Evaluation Reforms NEP 2020

Second year Bachelor of Engineering

Shroff S R Rotary Institute of Chemical Technology,

Ankleshwar

MECHANICAL ENGINEERING

EFFECTIVE FROM A.Y. 2026-2027

Teaching Scheme for
Second Year Bachelor of Mechanical Engineering

Semester-III:

Sub Code	Subject	Teaching Scheme (hrs. / week)			Total	Credit	Examination Scheme				
		L	T	P	Hr	C	SEE	CCE	I/TW	V	Total
BUNBS311	Mathematics -III	3	1	0	4	4	50	50	25	25	150
BMEPC301	Engineering Thermodynamics	3	1	0	4	4	50	50	25	25	150
BMEPC302	Manufacturing Process-I	3	0	2	5	4	50	50	25	25	150
BMEPC303	Material Science and Metallurgy	3	0	2	5	4	50	50	25	25	150
BUNAE321	English Proficiency Course	2	0	2	4	3	50	50	25	25	150
BUNVA331	Yoga for Well-Being	0	0	4	4	2	00	00	25	25	50
	Total	**14**	**2**	**10**	**26**	**21**	**250**	**250**	**150**	**150**	**800**

Semester-IV:

Sub Code	Subject	Teaching Scheme (hrs/week)			Total	Credit	Examination Scheme				
		L	T	P	Hr	C	SEE	CCE	I/TW	V	Total
BMEPC401	Strength of Material	3	1	0	4	4	50	50	25	25	150
BMEPC402	Manufacturing Process-II	3	0	2	5	4	50	50	25	25	150
BMEPC403	Fluid Mechanics	3	0	2	5	4	50	50	25	25	150
BMEVS404	Measurement Lab	0	0	2	2	1	00	00	25	25	50
BMEPE405/ BMEPE406	Mechanical Measurement and Metrology/ Lubrication Technology	3	0	0	3	3	50	50	00	00	100
BUNVA431	Universal Human Values	2	0	0	2	2	50	50	00	00	100
BXXOE441	Open Elective - 1	2	0	0	2	2	50	50	00	00	100
	Total	**16**	**1**	**6**	**23**	**20**	**300**	**300**	**100**	**100**	**800**
Multi-Disciplinary Minor Course-1 (Offer to other department students)											
BXXMD451	Multi Disciplinary Minor Course -1	4	0	0	4	4	50	50	00	00	100

L	Lecture	**SEE**	Semester End Examination
T	Tutorial	**CCE**	Continuous and Comprehensive Examination
P	Practical	**I**	Internal
C	Credit	**TW**	Term Work
		V	Viva

Open Elective - I (Semester – IV)

(Open Electives for Mechanical Engineering Students)

Sr. No.	Course Code	Course	Offered by
1	BEVOE441	Industrial Wastewater Treatment	Department of Environmental Science & Technology
2	BCHOE441	Introduction to Chemical Industry	Department of Chemical Engineering
3	BEEOE441	Fundamentals of Renewable Energy Technologies	Department of Electrical Engineering
4	BCTOE441	Materials Engineering	Department of Chemical Technology
5	BCOOE441	Emerging Technologies	Department of Computer Engineering
6	BITOE441	IT for Sustainability	Department of Information Technology

**Detailed syllabus separately available*

MDC - I (Semester – IV)

Multidisciplinary Minor Course-I (MDC-1) for Mechanical Engineering Students

Sr. No.	Course code	MDC-1 (Semester-4)	Minors (Certification)	Offered by (department)
1	BEVMD451	Introduction to Environmental Management	Environmental Management	Department of Environmental Science & Technology
2	BCHMD451	Introduction to Industrial Safety	Industrial Safety	Department of Chemical Engineering
3	BEEMD451	Basics of Measuring Instruments	Industrial Instrumentation and Automation	Department of Electrical Engineering
4	BPTMD451	Fundamentals of Pharmaceutical Engineering	Pharmaceutical Engineering	Department of Chemical Technology (Pharmaceutical Technology)
5	BGCMD451	Fundamentals of Materials Science and Engineering	Ceramics Engineering	Department of Chemical Technology (Glass & Ceramics Technology)
6	BDPMD451	Introduction to Paint and Coating Technology	Paint Technology	Department of Chemical Technology (Dyes & Pigments Technology)

7	BPRMD451	Chemistry of Polymers	Polymer Science and Engineering	Department of Chemical Technology (Polymer & Rubber Technology)
8	BCOMD451	Fundamentals of Data Science	Data Science	Department of Computer Engineering
9	BITMD451	Fundamentals of Cloud and Virtualization	Cloud computing	Department of Information Technology

**Detailed syllabus separately available*

UPL University of Sustainable Technology
Shroff S R Rotary Institute of Chemical Technology
B.E. Semester III
Mathematics –III (BUNBS311)

Teaching Scheme (Hrs./week)				Credit	Examination Scheme				
L	T	P	Total		SEE	CCE	I/TW	V	Total
3	1	0	4	4	50	50	25	25	150

COURSE OVERVIEW:

This course introduces second-year B.E. students to advanced mathematical techniques such as Laplace Transforms, Fourier series and Integrals, Double Integrals, and Complex Variables. It focuses on developing analytical and problem-solving skills for engineering applications. The course enables students to apply mathematical tools effectively in solving real-world engineering problems.

COURSE CONTENT:

Sr. No.	Topics	COs	Hrs
	SECTION-A		
1	**Fourier Series:** Periodic function, Trigonometric series, Fourier series, Functions of any period, Even and odd functions, Half-range Expansion.	1	7
2	**Fourier integral:** Sine and cosine integral, even and odd functions.	2	6
3	**Laplace Transforms:** Definition of the Laplace transform, Linearity, shifting theorems, Laplace transformation of elementary function, basic properties of Laplace transformation, Differentiation of Laplace transformation (multiplication by t), Integration of Laplace transformation (division by t), Laplace transformation of derivatives and integrals, Evaluation of integrals using Laplace transformation.	4	10
	SECTION-B		
4	**Inverse Laplace transformation and its application:** Properties of inverse Laplace transformation, shifting theorem, multiplication and division by differentiation and integration of Laplace transformation. Convolution theorem, inverse Laplace transformation using partial fraction, solution of linear differential equation.	5	10
5	**Double integral and its applications:** Over rectangular and general regions, properties of double integrals, Change of order, change of variables, Area by double Integrals.	6	7
6	**Curve Sketching:** Curve sketching in Cartesian Co-ordinates and Polar co-ordinates, Relation between Polar and Cartesian Co-ordinates.	3	5

LIST OF TUTORIALS:

1. Tutorial-1 (Fourier Series)
2. Tutorial-2 (Fourier Series)
3. Tutorial-3 (Fourier Integral)
4. Tutorial-4 (Laplace Transform)
5. Tutorial-5 (Laplace Transform)
6. Tutorial-6 (Inverse Laplace Transformation)
7. Tutorial-7 (Inverse Laplace Transformation)
8. Tutorial-8 (Double Integral and its application)
9. Tutorial-9 (Double Integral and its application)
10. Tutorial-10 (Curve sketching)

TEXT BOOKS:

1. Advanced Engineering Mathematics by Ravish Singh and Mukul Bhatt.MC Graw Hill Education Pvt Ltd.
2. Engineering Mathematics Vol 2, by Baburam, Pearson

REFERENCE BOOKS:

1. Thomas' Calculus, Maurice D. Weir, Joel Hass, Frank R. Giordano, Pearson Education.
2. Advanced Engineering Mathematics (8th Edition), by E. Kreyszig, Wiley- India (2007)..
3. R. V. Churchill and J. W. Brown, Fourier series and boundary value problems (7th Edition), McGraw-Hill (2006).

