Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2024-25

Course Information

Programme	B. Tech.
Class, Semester	B. Tech., SEM-VII
Course Code	6OE491
Course Name	Engineering Economics
Desired Requisites:	

Teaching Scheme		Examination Scheme (Marks)			
Lecture	3 Hrs/week	MSE	ISE	ESE	Total
Tutorial	0 Hrs/week	30	20	50	100

Credits: 3

Course Objectives

1	Provide students with a solid foundation in economic theories and concepts relevant to engineering decision-making, including time value of money, cost analysis, and economic feasibility.
2	Equip students with the ability to apply economic analysis techniques such as net present value (NPV), internal rate of return (IRR), and sensitivity analysis to evaluate and compare engineering projects.
3	Foster an understanding of the ethical implications of financial decisions in engineering projects, emphasizing responsibility towards stakeholders and societal impact.

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	Students will demonstrate an understanding of economic theories and principles relevant to engineering economics, such as supply and demand, market structures, and economic indicators.	2	Understanding
CO2	Students will articulate the importance of ethical considerations in engineering economic decision-making, including the implications of financial choices on stakeholders and society.	2	Understanding
CO3	Students will apply economic analysis techniques, such as net present value (NPV), internal rate of return (IRR), and sensitivity analysis, to evaluate engineering projects and make informed financial decisions.	3	Applying

CO4	Using case studies and simulations, students will analyze real-world engineering scenarios, identifying economic constraints and proposing viable solutions to maximize project profitability and sustainability.	3	Applying

Module	Module Contents	Hours
I	1: Introduction to Engineering Economics • Overview of Engineering Economics: Definition, Importance, and Scope • Time Value of Money: Principles of Compound Interest and Present Value • Cash Flow Diagrams and Analysis Techniques • Decision Making under Uncertainty: Risk and Uncertainty Analysis • Economic Analysis Techniques: Net Present Value (NPV), Internal Rate of Return (IRR), Payback Period	7
II	: Cost Estimation and Analysis • Cost Concepts: Fixed Costs, Variable Costs, Total Costs • Cost Estimation Methods: Analogous Estimating, Parametric Estimating, Bottom-Up Estimating • Cost Behavior and Cost-Volume-Profit (CVP) Analysis • Break-Even Analysis and Margin of Safety • Life Cycle Cost Analysis (LCCA) and Total Cost of Ownership (TCO)	6
III	: Engineering Project Evaluation • Project Selection Criteria: Economic, Technical, and Environmental Factors • Benefit-Cost Analysis (BCA) and Cost-Effectiveness Analysis (CEA) • Sensitivity Analysis and Scenario Planning • Decision Trees and Real Options Analysis • Ethical Considerations in Engineering Economics	7
IV	: Financing and Investment Analysis • Sources of Financing: Debt Financing vs. Equity Financing • Capital Budgeting: Capital Rationing, Replacement Analysis • Investment Criteria: Profitability Index (PI), Discounted Payback Period • Leasing and Tax Considerations • Public-Private Partnerships (PPPs) in Infrastructure Projects	7
V	: Economic Analysis of Engineering Alternatives • Comparing Alternatives: Equivalent Annual Cost (EAC) and BenefitCost Ratio (BCR) • Replacement Analysis and Equipment Life Cycle Costing • Depreciation Methods: Straight-Line Depreciation, Declining Balance Depreciation • Taxation and Inflation Effects on Economic Analysis • Environmental and Social Cost-Benefit Analysis	6

