alK. K. Wagh Institute of Engineering Education and Research, Nashik
(Autonomous from Academic Year 2022-23)

S. Y. B. Tech.
(R&A /Mechanical)
Pattern 2023 Semester: III/ IV
Code 2300201D: Applied Mathematics

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory :03hrs/week	**03**	**Continuous Comprehensive Evaluation: 20Marks** **InSem Exam: 20Marks** **EndSem Exam: 60Marks**

Prerequisite Courses: - Linear Algebra, Vector algebra, Differential calculus and Integral calculus.

Course Objectives:

Find General solution of higher-order linear differential equation with constant & Variable coefficient usingdifferent Methods.

Find Laplace transform and Fourier transform of functions using definition & properties & solve Ordinary
D.E. using L.T.

Recognize nature of vector fields, use different vector differential operators& able to evaluate Line, surface&Volume integrals& its application

Solve boundary value problems for Laplace's equation, heat equation, the wave equation by separation ofvariables.

Find Laplace transform and Fourier transform of functions using definition & properties & solve Ordinary
D.E. using L.T

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

	Course Outcomes	**Bloom's Level**
CO1	Define and understand basic concept of L.D.E, PDE, Transforms, Statistics, Probability and Vector Calculus.	2-Understanding
CO2	Solve the problems on LDE, PDE, vector calculus using appropriate method.	3- Apply
CO3	Apply Statistics, Probability distributions and transforms to solve real life problems.	3- Apply
CO4	Analyze complex engineering problems by using concepts of differential calculus, Statistics, Probability distributions and Transforms.	4- Analyze
CO5	Evaluate the real life problems by using concepts of differential calculus, Statistics, Probability distributions and Transforms.	5 -Evaluate

COURSE CONTENTS

Unit I	**Transforms**	**(08hr)**	**COs Mapped CO1, CO3,CO4,CO5**

Laplace Transform (LT): LT of standard functions, properties and theorems, Inverse LT,

Application of LT to solve LDE.
Fourier Transform (FT): Fourier transform, Fourier Sine & Cosine transform, Inverse Fourier Transforms.

Unit II	**Linear Differential Equations with Constant Coefficient**	**(08hrs)**	**COs Mapped CO1, CO2,CO4,CO5**

LDE of nth order with constant coefficients, Method of variation of parameters, Cauchy's & Legendre's DE, Simultaneous DE.

Unit III	**Applications of Linear Differential Equations& Partial Differential Equations**	**(08hrs)**	**COs Mapped CO1, CO2,CO4,CO5**

Modeling of Mass-spring systems, Free & Forced Damped and undamped systems. Basic concepts, method of separation of variables, modeling of Vibrating String, Wave equation, one- and two-dimensional Heat flow equations.

Unit IV	**Statistics and Probability**	**(08hrs)**	**COs Mapped CO1, CO3, CO4, CO5**

Measures of central tendency, Measures of dispersion: Standard deviation, Coefficient of variation, Moments, Skewness and Kurtosis, Correlation and Regression, Curve fitting: fitting of straight line, parabola and related curves, Correlation and Regression, Reliability of Regression Estimates. Probability, Probability distributions: Binomial, Poisson and Normal distributions

Unit V	**Vector Calculus**	**(08hrs)**	**COs Mapped – CO1, CO2,CO4,CO5**

Vector differentiation, Gradient, Divergence and Curl, Directional derivative, Solenoid and Irrotational fields, Vector identities. Line, Surface and Volume integrals, Green's Lemma, Gauss's Divergence theorem and Stokes theorem.

Text Books

1. B.V. Ramana, " Higher Engineering Mathematics ", Tata McGraw-Hill.
2. B. S. Grewal, " Higher Engineering Mathematics ", Khanna Publication, Delhi.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Eastern Ltd.

Reference Books

1. Advanced Engineering Mathematics,7e, by peter V.O. Neil(Thomson Learning)
2. P. N. Wartikar and J. N. Wartikar, "Applied Mathematics" (Volumes I and II), Pune VidyarthiGriha Prakashan, Pune.
3. Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education).
4. Advanced Engineering Mathematics with MATLAB, 2e, by Thomas L. Harman, James Dabney and Norman Richert (Brooks/Cole, Thomson Learning).

Strength of CO-PO Mapping												
	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2	--	--	--	--	--	--	--	--	--	2
CO2	3	2	1	--	1	--	--	--	--	--	--	2
CO3	3	2	1	--	1	--	--	--	--	--	--	2
CO4	3	2	1	1	1	--	--	--	--	--	--	2
CO5	3	2	1	1	1	--	--	--	--	--	--	2

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Tests on each unit using LMS (Each test for 15 M and total will be converted out of 05 M)	05
2	Problem solving through Computational Software	05
3	Tutorial (1 tutorial on each unit for 15 marks and total will be converted out of 05 M)	05
4	Group Presentation on real life problem	05

Topics for Tutorial		
Sr. No.	**Title**	**CO Mapped**
1	Examples on transforms	**CO1, CO3, CO4, CO5**
2	Examples on LDE of nth order with constant coefficients.	**CO1, CO2, CO4, CO5**
3	Examples on Applications of LDE & PDE	**CO1, CO2, CO4, CO5**
4	Examples on Statistics & Probability distributions.	**CO1, CO3, CO4, CO5**
5	Examples on Vector Calculus.	**CO1, CO2, CO4, CO5**

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K. K. Wagh Institute of Engineering Education and Research, Nashik
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S. Y. B. Tech. Robotics and Automation
Pattern 2023, Semester: III
2312202 : Name of Subject: Electrical and Electronics System

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory :03hrs/week	**03**	**In Sem Exam: 20 Marks** **End Sem Exam: 60 Marks** **CCE: 20 Marks**

Prerequisite Courses: Fundamentals of Electronics Engineering, Fundamentals of Electrical Engineering

Course Objectives:

The Electrical and Electronics System solves challenges which are related to design of robots. This subject therefore provide sound foundation for robotics and automation engineering students which basically deals with the study of various electronics and electrical components and their application in robots.

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

	Course Outcomes	**Bloom's Level**
CO1	Demonstrate a solid understanding of fundamental electronic concepts	2,3
CO2	Demonstrate the knowledge, skills, and practical experience necessary to effectively utilize the various electronic applications in robotics	2,3
CO3	Understand the basics fundamentals of DC machine.	2,3
CO4	Demonstrate machine performance for robotic applications	2,3

COURSE CONTENTS

Unit I	**Basics of Electronics Engineering**	**(07 hrs)**	**COs Mapped: CO1**

Review of p-n junction diode, Introduction to BJT and MOSFETS (depletion & enhancement), Switching Devices, hybrid model for transistor at low frequencies.
Digital and analog signals, number systems(ASCII, EBCDIC) Boolean algebra, Switching Theory: - Boolean Algebra Postulates and Theorems, De' Morgan's Theorem, Switching Functions- Canonical Forms- logic gates with simple applications, Simplification of Switching Functions- Karnaugh Map and Quine Mc-Clusky Methods.

Unit II	Combinational Logic Circuits	(07 hrs)	COs Mapped: CO1, CO2
Review of basic gates- Universal gates, Adder, Subtractor. Serial Adder, Parallel Adder- Carry Propagate Adder, Carry Look-ahead Adder, Carry Save Adder, Comparators, Parity Generators, Decoder and Encoder, Multiplexer and De-multiplexer, Registers, ALU, PLA and PAL			
Unit III	**Integrated circuits and Switching Devices**	**(07 hrs)**	**COs Mapped: CO1, CO2**
Introduction, OPAMP as comparator, integrator, differentiator, buffer. Overview of IC 555 timer: pin configuration, internal block diagram, and operating modes (astable, monostable, and bistable), Understanding the timing functions of IC 555: frequency, duty cycle, and pulse width modulation (PWM). Introduction to relays: types of relays (electromechanical, solid-state), working principle, and applications			
Unit IV	**D. C. Machines**	**(07 hrs)**	**COs Mapped: CO3**
Introduction, Construction, working principle of D.C. generator, emf equation of D. C. generator, working principle of D.C. motor, types of D.C. motor, back emf, torque equation for D.C. motor, characteristics of D.C. motor (series and shunt only), methods for speed control of D.C. shunt and series motors, Braking of DC Motors, Effect of saturation and armature reaction on losses, Permanent Magnet DC Motors, Industrial applications.			
Unit V	**Motors in robotics**	**(07 hrs)**	**COs Mapped: CO3, CO4**
Introduction, Constructional feature, working principle of three phase induction motors, types, torque slip characteristics, efficiency, starters , methods of speed control, Construction, working principle, characteristic and applications of stepper motors, A.C. and D.C(digital & core less) servomotors, universal motors, brushless DC motors, linear induction motors , industrial applications.			

Reference Books

1."Electronic Devices and Circuit Theory" by Robert L. Boylestad and Louis Nashelsky Publisher: Pearson, ISBN-13: 978-0133983449

2. A.E. Fitzgerald, Charles Kingsley Jr., Stephen D. Umans, “Electric Machinery”, Tata McGraw Hill Publication, sixth edition, 2002.

3. P. C. Sen, “Principles of Electric Machines and Power Electronics “, John Wiley and Sons Publication, second edition 1997.