ONLINE RESOURCES:

1. https://digimat.in/nptel/courses/video/111105134/L36.html
2. http://www.digimat.in/nptel/courses/video/122104017/L12.html
3. https://www.digimat.in/nptel/courses/video/111105123/111105123.html

COURSE OUTCOMES:

CO1	**Define** Fourier series, periodic functions, trigonometric series, and perform half-range expansions for even and odd functions.
CO2	**Solve** problems involving Fourier sine and cosine integrals, including applications to even and odd functions.
CO3	**Sketch** curves in Cartesian.
CO4	**Calculate** Laplace transforms of functions using properties, shifting theorems, and apply them to evaluate integrals.
CO5	**Calculate** inverse Laplace transforms and solve linear differential equations using properties, convolution theorem, and partial fractions.
CO6	**Construct** and evaluate double integrals over different regions, including change of order and change of variables.

UPL University of Sustainable Technology
Shroff S. R. Rotary Institute of Chemical Technology
B.E. Semester III
Engineering Thermodynamics (BMEPC301)

Teaching Scheme (Hrs./week)				Credit	Examination Scheme				
L	T	P	Total		SEE	CCE	I/TW	V	Total
3	1	0	4	4	50	50	25	25	150

COURSE OVERVIEW:

This course introduces the fundamental principles and laws of thermodynamics with emphasis on energy, entropy, and their applications in engineering systems. It covers analysis of closed and open systems, power and refrigeration cycles, and basic gas laws. The course builds a strong foundation for advanced studies in thermal and energy engineering.

COURSE CONTENT:

Sr. No.	Topics	COs	Hrs
	SECTION-A		
1	**Basic Concepts of Thermodynamics:** Thermodynamic system, surroundings and control volume, microscopic and macroscopic point of view, thermodynamic properties, intensive and extensive properties, state of a substance, process and cycle, thermodynamic equilibrium, concept of continuum, quasi-static process, Zeroth law of thermodynamics, thermodynamic temperature scale, concept of heat and work	1	7
2	**First Law of Thermodynamics:** Energy and its forms, first law of thermodynamics for a closed system undergoing a cycle and change of state, PMM-I, first law of thermodynamics for steady flow systems, steady flow energy equation (SFEE), applications of SFEE	2	8
3	**Second Law of Thermodynamics:** Limitations of first law of thermodynamics, Kelvin–Planck statement, Clausius statement, equivalence of Kelvin–Planck and Clausius statements, PMM-II, causes of irreversibility, Carnot cycle, Carnot theorem, corollary of Carnot theorem, thermodynamic temperature scale	3	8
	SECTION-B		
4	**Entropy:** Clausius theorem, entropy as a thermodynamic property, inequality of Clausius, entropy change in reversible and irreversible processes, principle of increase of entropy, entropy change for closed systems, entropy change for steady flow systems	4	6
5	**Exergy:** Concept of exergy, exergy of a heat input in a cycle, exergy destruction	5	6

	due to irreversibility, Gouy–Stodola theorem, second law efficiency		
6	**Power and Refrigeration Cycles:** Carnot vapour cycle and its limitations, Rankine cycle, efficiency of Rankine cycle, factors affecting Rankine cycle efficiency, reheat cycle, regenerative cycle, reheat-regenerative cycle, Otto cycle, Diesel cycle, Dual cycle, air-standard efficiency, mean effective pressure, simple Brayton cycle, reversed Carnot refrigeration cycle and its limitations, simple vapour compression refrigeration cycle, P-h and T-s diagrams, COP and performance analysis, factors affecting COP	6	10

LIST OF TUTORIALS:

1. Fundamentals of Thermodynamics: Systems, Properties, and Processes
2. Steady Flow Energy Equation (SFEE) and Its Practical Applications
3. Second Law of Thermodynamics
4. Entropy Concepts: Clausius Theorem, Irreversibility, and Entropy Generation
5. Exergy Analysis: Available Energy, Losses, and Second Law Efficiency
6. Carnot Cycle & Rankine Cycle: Theory, Efficiency, and Improvements
7. Air Standard Cycles: Otto, Diesel, and Dual Cycle Performance Analysis
8. Refrigeration Cycles: Vapour Compression System, COP and Performance Factors

TEXT BOOKS:

1. Engineering Thermodynamics by J. P. Hadiya and H. G. Katariya, Books India Publications.
2. Engineering Thermodynamics by P. K. Nag, McGraw-Hill Education.

REFERENCE BOOKS:

1. Fundamentals of Engineering Thermodynamics by R. Yadav, Central Publishing House, Allahabad.
2. Engineering Thermodynamics by R.K. Rajput, Laxmi Publications, New Delhi.
3. Engineering Thermodynamics by Gordon Rogers and Yon Mayhew, Pearson Education Ltd.
4. Thermodynamics – An Engineering Approach by Yunus Cengel & Boles, Tata McGraw-Hill, New Delhi.
5. Engineering Thermodynamics by Jones and Dugan, PHI Learning Pvt. Ltd

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/112105123

COURSE OUTCOMES:

CO1	**Explain** basic thermodynamic concepts, properties, systems, and energy interactions.
CO2	**Analyze** the first law of thermodynamics for closed and open systems.
CO3	**Interpret** the second law of thermodynamics and evaluate theoretical limits of energy conversion.
CO4	**Analyze** entropy generation to identify irreversibility in thermodynamic systems.

CO5	**Evaluate** system performance using exergy analysis.
CO6	**Apply** thermodynamic principles to assess the performance of power and refrigeration cycles.

UPL University of Sustainable Technology
Shroff S R Rotary Institute of Chemical Technology
B.E. Semester III
Manufacturing Process-I (BMEPC302)

Teaching Scheme (Hrs./week)				Credit	Examination Scheme				
L	T	P	Total		CEE	M	I	V	Total
3	0	2	5	4	50	50	25	25	150

COURSE OVERVIEW:

Basic knowledge of mechanical workshop practices and manufacturing tools. This course introduces fundamental manufacturing processes used in producing metal components for automobiles, machines, and equipment. It equips students with essential process knowledge and parameter control to achieve high-quality production at minimum cost and time, preparing them for industrial applications.