VI	: Economic Decision Making in Engineering Practice • Case Studies in Engineering Economics: Project Feasibility Studies • Ethics in Economic Decision Making: Sustainability and Corporate Social Responsibility • International Engineering Economics: Exchange Rates, Globalization, and Trade Policies • Emerging Trends in Engineering Economics: Green Technologies, Circular Economy • Professional Development and Career Opportunities in Engineering Economics	6
Textbooks		
1.	"Engineering Economic Analysis" by Donald G. Newnan, Ted G. Eschenbach, and Jerome P. Lavelle	
2.	"Estimating in Building Construction" by Steven J. Peterson and Frank R. Dagostino	
3.	"Engineering Economic Analysis" by Donald G. Newnan, Ted G. Eschenbach, and Jerome P. Lavelle	
4.	"Investment Valuation: Tools and Techniques for Determining the Value of Any Asset" by Aswath Damodaran	
5.	"Engineering Economic Analysis" by Donald G. Newnan, Ted G. Eschenbach, and Jerome P. Lavelle	
6.	"Engineering Economic Analysis" by Donald G. Newnan, Ted G. Eschenbach, and Jerome P. Lavelle	
Online Resources:		
1	• Khan Academy: Finance and capital markets • Investopedia: Introduction to Engineering Economics	
2	• Construction Management: Cost Estimation Techniques • American Society of Professional Estimators (ASPE): Cost Estimation Resources	
3	• Project Management Institute (PMI): Project Selection Methods • Society of Cost Estimating and Analysis (SCEA): Project Evaluation Techniques	
4	• Harvard Business School: Financing and Investing • International Monetary Fund (IMF): Infrastructure Financing	
5	• The National Bureau of Economic Research (NBER): Cost-Benefit Analysis • United Nations Environment Programme (UNEP): Environmental Economics	

6.	• American Society of Civil Engineers (ASCE): Economic Decision Making in Engineering • International Monetary Fund (IMF): Engineering Economics and Policy Analysis

Useful Links	
1	For optics https://nptel.ac.in/courses/122/107/122107035/
2	For Quantum Physics https://nptel.ac.in/courses/122/106/122106034/

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								

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 2024-25

Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	6OE485
Course Name	Open Elective - 3: Data Visualization and Interpretation
Desired Requisites:	Programming Fundamentals

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

Course Objectives

1	To use R for analytical programming.
2	To visualize data in R.
3	To discuss problem solving approaches using appropriate machine learning techniques.

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	Choose set of complex mathematical formulae using LATEX	III	Applying
CO2	Explain critical R programming concepts	IV	Analyzing
CO3	Analyze data and generate reports based on the data.	IV	Analyzing
CO4	Create bar charts, histograms, pie charts, scatter plots, line graphs, box plots, and maps using R and related packages	VI	Creating

Module	**Module Contents**	**Hours**
I	**Introduction:** Introduction to Data Science, Overview of the Data Science process, Introduction to Data Science technologies, Introduction to Machine Learning, Regressions, Classification, Clustering, Recommendation systems	7
II	**Working with Data:** Variables , Vectors, Matrices, lists & Data frames , Logical vectored operators Image data type, Image representation, categorical data using Factors in R.	6
III	**Data/Image Visualization:** Using graphs to visualize data, Basic plotting in R, Manipulating the plotting window, Advanced plotting using lattice library in R. Image visualization in using Image processing tools.	7

IV	**Models in Machine Learning:** Regression Models, Classification Models, Unsupervised Learning Models, Recommendation Models. Models considered: – Linear regression: lm() – Logistic regression: glm() – Poisson regression: glm() – Survival analysis: Surv(), coxph() – Linear mixed models: lme()	7
V	**Data Reporting using LaTex:** LATEX Software installation, LATEX typesetting basics, LATEX math typesetting, Tables and matrices, Mathematics in Latex.	6
VI	**Case Studies –** Titanic Survival analysis, face detection, Housing price prediction analysis, Customer segmentation analysis, Iris	6

Text Books	
1	Dr. Mark Gardner, Beginning R:statistical Programming Languages, Wrox (Amazon),Mar2013
2	Griffithas, Higham, Learning LATEX ,Amazon,2014

References	
1	Basic Data Analysis Tutorial, by Jacob Whitehill, Department of Computer Science, University of the Western Cape, 24/07/2009 [UWCDataAnalysisTutorial.pdf]
2	NPTEL,edx,COURSERA (MOOC courses)

Useful Links	
1	Module I https://www.coursera.org/learn/what-is-datascience?specialization=introduction-datascience#syllabus
2	Module II, III, IV and VI https://onlinecourses.nptel.ac.in/noc21_cs23/preview https://www.coursera.org/learn/r-programming/home/welcome
3	Module V https://www.overleaf.com/learn/latex/Free_online_introduction_to_LaTeX_(part_1)

CO-PO Mapping

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

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 2024-25

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	6OE471
Course Name	Open Elective III: Cyber Security
Desired Requisites:	

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

Course Objectives	
1	Understand foundational concepts of cybersecurity.
2	Identify common cybersecurity threats and vulnerabilities.
3	Analyze strategies for mitigating cybersecurity risks.
4	Apply basic cybersecurity principles to real-world scenarios.

