turbomachinery, including stage design, blade design, impeller design, and volute casing function
2	**Apply** engineering principles to analyze stress distribution in critical components of turbomachinery and select appropriate materials based on design requirements.
3	**Interpret** the results obtained from computational design tools and utilize them to optimize a turbomachinery component's design

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Analyze the performance characteristics of axial and centrifugal turbomachines based on design parameters.	IV	Analyzing
CO2	Critically evaluate the design considerations and material selection for different types of hydraulic turbines.	V	Evaluate
CO3	Utilize computational design tools to model and analyze a turbomachinery component.	III	Applying
CO4	Develop a preliminary design for a selected turbomachine, considering performance, material selection, and manufacturability.	VI	Creating

Module	**Module Contents**	**Hours**
I	**Design Fundamentals of Axial Flow Compressors and Turbines:** Introduction to stage theory and performance parameters (work done, efficiency). Application of continuity, momentum, and energy equations to axial flow blading. Design methodologies for blade	7

	geometry using mean line analysis and velocity triangles. Introduction to blade element theory and performance maps.	
II	**Design Principles of Centrifugal Compressors and Pumps**: Overview of centrifugal compressor and pump stages. Application of Euler's equation for impeller design and performance prediction. Volute casing design principles for efficient flow guidance. Dimensional analysis and scaling laws for centrifugal machines.	7
III	**Design Considerations for Hydraulic Turbines:** Classification and operating principles of Pelton, Francis, and Kaplan turbines. Hydraulic design of turbine runners for specific flow rates and heads. Application of Bernoulli's equation for efficiency calculations. Draft tube design for efficient energy recovery in hydraulic turbines.	7
IV	**Material Selection and Stress Analysis for Turbomachinery components :** Selection of appropriate materials for blades, disks, and shafts based on strength, fatigue, and creep resistance	5
V	**Introduction to Computational Design Tools for Turbomachinery:** Overview of CFD (Computational Fluid Dynamics) principles for turbomachinery analysis. Pre-processing tools for creating 3D geometries of turbomachinery components. Setting up CFD simulations for predicting flow behavior and performance. Post-processing and interpretation of CFD results for informed design decisions.	6
VI	**Design Project: Preliminary Design of a Selected Turbomachine:** Students will select a specific type of turbomachine (compressor, pump, or turbine). Application of the learned design principles and mathematical analysis to perform preliminary design calculations. Introduction to computer-aided design (CAD) tools for creating basic geometry of the selected turbomachine. Final project report outlining the design concept, calculations, and justification for material selection.	7
Textbooks		
1	Turbomachinery: Design and Theory" by Rama S.R. Gorla and Aijaz A. Khan	
2	Principles of Turbomachinery" by Seppo A. Korpela	
3	Turbines, Compressors and Fans" by S.M. Yahya	
References		
1	Fluid Dynamics and Heat Transfer of Turbomachinery" by Budugur Lakshminarayana	
2	Centrifugal Compressor Design and Performance" by David Japikse	
3	Design of Modern Turbine Aerodynamics" by Edward M. Greitzer and Alan F. K. Craig	

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Course Information

Programme	B. Tech. (Mechanical Engineering)
Class, Semester	
Course Code	
Course Name	FEA & CFD Analysis of Turbomachinery
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3Hr/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	--	30	20	50	100
		Credits:3			

Course Objectives

1	**Develop** a fundamental understanding of the theoretical principles behind FEA and CFD relevant to turbomachinery applications.
2	**Gain proficiency** in using commercial FEA and CFD software for structural and flow analysis of turbomachinery components.
3	**Enhance** the ability to interpret and communicate the results of FEA and CFD simulations for effective design decision-making in the field of turbomachinery.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	**Apply** finite element analysis (FEA) techniques to solve structural problems in turbomachinery components like blades, casings, and shafts.	III	Applying
CO2	**Utilize** computational fluid dynamics (CFD) software to predict the performance and visualize the flow characteristics of turbomachines.	IV	Analyzing
CO3	**Critically evaluate** the results obtained from FEA and CFD simulations to assess the structural integrity and performance of turbomachinery components.	V	Evaluate
CO4	**Integrate** FEA and CFD analysis for comprehensive design and optimization of turbomachinery components	VI	Create

Module	Module Contents	Hours
I	**Introduction to Finite Element Analysis (FEA) for Turbomachinery Components:** Governing equations of solid mechanics (stress, strain, Hooke's Law) applied to turbomachinery components (blades, disks, shafts). Discretization techniques: Finite element concepts, mesh generation methods (structured, unstructured) for complex geometries.	7

	Introduction to FEA software: Pre-processing (geometry, material properties, boundary conditions), solution (matrix formulation, solvers), post-processing (stress, strain, deformation analysis).	
II	**FEA Applications in Structural Analysis of Blades, Casings, and Shafts:** Static and dynamic analysis of turbomachinery components using FEA: Thermal stress analysis of blades, vibration analysis of blades and shafts. Material behavior modeling: Linear elastic, elastic-plastic, fatigue analysis for life prediction.	7
III	**Introduction to Computational Fluid Dynamics (CFD) for Turbomachinery Flows:** Governing equations of fluid mechanics (continuity, Navier-Stokes equations) applied to turbomachinery flows (axial, radial, mixed flow). Discretization techniques for CFD: Finite volume method, finite difference method. Turbulence modeling concepts (RANS, LES). Introduction to CFD software: Pre-processing (geometry, mesh generation, boundary conditions), solution (solvers, convergence criteria), post-processing (flow visualization, performance parameters).	7
IV	**CFD Applications in Performance Prediction and Flow Visualization of Turbomachines:** CFD analysis for turbomachinery performance prediction: Efficiency, pressure ratio, work done calculations. Internal flow analysis: Visualization of streamlines, velocity profiles, boundary layer behavior. Design optimization: Parametric studies using CFD to improve turbomachinery performance.	7
V	**CFD Modeling Techniques for Turbomachinery (Mesh Generation, Boundary Conditions):** Advanced mesh generation techniques for complex turbomachinery geometries: Overset grids, boundary layer meshing. Boundary condition types: Inlet, outlet, wall, interface conditions for multi-component simulations. CFD modeling best practices: Grid convergence studies, turbulence model selection, verification and validation.	5
VI	**Case Studies: FEA & CFD Analysis of a Specific Turbomachinery Component:** Integration of FEA and CFD analysis for a complete turbomachinery component (e.g., turbine blade). Thermal-structural analysis using FEA results as input for CFD simulations. Design project: Students apply FEA and CFD tools to analyze and optimize a specific turbomachinery component.	6

Textbooks	
1	Computational Fluid Dynamics: The Basics with Applications" by John D. Anderson Jr.
2	An Introduction to Computational Fluid Dynamics: The Finite Volume Method" by H.K. Versteeg and W. Malalasekera
3	Numerical Heat Transfer and Fluid Flow" by Suhas V. Patankar
References	
1	The Finite Element Method: Linear Static and Dynamic Finite Element Analysis" by Thomas J.R. Hughes
2	Turbomachinery: Design and Theory" by Rama S.R. Gorla and Aijaz A. Khan
3	Fluid Dynamics and Heat Transfer of Turbomachinery" by Budugur Lakshminarayana

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Course Information

Programme	B. Tech. (Mechanical Engineering)
Class, Semester	
Course Code	
Course Name	Manufacturing Processes for Turbomachinery
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hr/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	--	30	20	50	100
		Credits:3			

Course Objectives

1	**Develop a comprehensive understanding** of conventional machining techniques (CNC machining, milling, turning) for manufacturing turbomachinery components with an emphasis on dimensional accuracy and surface finish.
2	**Gain knowledge and skills** in applying additive manufacturing (3D printing) techniques for creating complex geometries and lightweight components used in turbomachinery.
3	**Explore** casting processes (sand casting, investment casting) suitable for producing intricate blade and impeller designs in turbomachinery applications, considering factors like material selection and casting limitations.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	**Apply** various conventional and advanced manufacturing techniques to create complex turbomachinery components	III	Applying
CO2	**Analyze** the suitability of different manufacturing processes based on design requirements, material properties, and cost considerations for turbomachinery components.	IV	Analyzing
CO3	**Evaluate** the surface quality and integrity of turbomachinery components using appropriate finishing and coating techniques.	V	Evaluate
CO4	**Interpret** non-destructive testing (NDT) results to ensure the quality and functionality of turbomachinery components.	III	Interpret

Module	**Module Contents**	**Hours**
I	**Conventional Machining Techniques for Turbomachinery Components:** Principles and applications of CNC machining, milling, and turning for manufacturing complex turbomachinery components.	7

	Cutting tool selection, machining parameters, and process optimization for achieving dimensional accuracy and surface finish requirements. Programming techniques for CNC machining of intricate geometries.	
II	**Additive Manufacturing (3D Printing) for Complex Turbomachinery Components:** Additive manufacturing technologies like 3D printing for fabricating intricate and lightweight turbomachinery components. Capabilities and limitations of various 3D printing processes (e.g., selective laser melting) for producing high-performance parts.Design considerations and post-processing techniques for optimizing additively manufactured components for turbomachinery applications.	7
III	**Casting Processes for Blades and Impellers:** Principles and applications of sand casting and investment casting for producing complex turbomachinery blades and impellers. Influence of mold design, material selection, and casting parameters on the quality and performance of cast components. Advanced casting techniques like lost-foam casting for achieving intricate geometries with minimal post-processing requirements.	7
IV	**Joining Techniques for Turbomachinery Components:** Various welding and brazing processes used for joining critical components in turbomachinery assemblies. Suitability of different welding and brazing techniques based on material properties, joint configurations, and performance demands. Importance of pre-heating, post-welding heat treatment, and process control for ensuring joint integrity and strength in turbomachinery applications.	6
V	**Surface Finishing and Coating Techniques for Turbomachinery Components:** Various surface finishing techniques (e.g., grinding, polishing) for enhancing the surface quality and performance of turbomachinery components. Benefits of applying wear-resistant, corrosion-resistant, or thermal barrier coatings to improve component durability and efficiency. Selection and application methods for different coating technologies commonly used in turbomachinery manufacturing.	6
VI	**Quality Control and Non-Destructive Testing (NDT) for Turbomachinery Components:** Importance of quality control in turbomachinery manufacturing and the various inspection methods used to ensure dimensional accuracy and material integrity. Non-destructive testing (NDT) techniques like ultrasonic testing and radiographic testing for detecting internal flaws and defects in turbomachinery components. Selection and application of appropriate NDT methods based on component type, material, and potential failure modes.	6
Textbooks		
1	"Fundamentals of Modern Manufacturing: Materials, Processes, and Systems" by Mikell P. Groover	
2	Manufacturing Engineering and Technology" by Serope Kalpakjian and Steven Schmid	
3	"Manufacturing Processes for Engineering Materials" by Serope Kalpakjian and Steven Schmid	
References		

