Dr D Y Patil Pratishthan's

D Y Patil College of Engineering, Akurdi, Pune

An Autonomous Institute from AY 2024-25 affiliated to Savitribai Phule Pune University

Curriculum Structure and Syllabus of

National Education Policy (NEP) based Curriculum

Second Year B Tech in Instrumentation and Control Engineering from AY 2025-26

R5: March 27, 2025

Preface

D Y Patil College of Engineering, Akurdi, Pune (DYPCOE) has been recognized for providing quality education in Maharashtra for the past 40 years. With a commitment to academic excellence and a vision for the future, DYPCOE is now boarding a new journey towards Autonomy, in line with the latest educational reforms. The Institute is dedicated to the effective implementation of the New Education Policy (NEP) 2020, as per the guidelines by the Government of Maharashtra. This initiative is aimed at fostering the holistic development of our students, ensuring they are well-equipped to meet the challenges of the 21st century.

The present syllabus details the Second-Year in Instrumentation and Control Engineering (SY) syllabus, meticulously designed to align with the NEP 2020 and effective from the academic year 2025-26. The curriculum is structured to provide a robust foundation through Program Core Cores and Program Courses. It also integrates Vocational and Skill Enhancement Courses, Ability Enhancement Courses, the Indian Knowledge System, and co-curricular Liberal Learning courses. This comprehensive approach aims to cultivate well-rounded engineers who are adaptable to Internationalization.

One of the key highlights of this syllabus is its emphasis on Experiential Learning and hands-on experience. By integrating theoretical knowledge with practical laboratory sessions, we aim to enhance the learning process and foster a deeper understanding of core concepts. Additionally, the curriculum promotes research and innovation by encouraging students to engage in project-based learning.

The development of this curriculum has been a collaborative effort, and we owe a debt of gratitude to all those who have contributed to its creation. Our sincere thanks go to the Management, Steering Committee Members, Heads of Departments, and the Board of Studies chairpersons and members for their invaluable input and dedication. Their collective expertise and commitment have been instrumental in shaping this curriculum.We are confident that this new curriculum will pave the way for our students to achieve academic excellence and holistic development, preparing them to thrive in an ever-evolving global landscape.

Dr B B Musmade
BOS Chairman & HOD

Dr P Malathi
Principal

Abbreviations and Definitions

NEP: National Education Policy

PEO: Program Educational Objectives

PO: Program Outcomes

PSO: Program Specific Outcomes

CO: Course Outcomes

PCC: Program Core Courses

PEC: Program Elective Courses

VSEC: Vocational and Skill Enhancement Courses

AEC: Ability Enhancement Courses

CC: Co-Curricular Courses

IKS: Indian Knowledge System

HSSM: Humanities Social Science and Management

PCC: Program Core Course

CCE: Continuous Comprehensive Evaluation

ESE: End Sem Examination **Cr**: Credits

L: Lecture

T: Tutorial

P: Practical

FY: First Year

SY: Second Year

TY: Third Year

BY: Final Year

Index

Detailed Syllabus

*****

Curriculum Structure Semester III

D Y Patil College of Engineering, Akurdi, Pune

Second Year Engineering SY B Tech Semester III (2024 Course)

Course Code	Course	Teaching Scheme				Evaluation Scheme						
							Theory % Marks			Practical % Marks		
		L	T	P	Cr	Exam	Max	Min for Pass		Max	Min for Pass	
ICE2403L01	Sensors and Transducers	3	0	0	3	CCE	50	20	40			
						ESE	50	20				
ICE2403P01	Sensors and Transducers Lab	0	0	2	1	CCE				50	20	40
						ESE				50	20	
ICE2403L02	Applied Mathematics for Control and Signal Processing	3	0	0	3	CCE	50	20	40			
						ESE	50	40				
ICE2403L03	Analog Electronics	2	0	0	2	CCE	50	20	40			
						ESE	50	20				
ICE2403L03	Analog Electronics Lab	0	0	2	1	CCE	50	20	40			
						ESE	50	20				
ICEMDM2403L01	Test and Measuring Instruments	2	0	0	2	CCE	50	40	40			
						ESE	50	40				
ICEOE2403L01	Open Elective 1: Marine Technology	4	0	0	4	CCE	50	20	40			
						ESE	50	20				
IC124OE301	Entrepreneurship/Economics and Management 1	2	0	0	2	CCE	50	20	40			
						ESE	50	20				
IC124VS301	Value Education Course 1	2	0	0	2	CCE	50	20				
IC124FP301	Field Engineering Project	0	0	4	2	CCE	100	40				
IC124NC301	Non Credit Course- Design Thinking	0	0	2	0	CCE	50	20				
IC124NC302	Non Credit Course - Employability Skills	0	0	2	0	CCE	50	20				
	Total	**18**	**0**	**12**	**22**							
L	Lecture	**Theory**		**18**	**Hrs**							
T	Tutorial	**Pract/Lab**		**12**								
P	Practical	**Total**		**30**								
Cr	Credits											
NC	Non Credit Course (Pass/Fail)											
CCE	Continuous and Comprehensive Evaluation	Written exam, Presentations, Model-based Evaluation, Quiz/ group assignment, pair-to-pair assessment.										
ESE	End Semester Examination											

Curriculum Structure Semester IV

D Y Patil College of Engineering, Akurdi, Pune														
Second Year Engineering SY B Tech Semester IV(2024 Course)														
Course Code	Course	Teaching Scheme				Evaluation Scheme								
		L	T	P	Cr	Exam	Theory % Marks			Practical % Marks				
							Max	Min for Pass		Max	Min for Pass			
ICE2404L01	Process Control	3	0	0	3	CCE	50	20	40					
						ESE	50	20						
ICE2404P01	Process Control Lab	0	0	2	1	CCE				50	20	40		
						ESE				50	20			
ICE2404L02	Digital Electronics	3	0	0	3	CCE	50	20	40					
						ESE	50	20						
ICE2404P02	Digital Electronics lab	0	0	2	1	CCE				50	20	40		
						ESE				50	20			
ICE2404L03	Signals and Systems	2	0	0	2	CCE	50	20	40					
						ESE	50	20						
ICEMDM2404L01	Control System Components	2	0	0	2	CCE	50	20	40					
						ESE	50	20						
ICEOE2404L01	Open Electrive 2: Six Sigma	2	0	0	2	CCE	50	20	40					
						ESE	50	20						
IC124VC401	Vocational and Skill Enhancement Course 3	1	0	2	2	CCE	100	40						
IC124AC401	Ability Enhancement Course2	1	0	2	2	CCE	100	40						
IC124EM402	Entrepreneurship/Economics and Management 2	2	0	0	2	CCE	50	20	40					
						ESE	50	20						
IC124VC402	Value Education Course 2	2	0	0	2	CCE	50	20						
IC124NC303	Non Credit Course	0	0	2	0	CCE	50	20						
IC124NC304	Non Credit Course - Employability Skills	0	0	2	0	CCE	50	20						
	Total	**18**	**0**	**12**	**22**									
L	Lecture	**Theory**		**18**	Hrs									
T	Tutorial	**Pract/Lab**		**12**										
P	Practical	**Total**		**30**										
Cr	Credits													
NC	Non Credit Course (Pass/Fail)													
CCE	Continuous and Comprehensive Evaluation	Written exam, Presentations, Model-based Evaluation, Quiz/ group assignment, pair-to-pair assessment.												
ESE	End Semester Examination													
Rev 9	***27-3-2025***													

Teaching Scheme	Evaluation Scheme

Course Category	Program Core Course			Course Code		ICE2403L01		
Course Title	Sensors and Transducers							
L	T	P	Cr	Exam	Theory Marks		Practical Marks	
					Max	Min Marks for Pass	Max	Min for Pass
3	0	0	3	CCE	50	20	-	-
Total Hours				ESE	50	20	40	
39	0	0	Total hrs: 39		100			

Prerequisites: Electronics and Electrical Engineering, Engineering Physics

Course Objectives: (Min 3)

1. Understand the principles and types of sensors and transducers.
2. Select appropriate sensors for various applications.
3. Identify, understand and analyze the working of sensor.
4. Design of signal conditioning circuits for sensors and transducers.

Course Outcomes: After successful completion of the course the student will be able to

CO1	Apply knowledge of construction, working principle and characteristics of sensors.
CO2	Select temperature and pressure sensors for real life applications.
CO3	Analyse the performance of level and flow sensors.
CO4	Examine the performance of displacement and vibration sensors
CO5	Design of conditioning circuit for measurement of physical parameters using sensor.

Syllabus

Unit I	**Unit 1: Introduction to Sensors and Transducers**	**5 hrs**
	Definition and classification of sensors and Transducers, Basic Principles and Operation of Resistive, Capacitive, Inductive, Optical and Electro-mechanical sensors, performance characteristics and selection criteria.	
Unit II	**Temperature and Pressure Measurement**	**6 hrs**
	Construction, working, characteristics and types of temp sensors. Infrared sensors, pyrometers, Temperature measuring ICs LM35, Bimetallic temperature sensors Construction, working, characteristics and types of pressure sensors. Pressure units and their conversions, train Gauges, load cell, Piezoelectric Sensors, Bourdon tube, elastic sensors, high pressure measurement, vacuum measurement, optical sensors.	
Unit III	**Flow and Level Measurement**	**6 hrs**
	Types of flow and flow patterns, classification of flow sensors, Head type flow meters. Positive Displacement Flow Meters, Turbine Flow Meters, Electromagnetic Flow Meters, Ultrasonic Flow Meters, Thermal Mass Flow Meters, Variable Area Flow Meters. Construction, Working and types level sensors. Ultrasonic, Radar Level Sensors, LASER Level sensors, Float Level Sensors, Optical, Pressure based level sensors, Conductive Level Sensors.	

Unit IV	**Miscellaneous Measurement**	**6 hrs**
	Study of sensors used for the measurement of Displacement, Torque, Speed, Force, Vibration, Proximity, Accelerometer, Image sensors.	
Unit V	**Data acquisition using sensors**	**5 hrs**
	Overview, hardware and software, Configuration of DAQ systems for different types of sensors, Data logging and real-time monitoring. Importance of signal conditioning in data acquisition techniques: amplification, filtering, analog-to-digital conversion, Noise reduction and signal processing methods.	

References

Text Books

1. B.C Nakra, K.K. Chaudhary, Instrumentation, Measurement and Analysis, Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. A. K. Sawhney, Puneet Sawhney, A course in Electrical and Electronic Measurement and Instrumentation, Dhanpat Rai and Co.
3. Rangan, Mani, Sharma. Instrumentation systems and Devices, Tata McGraw Hill.
4. S. K. Singh, Industrial Instrumentation and Control, Tata McGraw-Hill Publishing Company Limited, New Delhi.

Reference Books

5. Doeblin E.D., Measurement system, Tata McGraw Hill.
6. Bela G. Liptak, Instrument Engineers' Handbook, Fourth Edition, Volume One: Process Measurement and Analysis.
7. Neubert Hermann K. P., Instrument Transducer, Oxford University Press, New Delhi.
8. Johnson Curtis D., Process Control Instrumentation Technology.
9. S.P. Sukhatme, Heat Transfer, University Press.
10. B.E. Jones, Instrument Technology.
11. Chortle Keith R., Fundamentals of Test, Measurement Instrument Instrumentation, ISA Publication.
12. Alan S Morris, Measurement and Instrumentation Principles.
13. D. V. S. Murty, Transducers and Instrumentation, PHI, New Delhi.

Journal : Journal of Sensor by willy.

Website: https://onlinecourses.nptel.ac.in/noc23_ee105/preview

Scheme for Examination

Component	Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Total	Pass
CCE	Faculty	5	5	5	5	5	25	20
	Department	CCE through any 3 evaluation methods					25	
		5	5	5	5	5		
ESE	Institute	10	10	10	10	10	50	20

Component	Level	Parameters	Marks	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Progressive Evaluation	Understanding Viva Voce	20	50	20
		Involvement, Participation, and Engagement	10		
		Quality of Submission of Report	10		
		Participation in teaching learning process	10		
	End Evaluation	Performance	25	50	20
		Oral Examination	25		

CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination, UT: Unit Test

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2					1			2	2	1
CO2	3	1	2							2	3	1	1
CO3	2	3	2			2		1	2	2	3	2	1
CO4	3	2	1			1			2		2	1	2
CO5	3	1	2								2	1	

3: High, 2: Moderate, 1: Low, 0: No Mapping

Course Category	Program Core Course	Course Code	ICE2403P01
Course Title	Sensors and Transducers Laboratory		

Teaching Scheme				Evaluation Scheme				
					Theory Marks		Practical Marks	
L	T	P	Cr	Exam	Max	Min Marks for Pass	Max	Min for Pass
	0	2	1	CCE			100	40

Prerequisites: Engineering Physics, Electical and Electronics Engg.	
Course Objectives: (Min 3)	
1. To familiarize the students to the basic principles of various transducers. 2. To impart knowledge in static and dynamic characteristics of sensors. 3. To impart knowledge in the design of signal conditioning circuits for transducers.	
Course Outcomes: After successful completion of the course the student will be able to	
CO1	Analyze the static characteristics of measurement systems.
CO2	Design signal conditioning circuits for level sensors
CO3	Design signal conditioning circuits for temerature sensors
CO4	Formulate the design specification of transducer for a given application.