4. "Practical Electronics for Inventors" by Paul Scherz and Simon Monk ,Publisher: McGraw-Hill Education TAB , ISBN-13: 978-1259587542

5. "Digital Systems: Principles and Applications" by Ronald J. Tocci, Neal S. Widmer, and Greg Moss, ISBN-13: 978-0134638942

Strength of CO-PO Mapping

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

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Tests on each unit using LMS (Each test for 20 M and total will be converted out of 10 M)	10
2	Timely Assignment Submission	10

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K. K. Wagh Institute of Engineering Education and Research, Nashik
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S. Y. B. Tech. Robotics and Automation **Pattern 2023, Semester: III** **2312203: Name of Subject: Manufacturing Technology**		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory :03hrs/week	**03**	**In Sem Exam: 20 Marks** **End Sem Exam: 60 Marks** **CCE: 20 Marks**

Prerequisite Courses: - Applied and Modern Physics

Course Objectives:
Understand the sand-casting process.
Analyze the various metal forming processes.
Understand the metal joining process.
Understand advanced manufacturing process

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

	Course Outcomes	**Bloom's Level**
CO1	Classify various casting processes.	2. Understand
CO2	Describe various forming processes	2. Understand
CO3	Classify various metal joining processes	2. Understand
CO4	Explain various machining processes.	2. Understand
CO5	Apply robotics in manufacturing.	3. Apply

COURSE CONTENTS

Unit I	**Sand casting process**	**(07 hrs)**	**COs Mapped: CO1, CO5**

Introduction of sand casting. Patterns, Pattern materials, pattern allowances and design. Core prints and core seats. Mould strength, Ingredients of molding materials and their effect on mould strength, testing of moulding sand. Melting: types of melting furnace, Solidification: progressive and directional solidification; rate of solidification Casting Design consideration, Metal pouring, Gating system, Principles of gating, design of gating system, solidification time, riser design, cleaning, finishing of casting. Defects and respective remedies in casting. Special Casting Process. Application of Robot in Sand Casting.

Unit II	**Material Forming 1**	**(07 hrs)**	**COs Mapped: CO2, CO5**
Fundamentals of Material Forming: Introduction of forming processes. Concept of plastic deformation Classification of material forming process, Theory of plasticity, **Rolling of Metals:** Scope and importance of rolling. Types of Rolling Mills - Construction and working. Defects in rolling. Application of Robot in Rolling. **Forging**: Introduction, Classification of forging processes. Forging equipment- Hammers, presses, Upstter etc., construction, working Basic forging operations, Types of forging dies, Cleaning and finishing of forgings, Forging defects and the remedies. Application of Robot in Forging.			
Unit III	**Material Forming 2**	**(07 hrs)**	**COs Mapped: CO2, CO5**
Sheet Metal working processes: Classification of cutting and forming, Types of dies, Elements of press tools, Application of Robot in press working, **Wire Drawing:** Introduction to rod and wire drawing machines - construction and working. Preparation of stock for wire drawing. Wire drawing dies, material and design. Maximum reduction in wire in one pass, forces required in drawing. **Extrusion:** Types: Direct, Indirect, impact, hydrostatic extrusion. Dies for extrusion, stock preparation. Extrusion ratio, Circumscribing circle diameter (CCD), Shape factor. Equipment (with and without friction), extrusion defects. Application of Robot in Wire Drawing and Extrusion.			
Unit IV	**Metal Joining Process**	**(07 hrs)**	**COs Mapped: CO3, CO5**
Welding: Introduction & classification of welding processes, Types of Electrodes, coding of Electrodes, Electrode efficiency, fluxes, welding symbols. **Arc welding processes,** Tungsten inert gas (TIG), Metal Inert gas (MIG), Plasma arc, stud welding, **Gas welding, Electric resistance welding**: processes and equipment used, Spot, Seam, Projection welding, Resistance tube welding, - merits, limitations and applications. **Solid state welding, Special welding processes:** Laser, electron Beam welding, Thermit welding. Application of Robot in welding.			
Unit V	**Machining Processes**	**(07 hrs)**	**COs Mapped: CO4, CO5**
Turning, Milling, drilling Processes, Abrasive jet machining, Ultrasonic machining, Chemical machining, Electrochemical machining, Electro discharge machining, Electron beam machining, laser beam machining, Plasma arc machining, Ion Beam machining, wire cut EDM. Application of Robot in machining process			

Text Books

1. S.K. Hajra Choudhury, A.K. Hajra Choudhury, Nirjhar Roy, "Elements of Workshop Technology" Vol I, II, Media Promoters, ISBN-10: 8185099154

2. S.K. Hajra Choudhury, A.K. Hajra Choudhury, Nirjhar Roy, "Elements of Workshop Technology" Vol I, Media Promoters, ISBN-10: 8185099154

3. R.K Jain., "Production Technology", Khanna Publishers, 2008, ISBN 81-7409-099-1.

4. P.C Sharma., "A Text Book of Production Technology- Manufacturing Processes", S.Chand & Co., 2008, ISBN: 81-219-111-4-1.

Reference Books

1. Rao P.N., "Manufacturing Technology, Foundry, Forming and welding", TataMcGraw-hill publishing, 2006, ISBN 0-07-463180-2.

2. Dieter, "Mechanical Metallurgy", McGraw hill, ISBN0071004068.

3. Rowe G.W., "Principles of Industrial Metal Working Process", Edward Arnold, ISBN8123904282.

4. Dr. R. Narayanswamy, Metal Forming Technology, Ahuja Book Co., ISBN8176190020

5. KalpakjianSerope and Schmid Steven, "Manufacturing Engineering & Technology", 2004. ISBN 10: 0131976397 ISBN 13: 9780131976399

6. Little Richard., "Welding & Welding Technology", Tata Mc-graw hill, 1992,ISBN 0-07-099409-9.

7. Parmar R.S., "Welding Process and Technology", 2ed., Khanna Publishers, ISBN-10: 8174091262, ISBN-13: 978-8174091260

8. HMT, "Production Technology", Tata McGraw Hill Publishing Co., 1980. ISBN: 0-07- 096443-2

9. Degarmo, Black and Kosherth, "Materials & Processes in manufacturing", 8thEdition, Prentice Hall of India Ltd, Delhi, 2002. ISBN: 8126525223

Strength of CO-PO Mapping

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

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Tests on each unit using LMS (Each test for 20 M and total will be converted out of 10 M)	10
2	Timely Assignment Submission (total will be converted out of 10 M)	10

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S. Y. B. Tech.
Robotics and Automation
Pattern 2023, Semester: III
2312204 : Name of Subject: Computer Aided Design Lab

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical:02hrs./week	**02**	**Term work : 25Marks** **Oral :25 Marks**

Prerequisite Courses: Engineering Graphics

Course Objectives:

Course Objectives	**Description** The course aims :
1	Understand Fundamentals of Computer Aided Design.
2	Understand Ability to use the software packers for drafting and modeling
3	To Ability to create 2D and 3D models of Engineering Component

Course Outcomes	**Description** On completion of the course, students will be able to–	**Blooms Level**
CO1	Understand Ability to use the software packers for drafting and modeling.	2-Understand
CO2	Ability to read engineering drawings	4-Analyze
CO	Ability to create 2D and 3D models of Engineering Component	4-Analyze

Course context, Relevance, Practical Significance:
Computer Aided Drafting is a process of preparing a drawing of an object on the screen of a computer. There are various types of drawings in different fields of engineering and sciences. In the fields of mechanical or aeronautical engineering, the drawings of machine components and the layouts of them are prepared.

Course Contents: (Perform any 7)

Assignment/ Experiment	**Contents**	**Pr.Hrs.**
1	Introduction to CAD	2
2	CAD – Basics	2
3	2 - D Figures Using ACAD	2
4	Isometric Drawings Using ACAD	2
5	3-D Figures Using ACAD commands	2
6	Introduction to CREO	2
7	Exercises on CREO	2

Course Mapping:

Experiment	Contents	CO-mapped	PO mapped	PSO mapped
1	Introduction to CAD	1,2	1,2	1
2	CAD – Basics	1,2	1,2	1
3	2 - D Figures Using ACAD	2	1,2,	1
4	Isometric Drawings Using ACAD	2,3	1,2,	1
5	3-D Figures Using ACAD commands	2,3	1,2	1
6	Introduction to CREO	2,3	1,2	1
7	Exercises on CREO	2,3	1,2	1

K. K. Wagh Institute of Engineering Education and Research, Nashik
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S. Y. B. Tech. Robotics and Automation
Pattern 2023, Semester: III
2312205 : Name of Subject: Electrical and Electronics System Lab

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory :03hrs/week	**03**	**TW: 50** **PR:50**

Prerequisite Courses: Fundamentals of Electronics Engineering, Fundamentals of Electrical Engineering

Course Objectives:

The Electrical and Electronics System solves challenges which are related to design of robots. This subject therefore provide sound foundation for robotics and automation engineering students which basically deals with the study of various electronics and electrical components and their application in robots.