1	Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing" by Ian Gibson, David W. Rosen, and Brent Stucker
2	Handbook of Turbomachinery" edited by Earl Logan Jr.
3	ASM Handbook, Volume 6: Welding, Brazing, and Soldering"

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Course Information

Programme	B. Tech. (Mechanical Engineering)
Class, Semester	
Course Code	
Course Name	Assembly and Maintenance of Turbomachinery
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hr/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	--	30	20	50	100
		Credits:3			

Course Objectives

1	Gain a comprehensive understanding of the principles and practices of turbomachinery maintenance and repair.
2	Develop the skills necessary to perform various maintenance tasks on turbomachinery. This includes skills in disassembly, alignment, condition monitoring data collection and analysis, troubleshooting, overhaul procedures, and safe work practices.
3	Gain the ability to diagnose faults in turbomachinery based on condition monitoring data and other observations.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	**Apply** assembly procedures and alignment techniques to ensure proper operation of turbomachinery.	III	Applying
CO2	**Develop** and implement preventative maintenance schedules for optimal performance and longevity of turbomachinery.	VI	Develop
CO3	**Analyze** condition monitoring data (vibration, oil analysis) to diagnose potential faults in turbomachinery.	IV	Analyzing
CO4	**Implement** safe and effective overhaul procedures for critical components in turbomachinery, adhering to industry regulations.	III	Applying

Module	**Module Contents**	**Hours**
I	**Assembly Procedures and Alignment Techniques for Turbomachinery:** Importance of proper disassembly and reassembly procedures for various turbomachinery components (compressors,	7

	turbines, etc.). Advanced shaft alignment techniques using lasers, dial gauges, and reverse dial methods. Importance of balancing rotors and the impact of imbalance on operation.	
II	**Maintenance Schedules and Preventive Maintenance Practices:** Effective maintenance scheduling based on manufacturer recommendations and operational experience. Preventive maintenance practices like lubrication, filter changes, and cleaning procedures. Role of preventive maintenance in maximizing equipment lifespan and minimizing downtime.	7
III	**Condition Monitoring Techniques for Turbomachinery:** Various vibration analysis techniques used to detect and diagnose machinery faults (spectrum analysis, time waveform analysis). Oil analysis principles and interpret results to identify wear patterns and potential component failures.Trending and data analysis for prediction and address potential issues before they escalate.	7
IV	**Fault Diagnosis and Troubleshooting of Turbomachinery:** Systematic troubleshooting approaches for identifying the root cause of common turbomachinery faults (vibration, performance degradation, etc.). Case studies to apply learned condition monitoring techniques for fault diagnosis. Advanced troubleshooting tools like borescopes and non-destructive testing methods.	6
V	**Overhaul Procedures and Replacement of Critical Components:** Planning and execution of scheduled overhauls for turbomachinery. Procedures for replacing critical components like bearings, seals, and blades. Techniques for inspection and refurbishment of components during overhauls.	6
VI	**Safety Regulations and Best Practices for Turbomachinery Maintenance:** Relevant safety regulations and best practices for working with turbomachinery. Safe handling procedures for hazardous materials (lubricants, coolants). Proper lockout/tagout protocols and safe execution of maintenance activities.	6
Textbooks		
1	"Turbomachinery: Design and Theory" by Rama S.R. Gorla and Aijaz A. Khan	
2	Turbomachinery: Performance Analysis and Troubleshooting" by Rama S.R. Gorla	
References		
1	Machinery Component Maintenance and Repair by Heinz P. Bloch and Fred K. Geitner	
2	Handbook of Turbomachinery by Earl Logan Jr. and Ramendra Roy	
3	Centrifugal Pump Clinic by Igor J. Karassik	

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Course Information	
Programme	B. Tech. (Mechanical Engineering)
Class, Semester	
Course Code	
Course Name	Global Scenario of Turbomachinery
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hr/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	--				
		Credits:3			

Course Objectives	
1	Gain a comprehensive understanding of global trends in turbomachinery development, including efficiency, emission reduction, sustainability considerations, and future applications in renewable energy.
2	Develop critical thinking skills to analyze market trends and business models for various turbomachinery applications. Additionally, acquire skills to utilize emerging technologies in turbomachinery design
3	Prepare for future careers in the turbomachinery industry by understanding the required skillsets and the impact of advancements like electric propulsion and additive manufacturing.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	**Analyze** the evolving landscape of turbomachinery development, considering factors like efficiency improvement, emission reduction, and sustainability	IV	Analyze
CO2	**Evaluate** business models and market potential for various turbomachinery applications.	V	Evaluate
CO3	**Design** future-oriented turbomachinery solutions by integrating emerging technologies like electric propulsion and additive manufacturing	VI	Design
CO4	**Critically assess** the future workforce needs and skillsets required for success in the turbomachinery industry.	IV	Analyze

Module	**Module Contents**	**Hours**

I	**Global Trends in Turbomachinery Development: G**lobal drivers for efficiency improvement and emission reduction in turbomachinery. Cutting-edge technologies like advanced aerodynamics, lightweight materials, and control systems. Impact of stricter environmental regulations on turbomachinery design and operation.	7
II	**Business Models and Market Analysis for Different Turbomachinery Applications:** Key market segments for turbomachinery (power generation, aerospace, transportation, etc.). Business models adopted by leading turbomachinery manufacturers. Market trend analysis and forecasting of future demand for different turbomachinery applications.	7
III	**Sustainability Considerations in Turbomachinery Design and Operation:** Life cycle assessment of turbomachinery, focusing on environmental impact reduction. Strategies for minimizing energy consumption and pollutant emissions throughout the turbomachinery lifecycle. Role of renewable energy sources and their impact on the future of turbomachinery design.	7
IV	**Future Developments in Turbomachinery:** Integration of turbomachinery with renewable energy sources like wind and solar power. Application of advanced materials like composites and high-temperature alloys in turbomachinery design. Potential of emerging technologies like additive manufacturing for creating complex turbomachinery components.	6
V	**Emerging Technologies for Turbomachinery:** The rise of electric propulsion systems and their impact on turbomachinery design. Potential of additive manufacturing (3D printing) for creating lightweight and complex turbomachinery components. Challenges and opportunities associated with integrating these emerging technologies.	7
VI	**The Future Workforce and Skillsets Required for Turbomachinery Industry:** Evolving skillsets required for success in the future turbomachinery industry (data analysis, digital tools, etc.). Impact of automation and artificial intelligence on the turbomachinery workforce landscape. Strategies for preparing future generations of engineers for the rapidly changing turbomachinery field.	6
Textbooks		
1	Global Engineering: Design, Decision Making, and Communication" by David A. Madsen	
2	"Turbomachinery: Design and Theory" by Rama S.R. Gorla and Aijaz A. Khan	
References		
1	Global Energy Market Trends: Challenges and Opportunities for Turbomachinery" (Industry Report)	
2	"Global Regulatory Frameworks and Standards for Turbomachinery" (Industry Guidelines)	

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Course Information

Programme	B. Tech. (Electrical Engineering)
Class, Semester	Third Year B. Tech., Sem V (Honors Course)
Course Code	7EL305
Course Name	Process Control
Desired Requisites:	Control System Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	To introduce the fundamental concepts of process control systems.
2	To model and analyze process dynamics and control loops.
3	To understand the role and tuning of basic controllers.
4	To explore multi-loop and multivariable control strategies used in industry.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Calculate the various models of industrial processes.	III	Appling
CO2	Analyze the problems associated with open loop and closed loop process control system.	IV	Analyzing
CO3	Evaluate the performance of processes with various conventional and advanced controllers.	V	Evaluating
CO4	Design various conventional and advanced controllers for the processes.	VI	Creating

Module	**Module Contents**	**Hours**
I	**Introduction to Process Control** Process variables, manipulated variables, control objectives, block diagrams, control loops, degrees of freedom, physical examples (e.g., level, flow, temperature)	7
II	**Dynamic Modeling of Processes** Transfer functions, dynamic behavior of first-order, second-order and higher order systems, linearization, computer simulation.	6
III	**Feedback Control of Process** Elements of feedback control system, types of feedback controllers, sensors, transmission lines, final control elements, effect of proportional (p) control, Integral (I) control and derivative (D) control on the response of controlled process, effect on performance & stability.	6
IV	**Multi Loop & Feed forward Control** Cascade control, Split- range control, Feed forward control, Ratio control, Dead time compensation, examples like distillation column, heat exchanger.	7
V	**MIMO Systems** MIMO systems, Degree of freedom and number of controlled and manipulated variables, Interaction and decoupling of control loops, Relative Gain Array (RGA), Loop selection.	6

VI	**Modern Process Control** PLC, SCADA, DCS, basic programming examples (ladder logic), introduction to Model Predictive Control (MPC), adaptive control.	7
Textbooks		
1	*"Chemical Process Control - An introduction to Theory and Practice",* by George Stephanopoulos, Prentice-Hall of India, 1st Edition 1984.	
References		
1	"Process Control - Design Processes and Control System for Dynamic Performance", by Thomas E. Marlin, 2nd Edition, McGraw Hill publication.	
2	"Process Control System – Application, Design and Tuning", by F.G. Shinskey, McGraw-Hill Publication, 3rd Edition, 1988.	
3	"Process Control Instrumentation Technology", by Curtis D. Johnson, 7th Edition, Pearson Education, 7th Edition. 2003.	
Useful Links		
1	https://nptel.ac.in/courses/103105064	
2	https://archive.nptel.ac.in/courses/103/101/103101142/	

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Course Information

Programme	B. Tech. (Electrical Engineering)
Class, Semester	Third Year B. Tech., Sem V (Honors Course)
Course Code	7EL306
Course Name	Biomedical Instrumentation
Desired Requisites:	Basic Electronics, Digital Signal Processing, Instrumentation, and Measurement

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	To explain the basics body cell structure and different types of transducers
2	To explain the different types of patient monitoring system
3	Understand the design concept of different medical instruments
4	To demonstrate different medical instruments

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Describe the physiological systems and components of basic medical instrumentation systems	II	Understanding
CO2	Apply knowledge of bio-potentials and biomedical sensors in recording and analyzing physiological signals.	III	Applying
CO3	Analyze the operation of patient monitoring and imaging systems used in medical diagnostics.	IV	Analyzing
CO4	Evaluate the functionality and clinical effectiveness of therapeutic and laser-based biomedical equipment.	V	Evaluating