List of Experiments /Assignments/Micro Project

Sr.	Experiment (Any 8)
1	Characteristics of (Resistive and Thermo emf) temperature sensor
2	Characteristics of Piezoelectric measurement system
3	Measurement of displacement using LVDT
4	Characteristics of Hall effect sensor
5	Measurement of strain using strain gauges
6	Measurement of torque using Strain gauges
7	Measurement using proximity sensors
8	Characteristics of capacitive measurement systems
9	Loading effects of Potentiometer
10	Design of Opto-coupler using photoelectric transducers

References

Text Books:

1. John P. Bentley, Principles of Measurement Systems, Pearson Education, 4th Edition, 2005.
2. Doebelin E.0, Measurement Systems - Application and Design, McGraw-Hill, 4th Edition, 2004.
3. S.M. Sze, Semiconductor sensors, John Wiley & Sons Inc., 3rd edition, 2006.

References Books:

1. John G. Webster, Sensors and Signal Conditioning, Wiley Inter Science, 2nd edition,2008

2. Patranabis, Sensors and Transducers, Prentice Hall, 2nd edition,2003.

3. Alok Baura, Fundamentals of Industrial Instrumentation, Wiley India Pvt. Ltd,2011.

4. Murthy D. V. S, Transducers and Instrumentation, Prentice Hall, 2nd Edition,201

Journal Papers:
Authors, *Title of Paper*, Name of Journal, Vol (issue), pp, Year, DOI
Website: https://onlinecourses.nptel.ac.in/noc20_mg38/preview

Scheme for Examination

Component	Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Total	Pass
CCE	Faculty	5	5	5	5	5	25	20
	Department	CCE through any 3 evaluation methods					25	
		5	5	5	5	5		
ESE	Institute	10	10	10	10	10	50	20

Scheme for Continuous Evaluation

Component	Level	Parameters	Marks	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Progressive Evaluation	Understanding Viva Voce	20	50	20
		Involvement, Participation, and Engagement	10		
		Quality of Submission of Report	10		
		Participation in teaching learning process	10		
	End Evaluation	Performance	25	50	20
		Oral Examination	25		

CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination, UT: Unit Test

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PO1
CO1	3	2	1		1	3	2			2	1	3		1
CO2	2	1	2							1	2	3	2	
CO3	3	2	1	1						1		3	2	
CO4	1	2	1							2	2	3	1	1
CO5	3	2	1							1	2	2		2

3: High, 2: Moderate, 1: Low, 0: No Mapping

Course Category	Program Core Course	Course Code	ICE2403L02
Course Title	Applied Mathematics for Control and Signal Processing		

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max	Min Marks for Pass		Max	Min for Pass
3	0	0	3	CCE	50	20			
Total Hours				ESE	50	20	40	-	-
39	0	0	Total hrs: 39		100				

Prerequisites: Engg Mathematics-I and Engineering Mathematics-II.	
Course Objectives:	
1. To make the students familiarize with concepts and techniques in Ordinary differential equations, Fourier Transform, Laplace-Transform, Statistical methods and Probability. 2. The aim is to equip them with the techniques to understand advanced level mathematics nd its applications that would enhance analytical thinking power, useful in their disciplines	
Course Outcomes: After successful completion of the course the student will be able to	
CO1	**Solve** higher order linear differential equations using appropriate techniques for modelling, analysing electrical circuits and control systems.
CO2	**Apply** the concept Laplace Transform and its applications to continuous & discrete systems, signal & image processing and communication systems. .
CO3	**Use** the concept Fourier Transform and its applications to continuous & discrete systems, signal & image processing and communication systems. .
CO4	**Apply** Statistical methods like correlation, regression as applicable to analyze and interpret experimental data related to energy management, power systems, testing and quality control
CO5	**Apply** Probability theory as applicable to analyze and interpret experimental data related to energy management, power systems, testing and quality control.

Syllabus

Unit I	**Differential Equation & Its Application**	**7 hrs**
	LDE of nth order with constant coefficients, Complementary Function, Particular Integral, Short methods, Method of variation of parameters, Cauchys and Legendre‟s DE. Modeling of Electrical circuits.	
Unit II	**Integral Transforms**	**8 hrs**
	Laplace Transform (LT): Definition of LT, Inverse LT, Properties & theorems, LT of standard functions, LT of some special function. Applications of LT for solving Linear differential equations	
Unit III	**Transforms for Signal and Control Systems**	**8 hrs**
	Fourier Transform (FT): Complex exponential form of Fourier series, Fourier integral theorem, Fourier Sine & Cosine integrals, Fourier transform, Fourier Sine & Cosine transforms and their inverses. Z-Transform (ZT): Introduction, Definition, Standard properties, Z To F standard sequences and their inverses. Solution of difference equations.	

Unit IV	**Statistics**	**8 hrs**
	Measures of central tendency, Measures of dispersion, Coefficient of variation, Moments, Skewness and Kurtosis, Correlation and Regression, Reliability of Regression estimates.	
Unit V	**Probability**	**8 hrs**
	Probability, Random variables, Mathematical Expectation, Probability distributions: Binomial, Poisson, Normal.	

References

Text Books:

1. Higher Engineering Mathematics by B. V. Ramana (Tata McGraw Hill)
2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi.

References Books:

1. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.)
2. Advanced Engineering Mathematics by M. D. Greenberg (Pearson Education)
3. Advanced Engineering Mathematics by Peter V. O'Neil (Thomson Learning)
4. Thomas' Calculus by George B. Thomas, (Addison-Wesley, Pearson)
5. Applied Mathematics (Vol. I and II) by P.N. Wartikar and J.N.Wartikar Vidyarthi Griha Prakashan, Pune.
6. Differential Equations by S. L. Ross (John Wiley and Sons)**Journal Papers:**

Authors, *Title of Paper*, Name of Journal, Vol (issue), pp, Year, DOI
Website: https://onlinecourses.nptel.ac.in/noc20_mg38/preview

Scheme for Examination

Component	Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Total	Pass
CCE	Faculty	5	5	5	5	5	25	20
	Department	CCE through any 3 evaluation methods					25	
		5	5	5	5	5		
ESE	Institute	10	10	10	10	10	50	20

Component	Level	Parameters	Marks	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Progressive Evaluation	Understanding Viva Voce	20	50	20
		Involvement, Participation, and Engagement	10		
		Quality of Submission of Report	10		
		Participation in teaching learning process	10		
	End Evaluation	Performance	25	50	20
		Oral Examination	25		

CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination, UT: Unit Test

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2							2	2	2	1
CO2	3	3	1							2	2	2	
CO3	2	1	1							1	2		3
CO4	2	2	2					1	1		2		1
CO5	2	2	2					1			3	1	

3: High, 2: Moderate, 1: Low, 0: No Mapping

Course Category	Program Core Course			Course Code		ICE2403L03			
Course Title	Analog Electronics								
Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max	Min Marks for Pass		Max	Min for Pass
3	0	0	3	CCE	50	20	40	-	-
Total Hours				ESE	50	20			
39	0	0	Total hrs: 39		100				

Prerequisites: Engineering Physics	
Course Objectives: (Min 3)	
1. **Analyze** the working principles and design of various operational amplifier (Op-Amp) circuits for different applications. 2. **Design** and **implement** signal generators and filters using analog electronic components. 3. **Evaluate** the characteristics and applications of power devices and special purpose ICs, including voltage regulators and converters.	
Course Outcomes (COs): The students will be able to	
CO1	**Explain** the types, characteristics, and biasing of BJTs and FETs, and their applications in amplifiers and switching circuits.
CO2	**Design** and **analyze** inverting and non-inverting Op-Amp circuits, including adders, differential amplifiers, and oscillators.
CO3	**Construct** and **test** various signal generators and filters, such as multi-vibrators, triangular wave generators, and Butterworth filters.
CO4	**Assess** the performance and applications of power devices like SCR, Triac, DIAC, UJT, MOSFET, and IGBT.
CO5	**Implement** circuits using special purpose ICs, such as voltage controlled oscillators, phase locked loops, and voltage regulators, and **evaluate** their performance.

Syllabus

Unit I	**Operational Amplifiers Fundamentals**	**7 hrs**
	Block diagram of Operational amplifier, Characteristics of Operational amplifier, Causes of Slew rate, Measurement of Slew rate (SR), Common Mode Rejection Ratio (CMRR), Power Supply Rejection ratio (PSRR/SVRR), Frequency response	
Unit II	**Operational Amplifier Circuits**	**8 hrs**
	Inverting and non-inverting amplifiers, adder, differential and summing amplifiers, Schmitt trigger, sample and hold circuits, precision rectifiers, I-V and V-I converters, Instrumentation amplifier	
Unit III	**Signal Generators and Filters**	**8 hrs**
	Triangular wave generator, Sawtooth wave generator, square wave generator, sine wave generator. Basics of filters, low pass and high pass Butterworth filters, band pass and band reject filters, filter specifications, and applications.	
Unit IV	**Power Devices and Applications**	**8 hrs**
	SCR, Triac, DIAC, UJT, MOSFET, IGBT - characteristics, principles of operation, switching characteristics, triggering requirements, protections, performance specifications, and applications.	
Unit V	**Timers and Regulators**	**8 hrs**
	Block diagram of IC 555 , Astable, Monostable and Bistable Multivibrators, Applications of IC555 for PWM,Frequency modulation,VCO Performance parameters (line regulation, load regulation, ripple rejection), fixed voltage regulators (IC78xx, 79xx), linear voltage regulator IC723.	

References

Text Books:

1. "Op-Amps and Linear Integrated Circuits" by Ramakant A. Gayakwad
2. "Power Electronics: Circuits, Devices, and Applications" by Muhammad H. Rashid
3. "Analog Integrated Circuit Design" by David A. Johns and Ken Martin
4. "Linear Integrated Circuits" by D. Roy Choudhury and Shail B. Jain

References Books:

5. Paul Horowitz, Winfield Hill, “The Art of Electronics”, 2 nd Ed., Cambridge University press, 2008.

Journal Papers:

Authors: Michael Lee, Sarah Davis Title of Paper: "Design and Application of Analog Circuits" Name of Journal: Analog Integrated Circuits and Signal Processing Vol (issue): 45(1) pp: 45-67 Year: 2023 DOI: 10.1007/s10470-023-001

Website : https://onlinecourses.nptel.ac.in/noc20_ee45/preview

Scheme for Examination

Component	Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Total	Pass
CCE	Faculty	5	5	5	5	5	25	20
	Department	CCE through any 3 evaluation methods					25	
		5	5	5	5	5		
ESE	Institute	10	10	10	10	10	50	20

Component	Level	Parameters	Marks	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Progressive Evaluation	Understanding Viva Voce	20	50	20
		Involvement, Participation, and Engagement	10		
		Quality of Submission of Report	10		
		Participation in teaching learning process	10		
	End Evaluation	Performance	25	50	20
		Oral Examination	25		

CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination, UT: Unit Test

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	1	-	-	-	-	-	1	3	2
CO2	3	3	3	2	2	-	-	-	-	-	2	2	
CO3	3	3	3	2	2	-	-	-	-	-	2	2	
CO4	3	2	2	1	1	-	-	-	-	-	1	1	2
CO5	3	3	3	2	2	-	-	-	-	-	2	2	

3: High, 2: Moderate, 1: Low, 0: No Mapping

Course Category	Program Core Course			Course Code	ICE2403P01				
Course Title	Analog Electronics Laboratory								
Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max	Min Marks for Pass		Max	Min for Pass
	0	2	1	CCE				100	40

Prerequisites:	
Course Objectives: (Min 3)	
Course Objectives: 1) To illustrate the basic characteristics of an Operational Amplifier. 2) To understand basic operational amplifiers circuits. 3) To design electronic circuits for Multivibrator, Voltage controlled oscillator.	
Course Outcomes (COs): The students will be able to	
CO1	understand the significance of op-amp selection for different applications.
CO2	Analyze different linear and non-linear circuits.
CO3	design electronic circuits for Phase lock loop, Sample and Hold Circuit.
CO4	design of filter and voltage regulator using special purpose ICs.

List of Experiments /Assignments/Micro Project

Sr.	Experiment (Any 8)
1	Design and implement transistor biasing circuits and measure the characteristics of BJT amplifiers.
2	Study the characteristics and applications of FETs and MOSFETs.
3	Design and analyze inverting and non-inverting amplifier circuits using operational amplifiers.
4	Design and implement an instrumentation amplifier using three Op-Amps and measure its performance.
5	Study the characteristics and triggering methods of SCRs and TRIACs.
6	Design and implement signal generator using Op-Amp.
7	Design and implement Voltage regulators: linear variable regulator LM723.

8	Design and implement VCO to determine free running frequency (F_0) using LM 566.
9	Design and implement V to F and V to F converter using LM331.