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	Define key terms and concepts in cybersecurity.	I	Remembering
CO2	Recognize common cyber threats and vulnerabilities.	II	Understanding
CO3	Evaluate cybersecurity strategies for risk mitigation.	III	Analyzing
CO4	Demonstrate the application of cybersecurity principles.	IV	Applying

Module	**Module Contents**	**Hours**
I	Introduction to Cybersecurity : Overview of Cybersecurity, Definition and Scope, Evolution of Cybersecurity, Foundational Concepts, Principles of Information Security, CIA Triad: Confidentiality, Integrity, Availability, Cybersecurity Threat Landscape, Types of Cyber Threats, Common Attack Vectors, Legal and Ethical Considerations, Cybersecurity Laws and Regulations, Ethical Issues in Cybersecurity	4
II	Cyber Threats and Attack Vectors: Malware and Viruses, Types of Malware, Detection and Prevention Techniques, Social Engineering Attacks, Phishing, Pretexting, Baiting, Mitigation Strategies, Network Attacks, DDoS Attacks, Man-in-the-Middle Attacks, Network Defense Mechanisms, Web Security Threats, Common Web Vulnerabilities, Best Practices for Web Security, IoT and Mobile Security, Challenges in IoT and Mobile Devices, Strategies for Securing IoT and Mobile Ecosystems,	6
III	Security Measures and Controls: Access Control Mechanisms, Authentication, Authorization, Accounting, Access Control Models, Firewalls and Intrusion Detection Systems, Types of Firewalls, IDS/IPS, Secure Software Development Practices, Secure Coding Principles, Tools for Secure Software Development, Endpoint Security, Endpoint Security Challenges, Endpoint Protection Solutions	8
IV	Cryptography and Data Protection : Fundamentals of Cryptography, Encryption Algorithms, Cryptographic Protocols, Cryptographic Applications, Public Key Infrastructure (PKI), Digital Signatures, Data Protection Mechanisms, Data Encryption, Data Masking and Tokenization	6

V	Network Security : Network Security Fundamentals, Network Vulnerabilities, Secure Communication Protocols, Wireless Security, Wi-Fi Security Mechanisms, Bluetooth Security, Virtual Private Networks (VPNs), VPN Types and Protocols, VPN Implementation and Management	6
VI	Security Policies and Compliance Security Policies Overview, Purpose and Scope of Security Policies, Components of Security Policies, Regulatory Compliance, Compliance Standards (e.g., GDPR, HIPAA), Compliance Implementation Strategies, Ethical Considerations, Responsible Disclosure, Privacy and Ethical Hacking	4

Textbooks	
1	"Cybersecurity Essentials" by William Stallings and Lawrie Brown.
2	"Principles of Computer Security" by Conklin, White, Williams, Davis, and Cothren.

References	
1	"Network Security Essentials" by William Stallings.
2	"Cryptography and Network Security" by William Stallings.

Useful Links	
1	National Institute of Standards and Technology (NIST) Cybersecurity Framework : https://www.nist.gov/cyberframework
2	OWASP (Open Web Application Security Project) Website : https://owasp.org/

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	2	2									2	
CO2	1	1	2	2									2	
CO3	1	1	2	2									2	
CO4	1	1	2	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 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 2024-25

Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	6OE457
Course Name	Open Elective III-Medical Image Processing
Desired Requisites:	Signal Processing

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	0 Hrs/week	30	20	50	100
		Credits: 3			

Course Objectives	
1	To learn facts about medical imaging sources and study various formats.
2	To study various segmentation and filtering technique of medical image.
3	To learn spatial transformation of medical image

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Demonstrate various image sources, there representation and various formats of image.	II
CO2	Apply segmentation, filtering and transformation on medical image.	IV
CO3	Analyze various facts of image registration and CT reconstructed image.	IV