Module	**Module Contents**	**Hours**
I	**Fundamentals of Medical Instrumentation** Physiological Systems of the body, Sources of Biomedical signals, Basic Medical Instrumentation system, Micro-Electro-Mechanical System (Mems), Wireless Connectivity in Medical Instruments, General Constraints in design of Medical Instrumentation Systems	7
II	**The Origin of Bio potentials, Bio potential Electrodes & Biosensors** Electrical activity of Excitable Cells, Functional Organization of the Peripheral Nervous System, Electrocardiogram (ECG), Electromyogram (EMG), Electroencephalogram (EEG), Electroretinogram (ERG) and their recording system, Biomedical signal Analysis and Processing Techniques.	7
III	**Patient Monitoring Systems** System Concepts, Cardiac Monitor, Bedside patient Monitoring Systems, Central Monitors, Measurement of Heart rate, Measurement of Temperature, Measurement of respiration Rate, Biomedical Telemetry Systems	6
IV	**Modern Imaging Systems** X-ray machines And Digital Radiography, X-ray Computed Tomography, Nuclear Medical Imaging Systems, Magnetic Resonance Imaging Systems, Ultrasonic Imaging Systems and Thermal Imaging Systems.	7
V	**Assisting and Therapeutic Equipment's** Cardiac Pacemakers, Defibrillators, Diathermy, Haemodialysis Machines, Ventilators	6

VI	**Laser Application in Biomedical Field** The Laser, Types of Lasers, Laser Application, Laser Safety	6
Textbooks		
1	“Medical Instrumentation”, John. G. Webster , John Wiley	
2	“Principles of Applied Biomedical Instrumentation”, Goddes& Baker, John Wiley	
3	“Biomedical Instrumentation & Measurement”, Carr & Brown, Pearson	
References		
1	Hand book of Medical instruments by R.S. Khandpur –TMH, New Delhi, 1987.	
2	Medical Electronics and Instrumentation by Sanjay Guha – University Publication, 200.	
3	Introduction to Biomedical electronics by Edwand J. Bukstein –sane and Co. Inc, 1973	
Useful Links		
1	https://www.coursera.org/specializations/biomedical-engineering	
2	https://nptel.ac.in/courses/102106457	

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Course Information

Programme	B. Tech. (Electrical Engineering)
Class, Semester	Third Year B. Tech., Sem VI (Honors Course)
Course Code	7EL324
Course Name	Power Plant Instrumentation
Desired Requisites:	-

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs./week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	To develop basic knowledge of power plant and power generation.
2	To explain measurement techniques used in power generation processes.
3	To make students to study analyzers in power plants.
4	It will make students to study control loops in power plant instrumentation

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Describe the working principles of conventional and renewable power plants and related instrumentation systems.	II	Understanding
CO2	Apply appropriate sensors and transducers to measure process parameters in power plants.	III	Applying
CO3	Analyze the selection and functioning of process analyzers used in power plants.	IV	Analyzing
CO4	Evaluate the configuration and performance of control loops used in power plant instrumentation	V	Evaluating

Module	**Module Contents**	**Hours**
I	**Power Generation & Instrumentation** Overview of conventional and non-conventional power generation methods: Hydro, Thermal, Nuclear, Solar, Wind, Ocean Energy, Geothermal, Biomass, Building Blocks of Thermal power plant - Combined Cycle System – Combined Heat and Power System, Sub Critical and Supercritical boilers – Operating Pressure and Temperature ranges, Role of Instrumentation Systems in Power Plants.	6
II	**Measurement Techniques in Power Plants** Measurement of key process variables: Feed water flow, Fuel flow, Airflow, and Steam flow (with correction factors), Measurement of Steam pressure and temperature, Turbine speed and vibration monitoring, Types of sensors and their selection criteria.	7

III	**Process Analyzers in Power Plants** Analysis of impurities in feed water and steam: Dissolved oxygen analyzer, Chromatography, pH meter, Fuel analyser, Flue gas oxygen analyser, Environmental monitoring: SOx, NOx measurement instruments and pollution monitoring instruments.	6
IV	**Boiler Control Loops** Combustion control, Air/fuel ratio control, Furnace draft control, Main steam and reheat steam temperature control, Super heater control, Distributed control system in power plants, Interlocks in boiler operation, Safety loops, Distributed Control System (DCS) applications in boilers.	7
V	**Nuclear Power Plant Instrumentation** Different types of nuclear power plant, Nuclear reactor control loops, Reactor dynamics, Control and Safety instrumentation, Reliability and redundancy in nuclear instrumentation.	7
VI	**Computer-Based Process Control Systems** Data loggers - Data Acquisition Systems (DAS), Supervisory Control and Data Acquisition Systems (SCADA), Hardware and software architecture, Remote Terminal Units (RTUs), Master station, Communication protocols.	6
Textbooks		
1	David Lindsley, "*Power Plant Control and Instrumentation*", Institution of Electrical Engineers, London, 2000.	
2	Sam G Dukelow, "*The Control of Boilers*", 2nd Edition, Instrument Society of America, 1991.	
References		
1	Elonka S M, Kohal A L, "*Standard Boiler Operations*", McGraw Hill, New Delhi, 1994.	
2	Bela G Liptak, "*Process Measurement and Analysis*", Vol. 1, CRC press, 2003.	
Useful Links		

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Course Information

Programme	B. Tech. (Electrical Engineering)
Class, Semester	Third Year B. Tech., Sem VI (Honors Course)
Course Code	7EL325
Course Name	Digital Protection of Power System
Desired Requisites:	Power System Protection

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	To make students understand digital techniques for realizing various needs of protection.
2	To strengthen the concepts in power system protection.
3	To develop the skills necessary to analyze, design and implement digital protective relays.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Interpret the performance of devices like CT, PT and relays used in digital protection of Power Systems.	III	Applying
CO2	Analyze the use of digital systems for protection of different parts of power system.	IV	Analyzing
CO3	Estimate and Justify settings of relays for protection of different parts of power system.	V	Evaluating
CO4	Design analog/digital protection scheme for simple electrical systems.	VI	Creating

Module	Module Contents	Hours
I	**Review of Relaying Schemes** Protection schemes for alternator, transformer, bus bar and induction motors. Transmission line protection using over current- time graded and current graded schemes, distance protection, Electromagnetic CT and PT.	6
II	**Comparators** Amplitude comparator, phase comparator, duality between amplitude and phase comparators, cosine-type and sine type phase comparators, coincidence type phase comparator.	7
III	**Over Current Relays** Different time-current characteristics of over current relay, Microprocessor/microcontroller based over current relay, Directional over current relay and its implementation using microprocessor/microcontroller-based scheme.	7
IV	**Differential Relays** Circulating current differential protection, percentage differential protection of power transformers, effect of magnetizing inrush, effect of over voltage inrush, hardware and software used for digital protection of transformer.	7

V	**Distance Protection Relays** Microprocessor/microcontroller-based impedance, reactance and admittance relays, and measurement of R and X. Digital protection scheme based upon fundamental frequency signals.	6
VI	**Recent Developments in Digital Protection** Digital Relaying techniques based on modern tools of digital signal processing like Discrete Fourier Transform, HAAR Transform, Wavelet Transform etc.	6
Textbooks		
1	Badri Ram, D.N. Vishwakarma, “Power System Protection and Switchgear”, TMH, 2004.	
2	Y.G. Paithankar, S.R. Bhide, “Fundamentals of Power System Protection”, PHI, 2003.	
References		
1	L.P. Singh, “Digital Protection”, New Age, Second Edition, 2004.	
2	A.G. Phadke, J.S. Thorp, “Computer Relaying for Power Systems”, Wiley India, II Edi., 2012.	
Useful Links		
1	https://nptel.ac.in/courses/108105167	
2	https://nptel.ac.in/courses/108107167	

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Course Information

Programme	B. Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem.-V
Course Code	7EN304
Course Name	Digital System Engineering
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	03Hrs/week	MSE	ISE	ESE	Total
Tutorial	0 Hrs/week	30	20	50	100

Credits: 3 (Select any one evaluation pattern)

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical					

Course Objectives

1	To explain the effect of parasitic of wires/interconnects in restricting the high speed performance of digital circuits and design the approaches to tackle this problem by using their engineering models.
2	To discuss and explain the different sources of interference (noise) in digital systems and apply engineering/statistical models of these to compute and compare bit error rates.
3	To illustrate the significance of signaling & timing issues in high speed digital design and select a proper one for error-free transfer of information (bits) from one location to another.
4	To compare Meso-chronous, Plesio-chronous and fully synchronous systems and to design synchronizers to avoid Meta-stability problems of fully synchronous systems. To explain further self timed circuits as a good alternative to synchronous circuits.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Descriptor**
CO1	Analyze the effect of parasitic of wires/interconnects in restricting the high speed performance of digital circuits and design the approaches to tackle this problem by using their engineering models.	IV	Analyze
CO2	Explain different sources of interference (noise) in digital systems and apply engineering/statistical models of these to compute and compare BER	II	Understand
CO3	Compare and contrast different signaling & timing approaches and choose the one for designing error-free transfer of information (bits) from one location to another.	IV	Analyze
CO4	Explain various types of digital systems and design synchronizers to avoid meta stability problems of fully synchronous systems.	II	Analyze

Module	**Module Contents**	**Hours**

I	**Wires** Geometrical and Electrical properties, Electrical models of wires (Ideal wire, Transmission line), Simple transmission lines (RC, lossless LC, lossy LRC transmission lines, Dielectric absorption)	6
II	**Noise in Digital Systems** Noise sources in a digital system, Power Supply Noise, Cross-talk, Inter-symbol Interference, Managing noise.	7
III	**Signaling Conventions Part I** CMOS and Low swing current mode signaling system, Considerations in transmission system design, Signaling modes for transmission lines, Transmitter signaling methods	6
IV	**Signaling Conventions part II** Receiver signal detection, Source termination, Under-terminated Drivers, Differential Signaling, Signaling over capacitive transmission medium, Signal encoding	4
V	**Timing Conventions** Conventional Synchronous system and closed loop pipelined system, Considerations in timing design, Timing fundamentals, Timing properties of combinational logic and clock storage elements, Eye diagram, Encoding Timing (Signals and Events), Open loop synchronous timing, Closed loop timing,	8
VI	**Synchronization** Synchronization Fundamentals, Applications of synchronization (Arbitration of asynchronous signals, Sampling asynchronous signals, Crossing clock domains), Synchronization failure and meta-stability, Synchronizer Design	8

Textbooks

1	William Dally and John Poulton, "Digital System Engineering", Cambridge University Press, Reprint 2007.

References

1	Howard W. Johnson, Martin Graham, *"High Speed Digital Design"*- A Handbook of Black Magic, Prentice Hall PTR, Englewood Cliffs, NJ 0763
2	Practices‖ Stephen H. Hall, Garrett W. Hall, James A. McCall, *"High Speed Digital System Design*: Interconnect Theory and Design Wiley-IEEE Press (ISBN: 978-0-471-36090-2 Net material on Clock distribution and power distribution