References

Text Books:

1. "Microelectronic Circuits" by Adel S. Sedra and Kenneth C. Smith
2. "Op-Amps and Linear Integrated Circuits" by Ramakant A. Gayakwad
3. "Power Electronics: Circuits, Devices, and Applications" by Muhammad H. Rashid
4. "Analog Integrated Circuit Design" by David A. Johns and Ken Martin
5. "Linear Integrated Circuits" by D. Roy Choudhury and Shail B. Jain

References Books:

1. Paul Horowitz, Winfield Hill, “The Art of Electronics”, 2 nd Ed., Cambridge University press, 2008.

Journal Papers:

Authors, *Title of Paper*, Name of Journal, Vol (issue), pp, Year, DOI

Website: https://onlinecourses.nptel.ac.in/noc20_mg38/preview

Scheme for Examination

Component	Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Total	Pass
CCE	Faculty	5	5	5	5	5	25	20
	Department	CCE through any 3 evaluation methods					25	
		5	5	5	5	5		
ESE	Institute	10	10	10	10	10	50	20

Component	Level	Parameters	Marks	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Progressive Evaluation	Understanding Viva Voce	20	50	20
		Involvement, Participation, and Engagement	10		
		Quality of Submission of Report	10		
		Participation in teaching learning process	10		
	End Evaluation	Performance	25	50	20
		Oral Examination	25		

CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination, UT: Unit Test

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	1	-	-	-	-	-	1	3	2
CO2	3	1	2	2	2	-	-	-	-	-	2	2	
CO3	3	1	2	2		-	-	-	-	-	2	2	
CO4	3	2	1	1	1	-	-	-	-	-	2	1	2
CO5	3	3	3	2	2	-	-	-	-	-	2	2	

3: High, 2: Moderate, 1: Low, 0: No Mapping

Course Category	Multi-Disciplinary Minor	Course Code	ICEMDM2404L01
Course Title: Test and Measuring Instruments			

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max	Min Marks for Pass		Max	Min for Pass
2	0	0	2	CCE	50	20			
Total Hours				ESE	50	20	40	-	-
26	0	0	Total hrs: 26		100				

Prerequisites: Engineering Physics, Electronics and Electrical Engineering

Course Objectives: (Min 3)

1. To give an overview of current, voltage and power measuring electrical, electronics and digital instruments.
2. To expose the students to the design of bridges for the measurement of resistance, capacitance and inductance.
3. To give an overview of test and measuring instruments.

Course Outcomes: After successful completion of the course the student will be able to

CO1	Familiar with various measuring instruments used to measure electrical quantities.
CO2	Able to design suitable DC and AC bridges for the measurement of R, L, C and Frequency measurement.
CO3	Suggest the kind of instrument suitable for typical measurements.
CO4	use the test and measuring instruments effectively.
CO5	Analyze the waveform using function generator

Syllabus

Unit I	**Electrical Measurements:**	**6 hrs**
	General features and Classification of electro mechanical instruments. Principles of Moving coil, moving iron instruments. Extension of instrument range: shunt and multipliers, CT and PT.	
Unit II	**Measurement of Power:**	**5 hrs**
	Electrodynamic wattmeter's, Low Power Factor (LPF) wattmeter, errors, calibration of wattmeter. Single and three phase power measurement, Hall effect wattmeter, thermal type wattmeter.	

Unit III	**Resistance, Inductance and Capacitance Measurements**	**5 hrs**
	Different methods of measuring low, medium and high resistances, measurement of inductance & capacitance with the help of AC Bridges, Q Meter.	
Unit IV	**Digital Measurement of Electrical Quantities:**	**5 hrs**
	Concept of digital measurement, block diagram Study of digital voltmeter, Digital multimeter, Digital LCR meter, Digital wattmeter and energy meters.	
Unit V	**Analyzers**	**5 hrs**
	DSO, Function generator, Audio frequency signal generation, Waveform analyzers, Spectrum analyzers	

References

Text Books:

1. Golding, E.W. and Widdis, F.C., Electrical Measurements and Measuring Instruments, A.H. Wheeler and Co, 5th Edition, 2011.
2. David A. Bell, Electronic Instrumentation and Measurements, Oxford University Press, 3rd Edition, 2013.
3. Shawney A K, A course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai and Sons. 19th revised edition, 2013.

Reference Books:

1. Cooper, W.D. and Helfric, A.D., Electronic Instrumentation and Measurement Techniques, Prentice Hall, 1st Edition, 2009.
2. Kalsi.H. S, Electronic Instrumentation, Tata McGraw Hill Education Private Limited, 3rd Edition, 2012.

Journal Papers:

Z. Qiu, M. Shimizu, Z. Wang and S. Kawamura, "A Position Estimation Method for Pneumatic Actuators Based on Flow and Pressure Sensors," in *IEEE Transactions on Instrumentation and Measurement*, vol. 73, pp. 1-9, 2024, Art no. 7509209, doi: 10.1109/TIM.2024.3476600

V. V. Shanbhag, T. J. J. Meyer, L. W. Caspers and R. Schlanbusch, "Failure Monitoring and Predictive Maintenance of Hydraulic Cylinder—State-of-the-Art Review," in *IEEE/ASME Transactions on Mechatronics*, vol. 26, no. 6, pp. 3087-3103, Dec. 2021, doi: 10.1109/TMECH.2021.3053173

Website: https://onlinecourses.nptel.ac.in/noc21_me67/preview

Scheme for Examination

Component	Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Total	Pass
CCE	Faculty	5	5	5	5	5	25	20
	Department	CCE through any 3 evaluation methods					25	
		5	5	5	5	5		
ESE	Institute	10	10	10	10	10	50	20

Component	Level	Parameters	Marks	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Progressive Evaluation	Understanding Viva Voce	20	50	20
		Involvement, Participation, and Engagement	10		
		Quality of Submission of Report	10		
		Participation in teaching learning process	10		
	End Evaluation	Performance	25	50	20
		Oral Examination	25		

CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination, UT: Unit Test

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1								2	2	
CO2	3	2	2								2	2	
CO3	2	2	3								1	2	
CO4	2	2	1								2	2	

3: High, 2: Moderate, 1: Low, 0: No Mapping

Course Category	Open Elective	Course Code	ICEOE2403L01
Course Title	Marine Technology		

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max	Min Marks for Pass		Max	Min for Pass
4	0	0	4	CCE	50	20			
Total Hours				ESE	50	20	40	-	-
39	0	0	Total hrs: 39		100				

Prerequisites: Engineering Physics, Thermodynamics

Course Objectives:

Course Objectives:

1. To expose the students to the importance of marine engineering
2. To expose the students to various controls in boilers.
3. To make the students knowledgeable in the design, installation and troubleshooting of process instruments.

Course Outcomes (COs): The students will be able to

CO1	Design of boiler controls used maritime industries.
CO2	use of various engines in marine prolusion.
CO3	evaluate refrigeration and air conditioning systems for marine engineering
CO4	apply knowledge of shafting, gear and transmission system.
CO5	demonstrate use of control system in maritime applications.

Syllabus

Unit I	**Introduction to marine engineering**	**7 hrs**
	Thermodynamic laws, work, power, energy, concept of entropy and enthalpy, units. Heat transfer- conduction, convection, radiation, heat exchangers. Turbines, pumps, their types and characteristics, cavitation.	
Unit II	**Maritime boilers and their controls:**	**8 hrs**
	Marine boilers, stack gas, economizers, superheaters, draft, calculations. Boiler Controls, Interlocks, Steam engines, steam turbines, steam cycles, calculations.	
Unit III	**Engines fundamentals:**	**8 hrs**
	Engines, cycles, indicator diagram, V-type engine, calculations. Fuel, lubrication, turbochargers, cooling systems, calculations. Gas turbines, nuclear-powered engines, cycles, calculations.	
Unit IV	**Refrigeration and air conditioning systems:**	**8 hrs**
	Refrigeration and air conditioning systems, cycles, refrigerants, calculations. Firefighting, incinerator, steering gear, rudder, propellers, desalination.	
Unit V	**Shafting and transmission system:**	**8 hrs**
	Shafting, bearing, thrust block, gear, lubrication, stern tubes, and transmission system. Sewage disposal, oily water separator, motors, generators.	

NPTEL Courses: Marine Engineering - Course

References

Text Books:

1. 1. Basic and Applied Thermodynamics by PK Nag, TMH, 2002,
2. Taylor, D.A., Introduction to Marine Engineering, Butterworths, London (1983)

Reference Books

1. Woodward, J.B., Low Speed Marine Diesel, Ocean Engineering, A Wiley series (1981)
2. Harrington, R.L. Marine Engineering, SNAME, New york (1992)
3. Pounder's Marine diesel engines and Gas turbines edited by Dough Woodyard, Elsevier Ltd,
4. Reed's Motor Engineering Knowledge for Marine Engineers by Thomas D Morton Reprinted by Adlard Coles Nautical
5. H.D. McGeorge Marine Auxiliary Machinery 7th edition.

Journal Papers:

Scheme for Examination

Component	Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Total	Pass
CCE	Faculty	5	5	5	5	5	25	20
	Department	Any 3 CCE Evaluation Methods					25	
		5	5	5	5	5		
ESE	Institute	10	10	10	10	10	50	20

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1
CO1	3	3	3	3	3			3	3	3	1	
CO2	2	2	2		2			2	2	2	2	1
CO3	1	1	1					1	1		2	
CO4	1	1	1						1		1	
CO5	1	1	1	1	1				1	1		1

3: High, 2: Moderate, 1: Low, 0: No Mapping

Course Category	Entrepreneurship/Economics/ Management Courses I	Course Code	
Course Title	Project Management		

Teaching Scheme				Evaluation Scheme					
					Theory Marks			Practical Marks	
L	T	P	Cr	Exam	Max	Min Marks for Pass		Max	Min for Pass
2	0	0	2	CCE	50	20			
Total Hours				ESE	50	20	40	-	-
26	0	0	Total hrs: 26		100				

Prerequisites: Fundamentals of Management, Indian Construction Industry, Economics.

Course Objectives:

1. Describe the various concepts involved in Project Management.
2. Explain scientific methods of planning and management
3. Demonstrates methods of manpower planning and Use various project monitoring methods.
4. Differentiate the methods of resource management and site planning.

Course Outcomes: After successful completion of the course the student will be able to

CO1	Describe project life cycle and the domains of Project Management.
CO2	Explain networking methods and their applications in planning and management
CO3	Demonstrate project monitoring techniques and their applications in project control
CO4	Apply safety norms to various types of activities
CO5	Design site layout as per the progress of site

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max	Min Marks for Pass		Max	Min for Pass
2	0	0	2	CCE	50	20	40	-	-
Total Hours				ESE	50	20			
26	0	0	Total hrs: 26		100				

Prerequisites: Engineering Physics, Electronics and Electrical Engineering	
Course Objectives:	
2. To give an overview of current, voltage and power measuring electrical, electronics and digital instruments. 2. To expose the students to the design of bridges for the measurement of resistance, capacitance and inductance. 3. To give an overview of test and measuring instruments.	
Course Outcomes: After successful completion of the course the student will be able to	
CO1	Familiar with various measuring instruments used to measure electrical quantities.
CO2	Able to design suitable DC and AC bridges for the measurement of R, L, C and Frequency measurement.
CO3	Able to suggest the kind of instrument suitable for typical measurements.
CO4	Able to use the test and measuring instruments effectively.

Syllabus

Unit I	**Introduction to Project Management**: Importance, Objectives & Functions of Management, Principles of Management, Categories of Project, Project Failure, Project--- Life Cycle Concept and Cost Components, Project Management Book of Knowledge.Different Domain Areas, Importance of Organizational Structure in Management- Authority / Responsibility Relation, Role of Project Management .	**6 hrs**
Unit II	**Project Planning and Scheduling**: WBS – Work Breakdown Structure, Gantt / Bar chart & its Limitations, Network Planning, Network analysis, Critical Path Method - Activity on Arrow, Critical Path and Types of Floats, Precedence Network Analysis, Types of Precedence Relationship, P. E. R.T. Analysis	**7 hrs**

Unit III	**Project Monitoring and Control:** Resource Allocation – Resource Smoothening and Leveling, Network Crashing – Time- Cost – Resource Optimization, Project Monitoring - Methods, Updating and Earned Value Analysis	**6 hrs**
Unit IV	**Project Resources** Objectives of Materials Management – Primary and Secondary Material Procurement Procedures -Material Requirement - Raising of Indents, Receipts, Inspection, Storage, Delivery, Record, Inventory Control - ABC Analysis, EOQ.	**4 hrs**
Unit V	**Site Planning**	
	Site Layout and Planning Safety Norms – Measures and Precautions on Site, Implementation of Safety Programs	**4 hrs**

References

Text Books:

1. Project planning and Control with PERT and CPM by DR. B.C. Punmia and K.K.Khadelwal Publisher: Firewall Media, Laxmi publication New Delhi.
2. Project management Principles and Techniques by B.B. Goel, Publisher: Deep and Deep publisher

3. **References Books:**

1. Project Management by Khatua, Oxford University Press
2. Construction Project Management-Planning, Scheduling and Controlling by K. K. Chitkara, Tata McGraw Hill Publishing Company, New Delhi.
3. Construction Management and Planning by B. Sengupta and H. Guha, Tata McGraw Hill Publishing Company, New Delhi.
4. The Essentials of Project Management by Dennis Lock, Gower Publishing Ltd. UK.
5. Essentials for Decision Makers by Asok Mukherjee, Scitech Publication, New Delhi.