Module	**Module Contents**	**Hours**
I	**Basics of Medical Image Sources:** Radiology, the electromagnetic spectrum, basic x-ray physics, attenuation and imaging, computed tomography, magnetic resonance tomography, ultrasound, nuclear medicine and molecular imaging, other imaging techniques, radiation protection and dosimetry	7
II	**Image Representation:** Pixels and voxels, gray scale and color representation, image file formats, DICOM, other formats, image quality, and the signal-to-noise ratio, the intensity transform function and the, dynamic range, windowing, histograms and histogram operations, dithering and depth	7
III	**Image segmentation:** Region growing, k-means clustering, snakes, introduction to level sets,speed functions, multi-atlas fusion-based segmentation	7
IV	**Image enhancement:** contrast enhancement, denoising, deblurring, edge detection, derivativesand Fourier theory, anisotropic diffusion;	6

V	**Image registration:** correlation, least squares, transform based registration, joint entropy, mutual information, binning discontinuities, registration optimization, registration by clustering, ensemble registration, gaussian mixture models.	6
VI	**Medical image reconstruction:** Theory of MRI reconstruction, MRI motion, compensation, algebraic CT reconstruction, CT filtered back-projection.	6

Textbooks	
1	Prince J L and Links J M, *Medical Imaging Signals and Systems*, Pearson (2015).
2	Suetens P, *Fundamentals of Medical Imaging*, Cambridge University Press (2009).

References	
1	Birkfellner W, *Applied Medical Image Processing: A Basic Course*, CRC Press (2014).
2	Nishimura D, *Principles of Magnetic Resonance Imaging*, Stanford University Press (2010).

Useful Links	
1	https://onlinecourses.nptel.ac.in/noc22_ee64/preview

CO-PO Mapping

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

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AY 2024-25

Course Information	
Programme	B. Tech. Electrical Engineering
Class, Semester	Final Year B. Tech., Sem. VII
Course Code	6OE443
Course Name	Open Elective-5: Renewable Energy
Desired Requisites:	Basic Mechanical Engineering, Basic Electrical Engineering

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

Course Objectives	
1	Explain the types of renewable energy resources with sustainability.
2	Explain the working of solar, wind, biomass, and geothermal energy systems.
3	Apply various renewable energy sources like biogas, geothermal, and MHD
4	Explain the need and operation of various energy storage technologies.

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 various renewable energy resources with Sustainability.	II	Understanding
CO2	Describe the working of solar, wind, biomass, and geothermal energy systems.	II	Understanding
CO3	Discuss the need and working of various energy storage, fuel cell, and battery management system technologies.	II	Understanding
CO4	Demonstrate the Grid-connected PV and wind energy system.	III	Applying

Module	**Module Contents**	**Hours**
I	**Introduction to Renewable Energy Sources** Energy sources: classification of energy sources, introduction to renewable energy, renewable energy trends, key factors affecting renewable energy supply, global and Indian scenario of renewable energy sources, policies of the government, sustainable development, challenges, advantages and disadvantages of renewable energy sources, and their uses. **Case Study:** PM Kusum Yojana and PM Suryoday Yojana 2024.	7
II	**Solar Energy** solar earth geometry, solar radiations, and measurement, fundamentals of semi-conductors, absorption of light, solar thermal power generation, heat transfer, solar thermal conversion: basics, solar concentrator, and tracking system, flat plate and concentrating collectors, single axis and two axes axis tracking collectors, selective coatings.	7

III	**Grid Connected PV System** PV power generation, basic principle of power generation in PV cell, solar cell, and its parameters, module and array, the efficiency of PV cell, characteristics curves of PV cell, effects of different electrical parameters on I-V & P-V curves, configuration of PV power generation system - off-grid system & grid-connected PV system, design methodology, stand-alone PV system, grid-connected PV systems.	6
IV	**Wind Energy** Power available in wind, wind turbine power & torque characteristics, types of rotors, characteristics of wind rotor, components of wind turbine, local effects, wind shear, turbulence & acceleration effects, measurement of wind, wind speed statistics, wind power calculations and Betz limit, capacity factor, speed ratio characteristics, grid-connected wind energy system	7
V	**Biomass Energy and other renewable energy systems** Overview of biomass as energy source, physicochemical and thermal characteristics of biomass as fuel, hydrogen generation methods, storage technologies, compression and chemical compounds, applications in energy storage and transportation, addressing safety, environmental impacts, and future trends in research and policy. geothermal energy different components, advantages, limitations.	6
VI	**Energy Storage and Fuel cell technologies** Introduction, need for storage for renewable energy sources, basic thermodynamic and electrochemical principles, classification, traditional energy storage system- battery, fuel cell, principle of operation, types, applications for power generation, battery management system.	6