Useful Links

1	Digital Systems Engineering Course I Stanford Online
2	Search | MIT OpenCourseWare | Free Online Course Materials

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2													
CO2			2											
CO3				3									3	
CO4		3	3											

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be Tests, assignments, oral, seminar etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 30 - 40% weightage on modules 1 to 3 and 60 - 70% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B. Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem. V
Course Code	7EN305
Course Name	Wireless Communication
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	03Hrs/week	MSE	ISE	ESE	Total
Tutorial	0 Hrs/week	30	20	50	100

Credits: 3 (Select any one evaluation pattern)

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical					

Course Objectives

1	To introduce the physical layer characteristics of wireless communication systems
2	To impart insights of fading channel parameter evaluation and study of statistical channel models

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Descriptor**
CO1	Understand the physical medium characteristics for the analysis of wireless communication systems	II	Understand
CO2	Identify the fading channel parameters to propose design solutions for terrestrial wireless systems	III	Apply
CO3	Conduct investigations and provide valid conclusions in the field of communication	V	Evaluate

Module	**Module Contents**	**Hours**
I	**Introduction to Wireless Communication System:** Evolution of mobile communications, Mobile Radio System around the world, Types of Wireless Communication System, Comparison of Common wireless system, Trend in Cellular radio and personal communication. Second generation Cellular Networks, Third Generation (3G) Wireless Networks , Wireless Local Loop(WLL),Wireless Local Area network(WLAN), Bluetooth and Personal Area Networks.	6
II	**The Cellular Concept System Design Fundamentals:** Cellular system, Hexagonal geometry cell and concept of frequency reuse, Channel Assignment Strategies Distance to frequency reuse ratio, Channel & co-channel interference reduction factor, S/I ratio consideration and calculation for Minimum Co channel and adjacent interference, Handoff Strategies, Umbrella Cell Concept, Trunking and Grade of Service, Improving Coverage & Capacity in Cellular System-cell splitting, Cell sectorization, Repeaters, Micro cell zone concept, Channel antenna system design considerations.	7

III	**Mobile Radio Propagation Model, Small Scale Fading and diversity:** Large scale path loss:-Free Space Propagation loss equation, Path loss of NLOS and LOS systems, Reflection, Ray ground reflection model, Diffraction, Scattering, Link budget design, Max. Distance Coverage formula, Empirical formula for path loss, Indoor and outdoor propagation models, Small scale multipath propagation, Impulse model for multipath channel, Delay spread, Feher's delay spread, upper bound Small scale, Multipath Measurement parameters of multipath channels, Types of small scale Fading, Rayleigh and rician distribution, Statistical for models multipath fading channels and diversity techniques in brief.	7
IV	**Multiple Access Techniques** Introduction, Comparisons of multiple Access Strategies TDMA,CDMA, FDMA, OFDM , CSMA Protocols.	6
V	**Wireless Systems** GSM system architecture, Radio interface, Protocols, Localization and calling, Handover, Authentication and security in GSM, GSM speech coding, Concept of spread spectrum, Architecture of IS-95 CDMA system,Air interface, CDMA forward channels, CDMA reverse channels, Soft handoff, CDMA features, Power control in CDMA, Performance of CDMA System, RAKE Receiver, CDMA2000 cellular technology, GPRS system architecture.	7
VI	**Recent Trends** Introduction to Wi-Fi, WiMAX, ZigBee Networks, Software Defined Radio, UWB Radio, Wireless Adhoc Network and Mobile Portability, Security issues and challenges in a Wireless network.	6

Textbooks	
1	Andrea Goldmith, "Wireless Communication", Cambridge University Press, 2005.
2	T.S. Rappaport, "Wireless Communication, Principles and Practice", Pearson Education, Second Edition, 2002.

References	
1	William C Y Lee, "Wireless and Cellular Communications", Tata McGraw Hill Publishing Company Limited, Third Edition, 2006.
2	Robert W. Heath Jr,,"Introduction to Wireless Digital Communication: A Signal Processing Perspective", Prentice Hall, First Edition, 2017.

Useful Links	
1	Wireless Communications for Everybody | Coursera
2	Introduction to Wireless Communications | Udemy
3	Introduction to Wireless and Cellular Communications - Course

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2													
CO2			2	3										
CO3		3		3									3	

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be Tests, assignments, oral, seminar etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 30 - 40% weightage on modules 1 to 3 and 60 - 70% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B. Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem. VI
Course Code	7EN324
Course Name	Image Analysis and Pattern Recognition
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	03Hrs/week	MSE	ISE	ESE	Total
Tutorial	0 Hrs/week	30	20	50	100

Credits: 3 (Select any one evaluation pattern)

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical					

Course Objectives

1	To imparts knowledge in the area of image and image processing
2	To learn the fundamentals of Pattern recognition and to choose an appropriate feature

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Descriptor**
CO1	Explain various types of digital systems and design synchronizers to avoid meta stability problems of fully synchronous systems.	II	Understand
CO2	Use foundational techniques of image processing and analysis such as filtering, segmentation and local features to solve image processing problems of real world application	III	Apply
CO3	Apply image processing and pattern recognition techniques to detect objects and activities in images	III	Apply
CO4	Compare and parameterize different learning algorithms for pattern recognition	IV	Analyze

Module	**Module Contents**	**Hours**
I	**Fundamentals of Image Processing** Pixel brightness transformation, position dependent brightness correction, gray scale transformation; geometric transformation, local pre-processing image smoothening, edge detectors, zero-crossing, scale in image processing, canny edge detection, parametric edge models, edges in multi spectral images, local pre-processing and adaptive neighbourhood pre-processing; image restoration	6
II	**Image Segmentation** Threshold detection methods, optimal thresholding, multispectral thresholding, thresholding in hierarchical data structures; edge based image segmentation- edge image thresholding, edge relaxation, border tracing, border detection	6

III	**Mathematical Morphology** Basic morphological concepts, four morphological principles, binary dilation, erosion, Hit or miss transformation, opening and closing; thinning and skeleton algorithms, Morphological segmentation –particles segmentation and watersheds, particle segmentation	7
IV	**Image Textures** Statistical texture description, methods based on spatial frequencies, co-occurrence matrices, edge frequency, and texture recognition method, applications Image representation and description- representation, boundary descriptors, regional descriptors	6
V	**Fundamentals of Pattern Recognition** Basic concepts of pattern recognition, fundamental problems in pattern recognition system, design concepts and methodologies, example of automatic pattern recognition systems, a simple automatic pattern recognition model	7
VI	**Pattern Classification Algorithms** Pattern classification by distance function: Measures of similarity. Clustering criteria. K means algorithm. Pattern classification by like hood function: Pattern classification as a Statistical decision problem. Bayes classifier for normal patterns	7

Textbooks	
1	Earl Gose and Richard Johnsonbaugh Steve Jost, “Pattern Recognition and Image Analysis”, PHI publication.
2	Sing Tze Bow, M. Dekker, “Pattern Recognition and Image Processing”, Springer, 1992

References	
1	Rafael C. Gonzalez and Richard E. Woods, “Digital Image Processing”, Addinson – Wesley.
2	M. A. SID – AHMED, “Image Processing Theory Algorithms and Architecture”, McGraw Hill Inc.

Useful Links	
1	https://www.coursera.org/
2	Pattern recognition and Application - Course
3	nptel.ac.in/courses/117105101

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2													
CO2			2											
CO3		3		3									3	
CO4			2	3										

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher’s assessment. Mode of assessment can be Tests, assignments, oral, seminar etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 30 - 40% weightage on modules 1 to 3 and 60 - 70% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information	
Programme	B. Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem. VI
Course Code	7EN325
Course Name	VLSI DSP
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	03Hrs/week	MSE	ISE	ESE	Total
Tutorial	0 Hrs/week	30	20	50	100

Credits: 3 (Select any one evaluation pattern)

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical					

Course Objectives	
1	To introduce techniques for altering the existing DSP structures to suit VLSI implementations.
2	To introduce efficient design of DSP architectures suitable for VLSI

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Descriptor**
CO1	Understand VLSI design methodology for signal processing systems.	II	Understand
CO2	Analyze VLSI algorithms and architectures for DSP.	IV	Analyze
CO3	Implement basic architectures for DSP using CAD tools.	V	Implement

Module	**Module Contents**	**Hours**
I	**Introduction to DSP Systems** Introduction; representation of DSP algorithms: Block Diagram, signal flow graph, data flow graph, dependence graph. Iteration Bound: Data flow graph representations, loop bound and iteration bound, longest path matrix algorithm	6
II	**Iteration Bound** Data flow graph representations, loop bound and iteration bound, longest path matrix algorithm, iteration bound of Multirate data flow graphs.	6
III	**Pipelining and Parallel Processing** Pipelining and parallel processing of FIR digital filters, pipeline interleaving in digital filters: signal and multichannel interleaving.	6
IV	**Retiming, Unfolding and Folding** Retiming techniques; algorithm for unfolding, Folding transformation, systolic architecture design, systolic array design methodology	7
V	**Fast Convolution, Filters and Transforms** Cook-toom algorithm, modified cook toom algorithm, winogard algorithm, iterated convolution Algorithm strength reduction in filters and transforms.	7

VI	**Delay Optimization** Delay optimization by folding, lifetime analysis, forward-backward data allocation, examples from digital filters	7

Textbooks	
1	Keshab k. Parhi," VLSI Digital Signal Processing Systems: Design and Implementation", Wiley, inter science.

References	
1	S.Y. kung, H.J.White house, T. Kailath," VLSI and Modern Signal Processing", Prentice hall,
2	J. G. Chung and Keshab K. Parhi, Kluwer."Pipelined Lattice and Wave Digital Recursive Filters", Wiley, inter science.