Research paper: Novy, Martin and NovÃ ¡ kovÃ ¡ , Jana and Waldhans, MiloÅ ¡ Project management in building industry management, 2012, pages 189-198, volume 60, Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis, doi = 10.11118/actaun201260070189

Website:

1. https://www.pmi.org/search#q=pmbok&sort=relevancy
2. https://www.projectmanager.com/blog/precedence-diagramming-method
3. https://pmo.huit.harvard.edu/resource-planning-management%E2%80%8B
4. https://www.wrike.com/project-management-guide/faq/what-is-resource-allocation-in-projectmanagement/

Scheme for Examination

Component	Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Total	Pass
CCE	Faculty	5	5	5	5	5	25	20
	Department	CCE through any 3 evaluation methods					25	
		5	5	5	5	5		
ESE	Institute	10	10	10	10	10	50	20

Component	Level	Parameters	Marks	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Progressive Evaluation	Understanding Viva Voce	20	50	20
		Involvement, Participation, and Engagement	10		
		Quality of Submission of Report	10		
		Participation in teaching learning process	10		
	End Evaluation	Performance	25	50	20
		Oral Examination	25		

CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination, UT: Unit Test

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	0	0	0	0	0	0	1	0	0	2	1	2	
CO2	0	1	0	1	0	0	0	1	1	2	1	2	
CO3	0	1	2	0	0	0	0	0	0	2	1	2	
CO4	0	0	2	1	0	0	0	1	1	2	1	2	

3: High, 2: Moderate, 1: Low, 0: No Mapping

Course Category	Value Education Course 1	Course Code	
Course Title	Sustainable Development - 1		

Teaching Scheme				Evaluation Scheme				
					Theory Marks		Practical Marks	
L	T	P	Cr	Exam	Max	Min Marks for Pass	Max	Min for Pass
2	0	0	2	CCA	100	40	-	-
Total Hours								
26	0	0	Total hrs: 26					

Prerequisites:

Subjects Included: Sustainable Development Goals (SDG - Basic) 2 units, Environment Studies 2 units, Intellectual Property Rights (IPR) 1 unit

Course Objectives:

Understand the Concept of SDGs – Introduce students to the importance of sustainable development and the role of SDGs in global and local contexts.
Explore SDG Interconnections – Analyze how various SDGs are linked and the challenges in achieving them collectively.
Understand Environmental Issues – Examine environmental challenges and their impact on sustainable development.
Study Environmental Policies – Analyze national and global policies related to environmental sustainability.
Learn Intellectual Property Rights (IPR) – Understand the basics of patents, copyrights, trademarks, and their role in innovation.

Course Outcomes: After successful completion of the course the student will be able to

CO1	**Define** the key concepts of SDGs and LIST the 17 SDGs with their significance.
CO2	**Explain** interconnections between different SDGs and analyze their holistic impact.
CO3	**Describe** key environmental challenges and their implications for sustainable development.
CO4	**Discuss** major environmental policies and governance frameworks.
CO5	**Undertand** fundamental concepts of Intellectual Property Rights (IPR) and their applications.

Syllabus

Unit I	**Introduction to SDGs & Sustainability**	**6 hrs**
	Evolution from MDGs to SDGs, significance in the UN 2030 Agenda, India's contributions, real-world applications.	
Unit II	**SDG Targets & Interconnections**	**6 hrs**

	Understanding SDG indicators, interlinkages, roles of stakeholders, case studies, impact assessment frameworks.	
Unit III	**Environmental Challenges & Sustainability**	**5 hrs**
	Key environmental issues like climate change, biodiversity loss, pollution; impact on health and society, mitigation strategies.	
Unit IV	**Environmental Policies & Governance**	**5 hrs**
	National and global environmental policies, role of regulatory bodies, sustainability standards, case studies of successful interventions.	
Unit V	**Introduction to Intellectual Property Rights (IPR)**	**4 hrs**
	Basics of patents, copyrights, trademarks, importance in innovation and sustainability, protection of intellectual property in academia and industry.	

Scheme for Examination

Component	Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Total	Pass
CCE	Faculty	5	5	5	5	5	25	20
	Department	CCE through any 3 evaluation methods					25	
		5	5	5	5	5		
ESE	Institute	10	10	10	10	10	50	20

Component	Level	Parameters	Marks	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Progressive Evaluation	Understanding Viva Voce	20	50	20
		Involvement, Participation, and Engagement	10		
		Quality of Submission of Report	10		
		Participation in teaching learning process	10		
	End Evaluation	Performance	25	50	20
		Oral Examination	25		

CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination, UT: Unit Test

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3									3	3
CO2	3	3	3	3									3	3
CO3	3	3	3	3									3	3
CO4	3	3	3	3									3	3
CO5	3	3	3	3									3	3

3: High, 2: Moderate, 1: Low, 0: No Mapping*****

Course Category	Field Engineering Project			Course Code	FEP2403P02				
Course Title	Field Engineering Project								
Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Practical Marks			TheoryMarks	
					Max	Min Marks for Pass		Max	Min for Pass
0	0	4	2	CCE	100	40	40	-	-
Total Hours									
0	0	32	Total hrs: 32		100	40			

Prerequisites:
Course Objectives: (Min 3)
Course Objectives: To engage students in constructive learning environment and develop self-learning abilities. 2. To develop critical thinking and solving civil engineering problems by exploring and proposing sustainable solutions. 3. To integrate knowledge and skills from civil and other engineering areas. 4. To develop professional skills and project management.
Course Outcomes (COs): The students will be able to

CO1	Identify the community/ practical/ societal needs and convert the idea into a product/ process/service.
CO2	Analyse and design the physical/ mathematical/ ICT model in order to solve identified problem/project.
CO3	Create, work in team and applying the solution in practical way to specific problem.

Syllabus

	Introduction to Field Engineering Projects **1.** Principles of Problem Design Seven Steps of Problem Design **2.** Applications and Research Trends **3.** Case Studies in Control, Automation and Instrumentation Engineering	
	Group Structure: 1. There should be team/group of maximum four students. 2. The students identify, plan, manage and complete a task/ field project/activity which address the stated problem related to Control,Automation and Instrumentation Engineering engineering. 3. A supervisor / mentor faculty teacher assigned to individual groups.	

	Selection of Field Project/Problem: 1. Selection of field project/problem related to any technical aspect of Control, Automation and Instrumentation Engineering is recommended 2. Give preference to select project/problem related to solving any field problem/ issue for which suitable model can be developed or software can be used. The field project/problem selected could have different alternative solutions which could be theoretical, practical, working model, demonstration or software analysis. The project/problem selected may have multi-disciplinary approach to get the solution. 3. Filed Problem needs to refer back to a particular practical, scientific, or technical domain. 4. It is recommended to include hands-on activities, organizational and field visits, expert consultation to make students aware with current use of technologies. 5. Proper representation of project/field problem, course work and report on the results and conclusion is important for assessment of course.	

References:

M. Savin-Baden and C. Howell Major, Foundations of Problem-based Learning. McGraw-Hill Education, 2004
2. T. J. Newby, D. A. Stepich, J. D. Lehman and J. D. Russell, Instructional technology for teaching and learning: Designing instruction, integrating computers, and using media. Englewood Cliffs, NJ: Merrill/Prentice-Hall, 1996\3. S. N. Alessi and S. R. Trollip, Multimedia for learning: methods and development. Needham Heights, MA: Allyn & Bacon, 2001
4. Guerra, Aida, Ulseth, Ronald, Kolmos, Anette, PBL in Engineering Education: InternationalPerspectives on Curriculum Change, Springer, 2017
5. Mahnaz Moallem Woei Hung Nada Dabbagh- The Wiley Handbook of Problem-Based Learning, Wiley, 2019
6. Jane I. Krauss, Suzanne K. Boss, Thinking Through Project-Based Learning: Guiding DeeperInquiry.
7. John Larmer, David Ross, John R. Mergendollar, Project Based Learning (PBL) Starter Kit.
8. William N. Bender, Project-Based Learning: Differentiating Instruction for the 21st Century.
9. Bob Lenz, Justin Wells, Sally Kingston, Transforming Schools Using Project-Based Learning, Performance Assessment, and Common Core Standards.

10. Suzie Boss with John Larmer (ASCD/Buck Institute for Education), Implementing Project-Based Learning Solutions by Suzie Boss

Website for references:

1. www.pblwork.org
2. www.my.pblworks.org
3. www.swayam.gov.in/nd2_ntr20_ed12/preview
4. www.schoology.com

Scheme for Examination

Component	Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Total	Pass
CCE	Faculty	5	5	5	5	5	25	20
	Department	CCE through any 3 evaluation methods					25	
		5	5	5	5	5		
ESE	Institute	10	10	10	10	10	50	20

Component	Level	Parameters	Marks	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Progressive Evaluation	Understanding Viva Voce	20	50	20
		Involvement, Participation, and Engagement	10		
		Quality of Submission of Report	10		
		Participation in teaching learning process	10		
	End Evaluation	Performance	25	50	20
		Oral Examination	25		

CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination, UT: Unit Test

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	1	2	2	1	1	2	1	3	2
CO2	3	1	2	2	2	1	2	2	2	1	2	2	
CO3	3	1	2	2		1	2	2		1	2	2	
CO4	3	2	1	1	1	2	1	1	1	2	2	1	2
CO5	3	3	3	2	2	3	3	2	2	3	2	2	

3: High, 2: Moderate, 1: Low, 0: No Mapping

Course Category	Non Credit Course 1	Course Code	NC12403P02
Course Title	Design Thinking		

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Practical Marks			TheoryMarks	
					Max	Min Marks for Pass		Max	Min for Pass
0	0	2	0	CCE	50	20			
Total Hours							20	-	-
14	0	16	Total hrs: 28						

Prerequisites:	
Course Objectives: (Min 3)	
Course Objectives: 1.Define the concepts related to design thinking. 2. Explain the fundamentals of Design Thinking and innovation. 3. Apply the design thinking techniques for solving problems 4. Examine to work in a multidisciplinary environment. 5. Appraise the value of creativity.	
Course Outcomes (COs): The students will be able to	
CO1	understand the concepts related to design thinking.
CO2	Apply the fundamentals of Design Thinking and innovation
CO3	Investigate design thinking techniques for solving problems in various sectors
CO4	Analyze to work in a multidisciplinary environment.
CO5	Evaluate the value of creativity

Syllabus

Unit I	**Introduction to Design Thinking**	3 hrs
	Introduction to elements and principles of Design, basics of design - dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry	
Unit II	**Design Thinking Process**	**3 hrs**
	Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions. Tools of design thinking - person, costumer, journey map, brainstorming, product development Activity: Every student presents their idea in three	

	minutes, every student can present design process in the form of flow diagram or flow chart etc.	
Unit III	**Art of innovation**	**4 hrs**
	Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity. Flow and planning from idea to innovation.	
Unit IV	**Product Design**	**4 hrs**
	Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.	
Unit V	**Activity**	
	Activity: Importance of modeling, how to set specifications, Explaining their own product design	

References

Text Book(s):

1. Tim Brown, Change by design, 1/e, Harper Bollins, 2009. \
2. Idris Mootee, Design Thinking for Strategic Innovation, 1/e, Adams Media, 2014

References:

1. David Lee, Design Thinking in the Classroom, Ulysses press, 2018.
2. Shrrutin N Shetty, Design the Future, 1/e, Norton Press, 2018. \
3. William lidwell, Kritinaholden, & Jill butter, Universal principles of design, 2/e, Rockport Publishers, 2010.

E Resources: •
https://nptel.ac.in/courses/110/106/110106124/
• https://nptel.ac.in/courses/109/104/109104109/
https://swayam.gov.in/nd1_noc19_mg60/preview
https://onlinecourses.nptel.ac.in/noc22_de16/preview

Scheme for Examination

Component	Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Total	Pass
CCE	Faculty	5	5	5	5	5	25	20
	Department	CCE through any 3 evaluation methods					25	
		5	5	5	5	5		
ESE	Institute	10	10	10	10	10	50	20

Component	Level	Parameters	Marks	Total	Passing
Continuous Comprehensi	Progressiv e	Understanding Viva Voce	20	50	20
		Involvement, Participation, and	10		

ve Evaluation (CCE)	Evaluation	Engagement			
		Quality of Submission of Report	10		
		Participation in teaching learning process	10		
	End Evaluation	Performance	25	50	20
		Oral Examination	25		

CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination, UT: Unit Test

Semester-II

Teaching Scheme	Evaluation Scheme

Course Category	Program Core Course			Course Code	ICE2404L01				
Course Title	Process Control								
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max	Min Marks for Pass		Max	Min for Pass
3	0	0	3	CCE	50	20			
Total Hours				ESE	50	20	40	-	-
39	0	0	Total hrs: 39		100				

Prerequisites: Sensors and Transducers, Analog and Digital Electronics.

Course Objectives: (Min 3)

1. To understand process loop elements and ISA diagrams.
2. Study of PID Control and their tuning.
3. Use of final control elements and acessaries.

Course Outcomes: After successful completion of the course the student will be able to

CO1	Demonstrate the working of process loop components.
CO2	Understand the need of standard signals and Use DPT for level and flow measurement
CO3	Determine the response of P,I,D control actions using process reaction curve.
CO4	Analyze characteristics of control valve, select control valve for gas, vapor, and liquid service.
CO5	Demonstrate the working of control valve accessories and design a spring and diaphragm actuator.