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

	Course Outcomes	**Bloom's Level**
CO1	Demonstrate a solid understanding of fundamental electronic concepts	2
CO2	Demonstrate the knowledge, skills, and practical experience necessary to effectively utilize the various electronic applications in robotics	2,3
CO3	Understand the basics fundamentals of DC machine.	3,4
CO4	Demonstrate machine performance for robotic applications	3,4

Sr. No.	**Contents**	**Pr. Hrs.**
1	To identify various electronic components with specifications	2
2	Study of different switches with power supply module.	2
3	To Study Transistor Input / Output Characteristics	2
4	Study of Relays.	2
5	Build and test op-amp as buffer circuit	2
6	Build and test op-amp as integrator circuit	2
7	Implementation of adder using logic gates.	2
8	Study of IC 555 (astable , monostable)	2
9	Speed control of DC motor	2
10	Load test on 3 phase Induction Motor	2
11	Study of DC servo motors	2
12	Study of stepper motors	2

Strength of CO-PO Mapping

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

K. K. Wagh Institute of Engineering Education and Research, Nashik
(Autonomous from Academic Year 2022-23)

S. Y. B. Tech.
Pattern 2023 Semester : III
Course Code: 2312206 Course Name: Numerical Methods

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory :03hrs/week	**03**	**Continuous Comprehensive Evaluation: 20Marks** **InSem Exam: 20Marks** **EndSem Exam: 60Marks**

Prerequisite Courses: - Basic Mathematics

Course Objectives:

1. Understand statistical hypothesis testing and its use in decision-making.
2. Learn to design experiments and analyze data using ANOVA and factorial designs.
3. Apply numerical methods to solve real-world algebraic, transcendental, and linear equations.
4. Develop skills in curve fitting, including the least squares criterion and interpolation methods.
5. Master numerical techniques for differentiation, integration, and solving differential equations for engineering and scientific problem-solving.

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

	Course Outcomes	**Bloom's Level**
CO1	Perform hypothesis testing in statistics	2
CO2	Design the experiments based on the processes parameters.	3
CO3	Establish the co-relation between input factors and performance measure using regression analysis	3
CO4	Use numerical method to solve the simultaneous equations, complex algebraic & transcendental equation, partial differentiation.	3

COURSE CONTENTS

Unit I	**Statistical hypothesis and tests**	**(7hrs)**	**Cos Mapped CO1**

Testing of Hypothesis Sampling distributions - Estimation of parameters, Statistical hypothesis, Large sample tests based on Normal distribution for single mean and difference of means,-Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit

Unit II	**Design and Analysis of Experiments**	**(7hrs)**	**Cos Mapped CO2**

Design and Analysis of Experiments: Importance of experiments, Experimental strategies, Basic Principles of Design Terminology, ANOVA, steps in experimentation, two and three full Factorial experiments, Taguchi Methods, Design using Orthogonal Arrays, S/N ratios, Data Analysis

Unit III	**Numerical Solutions of algebraic, transcendental and Linear Simultaneous Equations**	**(7hrs)**	**Cos Mapped CO3**

Errors and error propagation in numerical techniques, Numerical solution of algebraic and transcendental equations: Bisection method, Newton Raphson Method. Numerical solution of Linear Simultaneous Equations: Gauss Elimination Method, Gauss-Seidel Method			
Unit IV	**Methods of curve fitting**	**(7hrs)**	**Cos Mapped CO4**
Least Square Regression, Polynomial regression, Multiple linear regression, Nonlinear regression Curve fitting with sinusoidal functions, Fast Fourier Transforms			
Unit V	**Partial Differential Equations**	**(7hrs)**	**Cos Mapped CO4**
Elliptic Equations: Laplace Equation, Solution techniques, Boundary conditions Parabolic equations: Heat conduction Equations, Explicit methods, Crank Nicholson method			

Text Books

1. Jaan Kiusalaas, Numerical Methods in Engineering with Matlab, Cambridge University press.
2. S. S. Rao, Engineering Optimization: Theory and Practice, New Age International, 2000, ISBN: 9788122411492

Reference Books

1. Douglas C. Montgomery, Design and analysis of experiments, John Wiley and sons inc. New York 8th edition.
2. S.C. Chapra, R.P. Canale, ―Numerical Methods for engineers with programming and software applications, Tata McGraw Hill Co. Ltd, New Delhi, ISBN 0071158952.
3. Dr. Sadhu Singh, Computer aided Design and Manufacturing‖, Khanna Publication, New Delhi.
4. Ramin S. Esfandiari, Numerical Methods for Engineers and Scientists Using MATLAB, CRC press, Taylor and Francis group.

Strength of CO-PO Mapping														
	PO													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	-	1	-	-	1	-	-	2	-	-	-	1	-
CO2	3	3	2	-	-	2	-	1	3	-	-	2	1	-
CO3	2	1	3	1	-	2	-	1	3	-	-	2	1	-
CO4	2	1	1	3	3	1	-	2	2	1	-	2	1	-

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Assignments on each Unit	10
2	LMS Test on Each Unit	10
	Total	**20**

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S. Y. B. Tech. Robotics and Automation Pattern 2023, Semester: III Course Code: 2312207 Course Name: Numerical Methods Lab		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical: 02 hrs. /week	**01**	**Term work : 25 Marks** **Practical : 25 Marks**
Prerequisite Courses: Basic Mathematics		
Course Objectives:		

Course Objectives	Description
1	Understand statistical hypothesis testing and its use in decision-making.
2	Learn to design experiments and analyze data using ANOVA and factorial designs.
3	Apply numerical methods to solve real-world algebraic, transcendental, and linear equations.
4	Develop skills in curve fitting, including the least squares criterion and interpolation methods.
5	Master numerical techniques for solving differential equations for engineering and scientific problem-solving.

Course Outcomes:

Course Outcomes	Description
1	Perform hypothesis testing in statistics
2	Design the experiments based on the processes parameters.
3	Establish the co-relation between input factors and performance measure using regression analysis and interpolation methods
4	Use numerical method to solve the simultaneous equations, complex algebraic & transcendental equation, and partial differentiation.

Course context, Relevance, Practical Significance:

The Statistical and Numerical Methods course teaches students fundamental skills in data analysis, experimental design, and mathematical problem-solving. It covers statistical hypothesis testing for informed decision-making, experimental design techniques such as ANOVA, and factorial designs. Additionally, students learn numerical methods for solving equations and curve fitting techniques for accurate data modeling. The course also includes numerical techniques for differentiation, integration, and solving differential equations. Overall, it emphasizes the practical application of statistical and numerical methods across diverse fields.

Course Contents:

Sr. No.	Contents	Pr. Hrs.
1	Practical on parameter optimization of any one process using Taguchi based design of experiment. Validation of results using any statistical software	2
2	Practical on determination of significant factors for any one process using ANOVA. Validation of results using any statistical software.	2
3	Practical case study on regression analysis. (Data should be collected for some real life case). Validation of results Validation of results using any statistical software.	2
4	Practical case study on Solving linear simultaneous equations. (Data should be collected for some real life case). Validation of results using any statistical software	2
5	C/python Programming of any one method for finding roots of Equations	2
6	C/python Programming for numerical differentiation	2

Course Mapping:

Assignment/ Experiment	Contents	CO-mapped	PO mapped	PSO mapped
1	Practical on parameter optimization of any one process using Taguchi based design of experiment. Validation of results using any statistical software	1	1,2	1
2	Practical on determination of significant factors for any one process using ANOVA. Validation of results using any statistical software.	2	1,2	1
3	Practical case study on regression analysis. (Data should be collected for some real life case). Validation of results Validation of results using any statistical software.	3	1,2	1
4	Practical case study on Solving linear simultaneous equations. (Data should be collected for some real life case). Validation of results.	3	1,2	1
5	C/python Programming of any one method for finding roots of Equations	4	1,2	1
6	C/python Programming for numerical differentiation	4	1,2	1

S. Y. B. Tech. Robotics and Automation
Pattern 2023, Semester: III
2312208: Name of Subject: Sociology of Tourism

Teaching Scheme	Course Type	Credit Scheme	Examination Scheme:
Theory :02 hrs/week	**Open Elective**	**02**	**Continuous Comprehensive Evaluation: 50 Marks**

Prerequisite Courses: NA

Course Objectives:

Sr.No.	Description
1	Explain the impacts of tourism on communities and environments, and analyze them critically.
2	Explore power dynamics and social interactions within tourism contexts, considering issues of gender, race, and class.
3	Develop sustainable tourism strategies and ethical practices to minimize negative impacts and empower local communities.
4	Evaluate tourism policy frameworks and propose recommendations for enhancing destination management and sustainability.
5	Apply theoretical knowledge and empirical research to address emerging trends and challenges in tourism sociology, and effectively communicate recommendations.

Course Outcomes:

Course Outcomes	Description Student will be able to:
CO1	Describe the theoretical perspectives commonly used to analyse tourism phenomena, and explain their relevance in understanding tourist behaviour.
CO2	Apply theoretical frameworks to analyse power dynamics within tourism contexts, and propose strategies for promoting social equity and inclusivity.
CO3	Analyse the socio-cultural impacts of tourism on local communities, and propose strategies for cultural preservation and community empowerment.
CO4	Assess the environmental impacts of tourism activities, and devise action plans to minimize ecological footprints and promote conservation efforts
CO5	Develop effective communication skills to engage with stakeholders and advocate for responsible tourism practices, considering ethical and cultural sensitivities.

Course context, Relevance, Practical Significance:
Sociology provides invaluable insights into tourism by examining the social dynamics that shape travel patterns, behaviors, and experiences. It explores how tourism intersects with issues such as culture, identity, inequality, and globalization, shedding light on the complex relationships between tourists, host communities, and the industry. Through sociological perspectives, researchers and practitioners in tourism can better understand the societal impacts of tourism development, including its effects on local economies, environments, and social structures.