Useful Links	
1	Learn Physical Design Flow for Very Large Scale Integration (VLSI) | Udemy
2	VLSI Signal Processing - Course

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2													
CO2			2											
CO3		2		3									3	2

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be Tests, assignments, oral, seminar etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 30 - 40% weightage on modules 1 to 3 and 60 - 70% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B. Tech. (Electronics Engineering)
Class, Semester	Final Year B. Tech. Sem.-A
Course Code	7EN403
Course Name	Speech Signal Processing
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	03Hrs/week	MSE	ISE	ESE	Total
Tutorial	0 Hrs/week	30	20	50	100

Credits: 3 (Select any one evaluation pattern)

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical					

Course Objectives

1	To acquire the fundamentals of the digital signal processing that allows them to assimilate the concepts related to the speech processing.
2	To introduce the fundamentals of speech signal processing
3	To give an overview of speech processing applications including speech enhancement, speech recognition and speaker recognition.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Descriptor**
CO1	Understand speech recognition principles, methods, models and implementation	II	Understand
CO2	Apply speech recognition principles &methods to characterize the speech signal and to recognize the speech	III	Apply
CO3	Apply the Pattern Comparison Techniques and Hidden Markov Models to recognise the speech	III	Apply
CO4	Analyse the speech recognition methods, pattern comparison techniques and Hidden Markov Models	IV	Analyze

Module	**Module Contents**	**Hours**
I	**The Speech Signal:** Fundamentals of Speech recognition, the process of speech production and perception in human beings, the speech production process, representing speech in time and frequency domains, speech sounds and features.	7
II	**Signal Processing and Analysis methods for Speech Recognition:** Spectral analysis models, The Bank-of-filters front-end processor, Linear predictive coding model for Speech recognition, Vector quantization.	6
III	**Pattern Comparison Techniques:** Introduction, Speech detection, Distortion measures-Mathematical considerations, Distortion measures- Perceptual considerations, Spectral distortion measures.	6

IV	**Theory and Implementation of Hidden Markov Models:** Introduction, Discrete time Markov processes, Extensions to Hidden Markov models, Three basic problems for HMMs, Types of HMMs, Continuous observation densities in HMMs, comparison of HMMs, Implementation issues for HMMs, HMM system for isolated word recognition.	7
V	**Large Vocabulary continuous speech recognition:** Introduction, Sub word speech units, sub word unit models based on HMMs, Training of sub word units, Language models for Large vocabulary speech recognition, Statistical language modelling, Perplexity of the language model, Overall recognition system based on sub word units.	7
VI	**Speech based Applications** TTS, ASR and spoken language acquisition, case study examples	6

Textbooks

1	Thomas F. Quatieri, "Discrete-Time Speech Signal Processing: Principles and Practice", Prentise Hall PTR
2	L. R. Rabiner and R. W. Schafer, "Theory and Applications of Digital Speech Processing",

References

1	Lawrence Rabiner and Biing-Hwang Juang, Fundamentals of Speech Recognition, Pearson Education, 2007.
2	Frederick Jelinek, Statistical Methods of Speech Recognition, MIT Press, Cambridge, MA; London, England, 1997.
3	Claudio Becchetti and Lucio Prina Ricotti, Speech Recognition, John Wiley and Sons, 1999.
4	Daniel Jurafsky and James H Martin, Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, Pearson Education, 1st Ed., 2000
5	

Useful Links

1	https://home.iitk.ac.in/~rhegde/ee627_2019/index.html
2	https://onlinecourses.nptel.ac.in/noc22_ee117/preview

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2													
CO2			2											
CO3				3									3	
CO4		3	3											

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be Tests, assignments, oral, seminar etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 30 - 40% weightage on modules 1 to 3 and 60 - 70% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli
(Government Aided Autonomous Institute)

AY 2025-26

Course Information

Programme	B.Tech (Electronics Engineering)
Class, Semester	Final Year B. Tech. Sem.-B
Course Code	7EN421
Course Name	Broadband Antenna Design
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	03Hrs/week	MSE	ISE	ESE	Total
Tutorial	0 Hrs/week	30	20	50	100

Credits: 3 (Select any one evaluation pattern)

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 Hrs/week				

Course Objectives

1	To provide an in-depth understanding of modern antenna concepts, and practical antenna design for various applications.
2	Explain the theory of different types of antennas used in communication systems.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Descriptor**
CO1	Understand the analysis of simple antenna structures.	III	Analyze
CO2	Implement different types of antennas.	II	Understand
CO3	Analyze performance of antenna arrays	IV	Analyze
CO4	Apply the knowledge for wide area of recent applications.	III	Apply

Module	**Module Contents**	**Hours**
I	**Fundamental Concepts** Physical concept of radiation, Radiation pattern, near- and far-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions	6
II	**Radiation from Wires and Loops** Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobile communication, small circular loop	7
III	**Aperture Antennas** Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts.	6
IV	**Broadband Antennas** Broadband concept, Log-periodic antennas, frequency independent antennas. **Microstrip Antennas** Basic characteristics of microstrip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas	4

V	**Antenna Arrays** Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays.	8
VI	**Basic Concepts of Smart Antennas** Concept and benefits of smart antennas, Fixed weight beamforming basics, Adaptive beamforming	8

Textbooks	
1	Thomas A. Milligan, "Modern Antenna Design", Wiley InterScience, A JOHN WILEY & SONS, INC., PUBLICATION
References	
1	C. A. Balanis, "Antenna Theory and Design", 3rd Ed., John Wiley & Sons., 2005.
2	W. L. Stutzman, and G. A. Thiele, "Antenna Theory and Design", 2nd Ed., John Wiley & Sons., 1998.
3	R. S. Elliot, "Antenna Theory and Design", Revised edition, Wiley-IEEE Press., 2003
Useful Links	
1	Digital Systems Engineering Course I Stanford Online
2	Search | MIT OpenCourseWare | Free Online Course Materials

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2													2
CO2		2	2											
CO3				3									3	
CO4		2												2

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be Tests, assignments, oral, seminar etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 30 - 40% weightage on modules 1 to 3 and 60 - 70% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

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AY 2025-26

Course Information

Programme	B.Tech. (Computer Science and Engineering - Honors)
Class, Semester	Third Year B. Tech., Sem (V)
Course Code	7CS304
Course Name	Advanced Cryptography
Desired Requisites:	Basic knowledge of Cryptography and Network Security

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	To explore modern symmetric and asymmetric cryptographic techniques
2	To understand cryptanalysis and key management schemes
3	To evaluate security protocols and algorithms
4	To apply cryptography in real-world systems like blockchain, secure computation, etc.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain modern cryptographic principles and algorithms	II	Understand
CO2	Apply cryptographic algorithms for data confidentiality and integrity	III	Apply
CO3	Analyze security of cryptographic schemes and protocols	IV	Analyze
CO4	Design secure systems using advanced cryptographic methods	VI	Create

Module	**Module Contents**	**Hours**
I	Review of Classical Cryptography, Perfect Secrecy, Shannon Theory	6
II	Block Ciphers – AES, Modes of Operation	6
III	Public Key Cryptography – RSA, ElGamal, Key Distribution	7
IV	Cryptographic Hash Functions, MACs, Digital Signatures	7
V	Zero Knowledge Proofs, Secret Sharing, Elliptic Curve Cryptography	7
VI	Applications in Blockchain, Homomorphic Encryption, Post-Quantum Cryptography	6

Textbooks

1	William Stallings, *Cryptography and Network Security*, Pearson
2	Paar & Pelzl, *Understanding Cryptography*, Springer
3	Katz & Lindell, *Introduction to Modern Cryptography*, CRC Press

References

1	Menezes et al., *Handbook of Applied Cryptography*
2	Boneh & Shoup, *A Graduate Course in Applied Cryptography*

Useful Links

1	https://cryptobook.nakov.com
2	https://www.cs.umd.edu/~jkatz/crypto/

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1													
CO2		2												
CO3			3											
CO4					2									
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.														

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2025-26

Course Information

Programme	B.Tech. (Computer Science Engineering - Honors)
Class, Semester	Third Year B. Tech., Sem V
Course Code	7CS354
Course Name	Advanced Cryptography
Desired Requisites:	Basic knowledge of Cryptography and Network Security

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 01			

Course Objectives

1	To implement cryptographic algorithms
2	To analyze algorithm performance and security
3	To apply cryptography in secure communications
4	To experiment with modern cryptographic frameworks

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Implement symmetric and asymmetric algorithms	III	Apply
CO2	Analyze cryptographic protocols for vulnerabilities	IV	Analyse
CO3	Use cryptographic libraries and tools and evaluate the methods	V	Evaluate
CO4	Develop applications incorporating secure communication	VI	Create

List of Experiments / Lab Activities/Topics

List of Lab Activities:

1. Implement AES, DES in Python
2. RSA key generation and encryption
3. Digital Signature algorithm
4. Diffie-Hellman key exchange
5. Hashing with SHA-256
6. Using OpenSSL/GnuPG for encryption
7. Elliptic Curve Cryptography demo
8. Zero-Knowledge proof (simulated)
9. Blockchain-based transaction signing
10. Mini project on Secure Messaging

Textbooks

1	Paar & Pelzl, *Understanding Cryptography*
2	William Stallings, *Cryptography and Network Security*

References

1	OpenSSL documentation
2	GPG Manual

Useful Links

2	https://cryptopals.com
3	https://www.openssl.org

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2													
CO2	1	2												
CO3		1	2											
CO4					3									
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing (min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

Walchand College of Engineering, Sangli

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Course Information

Programme	B.Tech. (Computer Science and Engineering - Honors)
Class, Semester	Third Year B. Tech., Sem (V)
Course Code	7CS324
Course Name	Digital Forensic
Desired Requisites:	Basic understanding of Operating Systems and Computer Networks

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	Understand fundamentals and scope of digital forensics.
2	Learn tools and techniques for forensic acquisition and analysis.
3	Explore file systems, operating system artifacts, and networks for forensic evidence.
4	Gain skills in reporting and documenting forensic investigations.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain digital forensics process and legal aspects	II	Understand
CO2	Identify and acquire digital evidence using forensic tools	III	Apply
CO3	Analyze system, file, and network artifacts for forensic evidence	IV	Analyze
CO4	Document and present digital forensic findings	VI	Create

Module	**Module Contents**	**Hours**
I	Introduction to Digital Forensics, Ethics and Legal Aspects, Forensic Process	6
II	Digital Evidence and Acquisition Techniques, Imaging and Cloning	6
III	File System Forensics: FAT, NTFS, ext3/ext4	7
IV	Windows and Linux OS Artifacts Forensics	7
V	Network, Email and Web Browser Forensics	7
VI	Mobile Device, Cloud Forensics, Anti-forensics Techniques	6

Textbooks

1	Nelson, Phillips, Steuart, *Guide to Computer Forensics and Investigations*, Cengage Learning.
2	Kruse, Heiser, *Computer Forensics: Incident Response Essentials*, Addison-Wesley.

References

1	Eoghan Casey, Digital Evidence and Computer Crime, Academic Press.

Useful Links

1	https://www.sleuthkit.org/
2	https://www.autopsy.com/

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2

CO1	1													
CO2		2												
CO3			3											
CO4					2									
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.														