Syllabus

Unit I	**Fundamentals of Process Control:**	**7 hrs**
	Elements of process control loop: Process variables, set point, controlled variable, manipulated variable, load variable. Representation of Process loop components using standard symbols (basics with reference to control loop), and Examples of process loops like temperature, flow, level, pressure etc. Process Characteristics: Deadtime, capacity, disturbances.	
Unit II	**Transmitters:**	**8 hrs**
	Need of transmitter, standardization of signals current, voltage and pressure signal standards, concept of live, dead zero, two and four wire transmitters. Electronic Capacitive Differential Pressure Transmitter: Types, installation, calibration setup, application of DPT for level and flow measurement, zero elevation and suppression, manifold. SMART: Comparison with conventional transmitter, block schematic, specifications. Converters: Difference between converter and transmitter, current to pressure converter, pressure to current converter.	
Unit III	**Controller Principles:**	**8 hrs**
	Error, variable range, direct/reverse action. Discontinuous: two position, multi-position and floating control modes. Continuous: Proportional, integral, derivative, proportional-integral, proportional- derivative,	

	proportional- integral-derivative (PID) control modes, reset windup, rate before reset, bumpless transfer. Ziegler Nichols (closed loop), & Frequency response method. Digital PID controllers	
Unit IV	**Tuning of Controller:**	
	Tuning Methods: Process reaction curve (open loop), Ziegler Nichols (closed loop), & Frequency response method. Digital PID controllers: Velocity & Position algorithm, Block schematic, Faceplate of Digital controller, Introduction to Direct Digital Control.	
Unit V	**Control valves and Actuators**	**8 hrs**
	Control valve terminology, fail-safe actions, cavitation, flashing and noise, their effects and remedies. Control valve characteristics, Control valve classification, globe- Single seated, double seated, 3-way, diaphragm, rotary, angle, Gate, Needle, ball, butterfly. Actuators: construction, and applications. Design of a spring and diaphragm actuators.Positioners.	

References

Text Books:

1. C. D. Johnson, “Process control and Instrument technology”, Tata McGraw Hill Publications, 08th Ed.
2. N.A. Anderson, Boca Ratan, “Instrumentation for Process measurement and control”, Radnor Pennsylvania, CRC Press, 03rd Ed..

References Books:

1. G. Liptak, “Process Control”, Instrument Engineering Hand book CRC Press, 03rd Ed.
2. “Tuning of industrial control systems”, ISA.
3. “Control valve Handbook”, ISA.

Journal Papers:

Website: https://onlinecourses.nptel.ac.in/noc20_mg38/preview

Scheme for Examination

Component	Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Total	Pass
CCE	Faculty	5	5	5	5	5	25	20
	Department	CCE through any 3 evaluation methods					25	
		5	5	5	5	5		
ESE	Institute	10	10	10	10	10	50	20

Component	Level	Parameters	Marks	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Progressive Evaluation	Understanding Viva Voce	20	50	20
		Involvement, Participation, and Engagement	10		
		Quality of Submission of Report	10		
		Participation in teaching learning process	10		
	End Evaluation	Performance	25	50	20
		Oral Examination	25		

CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination, UT: Unit Test

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1
CO1	3	2	2		2	1	1	1	2	3		1
CO2	2	2	1						2	3	2	
CO3	3	3	1				2	2	2	2	2	1
CO4	2	2	2							2	1	1
CO5	2	2	2				2	2	1	2		1

3: High, 2: Moderate, 1: Low, 0: No Mapping

Course Category	Program Core Course	Course Code	ICE2404P02
Course Title	Process Control Laboratory		

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Practicaly Marks			Theory Marks	
					Max	Min Marks for Pass		Max	Min for Pass
0	0	2	3	CCE	50	20			
Total Hours				ESE	50	20	40	-	-
0	0	16	Total hrs:16		100				

Prerequisites:	
Course Objectives: (Min 3)	
1. To familiarize the students to the basic principles of variouscontrollers 2. To understand PID controllers and tuning. 3. To impart knowledge control valves and their accessories.	
Course Outcomes: After successful completion of the course the student will be able to	
CO1	Calibrate two wire transmitters for flow measurements.
CO2	Use of PID controller for level systems
CO3	Design PID controllers using tuning criteria
CO4	Apply use of control valve for a given application.

List of Experiments /Assignments/Micro Project

Sr.	Experiment (Any 8)
1	Study of D.P. Transmitter and its application for flow measurement.
2	Measurement of level using DPT.
3	Study and Calibration of I/P converter.
4	Study and Calibration of P/I converter.
5	Study & verification of different control actions (P, I, D, PI, PD, PID) for step input.
6	Study of on-off control mode for temperature control process.
7	Tuning of PID controller for temperature/pressure control loop.
8	Tuning of PID controller for level/flow control loop.
9	Study of Control valve & plot installed characteristics of Control valve 10. Control valve design using any software package.
10	Control valve design using any software package.

References

Text Books:

1. C. D. Johnson, "Process control and Instrument technology", Tata McGraw Hill Publications, 08th Ed.
2. N.A. Anderson, Boca Ratan, "Instrumentation for Process measurement and control", Radnor Pennsylvania, CRC Press, 03rd Ed..

References Books:

1. B. G. Liptak, "Process Control", Instrument Engineering Hand book CRC Press, 03rd Ed.
2. "Tuning of industrial control systems", ISA.
3. "Control valve Handbook", ISA.

Journal Papers:

Authors, *Title of Paper*, Name of Journal, Vol (issue), pp, Year, DOI
Website: https://onlinecourses.nptel.ac.in/noc20_mg38/preview

Scheme for Examination

Component	Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Total	Pass
CCE	Faculty	5	5	5	5	5	25	20
	Department	CCE through any 3 evaluation methods					25	
		5	5	5	5	5		
ESE	Institute	10	10	10	10	10	50	20

Component	Level	Parameters	Marks	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Progressive Evaluation	Understanding Viva Voce	20	50	20
		Involvement, Participation, and Engagement	10		
		Quality of Submission of Report	10		
		Participation in teaching learning process	10		
	End Evaluation	Performance	25	50	20

CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination, UT: Unit Test

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1
CO1	2	2	2	2	2	2	2	2	2			
CO2	2	2	2	2	2	2	2	2	2	2		
CO3	-	-	-	-	-	-	-	-	-	1		
CO4	-	-	-	-	-	-	-	-	-	1		
CO5	-	-	-	-	-	-	-	-	-		1	

3: High, 2: Moderate, 1: Low, 0: No Mapping

Course Category	Program Core Course				Course Code			ICE2404P02	
Course Title	Digital Electronics								
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max	Min Marks for Pass		Max	Min for Pass
3	0	0	3	CCE	50	20			
Total Hours				ESE	50	20	40	-	-
39	0	0	Total hrs: 39		100				

Prerequisites: Sensors and Transducers, Analog and Digital Electronics.

Course Objectives: (Min 3)

1. Understand and convert numerical values between various number systems and perform binary arithmetic operations.
2. Simplify logical expressions using Karnaugh Maps and the Quine-McClusky method, and design combinational circuits
3. Analyze the operation of various flip-flops and design synchronous and asynchronous counters.
4. Compare the characteristics of different digital logic families and implement interfacing techniques
5. To introduce the Embedded System building blocks along with detailed functioning of the blocks.

Course Outcomes: After successful completion of the course the student will be able to

CO1	Perform conversions and arithmetic operations, and simplify logical expressions using Boolean algebra.
CO2	Simplify logical expressions using Boolean algebra, Karnaugh Maps, and the Quine-McClusky method.
CO3	Design and implement combinational logic circuits
CO4	**Analyze** the operation of various flip-flops and **design** counters.
CO5	Gain a basic understanding of microcontroller principles needed for a specific application development.

Syllabus

Unit I	**Introdcution to Digital Electronics**	**7 hrs**
	Number Systems and Codes: Binary, Octal, Decimal, and Hexadecimal number systems; Conversion between number systems; Binary arithmetic; Signed numbers; Binary codes (BCD, Gray code, Excess-3 code), Error detecting & correcting Codes. **Logic Gates :** AND, OR, NOT, NAND, NOR, XOR, XNOR	
Unit II	**Logic Circuit Minimization Techniques**	**8 hrs**
	Simplification Techniques: Boolean algebra; De Morgan's Theorems; Karnaugh Maps (K-Maps); Quine-McClusky method , Simplification of logical functions	

Unit III	**Combinational Logic Circuits**	**8 hrs**
	Design of Combinational Circuits: Adders (Half and Full), Subtractors, Multiplexers, Demultiplexers, Encoders, Decoders, Comparators, Parity Generators and Checkers. Programmable Logic Devices: Introduction to PLDs, PALs, PLAs, and FPGAs.	
Unit IV	**Sequential Logic Circuits**	**8 hrs**
	Flip-Flops: SR, JK, MSJK, D, T flip-flops; Truth tables and Excitation tables **Counters and Registers:** Asynchronous (Ripple) counters, Synchronous counters, Up/Down counters, Ring counters, Johnson counters; Shift registers (SISO, SIPO, PISO, PIPO). State Machines: State diagrams; State tables; Design of synchronous sequential circuits; Mealy and Moore machines	
Unit V	**Digital Logic Families and Interfacing**	**8 hrs**
	Logic Families: Characteristics of digital ICs; TTL, CMOS, ECL, and their characteristics (speed, power consumption, fan-out, noise margin). **Interfacing:** Interfacing TTL and CMOS ICs; Tristate logic; Open collector outputs; Interfacing with analog systems (ADC and DAC).	

References

Text Books:

1. Floyd “Digital Principles”, Pearson Education, 11th Ed.

2. Gothman, ‘Digital Electronics’, 2nd edition, PHI 3. M. Morris Mano,’ Digital Design’,

Pearson Education, 03rd Ed.

Reference Books:

1. The 8051 Microcontroller Architecture, Programming and Applications by Kenneth J.Ayala, Penram International Publications.
2. The 8051 Microcontroller Based Embedded Systems”, Manish K Patel, McGraw Hill 2014, ISBN: 978-93-329-0125-4.
3. "Digital Design" by M. Morris Mano and Michael D. Ciletti
4. "Digital Fundamentals" by Thomas L. Floyd
5. "Modern Digital Electronics" by R. P. Jain

Journal Papers:

Authors: Amine Saddik, Rachid Latif, Abdelhafid El Ouardi, Mohamed Elhoseny, Adel Khelifi **Title of Paper**: Computer development based embedded systems in precision agriculture: tools and application **Name of Journal**: Acta Agriculturae Scandinavica Section B - Soil & Plant Science **pp**: 1-23 **Year**: 2022 **DOI**: 10.1080/09064710.2021.2024874

MLgIRKafl**Website : https://archive.nptel.ac.in/courses/108/105/108105132/#**

Scheme for Examination

Component	Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Total	Pass
CCE	Faculty	5	5	5	5	5	25	20
	Department	CCE through any 3 evaluation methods					25	
		5	5	5	5	5		
ESE	Institute	10	10	10	10	10	50	20

Component	Level	Parameters	Marks	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Progressive Evaluation	Understanding Viva Voce	20	50	20
		Involvement, Participation, and Engagement	10		
		Quality of Submission of Report	10		
		Participation in teaching learning process	10		
	End Evaluation	Performance	25	50	20

CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination, UT: Unit Test

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1
CO1	3	3	2	2	2	-	-	1	-	2		
CO2	3	3	3	2	3	-	1	1	1	2		
CO3	3	3	3	3	3	-	1	1	1	2		
CO4	3	3	3	2	3	-	1	1	1	2		
CO5	3	0	1	0	1	1	1	2	0	3		

3: High, 2: Moderate, 1: Low, 0: No Mapping

Course Category	Program Core Course	Course Code	ICE2404P02
Course Title	Digital Electronics		

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Practicaly Marks			Theory Marks	
					Max	Min Marks for Pass		Max	Min for Pass
0	0	2	1	CCE	50	20			
Total Hours				ESE	50	20	40	-	-
0	0	16	Total hrs:16		100				

Prerequisites:	
Course Objectives: (Min 3)	
Course Outcomes: After successful completion of the course the student will be able to	
CO1	Understand different logic families.
CO2	Understand operation basics of flip-flops, registers, decoders, encoders, multiplexers and de-multiplexers.
CO3	Design synchronous, asynchronous sequential and non- sequential counters.
CO4	Design digital clock and frequency counter circuits.

List of Experiments /Assignments/Micro Project

Sr.	Experiment (Any 8)
1	Verification of truth table of various logic gates and study of input & output characteristics of TTL logic family
2	Code Conversion
3	Design and Implementation of full adder and subtractor using logic gates.
4	Study of Multiplexer IC 74151
5	Study of Flip –Flop ICs (7476,7474) and conversion of flip –flop from one other
6	Implementation of counter of different Mod numbers using 7490 & 7493 ICs
7	Design of 1-bit and 2-bit comparator using logic gates.
8	Design Ring & Johnson counters using shift register IC 7495
9	Interfacing of TTL and CMOS ICs
10	Write and execute basic programs for the 8051 microcontroller to perform tasks such as blinking an LED, reading input from switches, and displaying output on a 7-segment display.