Course Contents:

Unit	Contents	Lecture Hrs.
1	**Unit 1: Introduction to Sociology and Tourism** Introduction to Sociology and Tourism: Definitions and Scope, Theoretical Foundations: Sociological Perspectives on Tourism, Understanding Tourist Behaviour: Motivations and Decision-making Processes, Socio-cultural Impacts of Tourism: Identity, Authenticity, and Commodification	7
2	**Unit 2: Tourism Development and Social Change** Historical Evolution of Tourism: From Pilgrimages to Mass Tourism, Tourism and Economic Development: Employment, Income, and Inequality, Tourism and Social Change: Modernization vs. Dependency Perspectives, Case Studies: The Role of Tourism in Shaping Local Communities.	7
3	**Unit 3: Tourism and Society** Social Interactions in Tourist Spaces: Host-Guest Relationships, Power Dynamics in Tourism: Gender, Race, and Class, Tourism and Social Integration: Bridging Cultural Divides, Tourism and Social Conflict: Environmental Concerns and Resistance Movements.	7
4	**Unit 4: Sustainable Tourism and Ethical Considerations** Principles of Sustainable Tourism Development, Ecotourism and Community-Based Tourism Initiatives, Responsible Tourism Practices: Minimizing Negative Impacts, Ethical Issues in Tourism: Human Rights, Cultural Appropriation, and Exploitation.	7
5	**Unit 5: Tourism Policy and Governance** Tourism Policy Formation and Implementation, Destination Management Organizations and Tourism Planning, Governance Structures in Tourism: Public-Private Partnerships, Future Trends and Challenges in Sociology of Tourism	7

Course Mapping:

Unit	Contents	Blooms Taxonomy Level	CO-mapped	PO mapped	PSO mapped
1	**Introduction to Sociology and Tourism**	2	1	1,6	--
2	**Tourism Development and Social Change**	2,3	3	3,6,9	--
3	**Tourism and Society**	2,3	2	2,6,9	--

4	**Sustainable Tourism and Ethical Considerations**	3,4	4	4,7,11	--
5	**Tourism Policy and Governance**	3,4	5	5,8,10	--

References Books:

1. Title: "Sociology of Tourism: An Introduction" Author: Nigel Morgan and Annette Pritchard Publisher: Routledge ISBN: 978-1138010760.
2. Tourism: Principles, Practices, Philosophies" by Charles R. Goeldner and J.R. Brent Ritchie
   ISBN-13: 978-0470648470.
3. "Tourism: A Critical Business" by Jean-Christophe Graz and Charles W. Hunt
   ISBN-13: 978-0415631075.
4. "The Sociology of Tourism: Theoretical and Empirical Investigations" by Yiorgos Apostolopoulos, Stella Leivadi, and Andrew Yiannakis, ISBN-13: 978-0415349165.
5. "Tourism and Leisure Research Methods: Data Collection, Analysis, and Interpretation" by Mick Cope, ISBN-13: 978-1910158835.

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(Autonomous from Academic Year 2022-23)

S. Y. B. Tech. Robotics and Automation
Pattern 2023, Semester: III
2312209: Name of Subject: Democracy

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory :02 hrs/week	**Tutorial: 02**	**CCE: 50 Marks**

Prerequisite Courses: - Introduction to Political Science, Introduction to Law and Governance

Course Objectives:
- Understand the concept, principles, and various forms of democracy.
- Analyse the functioning of democratic institutions and their roles in governance.
- Evaluate the importance of rights, liberties, and citizenship in democratic societies.
- Critically assess challenges and critiques faced by democratic systems.

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

	Course Outcomes	**Bloom's Level**
CO1	Understand the concept, principles, and various forms of democracy.	2. Understand
CO2	To critically analyze the roles and mechanisms of democratic institutions in the governance process.	2. Understand
CO3	Evaluate the importance of rights, liberties, and citizenship in democratic societies.	2. Understand
CO4	Critically assess challenges and critiques faced by democratic systems	2. Understand
CO5	Apply theoretical knowledge to real-world democratic contexts and issues.	3. Apply

COURSE CONTENTS

Unit I	**Introduction to Democracy**	**(07 hrs)**	**COs Mapped: CO1**

Definition and conceptual understanding of democracy, Historical evolution of democracy, Different forms of democracy (representative, direct, deliberative, etc.), Theoretical frameworks and ideologies underlying democracy (liberal democracy, social democracy, etc.).

Unit II	**Institutions of Democracy**	**(07 hrs)**	**COs Mapped: CO2, CO5**

The role and functions of key democratic institutions (legislature, executive, judiciary), Electoral systems and political parties, Civil society organizations and their significance in democratic governance, Media and its role in democracy.

Unit III	**Rights and Liberties in Democracy**	**(07 hrs)**	**COs Mapped: CO3, CO4**

Fundamental rights and liberties in democratic societies, Human rights and their protection mechanisms, Equality, diversity, and inclusion in democratic contexts, Challenges to rights and liberties in contemporary democracies.

Unit IV	Democratic Participation and Citizenship	(07 hrs)	COs Mapped: CO1, CO5

Participation mechanisms in democracy (voting, activism, advocacy, etc.), Role of citizens in democratic governance, Citizenship education and civic engagement, Emerging trends in citizen participation (online activism, social movements, etc.)

Reference Books

1. Chandra, Bipan. India's Struggle for Independence. New Delhi: Penguin Books India, 1989.
2. Khilnani, Sunil. The Idea of India. New York: Farrar, Straus and Giroux, 1997.
3. Choudhry, Sujit, ed. The Oxford Handbook of the Indian Constitution. Oxford: Oxford University Press, 2016.
4. Austin, Granville. The Indian Constitution: Cornerstone of a Nation. New Delhi: Oxford University Press, 1999.

Strength of CO-PO Mapping

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

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Tests on each unit using LMS (Each test for 20 M and total will be converted out of 30 M)	30
2	Timely Assignments Submission on each unit (5 M for each unit)	20

S. Y. B. Tech. Pattern 2023 Semester: III 2312210: Name of Subject: Basic Robotics Workshop		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Tutorial:01 **Practical:02hrs./week**	**01** **01**	**TU: 25 Marks** **TW:25Marks**
Prerequisite Courses, if any:-Fundamentals of mechanical Engineering, Electronics Engineering.		

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

	Course Outcomes	Bloom's Level (Cognitive domain)
CO1	Gain a fundamental understanding of robotics principles, including robot components, sensors, actuators, and programming concepts.	2-Understanding
CO2	Acquire hands-on experience in building, programming, and testing basic robotic systems using hardware and software tools.	3-Apply
CO3	Develop problem-solving skills through the design, construction, and troubleshooting of robotic projects.	4-Analyze
CO4	Engage in collaborative teamwork to plan, execute, and evaluate robotics projects, fostering effective communication and collaboration skills.	5-Evaluate
CO5	Develop an awareness of ethical considerations and societal implications related to robotics technology, including issues of safety, privacy, and responsibility.	5-Evaluate

Course context, Relevance, Practical Significance:

List of Laboratory Experiments/Assignments		
Sr. No.	**Content**	**CO Mapped**
1.	**Introduction to Robotics:** Overview of Robotics and its Applications, Introduction to Robot Components: Sensors, Actuators, Controllers, Basics of Robot Programming: Sequencing, Loops, Conditions, Hands-on Activity: Introduction to Robot Kits and Basic Programming Exercises	**CO1,CO2**
2	**Robot Sensors and Actuators** Types of Sensors in Robotics: Proximity Sensors, Touch Sensors, Light Sensors, etc. Understanding Actuators: DC Motors, Servo Motors, Stepper Motors, Interfacing Sensors and Actuators with Microcontrollers, Hands-on Activity: Building Simple Circuits and Controlling Motors and Sensors	**CO1,CO2**

3	**Robot Kinematics and Motion Control** Introduction to Robot Kinematics: Degrees of Freedom, Joints, End-Effectors, Understanding Robot Motion: Linear Motion, Rotational Motion, Basics of Motion Control: Speed Control, Trajectory Planning Hands-on Activity: Programming Robot Motion and Path Planning	**CO2,CO3**
4	**Robot Vision and Image Processing** Introduction to Robot Vision: Cameras, Image Processing Techniques Image Acquisition and Processing with OpenCV, Object Detection and Recognition Hands-on Activity: Implementing Object Detection Algorithms	**CO2, CO3, CO4**
5	**Robot Programming and Simulation** Introduction to Robot Programming Languages: Blockly, Python, C/C++, Basics of Robot Simulation: Using Simulators such as Webots, Gazebo, Simulation of Robot Tasks and Environments Hands-on Activity: Programming and Simulating Robot Tasks	**CO2, CO3,CO4, CO5**
6	**Project Work and Presentation** Project Planning and Design, Implementation of Robot Projects, Testing and Debugging, Project Presentation and Demonstration	**CO2,CO3, CO4,CO5**

Assignment/ Experiment	Contents	CO-mapped	PO mapped	PSO mapped
1	Hands-on Activity: Introduction to Robot Kits and Basic Programming Exercises	1,2	1,2,9	1
2	Hands-on Activity: Building Simple Circuits and Controlling Motors and Sensors	1,2	1,2,9	1
3	Hands-on Activity: Programming Robot Motion and Path Planning	2,3	1,2,9	1
4	Hands-on Activity: Implementing Object Detection Algorithms	2,3,4	1,2,9	1

5	Hands-on Activity: Programming and Simulating Robot Tasks	2,3,4,5	1,2,9	1
6	Mini Project: Project Planning and Design, Implementation of Robot Projects, Testing and Debugging, Project Presentation and Demonstration	2,3,4,5	1,2,3,4,5,9	1

S. Y. B. Tech. Robotics and Automation Pattern 2023, Semester: IV 2312211: Name of Subject: Robot Operating System		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory :03 hrs/week	**03**	**Continuous Comprehensive Evaluation: 20 Marks** **InSem Exam: 20 Marks** **EndSem Exam: 60 Marks**
Prerequisite Courses: Programming in C		
Course Objectives:		

Course Objectives	Description
1	To introduce students with fundamental concepts and theory of roboticautomation
2	To articulate the use of different types of devices to which robotic modules are connected
3	To demonstrate the knowledge about understanding of various types of robotic applications
4	To apply and analyses industry based project & advanced learning.