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2025-26

Course Information

Programme	B.Tech. (Computer Science Engineering - Honors)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	7CS373
Course Name	Digital Forensics Lab
Desired Requisites:	Basic programming skills and familiarity with Operating Systems

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 1			

Course Objectives

1	To develop proficiency in forensic acquisition and evidence handling tools.
2	To apply digital forensic tools for data extraction and investigation.
3	To examine OS and file system artifacts for forensic traces.
4	To document and report forensic investigations effectively.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Use forensic imaging and acquisition tools	III	Apply
CO2	Analyze OS and file system artifacts	IV	Analyse
CO3	Perform network and browser forensics	V	Evaluate
CO4	Present forensic analysis through professional documentation	VI	Create

List of Experiments / Lab Activities/Topics

List of Lab Activities:

1. Disk imaging using FTK Imager or `dd`
2. File carving and recovery using Autopsy
3. Windows registry and system log analysis
4. Browser history extraction and interpretation
5. RAM dump and analysis using Volatility
6. Network traffic analysis using Wireshark
7. Email header and content analysis
8. Mobile device forensic analysis using tools like Autopsy
9. Simulated cloud forensic investigation
10. **Mini Project**: Prepare and submit a forensic investigation report

Textbooks

1	Nelson, Phillips, Steuart, *Guide to Computer Forensics and Investigations*, Cengage Learning.
2	Kruse, Heiser, *Computer Forensics: Incident Response Essentials*, Addison-Wesley.
3	Brian Carrier, *File System Forensic Analysis*, Addison-Wesley.

References

1	Eoghan Casey, Digital Evidence and Computer Crime, Academic Press.

Useful Links

1	https://www.autopsy.com
2	https://www.sleuthkit.org

3	https://www.volatilityfoundation.org

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2													
CO2		2												
CO3			2											
CO4				2	3									
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing (min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

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Course Information	
Programme	B.Tech. (Computer Science Engineering - Honors)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	7CS346
Course Name	Seminar
Desired Requisites:	

Teaching Scheme		Examination Scheme (Marks)			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 1			

Course Objectives	
1	To enhance students' skills in research, analysis, and presentation.
2	To enable students to explore emerging areas in Computer Science.
3	To develop the ability to review literature and structure technical arguments.
4	To improve technical writing and communication skills.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Plan and structure a technical seminar with appropriate tools	III	Apply
CO2	Conduct literature survey in selected/emerging topic areas	IV	Analyse
CO3	Deliver effective oral presentations with clarity and confidence	V	Evaluate
CO4	Prepare a structured seminar report in professional format	VI	Create

List of Experiments / Lab Activities/Topics

List of Lab Activities: (in a team of 3 to 4)

1. Topic selection in consultation with faculty guide
2. Background study and literature survey
3. Weekly reviews and progress tracking
4. Annotated bibliography and research mapping
5. Mid-semester presentation and peer feedback
6. Final seminar presentation with Q&A
7. Preparation of technical report (IEEE/ACM format)
8. Evaluation by panel (guide + faculty members)
9. Submission of final report
10. Reflective summary and self-assessment

Textbooks

1	Nelson, Phillips, Steuart, *Guide to Computer Forensics and Investigations*, Cengage Learning.
2	Kruse, Heiser, *Computer Forensics: Incident Response Essentials*, Addison-Wesley.
3	Brian Carrier, *File System Forensic Analysis*, Addison-Wesley.

References

1	Eoghan Casey, Digital Evidence and Computer Crime, Academic Press.

Useful Links

1	https://www.autopsy.com
2	https://www.sleuthkit.org

3	https://www.volatilityfoundation.org

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2													
CO2		2							2	2				
CO3			2						1	1				
CO4				2	3									
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing (min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

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Course Information	
Programme	B.Tech. (Computer Science and Engineering - Honors)
Class, Semester	Third Year B. Tech., Sem (V/VI)
Course Code	7CS305
Course Name	Introduction to Blockchain
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	1000
		Credits: 3			

Course Objectives	
1	To understand the technology behind block chain
2	To gain the knowledge of emerging trends in block chain
3	To handle the Real-world applications of block chain.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Identify the importance of Blockchain technology	I	Remembering
CO2	Interpret the fundamentals and basic concepts in Blockchain	II	Understanding
CO3	Summarize the requirements of the basic design of blockchain.	II	Understanding
CO4	Compare the working of different blockchain platforms	IV	Analyzing

Module	**Module Contents**	**Hours**
I	Introduction to Blockchain & Cryptography: Basic ideas behind Blockchain, Evolution and its role in digital transformation, Introduction to cryptographic concepts, Hashing and Hash Puzzles, Public Key Cryptosystems, Difference between Public and Private Blockchain, Blockchain Use Cases	7
II	Blockchain Architecture and Terminologies: Basic architecture of Blockchain, Key terminologies: Node, Miner, Ledger, Consensus, Block, Chain, etc. , Characteristics of Blockchain, Types of networks: Public, Private, Consortium, Introduction to Smart Contracts	7
III	Core Components and Protocols: Core components of Blockchain: Nodes, Blocks, Hash, Ledger, Wallet, etc. , Blockchain Protocols overview, Permissioned vs Permissionless Blockchains, Types of Blockchains	6
IV	Digital Ledger Technologies (DLT): Short history of Money and Trust , Bitcoin: Working Mechanics and Architecture, Ethereum: Overview and Smart Contract Capabilities, Hyperledger: Introduction, Hyperledger Fabric Architecture , Hyperledger Composer	7
V	Blockchain Tools and Platforms: Overview of popular Blockchain platforms, Geth (Go-Ethereum Client). Ripple , Stellar, R3 Corda, Blockchain APIs, Blockchain Sandboxes	6

VI	Emerging Trends and Future of Blockchain: Cloud-based Blockchain solutions, MultiChain, Blockchain-as-a-Service (BaaS), Integration with other technologies (AI, IoT, Cloud), Challenges and future scope of Blockchain Technology	6

Textbooks	
1	Artemis Caro, "Blockchain: The Beginners Guide to Understanding the Technology Behind Bitcoin & Crypto currency".
2	Scott Marks, "Blockchain for Beginners: Guide to Understanding the Foundation and Basics of the Revolutionary Blockchain Technology", Create Space Independent Publishing Platform
References	
1	Mark Watney, "Blockchain for Beginners".
2	Alwyn Bishop, "Blockchain Technology Explained".
Useful Links	
1	NPTEL Course "Introduction to Blockchain Technology & Applications" https://nptel.ac.in/courses/106/104/106104220/
2	NPTEL Course "Introduction to Blockchain Technology & Applications" https://nptel.ac.in/courses/106/104/106104220/

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1				1								
CO2	2	2			1									
CO3	2	2	1		1									
CO4	1	3	1	1	2									

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2025-26

Course Information

Programme	B.Tech. (Computer Science Engineering - Honors)
Class, Semester	Third Year B. Tech., Sem
Course Code	7CS354
Course Name	Introduction to Blockchain Lab
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 1			

Course Objectives

1	To understand and apply core cryptographic techniques and blockchain principles
2	To design, develop, and deploy smart contracts and distributed ledger applications
3	To explore and experiment with emerging blockchain tools, platforms, and APIs

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Implement cryptographic algorithms and simulate blockchain mechanisms like hashing and proof of work.	III	Applying
CO2	Develop and deploy smart contracts using Ethereum-based platforms such as Remix IDE and MetaMask.	IV	Analyzing
CO3	Configure and demonstrate permissioned blockchain networks using tools like Hyperledger Fabric and Geth.	V	Evaluating
CO4	Integrate blockchain with modern platforms and APIs for real-world applications, including cloud and web services.	VI	Creating

List of Experiments / Lab Activities/Topics

List of Lab Activities:

1. Implement SHA-256 and Keccak (SHA3) hashing algorithms
2. Implement a basic asymmetric encryption/decryption using RSA
3. Simulate a basic blockchain structure
4. Demonstrate a simple Proof of Work (PoW) mechanism
5. Setup a private Ethereum blockchain using Geth
6. Configure permissioned and permissionless blockchain environments
7. Create and deploy a smart contract on Ethereum using Remix IDE
8. Setup Hyperledger Fabric network and install a sample chaincode
9. Use MetaMask with Remix for transaction simulation
10. Explore Ripple or Stellar test network for cross-border payment simulation
11. Deploy a blockchain node on cloud (e.g., using AWS/GCP)
12. Interact with Blockchain API or sandbox

Textbooks

1	"Mastering Blockchain" *By Imran Bashir* Covers: Cryptography, Blockchain architecture, Smart contracts, Ethereum, Hyperledger, Consensus, Emerging platforms.
2	"Blockchain Applications: A Hands-On Approach" *By Arshdeep Bahga and Vijay Madisetti*

References	
1	"Blockchain Technology and Applications" *By Sandeep Saxena and Ashutosh Kumar Singh*
2	"Blockchain Enabled Applications" By Vikram Dhillon, David Metcalf, Max Hooper
Useful Links	
2	https://geth.ethereum.org/docs
3	https://www.multichain.com/developers/

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	1	2									
CO2	3	3	3	2	3									
CO3	3	2	3	2	3									
CO4	3	2	3	2	3									
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing (min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26

Course Information	
Programme	B.Tech. (Computer Science and Engineering - Honors)
Class, Semester	Third Year B. Tech., Sem (VI)
Course Code	7CS325
Course Name	Blockchain use cases
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	1000
		Credits: 3			

Course Objectives	
1	To analyze and differentiate popular blockchain platforms such as Bitcoin, Ethereum, and Hyperledger
2	To investigate emerging trends in blockchain integration such as BaaS, cross-border payments, and enterprise-grade solutions (Ripple, Corda, Stellar)
3	To equip students with the ability to design, develop, and deploy blockchain-based solutions

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Identify and explain the fundamental concepts of blockchain, including cryptographic techniques, hash functions, and consensus mechanisms.	I	Understand
CO2	Analyze the architecture and components of blockchain platforms and distinguish between public, private, and consortium blockchains.	IV	Analyze
CO3	Develop and deploy smart contracts using platforms such as Ethereum and Hyperledger based on real-world use cases.	III	Apply
CO4	Evaluate the suitability of various blockchain platforms and technologies (e.g., Ripple, Stellar, BaaS) for emerging applications like identity management, supply chain, and financial services.	v	Evaluate

Module	**Module Contents**	**Hours**
I	Blockchain and Cryptography Fundamentals • Secure Online Voting System Uses public-key cryptography and hash functions to authenticate voters and encrypt ballots to ensure tamper-proof, transparent elections. • Document Verification in Education (MIT Diplomas on Blockchain) MIT issues diplomas on blockchain to ensure authenticity. Hashes of degrees are stored on a public blockchain for verifiable, permanent credentials.	7
II	Blockchain Architecture and Design • Supply Chain Management (IBM Food Trust) Tracks product lifecycle from origin to shelf using blockchain for real-time traceability, improving transparency and food safety. • Property Title Registration Land ownership records are stored on a blockchain to reduce fraud, enable secure transactions, and automate property transfers via smart contracts.	7