COURSE CONTENT:

Sr. No.	Topics	COs	Hrs
	SECTION-A		
1	**Introduction to manufacturing processes :** Definition and importance of manufacturing, Classification of manufacturing processes, Overview of Manufacturing Processes: Primary shaping processes, Machining processes, Joining processes, Surface finishing processes, Process Selection: Basic factors affecting selection of manufacturing process, Machinability and cutting Fluids.	1	7
2	**Lathe Operations:** Types of lathes – light duty, Medium duty and heavy duty geared lathe, Specifications; Basic parts and their functions, Single point cutting tool. Operations carried on engine lathe, Types of lathe machines, attachment extending the processing capacities of engine lathes, Taper turning on lathe, Thread cutting.	2	8
3	**Drilling Machines:** Classification; Basic parts and their functions; Types of drilling machines, Drilling and allied operation: drilling, boring, reaming, tapping, counter sinking, counter boring, spot facing; deep hole drilling, Tool signature of drill, various field of application of drilling machine.	3	8
	SECTION-B		
4	**Milling Machines:** Introduction; Types of milling machines: plain, Universal, vertical; constructional details – specifications; Milling operations: simple, compound and differential indexing; Milling cutters–types; Nomenclature of teeth; Teeth materials; Tool signature of milling cutter; Tool & work holding devices.	4	9

5	**Planers, Shapers and Sawing Machines::** Classification of planers and Shapers, Attachments extending the processing capacities of planers, Shapers machine and tooling requirements. **Sawing Machines:** Metal sawing classification: reciprocating sawing machines, circular sawing machines and band sawing machines.	5	6
6	**Grinding Machines and Abrasives:** Principles of metal removal by Grinding, Classification of grinding machines, cylindrical grinders, internal grinders, Surface grinders, tool and cutter grinders, center less grinders, Types of grinding wheels, wheel characteristics and wheel selection. Standard marking systems: Meaning of letters & numbers sequence of marking, Grades of letters.	6	7

LIST OF PRACTICALS:

1. Study of various Machine Tools (Lathe, Shaper).
2. Study of various cutting angles on Single point cutting tool.
3. Study of various turning operations like plain turning, facing, taper turning, knurling, threading, grooving, etc. performed on lathe machine
4. Turning Job: Prepare a job on centre lathe as per the given drawing.
5. Milling Job: Prepare a job on milling machine as per the given drawing using various milling operations.
6. Shaping and Drilling Job: Prepare a job having plain and inclined surfaces on shaping machine with minimum two holes as per given drawing.
7. Demonstration of Gear making process using Indexing mechanism on milling machine.

TEXT BOOKS:

1. Elements of workshop Technology (Volume I & II) – S. K. Hajra Chaudary, Bose & Roy, Media Promoters and Publishers Limited.
2. Production Technology (Volume I & II) – O. P. Khanna & Lal, Dhanpat Rai Publications.

REFERENCE BOOKS:

1. Manufacturing Processes for Engineering Materials, Kalpakjian and Schmid, Prentice Hall.Fundamentals of Metal Machining and Machine Tools, Winston A. Knight, Geoffrey Boothroyd, CRC Press.
2. Manufacturing technology – P N Rao, Tata McGraw-Hill Publications.
3. Workshop Technology _ B.S. Raghuwanshi, Dhanpat Rai and Co., New Delhi.
4. Manufacturing Technology, Metal Cutting & Machine tools– P. N. Rao, Tata McGraw-Hill Publications.
5. Workshop Technology I & II - J. A. Schey, Tata McGraw-Hill Publications.

ONLINE RESOURCES:

1. https://www.google.com/url?q=https://nptel.ac.in/courses/112104204&sa=D&source=editors&ust=1776228468800698&usg=AOvVaw2TmpwmLnPRnnLM97QtDkt3

COURSE OUTCOMES:

CO1	**Understand** the concept and basic mechanics of metal cutting and working of

	Standard machine tools.
CO2	**Demonstrate** various machining operations carried out at different machine tools.
CO3	**Apply** drilling and allied operations using suitable drilling machines and tools.
CO4	**Analyze** milling machines, cutters, indexing methods, and work-holding devices for component machining.
CO5	**Differentiate** planers, shapers, and sawing machines based on operation and application.
CO6	**Describe** the effect of different grinding and abrasive parameters on surface integrity.

UPL University of Sustainable Technology
Shroff S R Rotary Institute of Chemical Technology
B.E. Semester III
Material Science & Metallurgy (BMEPC303)

Teaching Scheme (Hrs./week)				Credit	Examination Scheme				
L	T	P	Total		SEE	CCE	I/TW	V	Total
3	0	2	5	4	50	50	25	25	150

COURSE OVERVIEW:

Basic principles of science are used to study the structure-properties relationships of various materials for their proper applications in this subject. Especially study of different types of ferrous and non-ferrous metals and alloys, in terms of their composition, structure, properties and applications; non-destructive testing is included in this course to understand the basic concept of selection and processing of metals and materials for their applications.

COURSE CONTENT

Sr. No.	Topics	COs	Hrs
	SECTION-A		
1	**Introduction to Material Science and Metallurgy:** Basics of Engineering Materials, their Classifications and Application, Engineering requirements of materials, Properties of engineering materials, Criteria for selection of materials for engineering Applications.	1	6
2	**Crystal Geometry and Crystal Imperfection:** Unit Cell, Crystal structure, atomic packing, coordination number, crystal structures of metallic elements, crystal directions and planes.	2	7
3	**TTT diagram and Heat Treatment of Steel:** Time-Temperature- Transformation Diagram, Study of heat treatment processes such as annealing, normalizing, spherodizing, hardening, tempering, carburizing, nitriding, cyaniding, Induction hardening, flame hardening and hardenability of steel.	3	9
	SECTION-B		
4	**Allotropy of Iron, Iron-Iron Carbide equilibrium system:** Allotropy of iron; Iron-iron carbide equilibrium diagram: Phases present and their properties, different reactions of the Iron-Iron Carbide equilibrium system; constituents, microstructures and properties of plain carbon steels.	4	8
5	**Powder Metallurgy:** Applications of powder metallurgy, advantages of powder metallurgy, manufacturing processes, production of powder, compacting, sintering, products of powder metallurgy.	5	7
6	**Non Destructive Testing:**	6	8

	Non Destructive testing of materials such as Radiography Testing, Dye Penetration Testing, Magnetic Particle Testing, Ultrasonic Testing with their Principle of non- destructive testing, the test methods, relative merits, demerits and applications.		