References

Text Books:
3. Floyd "Digital Principles", Pearson Education, 11th Ed.
4. Gothman, 'Digital Electronics', 2nd edition, PHI 3. M. Morris Mano,' Digital Design', Pearson Education, 03rd Ed.
Reference Books:
1. Leach, Malvino , Saha; Digital Principles and Applications; 7th Edition, McGraw Hill.
2. R. P. Jain; Modern Digital Electronics; 4th Edition, McGraw Hill.
Journal Papers:

Authors, *Title of Paper*, Name of Journal, Vol (issue), pp, Year, DOI
Website: https://onlinecourses.nptel.ac.in/noc20_mg38/preview

Scheme for Examination

Component	Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Total	Pass
CCE	Faculty	5	5	5	5	5	25	20
	Department	CCE through any 3 evaluation methods					25	
		5	5	5	5	5		
ESE	Institute	10	10	10	10	10	50	20

Component	Level	Parameters	Marks	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Progressive Evaluation	Understanding Viva Voce	20	50	20
		Involvement, Participation, and Engagement	10		
		Quality of Submission of Report	10		
		Participation in teaching learning process	10		
	End Evaluation	Performance	25	50	20

CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination, UT: Unit Test

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	2	-	-	-	1	-	2		1
CO2	3	3	3	2	3	-	-	1	1	1	2	2	
CO3	3	3	3	3	3	-	-	1	1	1	2	1	
CO4	3	3	3	2	3	-	-	1	1	1	2	2	
CO5	3	0	1	0	1	1	2	1	2	0	3		2

3: High, 2: Moderate, 1: Low, 0: No Mapping

Course Title	

Course Category	Program Core Course	Course Code	ICE2404L03
Course Title	Signals and Systems		

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max	Min Marks for Pass		Max	Min for Pass
3	0	0	3	CCE	50	20			
Total Hours				ESE	50	20	40	-	-
39	0	0	Total hrs: 39		100				

Prerequisites:

Course Objectives: (Min 3)

1.To introduce the student to identify and represent the type of signals and systems.

2. To introduce the mathematical tools available to analyze continuous time signals and systems.

3. To introduce the mathematical tools available to analyze discrete time signals and systems.

4. To introduce about the random phenomena in the real world, the mathematical models and pseudo-random signals in identifying system

Course Outcomes: After successful completion of the course the student will be able to

CO1	Classify the signals and systems based on their properties
CO2	Determine the response of LTI system using convolution
CO3	Determine Fourier series of Continuous time signals and Discrete time signals
CO4	Analyze the spectral characteristics of signals and systems using Fourier transforms.
CO5	Apply Z transform to analyze continuous and discrete time systems

Syllabus

Unit I	Introduction to Signals and Systems	**7 hrs**
	Definition of signal and systems, Continuous time and discrete time signal. Classification of signals: Even and Odd, Periodic and Non-periodic, Energy and Power, Deterministic and random signal. Basic Elementary Operations on signals: Amplitude scaling, addition, multiplication, subtraction, time scaling, time shifting and time folding. Classification of Systems: linear and non-linear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible.	
Unit II	Time domain representation of LTI System	**8 hrs**
	Definition of LTI System, Convolution Integral, Convolution Sum, Properties of Impulse Response representations for LTI systems, Cascade connection of systems, Parallel connection of systems,	

	Causality and stability of LTI systems	
Unit III	Fourier Series	**8 hrs**
	Continuous Time Fourier Series representation Types of Fourier Series, Convergence of Fourier Series-Dirichlet conditions, Properties of Fourier Series, Discrete Time Fourier Series: Definition, Convergence, Properties	
Unit IV	Fourier Transform	**8 hrs**
	Purpose, Definition, Existence of Fourier Transform- Dirichlet conditions, Properties, Inverse Fourier Transform, DTFT: Definition, Properties	
Unit V	Z-Transform	**8 hrs**
	Definition, ROC, Properties of the ROC, Properties of Z-Transform, Z-transform of Standard signals, Inverse Z-Transform, Relationship between Z-transform and DTFT	

References

Text Books:
1. Gabel R.A. and Robert R.A., Signals and Linear Systems, John Wiley and Sons, 3rd Edition, 1987.

2. Oppenheim A.V., Wilsky and Nawab, Signals and Systems, Pearson India Education Services Private limited India, 2nd Edition, 2016.

3. Chen C.T., Systems and Signal Analysis - A Fresh Look, Oxford University Press India, 3rd Edition, 2004.

4. B.P. Lathi, Principles of Linear Systems and Signals, Oxford University Press, 2nd Edition, 2009

References Books:
1. Cooper G.R and Mc Gillem C.D, Probabilistic Methods of Signals and System Analysis, Oxford University Press, 3rd Edition, 1999.

2. Chesmond, Wilson and Lepla, Advanced Control System Technology, Viva Books, 1st Edition, 1998.

3. Ziemer R.E., Tranter W.H., and Fannin D.R., Signals and Systems: Continuous and Discrete, Prentice Hall, 4th Edition, 1998.

4. Oppenheim, Alan V & Verghes, G.G., Signals, Systems & Inference – Class Notes for 6.011: Introduction to Communication, Control & Signal Processing, MIT Open Courseware.

Journal Papers:

Authors, *Title of Paper*, Name of Journal, Vol (issue), pp, Year, DOI

You Tube: https://youtu.be/xrVWB9VYZ64?si=dzFxkAHOq5CwLEXY
Website: https://onlinecourses.nptel.ac.in/noc21_ee28/preview

Scheme for Examination

Component	Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Total	Pass
CCE	Faculty	5	5	5	5	5	25	20
	Department	CCE through any 3 evaluation methods					25	
		5	5	5	5	5		
ESE	Institute	10	10	10	10	10	50	20

Component	Level	Parameters	Marks	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Progressive Evaluation	Understanding Viva Voce	20	50	20
		Involvement, Participation, and Engagement	10		
		Quality of Submission of Report	10		
		Participation in teaching learning process	10		
	End Evaluation	Performance	25	50	20

CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination, UT: Unit Test

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	2							1	2	2	1
CO2	2	1	2							2	2	1	2
CO3	2	1	2							2	1	2	3
CO4	2	1	2							1	2	1	1
CO5	2	1	2							1	2	2	1

3: High, 2: Moderate, 1: Low, 0: No Mapping

Course Category	Multi Disciplinary Minor	Course Code	ICEMDM2404L02
Course Title: Control System Components			

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max	Min Marks for Pass		Max	Min for Pass
2	0	0	2	CCE	50	20			
Total Hours				ESE	50	20	40	-	-
26	0	0	Total hrs: 26		100				

Prerequisites: Engineering Physics, Sensors, Process Control	
Course Objectives: (Min 3)	
1. Comprehensive knowledge of industrial switches, relays, and contactors, 2. Equip students with the ability to design and interlock motor control circuits 3.Introduce students to the design, simulation, and implementation of a pneumatic system 4. Introduce students to electro-hydraulic systems	
Course Outcomes: After successful completion of the course the student will be able to	
CO1	Understand the use of switches for various applications
CO2	Implements logic gates using relays
CO3	Design electric wiring diagram for motor control
CO4	Design Pneumatic system for 3 way valve
CO5	compare of Pneumatic and hydraulic system

Syllabus

Unit I	Basic components	6 hrs
	Mechanical Switches, Types of switches, SPST, DPDT, SPDT, Applications, working principle: Toggle, Slide, DIP, Rotary, Thumbwheel, Selector, Push-button, Drum, Limit, Temperature, Pressure, Level, and Flow switches. PLC-compatible switches, selection of switches based on application, and troubleshooting.	
Unit II	Indsutrial Drives	5 hrs

	Relays :- constriction, working , Application, Types of relays Electromechanical relay, Reed relay, Hermetically sealed relay, Solid state relays., Implementation of logic gate using relay, Selection criteria. Contactor:- constriction, working, Application, comparison of Relay and contactor	
Unit III	**Motor Control Operations**	**5 hrs**
	Electrical Wiring diagram, Concept of sequencing & Interlocking, Starting methods: Direct-on-line (DOL), star-delta, and soft starters. Motor Control Center: Concept and wiring diagrams	
Unit IV	**Pneumatic**	**5 hrs**
	Pneumatic components: Pneumatic relay (Bleed & Non bleed, Reverse & direct) ,Single acting & Double acting cylinder, Standard Symbols used for developing pneumatic circuits.	
Unit V	**Hydraulic system**	**5 hrs**
	Hydraulic components: Hydraulic supply, Hydraulic pumps, Actuator (cylinder & motor), Hydraulic valves , Standard Symbols for developing hydraulic circuits. Comparison of Pneumatic and hydraulic system, Introduction to electro-hydraulic systems	

References

Text Books:

1. Process control and Instrument technology, C.D.Johnson, TMH, 07th Ed.

2. Process Control, Instrument Engineering Hand book, B.G. Liptak,

Reference Books:

1. ButterworthHeinemann Ltd, Butterworth-Heinemann Ltd, 3rd Edition

2. Industrial Electronics, Petruzella, McGraw-Hill, ISE Editions .

3. Pneumatic Instrumentation, Majumdhar, TMH, 01st Edition

4. Industrial Hydraulics, Pipenger, McGraw-Hill Education, 3rd Edition

Z. Qiu, M. Shimizu, Z. Wang and S. Kawamura, "A Position Estimation Method for Pneumatic Actuators Based on Flow and Pressure Sensors," in *IEEE Transactions on Instrumentation and Measurement*, vol. 73, pp. 1-9, 2024, Art no. 7509209, doi: 10.1109/TIM.2024.3476600

V. V. Shanbhag, T. J. J. Meyer, L. W. Caspers and R. Schlanbusch, "Failure Monitoring and Predictive Maintenance of Hydraulic Cylinder—State-of-the-Art Review," in *IEEE/ASME Transactions on Mechatronics*, vol. 26, no. 6, pp.

3087-3103, Dec. 2021, doi: 10.1109/TMECH.2021.3053173
Website: https://onlinecourses.nptel.ac.in/noc21_me67/preview

Scheme for Examination

Component	Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Total	Pass
CCE	Faculty	5	5	5	5	5	25	20
	Department	CCE through any 3 evaluation methods					25	
		5	5	5	5	5		
ESE	Institute	10	10	10	10	10	50	20

Component	Level	Parameters	Marks	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Progressive Evaluation	Understanding Viva Voce	20	50	20
		Involvement, Participation, and Engagement	10		
		Quality of Submission of Report	10		
		Participation in teaching learning process	10		
	End Evaluation	Performance	25	50	20

CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination, UT: Unit Test

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	2							1	2	2	1
CO2	2	1	2							2	2	1	2
CO3	2	1	2							2	1	2	3
CO4	2	1	2							1	2	1	1
CO5	2	1	2							1	2	2	1

3: High, 2: Moderate, 1: Low, 0: No Mapping

Course Category	Open Elective	Course Code	ICEOE2404L02
Course Title	Six Sigma		

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory Marks			Practical Marks	
					Max	Min Marks for Pass		Max	Min for Pass
4	0	0	4	CCE	50	20			
Total Hours				ESE	50	20	40	-	-
39	0	0	Total hrs: 39		100				

Prerequisites: Engineering Physics

Course Objectives: (Min 3)

Course Objectives:

1. Apply Six Sigma and Lean concepts to process control environments.
2. Use statistical tools for improving measurement and instrumentation systems.
3. Conduct root cause and failure mode analyses.
4. Execute improvement projects using DMAIC framework.
5. Design control strategies to maintain process stability and quality.

Course Outcomes (COs): The students will be able to

CO1	Evaluate the suitability of Six Sigma and Lean principles for optimizing measurement, instrumentation, and control system processes.
CO2	Assess Six Sigma project selection and stakeholder roles using DMAIC methodology in the context of control engineering applications.
CO3	Evaluate data collection plans and measurement system capability (GR&R) for instrumentation accuracy and repeatability.
CO4	Judge the effectiveness of root cause analysis tools such as FMEA, 5 Whys, and Fishbone diagrams in identifying failure sources in instrumentation systems.
CO5	Analyze and evaluate the impact of improvement strategies like PDCA, Kaizen, and SMED on reducing process variations and enhancing system control efficiency.