Textbooks	
1	Boyle, Godfrey, "*Renewable Energy*", (2nd edition), Oxford University Press, 2004.
2	Masters, Gilbert M., "*Renewable and efficient electric power systems*", John Wiley & Sons, 2013.
3	Solanki, Chetan Singh. , "*Solar Photovoltaics: fundamentals, technologies and applications*", PHI Learning Pvt. Ltd., 2015.

References	
1	G.S.Sawhney, "*Non-Conventional Resources of Energy*", PHI Publication 2012. Gary-L. Johnson Wind Energy Systems Tata Mc-Graw-Hill Book Company.
2	S. P. Sukhatme, J. K. Nayak, "*Solar Energy- Principles of Thermal Collection and Storage",* (3rd edition), Tata McGraw-Hill Publication.

Useful Links	
1	https://nptel.ac.in/noc/courses/noc21/SEM1/noc21-ch11/
2	https://www.coursera.org/learn/exploring-renewable-energy

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

Syllabus Prepared By	Mr. A. N. Inamdar
Syllabus Checked By	Dr. S. D. Patil

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2024-25

Course Information	
Programme	B. Tech. (Mechanical Engineering)
Class, Semester	Final Year, Sem VII
Course Code	6OE429
Course Name	Additive Manufacturing
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
Practical	-	-			
Interaction	-	**6Credits: 3**			

Course Objectives	
1	To impart knowledge to the students on 3D printing technologies
2	To develop students to select material, process and application of 3D Printing.
3	To make students aware of software tools, processes and techniques of additive manufacturing.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Understand 3D printing process, data formats and software.	II	Understand
CO2	Select 3D printing techniques and materials.	III	Apply
CO3	Justify product quality and applications of 3D Printing in various domains.	IV	Analyze
CO4	Evaluate the quality and feasibility of additive manufacturing prototypes and finished products.	V	Evaluate

Module	**Module Contents**	**Hours**
I	**Introduction to 3D Printing** Overview, History, Process, Classifications, Advantages, Additive v/s Conventional Manufacturing processes	7
II	**CAD Models** CAD Data formats, Data translation, Data loss, STL format; CAD model preparation, Part Orientation and support generation, Model Slicing, Software features	7
III	**3D Printing Techniques** Stereo-lithography Apparatus (SLA), Fused Deposition Modeling (FDM), Laminated Object Manufacturing (LOM), Selective Laser Sintering (SLS), SLM, Binder Jet technology	7
IV	**Materials for 3D Printing** Polymers and their properties, Metals, Various forms of raw material- Liquid, Solid, Wire, Powder; Powder Preparation and their desired properties; Support Materials	6
V	**Post Processing and Product Quality**	6

	Requirement and Techniques, Support Removal, Sanding, Acetone treatment, polishing; Inspection and testing; Defects and their cause	
VI	**Application Domains** Aerospace, Electronics, Health Care, Defense, Automotive, Construction, Food Processing, Machine Tools, Retail industry.	6

Text Books	
1	LiouW.Liou, Frank W.Liou, "Rapid Prototyping and Engineering applications: A tool box for prototype development", CRC Press, 2007.
2	Lan Gibson, David W. Rosen and Brent Stucker, "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010
3	CK Chua, Kah Fai Leong, "3D Printing and Rapid Prototyping- Principles and Applications", World Scientific, 2017.
References	
1	T. A. Grimm & Associates, "Users Guide to Rapid Prototyping", Society of Manufacturing Engineers (SME) ISBN 0872636976, 2014.
2	Andreas Gebhardt, "Understanding Additive Manufacturing: Rapid Prototyping, Rapid Tooling, Rapid Manufacturing", Hanser Publisher, 2011.
3	C. E. Bocking, AEW Rennie, "Rapid & Virtual Prototyping & applications", Wiley Eastern, 2011.
Useful Links	
1	NPTEL and MOOC links