LIST OF PRACTICAL:

1. To get acquainted with the operation, construction, use and capabilities of a metallographic microscope.
2. To study the procedure of specimen preparation for microscopic examination and to carry out a specimen preparation.
3. To understand what micro examination is, the importance of micro examination and to study various ferrous, non-ferrous microstructures.
4. To identify the different types of material available for design, manufacturing and processing of various components based on structure-property- performance-processing relationships.
5. To show the effect of different quenching media (Oil, Water and Brine) on the hardness of medium carbon steel.
6. To understand the Iron-Iron Carbide Equilibrium Diagram.
7. Study of different heat treatment processes- annealing, normalizing, hardening and tempering, surface and casehardening to improve properties of steel during processes and applications.
8. To understand the concept of hardenability and its relevance to heat treatment procedures to be adopted in practice.
9. To understand the principle & working of the liquid penetrant test and the magnetic particle test.
10. To understand the principle & working of the Eddy current test and the Ultrasound test.

TEXT BOOKS:

1. O. P. Khanna, "A Textbook of Material Science and Metallurgy", Edition, 5, Dhanpat Rai, 1987.

REFERENCE BOOKS:

1. Donald R. Askeland and Pradeep P. Phule, “The Science and Engineering of Materials”, Edition, 5, Cengage Learning, 2005.
2. William F. Smith, “Principles of Materials Science and Engineering”, Edition, 4, McGraw Hill, 2020.
3. Lawrence H. Van Vlack, “Elements of Material Science and Engineering”, Pearson Education.
4. Ed. George F. Vander Voort, “Metallography and Microstructure”, ASM International 2004.
5. Baldev Raj, T. Jayakumar and M. Thavasimuthu, “Practical Non- Destructive Testing”, Narosa Pub. House. ASM Handbook Vol.
6. K. I. Parashivamurthy, “Materials Science and Metallurgy”, Pearson Education

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc24_mm12/preview

2. https://nptel.ac.in/courses/113102080
3. https://nptel.ac.in/courses/113104105
4. https://nptel.ac.in/courses/113104074

COURSE OUTCOMES:

CO1	**Understand** the basic concept of Material Science and Metallurgy.
CO2	**Know** about the crystal geometry, ferrous and non-ferrous metals and alloys and their Applications.
CO3	**Describe** various heat treatment processes for the different metals.
CO4	**Evaluate** the significance & applicability of allotropy & Iron-iron carbide equilibrium diagram.
CO5	**Understand** powder metallurgy process & their products.
CO6	**Judge** the Scope and limitations of non-destructive testing methods.

UPL University of Sustainable Technology
Shroff S R Rotary Institute of Chemical Technology
B.E. Semester III
English Proficiency Course (BUNAE321)

Teaching Scheme (Hrs./week)				Credit	Examination Scheme				
L	T	P	Total		SEE	CEE	I	V	Total
2	0	2	4	3	50	50	25	25	150

COURSE OVERVIEW:

Students should have basic communication skills in English, including reading, writing, and speaking. Familiarity with grammar, vocabulary, and sentence structure is important. Awareness of interpersonal communication and professional behavior is helpful. Willingness to participate in discussions and presentations, along with interest in self-development and effective communication, will support learning outcomes.

COURSE CONTENT:

Sr. No.	Topics	COs	Hrs
	SECTION-A		
1	**Dynamics of Communication:** Definition and process Kinesics Proxemics Paralinguistic features Importance of Interpersonal and Intercultural Communication in today's organizations.	1	6
2	**Technical Writing:** Report writing Technical proposal Technical description Business letters(sales, order, complaint, adjustment, inquiry, recommendation, appreciation, apology, acknowledgement, cover letter) Agenda of meeting, Minutes of meeting, Resume writing.	2	4
3	**Technical Communication:** Public speaking, Group discussion, Presentation strategies, Interview skills, Negotiation skills, Critical and Creative thinking in communication.	3	5
	SECTION-B		
4	**Ethics in Engineering:** Scope of engineering ethics, Accepting and sharing responsibility, Resolving ethical dilemmas, Making moral choices.	4	4
5	**Etiquettes:** Telephone etiquettes, Etiquettes for foreign business trips, Etiquettes for small talks, Respecting privacy, Learning to say NO, Time management.	5	5
6	**Self-development and Assessment:** Change, Grow, Persist, Prioritize, Read, Learn, Listen, Record, Remember, Asses, Think, Communicate, Relate, Dream.	6	6

LIST OF PRACTICALS:

1. Role Play
2. Letter Writing
3. Group Discussion
4. Presentation
5. Book Review (Preferably related to self- development)
6. Mock Interview
7. Report Writing
8. Case studies related to unit 4, 5 and 6
9. Conducting meeting with Agenda
10. Minutes of the Meeting

TEXT BOOKS:

1. Raman and Sharma, Technical Communications, OUP, New Delhi, 2017

REFERENCE BOOKS:

1. Lata and Kumar, Communication Skills, OUP, New Delhi, 2018
2. Mike Martin and Roland Schinzinger, Ethics in Engineering, McGraw Hill, New York, 2014
3. Mohapatra and Sreejesh S., Case Studies in Business Ethics and Corporate Governance, Pearson, UP, 2013
4. Ramesh and Ramesh, The Ace of Soft Skills, Pearson, UP, 2019
5. Sherfield, Montgomery and Moody, Cornerstone: Developing Soft Skills, UP, 2009

ONLINE RESOURCES:

1. https://www.scu.edu/ethics/focus-areas/more/engineering-ethics/engineering-ethics-cases

COURSE OUTCOMES:

CO1	**Define** and describe dynamics of verbal and non-verbal aspects of communication.
CO2	**Associate** with various formal documents of technical and professional communication
CO3	**Interpret** communication of diverse formal situations taking place in organizations.
CO4	**Illustrate** and examine the knowledge of ethical aspects of engineering
CO5	**Establish** and explain social and professional etiquettes.
CO6	**Recommend** self -development and self - assessment.

UPL University of Sustainable Technology
Shroff S R Rotary Institute of Chemical Technology
B.E. Semester III
Yoga for Well-Being (BUNVA331)

Teaching Scheme (Hrs./week)				Credit	Examination Scheme				
L	T	P	Total		CEE	M	I	V	Total
0	0	4	4	2	00	00	25	25	50

COURSE OVERVIEW

No prior yoga experience is required; the course is open to all interested in improving physical, mental, and emotional well-being. Participants should be medically fit for moderate activity, and those with existing health conditions must consult a doctor and inform the instructor in advance. Regular attendance, discipline, and willingness to learn are essential.