Syllabus

Unit I	Introduction to Six Sigma and Lean Principles	**7 hrs**
	Overview of Six Sigma History and Evolution (Deming, Juran, Shewhart), DMAIC vs DMADV in process improvement, Lean Basics - Waste Identification (7 wastes, 5S, JIT, Poka-Yoke, Kanban), Lean in process control, Six Sigma and Organizational Goals - Role of Six Sigma in improving process accuracy and reliability, Key Performance Indicators (KPIs), CTQs, and their relevance to control systems	
Unit II	Define Phase & Project Management in Control Systems	**8 hrs**
	Project Identification for Process Improvement-Voice of Customer (VoC), SIPOC for instrumentation projects, Selection of Six Sigma projects in control loops and system tuning, Project Charter Development-Scope, Problem Statement, Goals, Project Management Tools- Gantt Chart, WBS, Risk Management (RPN), Tollgate Reviews, Team Roles and Communication in Engineering Teams - RACI matrix, types of team dynamics (forming to adjourning)	
Unit III	Measure Phase – Data and System Performance Analysis, Basic Statistics for Process Monitoring	**8 hrs**
	Mean, Median, Standard Deviation, Range, Data Collection Techniques -Sampling techniques, Check Sheets, Interviews, Sensor-based Data Logging, Measurement System Analysis (MSA) - GR&R, Accuracy, Precision, Bias in Instrumentation, Control Charts and Sigma Metrics - DPU, DPMO, RTY, Cycle Time, COPQ relevant to process performance	
Unit IV	Analyze Phase-Root Cause and Risk Analysis, Process Mapping and Failure Analysis	**8 hrs**
	-Value Stream Mapping (VSM), FMEA (Design and Process), Fault Tree Analysis and Cause & Effect Diagrams, Root Cause Tools - 5 Whys, 8D, Force Field Analysis, Hypothesis Testing and Correlation-Basics of p-value, Type I & II Errors, Regression for prediction in sensor output, Common vs Special Cause Variations- Relevance to process instrumentation reliability	
Unit V	Improve and Control Phase – Sustaining Quality Improvements, Improvement Tools	**8 hrs**
	-Kaizen, PDCA Cycle, Cost-Benefit Analysis, SMED, Cycle-Time Reduction, Standard Work, Control Techniques -Control Plan for instrumentation, SOPs, Document Control, Training Plans, SPC and Visual Factory Tools - ImR, X-R charts, TPM, Andon systems for alerts, Sustaining Changes - Audit types, Visual Factory for control rooms and maintenance tracking.	

NPTEL Courses: Six Sigma - https://onlinecourses.nptel.ac.in/noc20_mg19/preview

References

Ramu, G. (2022). *The certified Six Sigma yellow belt handbook* (2nd ed.). ASQ Quality Press.

Munro, R. A., Maio, M. J., Nawaz, M. B., & Ramu, G. (2022). *The certified Six Sigma green belt handbook* (3rd ed.). ASQ Quality Press.

George, M. L. (2023). *Lean Six Sigma for Service* (2nd ed.). McGraw-Hill Education.

Matthews, R. (2018). *Handbook of Lean Six Sigma*. Larsen & Keller Education.

Salah, S., Rahim, A., & Carretero, J. A. (2019). *Lean Six Sigma for Leaders: A Practical Guide for Leaders to Transform the Way They Run Their Organization*. Wiley.

Pyzdek, T., & Keller, P. A. (2022). *The Six Sigma Handbook: A Complete Guide for Green Belts, Black Belts, and Managers at All Levels* (5th ed.). McGraw-Hill Education.

Scheme for Examination

Component	Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Total	Pass
CCE	Faculty	5	5	5	5	5	25	20
	Department	CCE through any 3 evaluation methods					25	
		5	5	5	5	5		
ESE	Institute	10	10	10	10	10	50	20

Component	Level	Parameters	Marks	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Progressive Evaluation	Understanding Viva Voce	20	50	20
		Involvement, Participation, and Engagement	10		
		Quality of Submission of Report	10		
		Participation in teaching learning process	10		
	End Evaluation	Performance	25	50	20

CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination, UT: Unit Test

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO101	PO11
CO1	3	3	2	2	3	1	3	3	2	3	3
CO2	3	3	3	2	3	3	3	3	3	2	2
CO3	3	3	2	2	3	3	2	3	3	2	2
CO4	3	3	3	2	3	2	3	3	3	2	3
CO5	3	3	3	3	3	3	2	3	2	3	3

3: High, 2: Moderate, 1: Low, 0: No Mapping

Course Category	Vocational and Skill Enhancement Course 3	Course Code	ICEVSEC2404L03
Course Title: Computational Techniques			

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Marks			Practical Marks	
					Max	Min Marks for Pass		Max	Min for Pass
1	0	2	2						
Total Hours				ESE			40	50	20
13	0	16	Total hrs: 29						

Prerequisites:	
Course Objectives: (Min 3)	
1. To understand the MATLAB environments. 2. Basic programs using MATLAB 3. Study of various toolboxes and its applications.	
Course Outcomes: After successful completion of the course the student will be able to	
CO1	Practice with MATLAB environment.
CO2	Develop MATLAB program for mathematical problem.
CO3	Import and Export data using MATLAB
CO4	Develop simulink model of system.
CO5	Design GUI model for specific applications

Syllabus

Unit I	Introduction to MATLAB	7 hrs
	Brief Introduction Installation of MATLAB, MatLab environment: MATLAB window Command window Workspace Command history Setting directory working with the MATLAB user interface Basic commands Assigning variables, operations with variables.	
Unit II	**Basic and Matrices Operations**	**8 hrs**
	Data types: int float, double, long character,etc, MatLab command format, BODMAS Rules, Arithmetic operations, Operators and special characters, Mathematical and logical operators. Solving arithmetic equations. Typing Matrices, Indexing of Arrays and Matrix,	

	Manipulation of Arrays and Matrix like Concatenating Matrices, etc, Transpose. Useful Matrix Generators, Subscripting, End as a subscript Deleting Rows or Columns, Matrix Arithmetic.	
Unit III	**Programming**	**8 hrs**
	Writing scripts in Matlab. M files working with script tools Writing Script file Executing script files The MATLAB Editor Saving m files Scripts, Functions, Flow Control, Conditional loop: If, elseif, else, switch Case, otherwise, break Loops: For, While, Break, Continue, return, pause, parfor, end Publishing script, Calling and exporting data form and to external sources like excel, image etc Basic	
Unit IV	**Graphics:**	**8 hrs**
	Components of figure window, Types of plots, ploting 2D Plot, single plot and multiple plots in sane figure window, Formating and Annotations Subplots, Clearing the Figure Window , Three-Dimensional Plots.	
Unit V	**GUI Design**	
	Introduction of Graphical User Interface, GUI Function, Property, GUI Component Design, GUI Container Writing the code of GUI Callback Dialog Box Menu Designing Applications.Various Functions and Toolboxes Documentation, Miscellaneous Useful Functions, Graphical, Symbolic Toolbox, Control system Toolbox, Hardware Interface	

References

Text Books:

1. A Guide to MATLAB: For Beginners and Experienced User, Brian R Hunt, Ronald L Lipsman, J.M. Rosenberg 3rd Edition

2. MATLAB for Beginners: A Gentle Approach: Peter Kattan Revised Edition.

Reference Books

3. Begging MATLAB and Simulink , Sulaymon Eshkabilov, APRESS Publication

4. MATLAB and Introduction with Application, Gilat A, John Wiley Publication,4th Edition

You Tube:

Website:

Scheme for Examination

Component	Level	Unit	Unit	Unit	Unit	Unit	Total	Pass

		I	II	III	IV	V		
CCE	Faculty	5	5	5	5	5	25	20
	Department	CCE through any 3 evaluation methods					25	
		5	5	5	5	5		
ESE	Institute	10	10	10	10	10	50	20

Component	Level	Parameters	Marks	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Progressive Evaluation	Understanding Viva Voce	20	50	20
		Involvement, Participation, and Engagement	10		
		Quality of Submission of Report	10		
		Participation in teaching learning process	10		
	End Evaluation	Performance	25	50	20

CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination, UT: Unit Test

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	2							1	2	2	1
CO2	2	1	2							2	2	1	2
CO3	2	1	2							2	1	2	3
CO4	2	1	2							1	2	1	1
CO5	2	1	2							1	2	2	1

3: High, 2: Moderate, 1: Low, 0: No Mapping

Course Code: HSM2401P01, Course Title: Soft Skills: Workplace and Life Readiness
Category: Ability Enhancement Course

Prerequisites: Basic English Grammar Skills
Course Objective: Purposes of Course are:
1. This course is designed to equip students with essential professional and technical communication skills necessary for success in the modern workplace. 2. Emphasizing both written and verbal communication 3. The course covers a wide range of topics, including effective written communication,

active listening and public speaking.	
Course Outcomes: After Successful completion of course units, students will	
CO1	Express effectively through verbal or oral communication and Write precise briefs, essays, summaries or reports and technical documents for official communication.
CO2	Students will understands ethics and values for being a good professional
CO3	Learn to work in a heterogeneous and multidisciplinary teams and handle conflicting situations in corporate world
CO4	Students will develop their leadership qualities for being a successful professional
CO5	Students will be able to constructively participate in group discussion, meetings, prepare and deliver presentations

Syllabus

Unit I	**Self-Introduction & SWOC Analysis**	**02 Hrs.**
Difference between hard skills and Soft skills, Introduction of SWOC Analysis, Importance of Soft Skills in corporate setting, Formal / Informal self-introduction, goal setting, and how to maintain your attitude towards various circumstances. Applications of SWOC in domain specific Industry		
Unit II	**Writing Skills**	**02Hrs.**
Practicing and understanding various formats of writing skills. Discussion on types of reports, various formats of report writing. Understanding Email etiquette and types of email. Writing emails on different topics. Practicing resume writing and its various formats. Types of application and how to write them.		
Unit III	**Professionalism & Ethics**	**03 Hrs.**
Understanding ethics and morals, Importance of Professional Ethics, hindrances due to absence of Work ethics, Professional etiquette – Introductions, with colleagues, attire, events, dinning, telephone, travelling, netiquette, social media, writing. Stress as integral part of life, Identifying signs and sources of stress, Steps to cope with stress – open communication, positive thinking, Belief in oneself, ability to handle failure, Retrospective thinking for future learning, Organizing skills to enhance time management, Focusing on goals, smart work vs hard work, Prioritizing activities, Perils of procrastination, Daily evaluation of “to-do” list. Case studies about development of ethics		
Unit IV	**Group Discussion & Personal Interview**	**03 Hrs.**
Introduction to Group Discussion, Difference between Group Discussion and debate, Etiquettes while conducting Group Discussion, Professional Phases to be used in Group		

Discussion, handling complexities in GD, Understanding types of Interview, Grooming and etiquette while giving an Interview, Understanding Job Description and Studying Company Profile, Strategies and techniques to ace the interview.

Unit V	**Interpersonal & Intrapersonal Skills**	**03 Hrs.**

Differences of interpersonal and interpersonal skills, Introduction of team building, Introduction to leadership and types of Leadership, Identifying your weakness and focussing on your strength to become a good leader, Introduction to Presentation Skills, 5P's of Presentation, Types of Presentation

	Practical/ Lab Sessions	
Lab Session	**Activities**	**Duration (Hrs.)**
1	Speaking Skills- Self Introduction: Introduce your friend	2
2	Team Building Activity	2
3	How to study job description and company profile : "Job Detective"	2
4	Grooming and image management	2
5	Speaking Skills- JAM Session	2
6	Speaking Skills- Debate session	2
7	Group Discussion	2
8	Group Discussion	2
9	Case study analysis : Problem solving and critical thinking : "The Problem-Solvers' Challenge"	2
10	Presentation Skills	2
11	Presentation Skills	2
12	Personal Interview – Conducting of mock interview	2
13	Personal Interview – Conducting of mock interview	2

Reference Books

1. Indrajit Bhattacharya, "An Approach to Communication Skills", Dhanpat Rai.
2. Simon Sweeney, "English for Business Communication", Cambridge University Press.
3. Sanjay Kumar and Pushpa Lata, "Communication Skills", Oxford University Press.
4. Atkinson and Hilgard's, "Introduction to Psychology", 14th Edition.
5. Kenneth G. Mcgee, "Heads Up: How to Anticipate Business Surprises & Seize

Opportunities First", Harvard Business School Press, Boston, Massachusetts.
6. R. Gajendra Singh Chauhan and Sangeeta Sharma, "Soft Skills-An integrated approach to maximize personality", Wiley Publication, ISBN: 987-81-265-5639-7

MOOC / NPTEL Courses:

1. NPTEL Course "Developing Soft skills & Personality" https://nptel.ac.in/courses/109/104/109104107/
2. NPTEL Course "Communication Skills" https://nptel.ac.in/courses/109/104/109104030/
3. NPTEL Course "Effective Writing" https://nptel.ac.in/courses/109/107/109107172/
4. NPTEL Course "Interpersonal Skills" https://nptel.ac.in/courses/109/107/109107155/

Marking Scheme for Evaluation

Marking Scheme for ISE (100)		
No	**Component**	**Marks**
1	Assignment 6 Assignments*5 Marks each = 30Marks	30
2	Quiz - Pre & Post Diagnostic Test-15 Marks Quiz on Unit 1 & 2 -15 Marks	30
3	Micro Project: Content creation- 15 Marks Presentation of the Report-15 Marks	30
4	Participation in Teaching Learning Process	10
	Total Marks:	**100**

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	0	0	0	0	0	0	1	3	0	2
CO2	0	2	0	0	0	0	3	1	0	0	2
CO3	0	0	2	0	0	1	3	3	1	3	2
CO4	0	0	0	2	0	0	3	1	0	2	2
CO5	0	0	0	0	2	0	2	2	1	1	3

3: High, 2: Moderate, 1: Low, 0: No Mapping

Course Category	Entrepreneurship/Economics/ Management Courses II	Course Code	
Course Title	Project Management and Finance		

Teaching Scheme				Evaluation Scheme					
					Theory Marks			Practical Marks	
L	T	P	Cr	Exam	Max	Min Marks for Pass		Max	Min for Pass
2	0	0	2	CCE	50	20	40	-	-
Total Hours				ESE	50	20			
26	0	0	Total hrs: 26		100				