Civil

CO-PO Mapping															
	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			2		2										
CO2			2		2							1			
CO3			2		2							1			
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High															

Electronics

CO-PO Mapping															
	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			2		2										
CO2			2		2							1			
CO3			2		2							1			
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High															

Electrical

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

CO3			2		2							1			
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High															

Computer Science

CO-PO Mapping															
	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			2		2										
CO2			2		2							1			
CO3			2		2							1			
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High															

Information Technology

CO-PO Mapping															
	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			2		2										
CO2			2		2							1			
CO3			2		2							1			
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High															

Assessment (for Theory Course)
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course					
Bloom's Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember				
2	Understand	7	8	20	**35**
3	Apply	8	7	17	**32**
4	Analyze	5	5	23	**33**
5	Evaluate				
6	Create				
Total		**20**	**20**	**60**	**100**

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Course Information

Programme	B. Tech. (Other than Civil Engineering)
Class, Semester	Final Year B. Tech., Sem. VII
Course Code	6OE416
Course Name	Open Elective 3: Environmental Management Systems
Desired Requisites:	-

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	03 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
Practical	-				
Interaction	-	**Credits: 03**			

Course Objectives

1	To provide knowledge of ecological aspects.
2	To provide knowledge of Environmental Ethics and Environmental Legislation.
3	To provide necessary knowledge of different certifications.
4	To provide necessary knowledge of managerial tools required in the field of environmental management.

Course Outcomes (CO)

CO	Description	Blooms Taxonomy	
		Descriptor	Level
CO1	***Explain*** ecological aspects and effects due to various types of pollution	Understand	II
CO2	***Perceive*** environmental ethics and legislation.	Understand	II
CO3	***Choose*** appropriate methodology for EIA and auditing and assess the impacts.	Apply	III
CO4	Explain benefits and processes of different certifications.	Understand	II
CO5	***Implement*** EMS and Environmental Management Plan for infrastructural facilities.	Apply	IV

Module	**Module Contents**	**Hours**
I	**Ecological Aspects and types of Pollution** Ecological aspects: Salient features of major Ecosystems, Energy Transfer, Population Dynamics, Ecological imbalance, Preservation of Biodiversity. Land Pollution, Water Pollution due to sewage, industrial effluents and leachate, Pollution due to Nuclear Power Plants, Radioactive Waste, Thermal pollution, causes and control. Noise Pollution: Decibel Levels, Monitoring, Hazards, Control measures.	7
II	**Environmental Ethics and Legislation** Environmental Ethics: Ethics in society, Environmental consequences, Responsibility for environmental degradation, Ethical theories and codes of Ethics, Changing attitudes, Sustainable development. Environmental Legislation: Water (prevention and control of pollution) act 1974, The environmental act 1986, The Noise Pollution (Regulation and Control) Rules, 2000. Environmental economics.	7
III	**Environmental Impact Assessment (EIA)** Definitions and Concept, Scope, Objectives, Types of impacts, Elements of EIA, Baseline studies. Methodologies of EIA, Prediction of impacts and its methodology, Uncertainties in EIA, Status of EIAs in India.	6

IV	**Environmental Auditing** Definitions and concepts, Scope and Objectives, Types of audit, Accounts audit, Environmental audit statement, Qualities of environment auditor. Environmental Impact Statement (EIS).	6
V	**ISO Standards** ISO and ISO 14000 Series: Introduction, Areas covered in the series of standards, Necessity of ISO certification. Environmental management system: Evolution, Need, Elements, Benefits, ISO 14001 requirements, Steps in ISO 14001 certification, ISO 14001 and sustainable development, Integration with other systems (ISO 9000, TQM, Six Sigma), Benefits of integration.	6
VI	**Environmental Management Plan** Definition, Importance, Development, Structuring, Monitoring, Cost aspects. Strategy for siting of Industries, Eco-Labelling, Life-Cycle Assessment.	6

Text Books

1	Canter, L. W., Environmental Impact Assessment, McGraw-Hill, 2nd Edition, 1997.
2	Agarwal, N. P., Environmental Reporting and Auditing, Raj Pub., 1st Edition, 2002.
3	Judith, P. and Eduljee, G., Environmental Impact Assessment for Waste Treatment and Disposal Facilities, John Wiley & Sons, 1st Edition, 1994.