Course Outcomes	Description Student will be able to:	Blooms level
1	Describe message communication of robot operating system.	2 – Understand
2	Demonstrate robot operating commands.	3 – Apply
3	Program and simulate robot applications.	3 – apply
4	Write the program for G-mapping in robot.	3 – Apply
5	Interface robot with embedded systems.	3 – Apply
6	Differentiate between process of ROS 1 and ROS2.	4- Analyze

Course context, Relevance, Practical Significance:

Robot Operating System provides libraries and tools to help software developers create robot applications. It includes hardware abstraction, device drivers, libraries, visualizers, message passing, package management, and more. ROS is being used for many of the world's most exciting and capable robots. The developer community and support for using ROS with robots now makes this an excellentchoice for a large variety of industrial applications.

Course Contents:

Unit	Contents	LectureHrs.
1	**Introduction to Robot Operating System** Introduction, Meta-operating system , Objective of Ros ,Components of Ros, Ros ecosystem , History of Ros , Ros versions ,Ros Terminology , Message Communication, Coordinate Transformation, File system, Build System.	7
2	**ROS Commands and Tools**	7

Unit	Contents	Lecture Hrs.
	Ros differnet Command list Ros shell commands ,Ros execution commands, Ros Information commands Ros catkin commands Ros package commands,Basic ROS Programming, Standard Unit, Coordinate Representation, Programming Rules.Creating and Running Publisher and Subscriber Nodes **Tools**:3D Visualisation Tool (Rviz) , Ros GUI development Tool (rqt): Installing and Running rqt ,rqt Plugins ,rqt_image_view ,rqt_graph ,rqt_plot, Introduction, Manipulator Structure and Control, Manipulator and ROS, Open Manipulator Modelling and Simulation, Gazebo Setting Move It, move group, Move It , Setup Assistant, Gazebo Simulation Applying to the Actual Platform, Service robots: Delivery service robots.	
3	**ROS Embedded system** OpenCR: Characteristics, Board Specification, Establish Development Environment, Rosserial: rosserial server, rosserial client, rosserial Protocol, Constraints of rosserial, Installing rosserial, Examples of rosserial.TurtleBot3 Firmware: Hardware, Software, Development environment, Remote Control, Simulation using RViz.	7
4	**Navigation and Slam** Navigation and Components, Navigation of Mobile Robot, Map, Pose of Robot, Sensing, Path Calculation and Driving, SLAM Practice, Robot hardware Constraints for SLAM, Measured Target Environment of SLAM,ROS Package for SLAM, Execute SLAM,SLAM Application, SLAM process, Coordinate Transformation (TF). Actual Platform, Service robots: Delivery service robots	7
5	**Introduction to ROS 2** Overview of ROS 2-Introduction to ROS 2 , its key features & Comparison between ROS 1 and ROS 2 , ROS 2 Architecture, ROS 2 Development Tools, ROS 2 command-line tools for package management, Introduction to ROS 2 launch system and launch files, Building and deploying ROS 2 nodes and packages	7

Course Mapping:

Unit	Contents	Blooms Taxonomy Level	CO-mapped	PO mapped	PSO mapped
1	Introduction to Robot Operating system	1,2	1,5	1,3,7	1, 2
2	ROS Commands and Tools	2,3	2,5	1,3,7	1, 2

3	ROS Embedded system	2,3,4	3,5	1,2,4	1, 2
4	Navigation and Slam	2,3,4	4,5	1,2,3,5,7	1, 2
5	Introduction to ROS 2	2,4	6	1,2,3,5	1, 2

Reference Books:

1. Jason M. O'Kane, A Gentle Introduction to ROS, independently published, ISBN 9781492143239
2. Lentin Joseph, "Robot Operating System (ROS) for Absolute Beginners", Apress Publication, ISBN: 9781484234044.
3. Morgan Quigley, Brian Gerkey, William D. Smart, "Programming Robots with ROS", O'Reilly Media Inc., ISBN: 9781449325503
4. C. Fairchild, T. L. Harman, "ROS Robotics by Example" Pakt Publishing, ISBN: 9781785286704

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S. Y. B. Tech.
Pattern 2023 Semester: IV
Course Code : 2312212 Course Name : Computer Graphics for Robotics

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory :03hrs/week	**03**	**Continuous Comprehensive Evaluation: 20Marks** **InSem Exam: 20Marks** **EndSem Exam: 60Marks**

Prerequisite Courses: - Applied Mathematics I, Applied Mathematics II, Engineering Drawing, Computational Thinking and C- programming,

Course Objectives:

1. To introduce students with fundamental concepts and theory of computer graphics.
2. To articulate the use of 2D and 3D interpolation methods for computer graphics
3. To demonstrate the applications of 2D and 3D transforms for robot kinematics
4. To present mathematical elements of important curves and surfaces

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

	Course Outcomes	**Bloom's Level**
CO1	Describe the basics of different graphics systems and analytic geometry.	2 – Understand
CO2	Use of geometric transformations on graphics objects and their application in robot kinematics analysis.	3- apply
CO3	Demonstrate the application of Bezier curves and interpolation in robot path planning	3- apply
CO4	Apply concept of geometric algebra for modelling in robotic physics	3- apply

COURSE CONTENTS

Unit I	**Analytic geometry**	**(7hrs)**	**Cos Mapped CO1**

2D analytic geometry - mathematical representation of line, conic sections, intersection of 2D lines, intersection of line and circle, 3D analytic geometry - mathematical representation of 3D line, planes, intersection of 3D lines, intersection of planes. Hidden surface removal.

Unit II	**Transforms:**	**(7hrs)**	**Cos Mapped CO2**

Introduction to 2D and 3D transforms: Scaling, shear, rotation, reflection, Concept of homogenous co-ordinates, General Rotation and general reflection matrix, Concatenated matrices, Application of 3D transformation to robotics: Cylindrical robot, Application of 3D transformation to robotics: Spherical robot/SCARA robot

Unit III	Interpolation:	(7hrs)	Cos Mapped CO2
Linear interpolation, Lagrange interpolation, Spline interpolation, Spatial interpolation: Inverse distance weighted method, Nearest neighbour, Natural neighbour, Shape function, Cubic interpolation, Interpolating quaternion			
Unit IV	**Curves and Surfaces**	**(7hrs)**	**Cos Mapped CO3**
Bezier curves. B-spline, 3D surfaces, Surfaces of revolution, Seep surfaces, Bezier Surface Patch, Applications of Bezier and Beta spline curves for robot path planning			
Unit V	**Geometric Algebra**	**(7hrs)**	**Cos Mapped CO4**
Geometric products in 2D, geometric product in 3D, outer product of 3D vectors, axioms, inverse of vectors, reflection and rotation, applied geometric algebra for modelling of robotics physics			

Reference Books

1. Jon Vince, Mathematics for Computer Graphics, Springer, ISBN: : 978-1-84628-034-4
2. Chopra Rajiv, "Computer Graphics", S. Chand and Co. Pvt. Ltd., ISBN: 81-219-3581-4
3. Roger D, Adams A. J. "Mathematical elements for computer graphics", McGraw Hill Education, ISBN: 978- 0070486775
4. Davis Martin J, "Computer Graphics", Nova science Publishers, ISBN: 9781617618116

Strength of CO-PO Mapping														
	PO													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	-	2	2	3	-	-	2	2	3	-	2	1	-
CO2	2	-	3	3	3	3	-	2	2	3	-	2	1	-
CO3	2	-	3	3	3	3	-	2	2	3	-	3	1	-
CO4	2	-	3	3	3	3	-	2	2	3	-	3	1	-

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Assignments on each Unit	10
2	LMS Test on Each Unit	10
	Total	**20**

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(Autonomous from Academic Year 2022-23)

S. Y. B. Tech. Robotics and Automation **Pattern 2023, Semester: IV** **2312213: Name of Subject: Design of Machines and Mechanisms**		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory :03hrs/week	**03**	**In Sem Exam: 20 Marks** **End Sem Exam: 60 Marks** **CCE: 20 Marks**

Prerequisite Courses: - Basic knowledge of physics and mathematics, Understanding of mechanics and kinematics, Familiarity with CAD software (preferred)

Course Objectives:
Understand the fundamental principles of machine and mechanism design.
Apply kinematic and dynamic analysis techniques to evaluate and design mechanisms.
Design and analyse various types of gearing systems for specific robotic applications.
Develop proficiency in CAD software for modelling and simulating machine components.
Design robotic manipulators with consideration for performance, accuracy, and workspace.
Apply optimization techniques to enhance the efficiency and functionality of robotic systems.