COURSE CONTENT

Sr. No.	Topics	COs	Hrs
1	**Yoga and Asana** • Meaning, Definition and Importance of Yoga • Meaning, Definition and Importance of Asana • Asanas for Prevention of Lifestyle Diseases	1	20
2	**Pranayama and Body Balance**: • Meaning, Definition and Importance of Pranayama • Various Types of Pranayama • Importance of Pranayama for Balanced Body and Mind	2	20
3	**Yoga Meditation and Stress Management:** • Meaning, Definition and Importance of Yoga Meditation • Basic Meditation Techniques • Stress Management through Yoga	3	20

LIST OF PRACTICALS:

1. Performance and viva of minimum 1-topic including explanation of benefits.
2. Demonstration of skills, techniques, and basic rules of any 5 selected Asana),
3. Any one of the Topic as specialization.
4. Asana Practical.

TEXT BOOKS:

1. **Yoga Education** – NCERT (National Council of Educational Research and Training)
2. **Common Yoga Protocol** – Ministry of AYUSH, Government of India
3. **Yoga for Healthy Living** – Swami Ramdev / Baba Ramdev's Yoga Textbook

REFERENCE BOOKS:

1. **The Heart of Yoga** – T.K.V. Desikachar
2. **Yoga for Wellness** – Yoga Journal Books

3. **Light on Yoga** – B.K.S. Iyengar
4. **Yoga: Its Meaning, Theory and Practice** – Swami Digambarji

ONLINE RESOURCES:

1. https://www.ayush.gov.in/
2. https://svyasa.edu.in/
3. https://www.artofliving.org/
4. https://nimhans.ac.in/

COURSE OUTCOMES:

CO1	**Understand** the fundamentals of Yoga, Asanas, Pranayama, and Meditation for holistic health and mental well-being.
CO2	**Develop** practical skills to perform Asanas and Pranayama with correct posture and breathing.
CO3	**Apply** yogic practices for improving fitness, managing stress, and preventing lifestyle-related diseases.
CO4	**Build** self-discipline through log-book and project work, and track personal health and fitness progress.

UPL University of Sustainable Technology
Shroff S. R. Rotary Institute of Chemical Technology
B.E. Semester IV
Strength of Materials (BMEPC401)

Teaching Scheme (Hrs./week)				Credit	Examination Scheme				
L	T	P	Total		SEE	CCE	I/TW	V	Total
3	1	0	4	4	50	50	25	25	150

COURSE OVERVIEW:

This course provides a comprehensive foundation in structural mechanics and material behaviour. You will begin by exploring stress-strain relationships, Hooke's Law, and the mechanical properties of ductile and brittle materials. The curriculum covers Structural Analysis, Support reactions and constructing Shear Force (SFD) and Bending Moment Diagrams (BMD) for various loading conditions, Stress Theory and torsional stresses in beams and Advanced Mechanics by Principal Stresses and Mohr's Circle. By mastering these concepts, you will gain the analytical tools necessary to ensure structural safety and integrity in engineering design.

COURSE CONTENT:

Sr. No.	Topics	COs	Hrs
	SECTION-A		
1	**Simple Stresses & Strains**: Elasticity and plasticity, Types of stresses & strains–Hooke's law, stress– strain diagram for mild steel, Working stress, Factor of safety, Lateral strain, Poisson's ratio & volumetric strain , Elastic moduli & the relationship between them, Bars of varying section.	1	8
2	**Statically Determinate Structures:** Analysis of support reactions, beams, Consideration of concentrated loads, moments/couples, Uniformly Distributed Loads (UDL), Uniformly Varying Loads (UVL). **Shear Force and Bending Moment**: Diagrams for Beams, Point of Contra flexures, Point and magnitude of Maximum bending moment and maximum shear force.	2	8
3	**Torsion:** Derivation of equation of torsion, Assumptions, application of theory of torsion equation to solid & hollow circular shaft, torsional rigidity, Power Transmitted by shaft.	3	6
	SECTION-B		
4	**Stresses in Beams:** Flexural stresses – Theory of simple bending, Assumptions, derivation of equation of bending, neutral axis, determination of bending stresses, section modulus of rectangular & circular (solid & hollow), I Sections. **Shear stresses:**	4	8

	Derivation of formula, shear stress distribution across various beam sections like rectangular, circular, I sections.		
5	**Principal Stresses:** Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr's circle of stress.	5	7
6	**Physical & Mechanical properties of materials:** Elastic, homogeneous, isotropic materials; Stress –Strain relationships for ductile and brittle materials, limits of elasticity and proportionality, yield limit, ultimate strength, strain hardening, proof stress, factor of safety, working stress, load factor, Properties: Toughness, hardness, Ductility, Brittleness.	6	8

LIST OF TUTORIALS:

1. Simple Stresses, Strains & Elastic Constants
2. Statically Determinate Structures & SFD/BMD
3. Theory of Torsion in Shafts
4. Flexural and Shear Stresses in Beams
5. Principal Stresses and Mohr's Circle
6. Mechanical Properties & Material Behavior

TEXT BOOKS:

1. R. S Kurmi, Gupta, ―Strength of Materials‖, S. Chand, 24th Edition, 2005.
2. Dr. R.P. Rethaliya, Dr. V.R. Panchal, Dr. Y.D. Patil, "Mechanics of Solids", Edition, 1, Atul Prakashan, 2014-15.
3. R K Bansal, "A Textbook of Strength of Materials", 4th Edition, Laxmi Publications, 2010

REFERENCE BOOKS:

1. Dr. B C Punamia, "Strength of Material & Mechanics of Structures, E-Book, 2019.
2. S. RAMAMURTHAN, R. Narayan, "Strength of Material", E-Book, 2005.
3. R.S.Khurmi, "Theory of Structures", S. Chand Publishing, New Delhi, 2000.
4. S.S. Rattan "Strength of Materials" McGraw Hill Education (India) Pvt. Ltd., 2nd Edition (Sixth reprint 2013)
5. Indrajeet M.Jain, "Mechanics of Solids", Tech-Max Publications, 2012

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc23_me140
2. https://youtu.be/GHpZgeGFYuA

COURSE OUTCOMES:

CO1	**Determine** the simple stresses and strains when members are subjected to axial loads.
CO2	**Construct** Shear Force diagram (SFD) and Bending Moment Diagrams (BMD) for statically determinate beams subjected to concentrated, UDL, and UVL loads.
CO3	**Analyze** circular shafts for power transmission by determining torsional stresses, rigidity, and the required dimensions for solid and hollow sections.

CO4	**Explain** the different types of stresses and strains developed in the member subjected to axial, bending, shear & torsional effects.
CO5	**Understand** the concept of principle stress & strain.
CO6	**Identify** and describe the physical and mechanical properties of engineering materials, including their behavior under ductile and brittle conditions.