Prerequisites: Fundamentals of Management, Mathematics

Course Objectives:

1. Describe the various concepts involved in Project Economics.
2. Select the most feasible project based on different appraisal techniques
3. Summarize the sources of project finance
4. Estimate working capital required for a project

Course Outcomes: After successful completion of the course the student will be able to

CO1	Classify various concepts in project economics
CO2	Apply the methods of project selection and recommend the best economical project.
CO3	Select Appropriate equipment for designing a project
CO4	Develop an understanding of financial management in Engineering projects
CO5	Understand working capital and its estimation for civil engineering projects

Syllabus

Unit I	**Project Economics**: Introduction to Project Economics - Definition, Principles, Importance in Construction Industry, Difference between Cost, Value, Price, Rent, Simple and Compound Interest, Profit, Cash flow Diagram, Annuities and its Types, Concept of Cost of Capital, Time Value of Money, assets, liabilities, balance sheet, numerical on preparation balance sheet, profit & loss account, difference between microeconomics and macroeconomics	**6 hrs**
Unit II	**Project Appraisal**: Types of Appraisals such as Political, Social, Environmental, Techno-Legal, Financial and Economical, Criteria for Project Selection - Benefit - Cost Analysis, NPV, IRR, Pay-Back Period, Break Even Analysis [Fundamental and Application Component],	**7 hrs**
Unit III	**Study of Project :-** Feasibility Report and Detailed Project Report (DPR) Project Selection – Decision Matrix, Technique for Order Preference using Similarity to Ideal Solution (TOPSIS), Simple Additive Weighting (SAW).	

	requirement, working capital management, estimation of working capital, components of working capital, financing resources of working capital	
Unit IV	**Project Finance:** Long- and short-term sources of finance, equity, debt government grants & alternative sources, numerical on calculation of leverage ratio, EBIT & dividend pay-out, financial market & instruments: money, market, secondary market, credit, bill & income security market; goal of financial management, key activities in financial management, banking institutions, Non Banking Financial Corporation (NBFC)	**6 hrs**
Unit V	**Working Capital:** Meaning, types of working capital, components of working capital, operating cycle, factors affecting working capital	**7 hrs**

References

Text Books:

01 Engineering Economics Management, Dr. Vilas Kulkarni and Hardik Bavishi, S. Chand Publication
02 Laws for Engineers, Vandana Bhatt and Pinky Vyas, Pro Care Publisher
03 Indian Economy, Gaurav Datt and Ashwani Mahajan, S. Chand Publication
04 Industrial Organization & Engineering Economics, T. R. Banga and S. C. Sharma, Khanna Publisher **Reference**

Books:

1. Engineering Economy, Theusen G. J. and Fabrycky W. J., 9th Edition, Prentice-Hall, Inc., New Delhi
2. Finance for Engineers: Evaluation and Funding of Capital Projects, Crundwell F. K., Springer, London
3. Financial Management, Khan and Jain, Tata McGraw-Hill Education
4. Engineering Economy, Leland T. Blank and. Anthony Tarquin, McGraw Hill
5. Case studies in Finance, Burner, McGraw Hill
6. Engineering Economics by R.Panneerselvam, PHI Learning; 2nd edition (2014)
7. Essentials for Decision Makers by Asok Mukherjee, Scitech Publication, New Delhi.

Website:

1. https://oldsite.pup.ac.in/e-content/education/Med73.pdf
2. https://www.tsu.edu/academics/colleges-and-schools/jesse-h-jones-school-of-business/pdf/fin-capitalbudgeting.pdf
3. https://mgcub.a https://aits-tpt.edu.in/wp-content/uploads/2018/08/CapitalBudgeting.pdfc.in/pdf/material/2020042918503348c3ec74a6.pdf
4. https://dducollegedu.ac.in/Datafiles/cms/ecourse%20content/Working%20Capital-BMS.pdf

Scheme for Examination

Component	Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Total	Pass
CCE	Faculty	5	5	5	5	5	25	20
	Department	CCE through any 3 evaluation methods					25	
		5	5	5	5	5		
ESE	Institute	10	10	10	10	10	50	20

Component	Level	Parameters	Marks	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Progressive Evaluation	Understanding Viva Voce	20	50	20
		Involvement, Participation, and Engagement	10		
		Quality of Submission of Report	10		
		Participation in teaching learning process	10		
	End Evaluation	Performance	25	50	20

CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination, UT: Unit Test

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	0	0	0	0	0	0	1	0	0	2	1
CO2	0	1	0	1	0	0	0	1	1	2	1
CO3	0	1	2	0	0	0	0	0	0	2	1
CO4	0	0	2	1	0	0	0	1	1	2	1

*****

Course Category	Value Education Course 2	Course Code	
Course Title	Sustainable Development - 2		

Teaching Scheme				Evaluation Scheme				
					Theory Marks		Practical Marks	
L	T	P	Cr	Exam	Max	Min Marks for Pass	Max	Min for Pass
2	0	0	2	CCA	100	40	-	-
Total Hours								
26	0	0	Total hrs: 26					

Prerequisites:

Subjects Included: Universal Human Values (UHV) 3 units, Constitution of India 1 unit, Corporate Laws 1 unit

Course Objectives:

Understand Universal Human Values (UHV) – Develop ethical, moral, and professional values in students.

Apply UHV in Personal and Professional Life – Explore human relationships, harmony, and responsible behavior.

Develop Ethical Decision-Making Skills – Analyze real-life scenarios and case studies to build decision-making abilities.

Study Constitutional Rights and Duties – Understand fundamental rights, directive principles, and governance structure.

Understand Corporate Laws – Explore the regulatory framework governing businesses and corporate ethics.

Course Outcomes: After successful completion of the course the student will be able to

CO1	**Define** the fundamental concepts of Universal Human Values (UHV).
CO2	**Explain** the significance of ethical values and human relationships in society.
CO3	**Analyze** ethical dilemmas and decision-making frameworks in professional contexts.
CO4	**Describe** the fundamental rights, duties, and governance structure of India.
CO5	**Understand** key aspects of corporate laws and ethical business practices.

Unit I	**Introduction to Universal Human Values (UHV)**	**6 hrs**
	Meaning and importance of UHV, ethical values, role in personal and professional life, self-exploration.	
Unit II	**Human Relationships & Harmony**	**6 hrs**

	Role of relationships in family, society, and workplace; conflict resolution; social responsibility; sustainability in human interactions.	
Unit III	**Ethical Decision-Making**	**6 hrs**
	Case studies on ethical dilemmas, corporate ethics, moral reasoning, frameworks for ethical decision-making.	
Unit IV	**Constitution of India**	**4 hrs**
	Fundamental rights and duties, directive principles, governance structure, significance of constitutional amendments, case laws.	
Unit V	**Corporate Laws & Business Ethics**	**4 hrs**
	Overview of business laws, corporate governance, ethical leadership, corporate social responsibility (CSR), impact of regulations on industries.	

Scheme for Examination

Component	Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Total	Pass
CCE	Faculty	5	5	5	5	5	25	20
	Department	CCE through any 3 evaluation methods					25	
		5	5	5	5	5		
ESE	Institute	10	10	10	10	10	50	20

Component	Level	Parameters	Marks	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Progressive Evaluation	Understanding Viva Voce	20	50	20
		Involvement, Participation, and Engagement	10		
		Quality of Submission of Report	10		
		Participation in teaching learning process	10		
	End Evaluation	Performance	25	50	20

CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination, UT: Unit Test

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3									3	3
CO2	3	3	3	3									3	3
CO3	3	3	3	3									3	3
CO4	3	3	3	3									3	3
CO5	3	3	3	3									3	3

3: High, 2: Moderate, 1: Low, 0: No Mapping*****

Course Code: NC3 , Course Title: Electrical Machines (Simulation)

Teaching Scheme				Evaluation Scheme				
L	T	P	Cr	Exam	Theory % Marks		Practical % Marks	
					Max	Min for Pass	Max	Min for Pass
0		2	0		--	--	--	–	–
Total Hours								
0		13	Total: 26		---	--			

Prerequisites:

Course Objectives: (Min 3)

Course Objectives:

1) To illustrate the basic characteristics of electrical Machines

2) To understand basic operations of Electrical Machines,

3) To test electrical machines.

Course Outcomes (COs): The students will be able to

CO1	Test Load Characteristics of DC shunt generator
CO2	apply Speed Control of DC motor
CO3	execute speed control of DC motor by speed control
CO4	Test slipring Induction Motor for speed control application
CO5	Determine Transformer equivalent circuit from Open Circuit and Short Circuit Test.

List of Experiments /Assignments/Micro Project

Sr.	Experiment (Any 8)
1	Familiarization of the electrical machine laboratory apparatus
2	To study the Load Characteristics of DC shunt generator
3	Speed Control of DC motor by field resistance control
4	Speed Control of DC motor by armature resistance control
5	To perform speed control of DC motor by using Ward- Leonard Method of speed control
6	Determination of Transformer equivalent circuit from Open Circuit and Short Circuit Test
7	To study Magnetisation Characteristics of DC shunt generator
8	Speed control of slipring Induction Motor

References

Simulation Platform: https://ems-iitr.vlabs.ac.in

Text Books:

1. I. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.

REFERENCES:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery”, New York, McGraw Hill Education, 2013.

2. 2. A. E. Clayton and N. N. Hancock, “Performance and design of DC machines”, CBS Publishers, 2004.

3. 3. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.

Scheme for Examination

Component	Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Total	Pass
CCE	Faculty	5	5	5	5	5	25	20
	Department	CCE through any 3 evaluation methods					25	
		5	5	5	5	5		
ESE	Institute	10	10	10	10	10	50	20

Component	Level	Parameters	Marks	Total	Passing
Continuous Comprehensive Evaluation (CCE)	Progressive Evaluation	Understanding Viva Voce	20	50	20
		Involvement, Participation, and Engagement	10		
		Quality of Submission of Report	10		
		Participation in teaching learning process	10		
	End Evaluation	Performance	25	50	20

CCE: Continuous Comprehensive Evaluation (CCE), ESE: End Semester Examination, UT: Unit Test

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	1	-	-	-	-	-	1	3	2
CO2	3	1	2	2	2	-	-	-	-	-	2	2	
CO3	3	1	2	2		-	-	-	-	-	2	2	
CO4	3	2	1	1	1	-	-	-	-	-	2	1	2
CO5	3	3	3	2	2	-	-	-	-	-	2	2	

3: High, 2: Moderate, 1: Low, 0: No Mapping

Communication Category: Non Credit Mandatory Course

Course Code: NCMC4, Course Title: Aptitude & Technical Mastery for Placements-II

Teaching Scheme				Evaluation Scheme					
L	T	P	Cr	Exam	Theory % Marks			Practical % Marks	
					Max	Min for Pass		Max	Min for Pass
0		2			--	--	--	50	20
Total Hours									
0		26	Total: 26		---	--			

Communication Category: Non Credit Mandatory Course

Prerequisites: Basic Mathematics & Fundamentals of Programming

Course Objective:

1. Strengthen **advanced aptitude and reasoning skills** for competitive placement tests.
2. Introduce **industry-relevant programming concepts** for technical rounds.
3. Provide **hands-on coding practice** on **LeetCode & HackerRank** for problemsolving.
4. Improve **data interpretation, decision-making, and coding efficiency** for placement exams.

Course Outcomes: After Successful completion of course units, students will

1. Solve **complex aptitude problems** with confidence and efficiency.
2. Demonstrate **logical reasoning and data interpretation** skills for real-world scenarios.
3. Write, debug, and optimize **Python/Java programs** to solve industry-standard coding problems.
4. Successfully attempt **company-specific technical assessments** using hands-on coding practice.

Unit I	Quantitative Aptitude	4 Hrs.
1.	Time, Speed, and Distance - Intermediate and Advanced	
2.	Areas and Volumes - Intermediate and Advanced	

Unit II	**Verbal Ability**	**03 Hrs.**
1. Critical Reasoning & Analogies 2. Sentence Completion- Advance		
Unit III	**Reasoning Ability**	**06 Hrs.**
1. Data Interpretation - Advanced 2. Cubes & Dices 3. Data Sufficiency		
Unit IV	**Career Skills**	**03 Hrs.**
1. Networking Skills 2. LinkedIn Profile Building & Internship Outreach		
Unit IV	**Tech Essentials**	**10 Hrs.**
1. Python for Non-Circuit, 2. Java for Circuit Branches 3. Programming fundamentals & applications 4. Hands-on Coding on LeetCode & HackerRank 5. Solving industry-standard problems		
Reference Books		
1. R. S. Aggarwal,. *Quantitative Aptitude for Competitive Examinations*, 3rd (Ed.). New Delhi: S. Chand Publishing 2. ETHNUS,. *Aptimithra,* 1st (Ed.). Bangalore: McGraw-Hill Education Pvt. Ltd. 3. Arun Sharma, (2016). *Quantitative Aptitude*, 7th (Ed.). Noida: McGraw Hill Education Pvt. Ltd. 4. Soft Skills & Interview Prep – Dale Carnegie, LinkedIn Learning 5. **Python & Java Programming** – CodeWithHarry, GeeksforGeeks, HackerRank, LeetCode		