References

1	"Environmental Auditing", Published by CPCB, Govt. of India Publication, New Delhi.
2	Mhaskar, A.K., Environmental Audit", Media Enviro Publications, 2002.
3	K. Whitelaw and Butterworth, ISO 14001: Environmental System Handbook, 1997.

Useful Links

1	https://www.youtube.com/watch?v=wEqrMCdNjX4
2	https://www.youtube.com/watch?v=hfLGI73N_iA
3	https://www.youtube.com/watch?v=MpR6YiSiHrs

CO-PO Mapping

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

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Course Information

Programme	B. Tech. Applied Mechanics
Class, Semester	Final Year B. Tech, Sem VII
Course Code	6OE401
Course Name	Structural Health Monitoring
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 examine the use of low-cost, long term monitoring systems to keep civil infrastructure under constant surveillance, ensuring structural integrity.
2	To develop sustainable maintenance and rehabilitation schemes for structures.
3	To assess the civil infrastructure using structural health monitoring systems after disaster.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	**Demonstrate** the knowledge of SHM for various components of structures.	Applying
CO2	**Evaluate** various techniques for SHM of structures	Evaluating
CO3	**Design** various SHM techniques for various structures.	Creating

Module	**Module Contents**	**Hours**
I	**Introduction to Structural Health Monitoring (SHM)** Definition & motivation for SHM, SHM - a way for smart materials and structures, SHM and bio mimetic - analog between the nervous system of a man and a structure with SHM, SHM as a part of system management, Passive and Active SHM, NDE, SHM and NDECS, basic components of SHM, materials for sensor design.	7
II	**Application of SHM systems** Introduction to capacitive methods, capacitive probe for cover concrete, SHM of a bridge, applications for external post tensioned cables, monitoring historical buildings.	7
III	**Non Destructive Testing of Concrete Structures** Introduction to NDT - Situations and contexts, where NDT is needed, classification ofNDT procedures, visual Inspection, half-Cell electrical potential methods, Schmidt Rebound Hammer Test, resistivity measurement, electromagnetic methods, radiographic Testing, ultrasonic testing, Infra Red thermography, ground penetrating radar, radio isotope gauges, other methods.	7
IV	**Condition Survey & NDE of Concrete Structure** Definition and objective of Condition survey, stages of condition survey (Preliminary, Planning, Inspection and Testing stages), possible defects in concrete structures, quality control of concrete structures - Definition and need, Quality control applications in concrete structures, NDT as an option for Non-Destructive Evaluation (NDE) of Concrete structures, case studies of a few NDT procedures on concrete structures.	6
V	**Rehabilitation and Retrofitting of Concrete Structure** Repair rehabilitation & retrofitting of structures, damage assessment of concrete structures, Materials and methods for repairs and rehabilitation, modeling of repaired composite structure, structural analysis and design -	6

	Importance ofre-analysis, execution of rehabilitation strategy, Case studies.	
VI	**Damage Detection of Composite Structures** Introduction to composites and their applications in structural Industry. Learning from failures. Various kinds of damage detection techniques. Repair **&** rehabilitation & retrofitting of composite structures, damage assessment of composites structures, Case studies.	6

Textbooks	
1	Daniel Balageas, Claus - Peter FritzenamI Alfredo Guemes, Structural Health monitoring, Published by ISTE Ltd., U.K. 2006
2	Guide Book on Non-destructive Testing of Concrete Structures,Training course series No.17, International Atomic Energy Agency,Vienna, 2002.
References	
1	Hand book on "Repair and Rehabilitation of RCC Buildings ", Published by Director General, CPWD, Govt. of India, 2002.
2	Hand Book on Seismic Retrofitting of Buildings, Published by CPWD & Indian Building Congress in Association with IIT, Madras, Narosa Publishing House, 2008.
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	3			3										2
CO2	2			2										2
CO3	2			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 a teacher's assessment. 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 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 2024-25

Course Information

Programme	B.Tech. All Branches
Class, Semester	Final Year B. Tech., Sem VII
Course Code	6OE492
Course Name	Human Relations at Work
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	03 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	00 Hrs/week	30	20	50	100
		Credits: 03			

Course Objectives

These objectives aim to equip students with the knowledge and skills necessary to navigate interpersonal relationships and dynamics effectively within the workplace.