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

	Course Outcomes	**Bloom's Level**
CO1	Understand the fundamental principles of machine and mechanism design.	2. Understand
CO2	Understand kinematic and dynamic analysis techniques for evaluating and designing mechanisms.	2. Understand
CO3	Understand the design and analysis of gearing systems for specific robotic applications.	2. Understand
CO4	Understand the principles of CAD software for modeling and simulating machine components.	2. Understand
CO5	Apply optimization techniques to enhance the efficiency and functionality of robotic systems.	3. Apply

COURSE CONTENTS

Unit I	**Introduction to Machine Design and Kinematic Analysis**	**(07 hrs)**	**COs Mapped: CO1, CO2**

Introduction to machine design process, Design considerations and constraints, Material selection and properties, Safety factors and reliability, Degrees of freedom and mobility analysis, Position, velocity, and acceleration analysis, Graphical and analytical methods for kinematic analysis, Application to robotic manipulators.

Unit II	**Linkage Synthesis and Gearing Systems**	**(07 hrs)**	**COs Mapped: CO1, CO3**
Design requirements and specifications, Four-bar linkage synthesis, Function generation and path synthesis, Optimization techniques in linkage design, Types of gears and gear trains, Gear tooth profiles and design considerations, Gear ratio and transmission efficiency, Design of gearboxes for robotic applications.			
Unit III	**Design of Robotic Manipulators**	**(07 hrs)**	**COs Mapped: CO1, CO5**
Classification of robotic manipulators, Forward and inverse kinematics, Jacobian matrix and velocity analysis, Trajectory planning and control strategies.			
Unit IV	**Mechanism Dynamics and Design Optimization**	**(07 hrs)**	**COs Mapped: CO2, CO5**
Analysis of dynamic forces and moments, Inertia forces and torques in mechanisms, Dynamic balancing techniques, Vibration analysis and control, Introduction to optimization methods, Single and multi-objective optimization, Optimization algorithms and their applications, Case studies in design optimization for robotics.			
Unit V	**CAD Modeling for Machine Design**	**(07 hrs)**	**COs Mapped: CO1, CO4**
Introduction to CAD software, 2D and 3D modeling techniques, Assembly modeling and kinematic simulation, Finite element analysis for structural analysis, Review of real-world examples of machine and mechanism design in robotics and automation, Analysis of successful design solutions and challenges faced.			

Text Books

1. Norton, Robert L. Design of Machinery. McGraw-Hill Education, 2020.

2. Shigley, Joseph E., and John J. Uicker Jr. Theory of Machines and Mechanisms. Oxford University Press, 2016.

3. Sclater, Neil, and Nicholas Chironis. Mechanisms and Mechanical Devices Sourcebook. McGraw-Hill Professional, 2011.

4. Siciliano, Bruno, and Lorenzo Sciavicco. Robotics: Modelling, Planning and Control. Springer, 2016.

Reference Books

1. Erdman, Arthur G., and George N. Sandor. Mechanism Design: Analysis and Synthesis. Pearson, 2001.

2. Uicker, John J., Gordon R. Pennock, and Joseph E. Shigley. Theory of Machines and Mechanisms. Oxford University Press, 2003.

Strength of CO-PO Mapping												
	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	1	1	-	-	-	-	-	-	-	-	-	-
CO2	1	-	1	-	-	-	-	-	-	-	-	-
CO3	1	-	-	-	1	-	-	-	-	-	-	-
CO4	-	1	-	-	1	-	-	-	-	-	-	-
CO5	1	-	-	1	-	-	-	-	-	-	-	-

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Tests on each unit using LMS (Each test for 20 M and total will be converted out of 10 M)	10
2	Timely Assignment Submission on each unit (total will be converted out of 10 M)	10

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S. Y. B. Tech. Robotics and Automation Pattern 2022, Semester: IV 2312214: Name of Subject: Robot Operating System Lab		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical : 02 hrs./week	**01**	**Term work : 25 Marks** **Practical : 25 Marks**
Prerequisite Courses: Programming in C		
Course Objectives:		

Course Objectives	Description
1	To introduce students with fundamental concepts and theory of roboticautomation
2	To articulate the use of different types of devices to which robotic modules are connected
3	To demonstrate the knowledge about understanding of various types of roboticapplications
4	To apply and analyses industry based project & advanced learning.

Course Outcomes	Description Student will be able to:	Blooms level
1	Describe message communication of robot operating system.	2 – Understand
2	Demonstrate robot operating commands.	3 – Apply
3	Program and simulate robot applications.	3 – apply
4	Implement 3D models in any CAD tools to interface with ROS visualization.	3 – Apply
5	Interface robot with embedded systems.	3 – Apply
6	Differentiate between process of ROS 1 and ROS2.	4- Analyze

Course context, Relevance, Practical Significance:

Robot Operating System provides libraries and tools to help software developers create robot applications. It includes hardware abstraction, device drivers, libraries, visualizers, message passing, package management, and more. ROS is being used for many of the world's most exciting and capable robots. The developer community and support for using ROS with robots now makes this an excellentchoice for a large variety of industrial applications.

Course Contents:

Sr. No.	Contents	Pr. Hrs.
1	ROS Essentials: Introduction to ROS Topics, Services, Actions and Nodes.	2
2	Simple interaction with the course simulation environment. I) Creating Catkin workspace & Packages. ii) Perform message communication by using ROS publishing and subscribing Model.	2
3	Implement STL files for any 3 D Models in any CAD tool.	2
4	Building robot environment: Software representation of a Robot using Unified Robot Description Format (URDF), ROS parameter server and adding real-world object representations to the simulation environment	2
5	Autonomous Navigation: Map creation with G Mapping package, autonomously Navigate a known map with ROS navigation.	2
6	Manipulation: Motion planning, pick and place behaviors using industrial robots with ROS Move It	2
7	Simple interaction with ROS 2 simulation Environment Setup.	2

Course Mapping:

Assignment/ Experiment	Contents	CO-mapped	PO mapped	PSO mapped
1	ROS Essentials: Introduction to ROS Topics, Services, Actions and Nodes.	1,5	1,3,5,7	1, 2
2	Simple interaction with the course simulation Environment. i) Creating Catkin workspace & Packages. ii) Perform message communication by using ROS publishing and subscribing Model.	2,5	1,3,5,7	1, 2
3	Implement STL files for any 3 D Models in any CAD tool.	4	1,3,5	1,2
4	Building robot environment: Software representation of a Robot using Unified Robot Description Format (URDF), ROS parameter server and adding real-world object representations to the simulation environment	3,5	1,2,4,5,6,7, 9,12	1, 2
5	Autonomous Navigation: Map creation with G Mapping package, autonomously navigate	4,5	1,2,3,5,6,7, 9,12	1, 2

	aknown map with ROS navigation.			
6	Manipulation: Motion planning, pick and place behaviors using industrial robots with ROSMove It	4,5	1,2,3,5,6,7, 9,12	1, 2
7	Simple interaction with ROS 2 simulation Environment Setup.	6	1,2,3,5,9,12	1, 2

S. Y. B. Tech. Pattern 2023 Semester: IV Course Code : 2312215 Course Name : Computer Graphics for Robotics Lab		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical: 02 hrs. /week	**02**	**Term work : 50 Marks** **Practical : 50 Marks**
Prerequisite Courses: Applied Mathematics I, Applied Mathematics II, Engineering Drawing, Computational Thinking and C- programming,		
Course Objectives:		

Course Objectives	Description
1	To introduce students with fundamental concepts and theory of computer graphics.
2	To articulate the use of 2D and 3D interpolation methods for computer graphics
3	To demonstrate the applications of 2D and 3D transforms for robot kinematics
4	To present mathematical elements of important curves and surfaces

Course Outcomes:

Course Outcomes	Description
1	Describe the basics of different graphics systems and analytic geometry.
2	Use of geometric transformations on graphics objects and their application in robot kinematics analysis.
3	Demonstrate the application of Bezier curves and interpolation in robot path planning
4	Apply concept of geometric algebra for modelling in robotic physics

Course context, Relevance, Practical Significance:

This course, "Computer Graphics for Robotics," provides students with foundational knowledge and skills in computer graphics tailored to robotics applications. In today's technological landscape, robotics is increasingly prevalent across industries, driving the demand for engineers with expertise in designing, simulating, and optimizing robotic systems. Computer graphics are integral to visualizing and analyzing these systems.