UPL University of Sustainable Technology
Shroff S. R. Rotary Institute of Chemical Technology
B.E. Semester IV
Manufacturing Process-II (BMEPC402)

Teaching Scheme (Hrs./week)				Credit	Examination Scheme				
L	T	P	Total		SEE	CCE	I/TW	V	Total
3	0	2	5	4	50	50	25	25	150

COURSE OVERVIEW:

This course provides an integrated understanding of fundamental manufacturing processes, combining theoretical knowledge with practical exposure. The syllabus covers foundry and casting processes, metal forming, metal joining and welding, finishing operations and plastic processing techniques with emphasis on process principles, material behaviour, tooling, defects and quality aspects. The course is structured to help students apply classroom concepts through laboratory work and industrially relevant examples, enabling them to analyse, select and improve manufacturing processes and components while considering productivity, quality and sustainability.

COURSE CONTENT:

Sr. No.	Topics	COs	Hrs
	SECTION-A		
1	**Foundry Technology:** Fundamentals and importance of metal casting; pattern practices; moulding materials and moulding sands with their properties and testing; core materials and core-making practices; gating system and its design; moulding practices including sand, shell, permanent, and CO_2 moulding methods; various casting processes such as sand, shell, investment, die, centrifugal, continuous, and special casting processes; casting defects and remedies; design considerations for castings including gating and riser design with metallurgical aspects and melting furnaces used in foundry operations.	1	10
2	**Metal Joining Processes:** Operating principle, basic equipment, merits and applications of : Fusion welding processes : Gas welding: Types, Flame characteristics; Manual metal arc welding: Gas Tungsten arc welding , Gas metal arc welding, Submerged arc welding, Electro slag welding; Operating principle and applications of: Resistance welding, Plasma arc welding, Thermit welding, Electron beam welding, Friction welding and Friction Stir Welding; Brazing and soldering; Weld defects: types, causes and cure.	2	8
3	**Advance Super Finishing Technology:** Introduction, Lapping, Horning, Buffing, Barrel Tumbling, Burnishing, Powder coating, Polishing.	3	5
	SECTION-B		

4	**Metal Forming Processes:** Hot working and cold working of metals, Forging Processes: Open, impression and closed die forging, forging operations. Rolling of metals: Types of Rolling, Flat strip rolling, shape rolling operations, Defects in rolled parts. Principle of rod and wire drawing, Tube drawing, Principles of Extrusion, Types: Hot and Cold extrusion.	4	8
5	**Sheet Metal Processes:** Sheet metal characteristics: shearing, bending and drawing operations, Stretch forming operations, Formability of sheet metal, Special forming processes: Hydro forming, Rubber pad forming, Metal spinning, Introduction of Explosive forming, magnetic pulse forming, peen forming, Super plastic forming ,Micro forming.	5	8
6	**Manufacture of Plastic Components:** Introduction, Classification of Plastics, Ingredients of Moulding compounds, General Properties of Plastics, Plastic part manufacturing processes such as compression moulding, Transfer moulding, Injection moulding, Extrusion moulding, Blow moulding, Calendaring, Thermoforming, slush moulding, laminating.	6	6

LIST OF PRACTICAL:

1. Identify and understand various equipment and methods associated with the casting process and various safety aspects of it.
2. Study of various casting defects, their causes and cure.
3. Edge preparation practice on a given specimen for a welding job.
4. Workshop job practice on plate Welding-Lap joint, V Butt joint.
5. Study of modern welding processes.
6. Workshop job practice on given specimens with soldering operations.
7. Study of various metal forging and rolling processes.
8. Workshop job practice on sheet metal specimens.
9. Study of various plastic manufacturing processes.
10. Study of various superfinishing processes with advancement in manufacturing technology.

TEXT BOOKS:

1. Elements of workshop Technology (Volume I & II) – S. K. Hajra Chaudary, Bose & Roy, Media Promoters and Publishers Limited.
2. Production Technology by P.C. Sharma S Chand & Co Ltd.

REFERENCE BOOKS:

1. Production Technology, by R.K. Jain, Khanna publishers.
2. Manufacturing Technology Vol-II, By P.N. Rao, Tata McGraw Hill.
3. Manufacturing Engg. And Technology By S. Kalpakajain, PHI/Pearson.
4. Welding Technology, by O.P.Khanna, Dhanpat Rai publishers.
5. Processes and Materials of Manufacture by Roy. A. Lindberg, PHI / Pearson education, 2006

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc25_me119/preview?utm_source
2. https://onlinecourses.nptel.ac.in/noc24_me84/preview?utm_source

COURSE OUTCOMES:

CO1	Interpret different foundry practices, merits and demerits, associated defects and their inspection.
CO2	Select appropriate metal joining processes to join similar or dissimilar metals.
CO3	Distinguish different Super Finishing Technology.
CO4	Describe various metal forming processes and compare different hot working and cold working processes.
CO5	Understand different types of sheet metal work and identify products manufactured with various sheet metal operations.
CO6	Classify different plastic moulding processes and applications.

UPL University of Sustainable Technology
Shroff S R Rotary Institute of Chemical Technology
B.E. Semester IV
Fluid Mechanics (BMEPC403)

Teaching Scheme (Hrs./week)				Credit	Examination Scheme				
L	T	P	Total		SEE	CCE	I/TW	V	Total
3	0	2	5	4	50	50	25	25	150

COURSE OVERVIEW:

The course typically covers fluid properties, pressure and forces in static fluids, and the principles governing fluid motion such as the continuity equation and Bernoulli's equation. It also introduces concepts like laminar and turbulent flow, flow through pipes, boundary layers, and dimensional analysis.

COURSE CONTENT:

Sr. No.	Topics	COs	Hrs
	SECTION-A		
1	**Fluid Properties:** Introduction of fluid, fluid classifications**,** Physical properties of fluids- specific gravity, viscosity and its significance, surface tension, capillarity, vapor pressure, cavitation, compressibility and the bulk modulus.	1	5
2	**Fluid Statics:** Pascal's law, hydrostatic law, Buoyancy and floatation: Meta center, stability of floating body, Submerged bodies, Calculation of metacenter height, Total pressure and center of pressure on submerged plane surfaces; horizontal, vertical and inclined plane surfaces, curved surface submerged in liquid.	2	8
3	**Fluid Kinematics:** Introduction, flow types. Motion of a fluid particle, acceleration of a fluid particle, discharge and mean velocity. Continuity equation in 2D and 3D (Cartesian Co-ordinates only), circulation and vorticity, Stream line, path line and streak lines and stream tube. Stream function and velocity potential function.	3	9
	SECTION-B		
4	**Fluid Dynamics:** Surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its applications, application of Bernoulli's theorem. Venturimeter, orificemeter, pitot-tube, vertical orifice, Notches.	4	8
5	**Closed Conduit Flow:** Reynolds number and Reynolds experiment, flow of viscous fluid through circular pipe- Hagen Poiseuille formula, Expression for	5	8

	coefficient of friction -Darchy Weishbach Equation, shear stress and velocity distribution in turbulent flow through pipes. Major energy losses, Minor energy losses, Pipes in series and parallel, Equivalent pipes, power transmission through pipe.		
6	**Dimensional Analysis and Similarities:** Dimension, dimensional homogeneity, dimensional analysis using Rayleigh's method, Buckingham π-theorem, significance of dimensionless numbers, use of dimensionless numbers in experimental investigation, geometric similarity, dynamic similarity, Kinematic similarity, model testing-Model laws.	6	7