III	Blockchain Platforms and Components • Decentralized Identity (Microsoft ION on Bitcoin) Creates secure digital identities that users own and control, built on a permissionless blockchain (Bitcoin) with public-key infrastructure. • Trade Finance using R3 Corda Corda is used by financial znstitutions to streamline KYC, reduce paperwork, and process cross-border transactions with security and trust.	6
IV	Distributed Ledger and Blockchain Ecosystems • Patient Health Records (MedRec on Ethereum/Hyperledger) A decentralized medical record system where patients control their data and grant access securely to providers via blockchain. • Digital Currency – Bitcoin Mechanics Demonstrates proof-of-work, transaction verification, and block mining with a real-world cryptocurrency. Emphasizes distributed consensus.	7
V	Blockchain Development and Smart Contracts • Decentralized Crowdfunding (KickICO, Ethereum) Smart contracts automatically manage and release funds based on project milestones or funding thresholds. • Car Leasing via Smart Contracts (EY + Microsoft) Automates contracts between lessee, lessor, and banks. Ensures secure, transparent records of leasing terms and payments	6
VI	Emerging Trends and Blockchain Integration • Cross-Border Payments (RippleNet & Stellar) Ripple facilitates instant, low-cost global payments between financial institutions; Stellar enables micropayments and remittances. • Blockchain-as-a-Service (Azure BaaS / IBM Blockchain Platform) Enterprises deploy blockchain apps quickly on cloud platforms using pre-built infrastructure for permissioned networks.	7

Textbooks	
1	"Blockchain Technology: Concepts and Applications" Author: Sandeep Kumar Pan
2	"Blockchain Applications: A Hands-On Approach" Arshdeep Bahga and Vijay Madisetti

References	
1	Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications by Imran Bashir
2	Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction by Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder

Useful Links	
1	https://ethereum.org/en/developers/docs/
2	

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2			2									
CO2	3	3	2	2	2	1								
CO3	2	2	3	2	3				2					
CO4	2	3	3	3	3	2	1	1	1					

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B.Tech. (Computer Science Engineering - Honors)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	7CS374
Course Name	Blockchain use cases Lab
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 1			

Course Objectives

1	hands-on experience in implementing advanced cryptographic and blockchain principles
2	to simulate and develop real-world blockchain solutions
3	To familiarize with current trends and technologies in blockchain integration

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Demonstrate understanding of blockchain cryptographic concepts such as hashing and Merkle trees.	II	Understand
CO2	Apply blockchain tools and platforms (Ethereum, Hyperledger, etc.) to develop and test basic blockchain networks.	III	Apply
CO3	Analyze and evaluate blockchain use cases such as digital voting, token creation, and escrow services.	IV	Analyze

List of Experiments / Lab Activities/Topics

List of Lab Activities:

1. Simulate a Merkle Tree Construction and Verification
2. Create and Validate Blockchain Hash Puzzles
3. Configure and Compare Public vs Private Blockchain Networks
4. Monitor a Blockchain Node's Behavior Using Logs and APIs
5. Launch a Blockchain Node in Docker (e.g., Besu, Hyperledger Sawtooth)
6. Compare Consensus Algorithms: PoW vs PoA vs RAFT (Simulation/Docs)
7. Simulate a Voting System Using Blockchain Ledger (CLI-based)
8. Analyze Ethereum Transactions Using Etherscan API
9. Develop a Custom ERC-20 Token and Deploy it on a Testnet
10. Simulate Escrow Smart Contract for eCommerce Payment
11. Integrate Blockchain API with a Mobile/Web App (Using Moralis or Infura)
12. Create and Transfer NFTs on Polygon or Ethereum Testnet

Textbooks

1	"Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications" by Imran Bashir
2	"Blockchain Basics: A Non-Technical Introduction in 25 Steps" by Daniel Drescher

References

1	"Ethereum Smart Contract Development" by Mayukh Mukhopadhyay

Useful Links	
1	https://remix.ethereum.org

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2		2	2									
CO2	3	3	2	2	3									
CO3	2	3	3	3	3									
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing (min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

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Course Information

Programme	B.Tech. (Computer Science Engineering - Honors)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	7CS347
Course Name	Seminar
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 1			

Course Objectives

1	To enhance students' skills in research, analysis, and presentation.
2	To enable students to explore emerging areas in Computer Science.
3	To develop the ability to review literature and structure technical arguments.
4	To improve technical writing and communication skills.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Plan and structure a technical seminar with appropriate tools	III	Apply
CO2	Conduct literature survey in selected/emerging topic areas	IV	Analyse
CO3	Deliver effective oral presentations with clarity and confidence	V	Evaluate
CO4	Prepare a structured seminar report in professional format	VI	Create

List of Experiments / Lab Activities/Topics

List of Lab Activities: (in a team of 3 to 4)

1. Topic selection in consultation with faculty guide
2. Background study and literature survey
3. Weekly reviews and progress tracking
4. Annotated bibliography and research mapping
5. Mid-semester presentation and peer feedback
6. Final seminar presentation with Q&A
7. Preparation of technical report (IEEE/ACM format)
8. Evaluation by panel (guide + faculty members)
9. Submission of final report
10. Reflective summary and self-assessment

Textbooks

1	Nelson, Phillips, Steuart, *Guide to Computer Forensics and Investigations*, Cengage Learning.
2	Kruse, Heiser, *Computer Forensics: Incident Response Essentials*, Addison-Wesley.
3	Brian Carrier, *File System Forensic Analysis*, Addison-Wesley.

References

1	Eoghan Casey, Digital Evidence and Computer Crime, Academic Press.

Useful Links

1	https://www.autopsy.com
2	https://www.sleuthkit.org

3	https://www.volatilityfoundation.org

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2													
CO2		2							2	2				
CO3			2						1	1				
CO4				2	3									
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing (min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

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Course Information

Programme	Honor
Class, Semester	
Course Code	
Course Name	Digital Image Processing and Remote Sensing
Desired Requisites:	--

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	To introduce the fundamentals of Digital Image Processing and Remote Sensing (RS)
2	To comprehend to concepts of image enhancement, segmentation, classification and various image processing algorithms
3	To explore various Remote Sensing satellites, their characteristics and data products.
4	To inculcate advantages, limitations and interdisciplinary applications of Image processing and Remote Sensing.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	Explain fundamental concepts of Image Processing and Remote Sensing	Understanding
CO2	Apply various image processing algorithms to the Satellite images	Applying
CO3	Compare and Analyze the images acquired from different satellites and sensors.	Analyzing
CO4	Identify and validate appropriate remote sensing datasets and image processing techniques to develop effective solutions for diverse interdisciplinary challenges using image analysis methods and remote sensing tools	Evaluate

Module	**Module Contents**	**Hours**
I	**Digital Image Fundamentals** Introduction and applications, Fundamental Steps andComponents of Image Processing System Digital Image Fundamentals: Image Acquisition, A simple image model, Sampling and Quantization, Imaging, Different types of digital images	6
II	**Image Transforms and Enhancement** Mathematical preliminaries, 2D Orthogonal and Unitary Transforms, Discrete Fourier Transform, Point Processing, Basic Gray Level Transformations, Convolution and Correlation, HistogramProcessing, Spatial domain Filtering	8
III	**Image Segmentation and Classification** Edge Detection-Canny, Sobel, Prewitt, Robert edge detector, Region-based Segmentation –region growing, region splitting and merging, Classification – Supervised and unsupervised classification.	6
IV	**Concepts and Foundation of Remote Sensing** Introduction, Remote Sensing System, Electromagnetic Energy, Electromagnetic Spectrum and its Characteristics, Energy Interaction in the Atmosphere and with the Earth□s Surface, Resolution in Remote Sensing, Applications of Remote Sensing.	7

V	**Sensors, Platforms and Satellite Data Products** Broad Classifications of Sensors and Platform, Earth Observation Satellite and Sensors, Data Reception, Transmission and Processing, Remote Sensing Data and Data Products	6
VI	**Satellite Image Interpretation and Processing** Interpretation Procedure and Elements, Interpretation strategies and keys, Digital Image processing and Image Analysis steps, Image Rectification and Restoration, Image Enhancement, Image Transformation, Image Classification and Analysis.	6

Text Books	
1	R. C. Gonzalez, R. E. Woods, Digital Image Processing, 4th Edition. 2018, PHI
2	S. Jayaraman, S. Esakkirajan, T. Veerkumar, Digital Image Processing, Tata McGrawHill
3	Chandra, A.M. and Ghosh, S.K., "Remote Sensing and GIS", Narosa Publishing House. 2008
4	Lo, C.P. and Young, A.K.W., "Concepts and Techniques of Geographical Information System", Prentice Hall India. 20012

References	
1	Milan Sonka, Vaclav Hlavac, Boyle, Digital Image Processing and Computer Vision, Cengage Learning
2	A. K. Jain, Fundamentals of Digital Image Processing, PHI
3	Lillesand, T.M. and Kieffer, "Remote Sensing and Image Interpretation", - 6th Edition, John Wiley and Sons. 2012

Useful Links	
1	https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ce08

CO-PO Mapping															
	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	2	2											1		
CO2		2	3						3					2	
CO3	3			2				3			2		1	2	
CO4					2	3						3		3	
1:Low, 2:Medium, 3:High															

Assessment (for Theory Course)
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments, quiz etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

Walchand College of Engineering, Sangli

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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Sem V Honor Course
Course Code	
Course Name	Geographic Information System
Desired Requisites:	NA

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	ISE	MSE	ESE	Total
Tutorial		20	30	50	100
		Credits: 2			

Course Objectives

1	To introduce basic concepts in GIS.
2	To describe how geographical data is used, managed, and analyzed.
3	To gain an understanding of how to model and analyze spatial data.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Descriptor
CO1	Understand the fundamental concepts, components and applications of GIS	2	Understand design
CO2	Identify and correct spatial data errors using topological editing, coordinate transformation	3	Applying
CO3	Apply geodatabase concepts and manage attribute and spatial data through appropriate DBMS tools	3	Applying
CO4	Analyze various spatial and non-spatial data types, formats, and models	4	Analyzing

Module	Module Contents	Hours
I	**Basics of GIS:** Introduction to GIS and history and development, components and applications trends of GIS, GPS system, DGPS, digital mapping concepts, paper based maps, computer automated cartography, advantages of digital maps.	4
II	**Data Types and Data Models:** Modeling real world features, data structure and formats, spatial data models – raster and vector, data types, point, line, polygon-arc, nodes, vertices, and topology. spatial data, non-spatial data, data input, metadata, conversion of existing data, creating new data, data models, vector data model, raster data model, integration and comparison of vector and raster data models	4
III	**Database Management:** Geo-database model, role of databases in GIS, attribute data in GIS, attribute data entry, manipulation of fields and attribute data, data exploration, database structures, files, standard data formats, compression techniques, DBMS software.	4
IV	**Spatial Data error handling:** Types of digitizing errors, causes for digitizing errors, detecting and correcting errors, re-projection, transformation and generalization, edge matching and rubber sheeting, topology, topological editing and non-topological editing, editing using topological rules, conversion from other digital sources.	6
V	**Spatial Analysis:** Set theory and map algebra, vector and raster based GIS operations, overlay analysis, buffer analysis, proximity analysis, network analysis.	4

VI	**GIS Project Planning and Implementation**: Map elements and composition, preparation of qualitative and quantitative maps, understanding the requirements, phases of planning, specifications, and procedure for analysis projects and design projects, introduction to Web GIS.	4

Textbooks	
1	Kang-Tsung Chang (2018), 'Introduction to Geographic Information Systems' Tata McGraw Hill, New Delhi, 9th Edition.
2	Paul Longley (2015), Geographic Information systems and Science, John Wiley & Sons, 4th Edition.
3	C. P. Lo & Albert K. W. Yeung, (2016), Concepts and Techniques of Geographic Information Systems, Prentice Hall India Pvt. Ltd, 2nd Edition.