1	To enable the students with an understanding about the very importance of human relations, its relationship with self and the processes involved in interaction with people at work.
2	To provide relevant knowledge to address human relations at work by exposure to personal growth and challenges at work.
3	To infuse the ability to positively consider other's views and to work effectively with others in team and to support a shared purpose or goal.
4	Explore the importance of trust and ethical behaviour in building successful work relationships.
5	Recognize and appreciate diversity in the workplace, and learn to leverage it for increased creativity and productivity.

Course Outcomes (CO) with Bloom's Taxonomy Level

Upon successful completion of this course, students will be able to

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Descriptor**
CO1	Sense a comprehensive understanding of the principles of human relations.	II	Understanding
CO2	Recall different forms of communication (verbal, non-verbal, written) and their importance in workplace interactions.	I	Remembering
CO3	Developing good work habits, value workload, understanding the changing roles of men and women in the society.	III	Applying
CO4	Demonstrate ethical behaviour, treat other team members respectfully, uphold personal values, foster team work and understand its significance in decision-making and various societal contexts.	III	Applying

Module	**Module Contents**	**Hours**
I	**Human Relations and Personal Growth** Understanding Human Relations, Managing Yourself and Human Relations, Attitude, Self-Esteem, Self-Confidence, Self-Motivation, Emotional Intelligence, Happiness, Values and Ethics,	7
II	**Challenges in Human Relations** Dealing effectively with People, Communication in the Workplace, Specialized tactics for getting along with others in the workplace, Diversity and Cross-Cultural Competence. Managing or Resolving Conflict and Dealing with Difficult People, A Life Plan for Effective Human Relations.	7
III	**Teamwork** Definition, Importance and Benefits of teamwork, promoting effective teamwork at workplace, Becoming an effective leader, Motivating Others.	7
IV	**Personal Strategies for improving Human Relations**	4

	Staying Physically Healthy: Yoga, Pranayama and Exercise, Improving Interpersonal Relations, Achieving Emotional Balance in a chaotic world, Finding Positive Energy.	
V	**Individual Career Management** Staying psychologically healthy, Managing Stress and Personal Problems, Meditation, Developing Career Thrust, Getting Ahead in Your Career, Learning and Developing Individual Strategies, Environmental Awareness, Career Goals, Strategies, Appraisal, Individual Career Management	7
VI	**Measures for Successful Human Relations** Developing Good Work Habits. Responding and managing to work related stress, Valuing work load, The changing roles of men and women, Sexual harassment of women at workplace, Laws and penalties concerning the harassment of women in the workplace. Respect to employees (men, women and transgender).	7

Textbooks	
1	Dubrien, A. J. (2018). Human Relations for Career and Personal Success: Concepts, Applications and Skills, 11th edition. Upper Saddle River, NJ: Pearson.
2	Barry Reece and Monique Reece (2016). Effective Human Relations: A Guide to People at Work, 13th edition, Cengage Learning.
3	Lowell H. Lamberton and Leslie Minor-Evans (2020). Human Relations: Strategies for Success, 6th edition, McGraw-Hill Education.

References	
1	Greenberg, J. S. (2017). Comprehensive stress management 14th edition. New York: McGraw Hill.
2	Udai, Y. (2015). Yogasan aur Pranayam. New Delhi: N.S. Publications.
3	Brian Luke Seaward, (2017). Managing Stress: Principles and Strategies for Health and Well-Being, 9th edition, Jones & Bartlett Learning.

Useful Links	
1	https://hbr.org/topic/subject/organizational-culture
2	https://www.apa.org/topics/healthy-workplaces
3	https://www.mindtools.com/caiprxt/team-management
4	https://www.verywellmind.com/how-to-deal-with-stress-at-work-3145273

CO-PO Mapping

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