LIST OF PRACTICALS:

1. Verification of Bernoulli's theorem.
2. To measure the flow using the Orifice meter.
3. To measure the flow using the Rotameter.
4. To determine the coefficient of discharge through open channel flow over a notch.
5. To determine the different types of flow patterns by Reynolds' experiment.
6. To determine the friction factor for the different pipes.
7. To determine the loss coefficients for different pipe fittings.
8. Study of Buoyancy, metacenter, and metacentric height.
9. Study of compressible flows.
10. Study of boundary layer theory.

TEXT BOOKS:

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S. K. Kataria & Sons
2. Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Laxmi Prakashan

REFERENCE BOOKS:

1. Fluid Mechanics and Hydraulic Machines by R.K. Rajput, S.Chand & Co.
2. Theory and Applications of Fluid Mechanics by K. Subramanya, McGraw Education
3. Fluid Mechanics by Frank .M. White, McGraw Hill Education
4. Mechanics of Fluids by Shames, McGraw Hill Education

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/112105269

COURSE OUTCOMES:

CO1	**Understand** fundamental properties of fluids to analyze fluid characteristics.
CO2	**Evaluate** fluid systems to determine pressure distribution, buoyancy, stability, and forces under different conditions.
CO3	**Apply** the concept of fluid kinematics
CO4	**Explain** behavior of fluid in dynamic mode.
CO5	**Analyze** fluid flow through closed conduits under laminar and turbulent conditions.
CO6	**Understand** the importance of dimensional analysis.

UPL University of Sustainable Technology
Shroff S. R. Rotary Institute of Chemical Technology
B.E. Semester IV
Measurement Lab (BMEVS404)

Teaching Scheme (Hrs./week)				Credit	Examination Scheme				
L	T	P	Total		SEE	CCE	I/TW	V	Total
0	0	2	2	1	00	00	25	25	50

LAB ACTIVITIES:

A minimum of eight practicals should be performed from the topics listed below.

LIST OF PRACTICALS:

1. Measurement of dimensions using Vernier Caliper, Micrometer, and Height Gauge.
2. Measurement of dimensions using different Gauges (Plug, Ring, Screw, and Thread).
3. Measurement of taper angle using Universal Bevel Protractor, Sine Bar, and Slip Gauges.
4. Measurement of roundness using V-Block, and Dial-Indicator.
5. Measurement of Spur Gear tooth thickness and height using a Gear Tooth Vernier Caliper.
6. Measurement of screw thread pitch and angle using Tool Makers Microscope.
7. Measurement of temperature using Thermocouple, RTD, and Thermistor.
8. Measurement of pressure using Bourdon Gauge, Diaphragm, and Pressure Indicator.
9. Measurement of stress and strain using LVDT, and Load Cell/Strain Gauge.
10. Measurement of torque and power using Rope Brake Dynamometer.

COURSE OUTCOMES:

CO1	**Explain** the fundamentals of metrology, standards of measurement, errors, and perform linear measurements using basic measuring instruments and comparators.
CO2	**Apply** principles of limits, fits, tolerances, and angular measurement for interchangeability and design GO and NO-GO gauges.
CO3	**Measure** screw threads, gears, and surface texture parameters using appropriate metrological instruments and methods.
CO4	**Analyze** force, torque, and strain using mechanical, electrical, and strain gauge based measurement systems.
CO5	**Select** suitable instruments for the measurement of temperature, pressure, and flow in engineering applications.
CO6	**Apply** statistical quality control techniques for process variation, assess process capability, and implement acceptance sampling plans.

UPL University of Sustainable Technology
Shroff S. R. Rotary Institute of Chemical Technology
B.E. Semester IV
Mechanical Measurement and Metrology (BMEPE405)

Teaching Scheme (Hrs./week)				Credit	Examination Scheme				
L	T	P	Total		SEE	CCE	I/TW	V	Total
3	0	0	3	3	50	50	00	00	100

COURSE OVERVIEW:

In the era of Industry 4.0 and zero-defect manufacturing, the ability to accurately measure, quantify, and control physical parameters is essential. This course equips mechanical engineering undergraduates with the theoretical foundations and practical skills required to evaluate and verify product quality. It bridges the gap between design concepts such as Geometric Dimensioning and Tolerancing (GD&T) and manufacturing processes, using measurement as a key verification tool. The course reinforces the principle that effective control is achievable only through accurate and reliable measurement.

COURSE CONTENT

Sr. No.	Topics	COs	Hrs (36)
	SECTION-A		
1	**Fundamentals of Metrology and Linear Measurement:** Introduction to Metrology: Definition, Objectives, Categories (Scientific, Industrial, Legal), Precision vs. Accuracy, Sensitivity, Readability, Reproducibility, Calibration, and Traceability. Line, End, and Wavelength Standards. Errors in Measurement: Types of errors (Systematic, Random, Environmental, Parallax, etc.) and sources of errors. Linear Measurement: Vernier caliper, Micrometers, and Height Gauges Slip gauges: Types, Wringing, and Selection (Numerical Problems). Comparators: Requirement of a Good Comparator, Classification. Principle and working of Dial Indicators, Sigma Comparator (Mechanical), Pneumatic Comparator, and LVDT (Electrical).	1	8
2	**Limits, Fits, Tolerances and Angular Measurement:** Limits, Fits, and Tolerances: Terminology (Basic Size, Deviation, Tolerance), Hole Basis and Shaft Basis systems, Interchangeability, and Selective Assembly. Design of Gauges: Taylor's Principle for Limit Gauges, Design of GO and NO-GO Gauges (Plug and Ring Gauges). Angular Measurement: Spirit Level, Universal Bevel Protractor, Sine Bar (Principle, Limitations, and Sources of Error), Sine Center, Angle Gauges (Numerical Problems), Clinometer, and Angle Dekkor (Optical).	2	8
3	**Metrology of Screw Threads, Gears, and Surface Texture:**	3	7