References	
1	Magwire, D.J. Goodchild, M.F. and Rhind, D.M., (2005), 'Geographical Information Systems: Principles and Applications', Longman Group, U.K.
2	John E. Harmon & Steven J. Anderson., (2003), The design and implementation of Geographic Information Systems, John Wiley & Sons.

Useful Links	
1	https://nptel.ac.in/courses/105107206 (accessed on 05.05.2025)
2	https://nptel.ac.in/courses/107105088 (accessed on 05.05.2025)

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2					2								2
CO2			2	2					2		2		2	
CO3		3	3		3		2		2				3	3
CO4			3		4			3		2	3	3		3

The strength of mapping is to be written as 1,2,3, Where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Sem V Honor Course
Course Code	
Course Name	Geographic Information System Laboratory
Desired Requisites:	-

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
	-	30	30	40	100
		Credits: 1			

Course Objectives

1	To provide exposure to basic tools and techniques in GIS software.
2	To develop technical skills and competence in GIS data acquisition, management and analysis.
3	To apply GIS tools and techniques in related applications.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Create raster and vector data (point, line, polygon, attribute).	3	Create
CO2	Create and manage Geo-database.	4	Create
CO3	Write and execute queries on Geo-database and GIS data.	4	Execute
CO4	Perform spatial (vector and raster) operations on GIS data.	5	Perform
CO5	Designing thematic GIS maps using software.	5	Designing

List of Experiments / Lab Activities/Topics

List of Lab Assignments :

1. Study of open source GSI software – QGIS-1.
2. Working with Bhuvan – Indian Geo platform of ISRO
3. Collecting GPS and spatial data and mapping in GIS software
4. Geo-database creation with Spatial data Integration (Digitization) – point, line, polygon and Non-Spatial (attribute) Data Integration.
5. Editing of Spatial & Non-Spatial data in geo-database.
6. Querying GIS data.
7. Raster data calculations and operations-1.
8. Vector data calculations and operations-2.
9. Spatial Data Analysis.
10. Classification & Modeling of GIS data.
11. Generalizations of maps, map design, map production.
12. Mapping and editing of digital maps.
13. Web GIS and Mobile GIS Applications.

Textbooks

1	Kang-Tsung Chang (2018), 'Introduction to Geographic Information Systems' Tata McGraw Hill, New Delhi, 9th Edition.
2	Hwang Sungsoon, Follett Cassie (2019), 'GIS : An Introduction to Mapping Technologies', McHaffie, Patrick; Boca Raton CRC Press

References

1	Jonathan Campbell, Michael Shin (2011), Essentials of Geographic Information Systems, Saylor Foundation
2	John Krygier, Denis Wood (2011), Making Maps, Second Edition: A Visual Guide to Map Design for GIS, The Guilford Press, 2nd Edition.

Useful Links	
1	"Gentle Introduction to GIS" guide, found at www.docs.qgis.org
2	QGIS User Manual, https://docs.qgis.org/3.10/en/docs/training_manual/foreword/intro.html
3	**Bhuvan User Hand Book - Indian Geo Platform of ISRO – NRSC,** https://bhuvan-app1.nrsc.gov.in/2dresources/documents/1_Bhuvan_User_Handbook.pdf

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2				3			3		3			3	
CO2		3	3						3			3	3	2
CO3					3			3		3				3
CO4	3				3			3			3		3	3
CO5					3			3			3	3		4

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO, and preferably to only one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.

Walchand College of Engineering, Sangli

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AY 2025-26

Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Sem VI Honor Course
Course Code	
Course Name	Surveying and Data Handling
Desired Requisites:	Engineering graphics, basic geometry and geography

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial		30	20	50	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	To understand the importance of maps in engineering projects and the principles of map preparation.
2	To learn land surveying methods and instruments used in civil engineering.
3	To learn the concepts and applications of topographical mapping.

Course Outcomes (CO)

CO	Description	Blooms Taxonomy	
		Descriptor	Level
CO1	Identify and classify different types of maps and scales, and understand coordinate systems and map projections.	Understanding	I
CO2	Apply various land surveying techniques for engineering projects.	Applying	III
CO3	Utilize principles of aerial photogrammetry for terrain modelling.	Applying	III
CO4	Understand GPS functioning and its use in surveying and mapping	Understanding	III

Module	Module Contents	Hours
I	**Principles of Land Surveying** Overview of survey levels and their classifications. Levelling methods: Differential levelling, reciprocal levelling, and precise levelling. Surveying instruments: Compass, Theodolite, Total Station, and Tachometer. Applications of surveying in infrastructure development.	4
II	**Advanced Surveying Techniques** Trigonometric levelling: Concepts and applications. Traversing: Methods, adjustments, and plotting. Triangulation and trilateration: Principles, computations, and applications.	4
III	**Coordinate systems** Cartesian and geographical map projections and their types: Conformal, equal-area, and equidistant. Map datum: Concepts of MSL (Mean Sea Level), Geoid, spheroid, and WGS-84. Importance of map datum in GIS and engineering applications. Systems and Map Projections	5
IV	**Introduction to Maps** Definition and significance of maps in engineering projects. Types of maps: Topographical maps, cadastral maps, thematic maps, engineering maps. Scales of maps: large scale, medium scale, small scale, and their applications. Plotting accuracy and precision in map-making. Map sheet numbering and standardization.	5
V	**Aerial Photogrammetry** Types of aerial photographs: Vertical, oblique, and panoramic. Flying height, scale, and their importance in photogrammetry. Relief displacement and its effects on map accuracy. Introduction to Digital Elevation Models (DEM). Applications of DEM in slope analysis and topographical mapping. Introduction to stereoscopy and creation of 3D models.	4

VI	**Global Positioning Systems** Introduction to GPS: GPS signal structure, GPS modernization, types of GPS receivers, time systems, pseudo-range measurements, GPS measurements. GPS errors and Biases: GPS ephemeris errors, Selective availability, satellite receiver, and clock error, multipath error, ionospheric error, tropospheric errors Applications: GPS for utilities industry, forestry and natural resources, precision farming.	4

Text Books	
1	Bindra S. P., "A Course in Highway Engineering", Dhanpat Rai Publications, 5th Edition 2012.
2	Kang-tsung Chang, "Introduction to Geographic Information Systems", Tata McGrawHill, 4thEdition, 2007
3	Ian HeyWood, Sarah Cornelius and Steve Carver , "An Introduction to Geographical Information Systems" , Pearson Education, 2nd Edition, 2006

References	
1	Fundamentals of Global Positioning System Receivers: A Software Approach James Bao-Yen Tsui Copyright @ 2000 John Wiley & Sons, Inc.
2	B.C. Punmia, Ashok Kumar Jain, and Arun Kumar Jain, Surveying Vol. 1, 2 & 3.
3	

Useful Links	
1	https://ocw.mit.edu/courses/12-540-principles-of-the-global-positioning-system-spring-2012/
2	https://nptel.ac.in/courses/106105219
3	

CO-PO Mapping

	Programme Outcomes (PO)												**PSPO**	
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2		1		1		2	1	2		1	2	1	
CO2	1	2	3	1					1					1
CO3	1		2	2	1						1		1	
CO4	1				2							1	1	

The strength of mapping: - 1: Low, 2: Medium, 3: High

Assessment

The assessment is based on MSE, ISE, and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of a teacher's assessment. The mode of assessment can be field visits, assignments, etc., and is expected to map at least one higher-order PO.

ESE shall be on all modules with around 25-30% weightage on modules 1 to 3 and 70-75% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed, and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

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Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Sem VI Honor Course
Course Code	
Course Name	Spatial Data Analysis
Desired Requisites:	NA

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	To learn and understand concepts of Remote sensing and GIS
2	To develop the skill for handling spatial data and perform spatial data analysis
3	To acquire knowledge of spatial information systems

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Understand the role of RS and GIS to handle large location-based spatial data	**2**	**Understanding**
CO2	Solve diverse societal issues using technical, engineering and GIS skills with spatial informatics	3	**Applying**
CO3	Measure accuracy in spatial dat analysis	5	**Evaluating**
CO4	Develop engineering practices relevant to theories and application of spatial data	6	**Creating**

Module	**Module Contents**	**Hours**
I	Remote Sensing, Coordinate Systems, Maps and Numbering, Map Projections, Positional Accuracy and Source of Errors, Classification Accuracy and Pixel Errors	7
II	Geographical Information System (GIS), components of GIS, Real World to Digital World through GIS, GIS data and structures, Data compression	6
III	Introduction to Spatial Informatics, Spatial Database, Spatial Data Models, Needs and Semantics, Attribute data,	6
IV	Spatial Query and analysis Spatial Query - Introduction, Spatial analysis, Raster and vector data analysis, Overlay operations, Basic spatial analysis, advanced spatial analysis	7
V	Spatial Computing, Spatial Analysis Interpolation and extrapolation Basic operations on lines and points, Some operations for polygons, Spatial data transformations, Transformations between regular cells and entities, Access to spatial data	7
VI	Intelligent spatial information systems, Spatial Web Services, Spatial Data Infrastructure, Geo-visualization, Spatial Cloud	6

Textbooks

1	Kang-tsung Chang, "Introduction to Geographic Information Systems", Tata McGrawHill, 4th Edition, 2007
2	Ian HeyWood, Sarah Cornelius and Steve Carver , "An Introduction to Geographical Information Systems" , Pearson Education, 2nd Edition, 2006
3	Robert Laurini and Derek Thompson, "Fundamentals of Spatial Information Systems", Elsevier Ltd. 1992.

References	
1	Peter A. Burrough, Rachael A. McDonnell and Christopher D. Lloyd, "Principles of Geographical Information System", Oxford University Press, 2016
2	Keith C. Clarke, Bradley O. Parks, and Michael P. Crane, "Geographical Information Systems and Environmental Modeling", Prentice-Hall India, 2001
Useful Links	
1	https://nptel.ac.in/courses/106105219
2	https://www.sciencedirect.com/book/9780124383807/fundamentals-of-spatial-information-systems

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2											1	
CO2		2	3						3					2
CO3	3			2				3			2		1	2
CO4					2	3						3		3

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)