Course Contents:

Sr. No.	Contents	Pr. Hrs.
1	Creating 2D and 3D graphic elements	2
2	Forward kinematics of planer robot using 2D transformation	2
3	Forward kinematics of articulated/SCARA robot using 2D transformation	2
4	Generating Curves and Surfaces using Interpolation	2
5	2D curve generation: Bazier, β spline	2
6	3D surface generation: Surface of revolution, sweep surface	2
7	Algorithm for hidden surface removal	2

Course Mapping:

Assignment/ Experiment	Contents	CO-mapped	PO mapped	PSO mapped
1	Creating 2D and 3D graphic elements	1	1,2	1
2	Forward kinematics of planer robot using 2D transformation	2	1,2	1
3	Forward kinematics of articulated/SCARA robot using 2D transformation	2	1,2	1
4	Generating Curves and Surfaces using Interpolation	3	1,2	1
5	2D curve generation: Bezier, β spline	3	1,2	1
6	3D surface generation: Surface of revolution, sweep surface	4	1,2	1
7	Algorithm for hidden surface removal	4	1,2	1

K. K. Wagh Institute of Engineering Education and Research, Nashik
(Autonomous from Academic Year 2022-23)

S. Y. B. Tech. **Pattern 2023 Semester: Ⅳ** **Course Code : 2312216** **Course Name : Artificial Neural Network and Fuzzy System**		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory :03hrs/week	**03**	**Continuous Comprehensive Evaluation: 20Marks** **InSem Exam: 20Marks** **EndSem Exam: 60Marks**

Prerequisite Courses: - Linear algebra, differential calculus, statistical and numerical methods

Course Objectives:

1. Understand how neural networks mimic the brain's behavior and learn about their basic structure and training methods.
2. Master the backpropagation algorithm used in multi-layer neural networks to adjust weights and improve learning.
3. Explore fuzzy logic's approach to handling uncertainty using fuzzy sets and linguistic variables.
4. Learn how fuzzy logic is applied in controllers for reasoning and decision-making in uncertain environments.
5. Discover how neural networks and fuzzy logic are used in robotics for tasks like motion control, vision systems, and path planning.

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

	Course Outcomes	**Bloom's Level**
CO1	Comprehend the concepts of feed forward neural networks and fuzzy logic	1
CO2	Analyze the various feedback networks	3
CO3	Apply the concept of fuzziness involved in various systems and fuzzy set theory	3
CO4	Analyse the application of fuzzy logic control to real time systems	3

COURSE CONTENTS

Unit I	**Neural Network Fundamentals**	**(08hrs)**	**Cos Mapped CO1**

Biological Neural network, framework for distributed representation, Network topologies, training of ANN, Perceptron learning rules and convergence theorem

Unit II	**Back Propagation**	**(8hrs)**	**Cos Mapped CO2**

Multi-Layer feed forward networks, weight adjustment with sigmoid activation function, other activation functions, back propagation in fully recurrent network, Hopfield network,

Unit III	Fuzzy set and fuzzy logic	(8hrs)	Cos Mapped CO3
Fuzzy sets, operations of fuzzy sets, fuzzy relations, operations of fuzzy relations. Fuzzy implications, Linguistic variables			
Unit IV	**Fuzzy Logic Controllers**	**(8hrs)**	**Cos Mapped CO4**
Theory of approximate Reasoning Translation rules, rationale properties, fuzzy rule based systems, fuzzy reasoning schemes, fuzzy logic controllers, de-fuzification methods			
Unit V	**Applications of Neural Network and Fuzzy Logic in Robotics**	**(8hrs)**	**Cos Mapped CO4**
Applications of Neural Network and Fuzzy Logic for forward and inverse kinematics of robots, dynamic control of robots, trajectory generation, robot vision system, robot path planning etc.			

Reference Books

1. C. R. Alavala, Fuzzy Logc and Nueral Networks: basic concepts and applications, New Age International Publishers
2. Jack M. Zurada, "Introduction to Artificial Neural Systems", PWS Publishing Co., Boston, 2002.
3. Zimmerman H.J., "Fuzzy set theory and its Applications", Kluwer Academic Publishers Dordrecht, 2001.
4. Laurance Fausett, Englewood cliffs, N.J., Fundamentals of Neural Networks, Pearson Education, New Delhi, 2008.

Strength of CO-PO Mapping														
	PO													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	1	2	-	2	-	-	-	-	-	-	1	1	-
CO2	2	1	2	-	2	-	-	-	-	-	-	1	1	-
CO3	2	1	2	-	2	-	-	-	-	-	-	1	1	-
CO4	2	1	2	-	2	-	-	-	-	-	-	1	1	-

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Assignments on each Unit	10
2	LMS Test on Each Unit	10
	Total	**20**

S. Y. B. Tech. Pattern 2023 Semester: IV Course Code : 2312217 Course Name : Artificial Neural Network and Fuzzy System Lab		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical: 02 hrs. /week	**01**	**Term work : 25 Marks** **Oral : 25 Marks**
Prerequisite Courses:---		
Course Objectives:		

Course Objectives	Description
1	Understand how neural networks mimic the brain's behavior and learn about their basic structure and training methods.
2	Master the back propagation algorithm used in multi-layer neural networks to adjust weights and improve learning.
3	Explore fuzzy logic's approach to handling uncertainty using fuzzy sets and linguistic variables.
4	Learn how fuzzy logic is applied in controllers for reasoning and decision-making in uncertain environments.
5	Discover how neural networks and fuzzy logic are used in robotics for tasks like motion control, vision systems, and path planning.

Course Outcomes:

Course Outcomes	Description
1	Comprehend the concepts of feed forward neural networks and fuzzy logic
2	Analyse the various feedback networks
3	Apply the concept of fuzziness involved in various systems and fuzzy set theory
4	Analyse the application of fuzzy logic control to real time systems

Course context, Relevance, Practical Significance:

The course content delves into fundamental principles of neural networks and fuzzy logic, offering insights into their practical applications in various fields. Understanding neural networks aids in modeling complex systems and pattern recognition tasks, while fuzzy logic provides a framework for dealing with uncertain and imprecise information. These concepts are highly relevant in today's technological landscape, where industries seek solutions for data analysis, decision-making, and automation. Mastery of these topics equips individuals with valuable skills applicable in areas such as artificial intelligence, robotics, finance, and healthcare, enhancing their capabilities to tackle real-world challenges effectively.

Course Contents:

Sr. No.	Contents	Pr. Hrs.
1	Implementation of Fuzzy Operations	2
2	Implementation of Fuzzy Controller for robotics application	2
3	Implementation of Perceptron Learning Algorithm	2
4	Robot inverse kinematics using fuzzy logic	2
5	Robot dynamics using neural network	2
6	Robot path planning using fuzzy logic controller	2

Course Mapping:

Assignment/ Experiment	Contents	CO-mapped	PO mapped	PSO mapped
1	Implementation of Fuzzy Operations	1	1,2	1
2	Implementation of Fuzzy Controller for robotics application	1	1,2	1
3	Implementation of Perceptron Learning Algorithm	2	1,2	1
4	Robot inverse kinematics using fuzzy logic	2	1,2	1
5	Robot dynamics using neural network	3	1,2	1
6	Robot path planning using fuzzy logic controller	4	1,2	1

K. K. Wagh Institute of Engineering Education and Research, Nashik
(Autonomous from Academic Year 2022-23)

T. Y. B. Tech. Robotics and Automation
Pattern 2022, Semester: V
2312218: Name of Subject: Open Elective 2: Comparative Philosophy

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory :02 hrs/week	02	CCE: 50 Marks

Prerequisite Courses: ---

Course Objectives:

1. Explain the perspective of different philosophies of the East and the West.
2. Compare parallel or distinctive worldviews and

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

	Course Outcomes	Bloom's Level
CO1	Identification of cross-cultural philosophical similarities and differences.	2. Understand
CO2	Critical analysis of diverse philosophical traditions.	2. Understand
CO3	Synthesis of insights to develop a global philosophical perspective.	2. Understand

COURSE CONTENTS

Unit I	**Background of Comparative Philosophy**	**(07 hrs)**	**COs Mapped: CO2, CO4**

Parallel developments and problem approach comparative attempts in classical period, Tendencies. Common themes, Major differences

Unit II	**Landscape and Traveling: East and West**	**(07 hrs)**	**COs Mapped: CO1, CO3**

The True, the Good, and the Beautiful, Tat Tvam Asi and the Realization of self-divinity, Benevolent Government, Laughter: East and West (a) Siddharta Gautama (b) Socrates (c). Zhuang Zi

Unit III	**Intra-Disciplinary Comparative Philosophy**	**(07 hrs)**	**COs Mapped: CO2, CO4**

Philosophy, Religions and Transcendence, Survey of Western search for transcendence, Chinese search for transcendence, Ascent in the Buddhist Trikaya, Catholicism and Culture (a) The evangelization of China (b) The evangelization of the Philippines (c) The evangelization of India

Reference Books

1. P. T. Raju, Introduction to Comparative philosophy, Motilal Banarsidass, 1992
2. Co, Alfredo,. Across the Ancient Philosophical World: Essays in Comparative Philosophy. Manila: UST Publishing House 2015
3. Liat, J. Kwee Swan, Methods of Comparative Philosophy, Philosophy East and West , Vol. 1,

No. 1(April 1951): pp. 10-15.
4. Moore, Charles, Some Problems of Comparative Philosophy, in Philosophy East and West , Vol. 1 No.1 (April 1951): pp. 67-70.
5. Nakamura, Hajime. "Methods and Significance of Comparative Philosophy," in Revue Internationale de Philosophie, Vol. 28, No. 107/108 (1974): pp. 184-193.

Strength of CO-PO Mapping

	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	1	1	1	1	1	1	-	-	-	-	-	1
CO2	1	1	-	-	1	-	-	-	-	1	-	-
CO3	-	-	-	1	-	-	1	-	-	-	-	-

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Tests on each unit using LMS (Each test for 20 M and total will be converted out of 30 M)	30
2	Timely Assignments Submission on each unit (5 M for each unit)	20

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K.K.Wagh Institute of Engineering Education and Research, Nashik
(Autonomous from Academic Year 2022-23)

S. Y. B. Tech
Robotics and Automation
Pattern 2023, Semester: IV
2312219:Name of Subject: Universal Human Values(UHV-II)

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
TU:2Hrs/Week	**02**	**CCE-50Marks**

Prerequisite Courses: NA

Course Objectives:

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

Course Methodology

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied skills.
3. State the need for UHV activities and its present relevance in the society and Provide real-life examples.
4. Support and guide the students for self-study activities.
5. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
6. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student in every activity, leading to continuous self evolution.
7. Encourage the students for group work to improve their creative and analytical skills.

Course Outcomes:

At the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature)

	Course Outcomes	**Bloom's Level**
CO1	They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.	5-Evaluate
CO2	They would have better critical ability	4-Analyze

CO3	They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).	3-Apply
CO4	It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction	3-Apply
CO5	Analyze ethical dilemmas and make informed decisions considering the broader implications.	4–Analyze
CO6	Evaluate the significance of professional ethics within their respective fields or disciplines	5-Evaluate

COURSE CONTETNT:

Unit I	**Introduction to Value Education**	**(07hrs)**	**COs Mapped - CO1, CO2,CO3**

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations

Unit II	**Harmony in the Human Being**	**(08hrs)**	**COs Mapped –CO2, CO3,CO4**

Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health

Unit III	**Harmony in the Family and Society**	**(08hrs)**	**COsMapped –CO3, CO4**

Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order

Unit IV	**Harmony in the Nature/Existence**	**(07hrs)**	**COs Mapped – CO2,CO3,CO 4**

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence

Unit V	**Implications of the Holistic Understanding – a Look at Professional Ethics**	**(07hrs)**	**COs Mapped - CO4,CO5**

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Course Mapping

Unit	Contents	Blooms Taxonomy Level	CO-mapped	PO mapped	PSO mapped
I	Introduction to Value Education	3,4,5	1,2,3	6,8,12	1
II	Harmony in the Human Being	3,4	2,3,4	6,8,12	1
III	Harmony in the Family and Society	3	3,4	6,8,12	1
IV	Harmony in the Nature/Existence	3,4	3,4	6,8,12	1
V	Implications of the Holistic Understanding – a Look at Professional Ethics	4,5	5,6	6,8,12	1

Learning Resources

Text Books: Teachers Manual

[T1] The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978- 93-87034- 47-1

[T2] The Teacher‟s Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G

.

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
5. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers.
8. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
9. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press
10. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
11. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books. 23. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Web links and Video Lectures (e-Resources):

1. Value Education websites,
2. https://www.uhv.org.in/uhv-ii,
3. http://uhv.ac.in,
4. http://www.uptu.ac.in
5. Story of Stuff,
6. http://www.storyofstuff.com
7. Al Gore, An Inconvenient Truth, Paramount Classics, USA
8. Charlie Chaplin, Modern Times, United Artists, USA
9. IIT Delhi, Modern Technology – the Untold Story
10. Gandhi A., Right Here Right Now, Cyclewala Productions
11. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
12. https://fdp-si.aicte-india.org/8dayUHV_download.php

1. https://www.youtube.com/watch?v=8ovkLRYXIjE
2. https://www.youtube.com/watch?v=OgdNx0X923I
3. https://www.youtube.com/watch?v=nGRcbRpvGoU
4. https://www.youtube.com/watch?v=sDxGXOgYEKM

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr.No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Assignments Weekly or bi-weekly assignments on topics related to human values, such as case studies, reflections, or short essays. (Total 3Assignment,Unit I and II 20marks, Unit III and IV 20marks and Unit V-10 marks & 50 marks will be converted to 10 Marks)	10
2	Tests on each unit using LMS (Each test for15 M and total will be converted out of 10M)	10
3	**Group Projects or Presentations** 1] Collaborative projects where students work in groups to research and present on specific human values topics. 2] Evaluation based on the quality of research, presentation skills, and alignment with course objectives.	10
4	**Ethical Dilemma Analysis** 1] Individual or group assignment where students analyze real-life ethical dilemmas and propose solutions based on human values principles. 2] Assessment based on the depth of analysis, clarity of reasoning, and alignment with ethical frameworks.	15
5	**Attendance (Above95% : 05Marks,below75%:0Marks)**	5

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S.Y. B. Tech. Robotics and Automation
Pattern 2023, Semester:IV
2312220: Name of Subject: Soft skills

Teaching Scheme	Course Type	Credit Scheme	Examination Scheme:
TU:01 hrs/week PR :02 hrs/week	**AEC**	**02**	**TU:25 marks TW:25 marks**

Prerequisite Courses: Communication Skills

Course Objectives: By the end of the course, students should be able to

Sr.No.	Description
1	Enhance oral and written communication skills tailored to engineering contexts, encompassing technical presentations, meetings, documentation, and active listening techniques.
2	Implement effective teamwork and collaboration strategies specific to engineering environments, focusing on roles, conflict resolution, and trust-building, and collaborative project execution.
3	Strengthen problem-solving and critical thinking abilities through structured methodologies and creative approaches, applied to engineering challenges and scenarios.
4	Cultivate adaptability, resilience, and time management techniques to navigate the dynamic engineering landscape, addressing setbacks, competing priorities, and stressors effectively.

Course Outcomes:

Course Outcomes	Description Student will be able to:
CO1	Demonstrate proficient oral and written communication skills tailored to engineering contexts, fostering effective technical exchanges and collaboration.
CO2	Implement teamwork and collaboration abilities, navigating diverse team dynamics and contributing effectively to engineering projects.
CO3	Explain advanced problem-solving and critical thinking capabilities, applying structured methodologies and creative approaches to engineering challenges.
CO4	Develop strong leadership qualities and a commitment to professional development, equipped to navigate ethical dilemmas, make informed decisions, and pursue career advancement in engineering fields.

Course context, Relevance, Practical Significance:

In today's rapidly evolving engineering landscape, professionals require a multifaceted skill set beyond technical expertise. This course aims to address the holistic development of engineering students by focusing on essential areas such as communication, teamwork, problem-solving, adaptability, and leadership. Through a structured curriculum comprising theoretical frameworks, practical exercises, and real-world applications, students will cultivate the competencies needed to thrive in diverse engineering projects and environments. By emphasizing these critical skills, the course endeavors to prepare students to meet the challenges and demands of the modern engineering profession effectively.

Course Contents:

Unit	Contents	Lecture Hrs.
1	**Unit 1: Communication Skills** Understanding the importance of effective communication in engineering projects. Developing oral communication skills: presenting technical information, leading meetings, and participating in discussions. Enhancing written communication skills: writing technical reports, emails, and documentation. Practicing active listening and feedback techniques. Role-playing exercises to simulate real-world communication scenarios. .	7
2	**Unit 2: Teamwork and Collaboration** Exploring the dynamics of effective teamwork in engineering environments. Understanding team roles and responsibilities. Strategies for conflict resolution and managing team dynamics. Building trust and fostering a positive team culture. Collaborative project work with peers to apply teamwork principles.	7
3	**Unit 3: Problem-Solving and Critical Thinking** Introduction to problem-solving methodologies in engineering. Developing critical thinking skills to analyse and evaluate complex problems. Applying structured problem-solving techniques, such as root cause analysis and brainstorming. Incorporating creativity and innovation into problem-solving processes. Case studies and hands-on exercises to practice problem-solving in engineering contexts.	7
4	**Unit 4: Adaptability and Resilience** Recognizing the importance of adaptability in a rapidly changing engineering landscape. Strategies for embracing change and uncertainty. Developing resilience to overcome setbacks and failures. Time management techniques to balance competing priorities and deadlines. Stress management and self-care practices for maintaining well-being.	7
5	**Unit 5: Leadership and Professional Development** Exploring leadership styles and qualities relevant to engineering roles. Developing skills in decision-making, delegation, and conflict resolution as a leader. Understanding ethical considerations and responsibilities in engineering practice. Strategies for career planning, goal setting, and professional networking. Guest lectures from industry professionals and alumni sharing their experiences and insights.	7

Course Mapping:

Unit	Contents	Blooms Taxonomy Level	CO-mapped	PO mapped	PSO mapped
1	**Communication Skills**	1,2,3	1	1,2,3,10	--

2	**Teamwork and Collaboration**	2,3	1,2	1,2,9,10, 11	--
3	**Problem-Solving and Critical Thinking**	2,3	1,2,3	1,2,5,12	--
4	**Adaptability and Resilience**	2,3	1,4	1,7,10	---
5	**Leadership and Professional Development**	2,3	1,2,3,4	1,2,11,12	--

References Books:

1. "Communication Skills for Engineers and Scientists" by Whiting, H.G., and Rycroft, D. ISBN-13: 978-0471938719
2. "Teamwork and Project Management" by Karl A. Smith and Ruth W. Crumbly ISBN-13: 978-0073381477
3. "Engineering Problem Solving: A Classical Perspective" by Delores M. Etters ISBN-13: 978-0131429159
4. "Leadership in Engineering: A Concise Guide to the Roles, Responsibilities, and Challenges of Engineering Managers" by Peter C. Haynes ,ISBN-13: 978-1108