	Screw Thread Metrology: Terminology, Errors in Threads. Measurement of Major/Minor Diameter, Effective Diameter using Two-Wire and Three-Wire methods. Best Wire Size. Tool Makers Microscope, Floating Carriage Micrometer. Gear Metrology: Gear Terminology, Profile Errors in Gears. Measurement of Tooth Thickness using Constant Chord and Chordal Thickness methods. Gear Tooth Vernier, Parkinson Gear Tester. Surface Finish Measurement: Primary vs. Secondary Texture, Surface finish parameters (Ra, RMS, and Rz). Measurement methods: Stylus Probe instruments (Tomlinson Surface Meter, and Taylor-Hobson Talysurf).		
	SECTION-B		
4	**Measurement of Force, Torque, and Strain:** Force Measurement: Elastic force meters, Load cells (Hydraulic, Pneumatic, and Electrical), Proving Rings. Torque Measurement: Dynamometers (Mechanical, Hydraulic, and Electrical), Torsion meters. Strain Measurement: Theory of Strain Gauges, Metallic Resistance Strain Gauges, Gauge Factor, Wheatstone Bridge Circuits, Strain Gauge Rosettes, Temperature compensation.	4	7
5	**Measurement of Temperature, Pressure, and Flow:** Temperature Measurement: Thermocouples (Laws of thermocouples, materials), Thermistors, Resistance Temperature Detectors (RTD), Pyrometers (Total Radiation, Optical). Pressure Measurement: Bourdon tube, Diaphragms, Bellows. Low-pressure measurement: McLeod Gauge, Pirani Gauge (Thermal conductivity), Ionization Gauges. Flow Measurement: Obstruction Meters (Venturi, Orifice, Flow Nozzle), Rotameter, Hot Wire Anemometer, Laser Doppler Anemometer.	5	8
6	**Statistical Quality Control (SQC):** Introduction to Quality: Definitions, Cost of Quality, Value of Quality, and Quality Assurance vs. Quality Control. Control Charts: Variation (Chance vs. Assignable causes). Variable Charts: $\bar{x}$ and R charts. Attribute Charts: P, nP, and C charts. Process Capability (Cp, Cpk). Acceptance Sampling: Concept, OC Curve (Operating Characteristic), Producer's Risk, Consumer's Risk, AQL, LTPD, Sampling Plans (Single, Double).	6	7

LIST OF PRACTICALS/TUTORIALS: N/A

TEXT BOOKS:

1. Engineering Metrology and Measurement by K. Duraivelu and S. Karthikeyan, Universities Press (India) Pvt. Ltd.

2. Metrology and Quality Control by Vinod Thombre Patil, Nirali Prakashan

REFERENCE BOOKS:

1. Engineering Metrology and Measurements, Bentley, Pearson Education.
2. Metrology and Measurement, Anand Bewoor & Vinay Kulkarni McGraw-Hill.
3. Mechanical Measurements and Instrumentations, Er. R. K. Rajput, Kataria Publications (KATSON).
4. Mechanical Measurement and Metrology by R. K. Jain, Khanna Publishers.
5. Mechanical Measurement & Control by D.S. Kumar, Metropolitan Book Co. Pvt. Ltd.
6. Industrial Instrumentation & Control by S. K. Singh, McGraw-Hill.
7. Engineering Metrology and Measurement, N. V. Raghavendra and Krishnamurthy, Oxford University Press.

ONLINE RESOURCES:

1. http://www.digimat.in/nptel/courses/video/112106138/L01.html
2. https://www.olabs.edu.in/?pg=topMenu&id=40&

COURSE OUTCOMES:

CO1	**Explain** the fundamentals of metrology, standards of measurement, errors, and perform linear measurements using basic measuring instruments and comparators.
CO2	**Apply** principles of limits, fits, tolerances, and angular measurement for interchangeability and design GO and NO-GO gauges.
CO3	**Measure** screw threads, gears, and surface texture parameters using appropriate metrological instruments and methods.
CO4	**Analyze** force, torque, and strain using mechanical, electrical, and strain gauge based measurement systems.
CO5	**Select** suitable instruments for the measurement of temperature, pressure, and flow in engineering applications.
CO6	**Apply** statistical quality control techniques for process variation, assess process capability, and implement acceptance sampling plans.

UPL University of Sustainable Technology
Shroff S. R. Rotary Institute of Chemical Technology
B.E. Semester IV
Lubrication Technology (BMEPE406)

Teaching Scheme (Hrs./week)				Credit	Examination Scheme				
L	T	P	Total		SEE	CCE	I/TW	V	Total
3	0	0	3	3	50	50	0	0	100

COURSE OVERVIEW:

The objective of this Course is to provide an introductory treatment of Engineering lubrication and fuels to all the students of engineering, with a view to prepare a good foundation for taking up advanced courses in the area in the subsequent semesters, An understanding of the mechanical behaviour of lubricants under various load conditions.

COURSE CONTENT:

Sr. No.	Topics	COs	Hrs
	SECTION-A		
1	**Manufacture of Fuels and Lubricants**: Structure of petroleum, refining process, fuels, thermal cracking, catalytic cracking, polymerization, alkylation, isomerization, blending, and products of refining process. Manufacture of lubricating oil base stocks, manufacture of finished automotive lubricants.	1	8
2	**Theory of Lubrication:** Engine friction: introduction, total engine friction, effect of engine variables on friction, hydrodynamic lubrication, elasto hydrodynamic lubrication, boundary lubrication, bearing lubrication, functions of the lubrication system.	2	8
3	**Lubricants:** Specific requirements for automotive lubricants, oxidation deterioration and degradation of lubricants, additives and additive mechanism, synthetic lubricants, classification of lubricating oils, properties of lubricating oils, tests on lubricants. Grease, classification, properties.	3	7
	SECTION-B		
4	**Properties and Testing of Fuels**: Thermo-chemistry of fuels, properties and testing of fuels, relative density, calorific value, distillation, vapour pressure, flash point, spontaneous ignition temperature, viscosity, pour point, flammability, ignitability, diesel index, API gravity, aniline point etc.	4	8
5	**Combustion & Fuel Rating :** SI Engines – flame propagation and mechanism of combustion, normal combustion, knocking, octane rating, fuel requirements. CI Engine, mechanism of combustion, diesel knock, cetane rating, fuel requirements. Additive - mechanism, requirements of an additive, petrol	5	7

	fuel additives and diesel fuel additives – specifications of fuels.		
6	**Lubrication Systems & Industrial Applications:** Need and objectives of lubrication, Classification of lubrication systems, Splash lubrication, Pressure lubrication, Basic components of lubrication system: oil pump, oil filter, oil sump and Applications of lubrication system.	6	7

LIST OF PRACTICALS/TUTORIALS: N/A

TEXT BOOKS:

1. Ganesan.V., "Internal Combustion Engineering", Tata McGraw-Hill Publishing Co., New Delhi, 2003.
2. M.L. Mathur, R.P.Sharma "A course in internal combustion engines", Dhanpatrai publication, 2003.
3. Obert.E.F "Internal Combustion Engineering and Air Pollution", International book Co., 1988.

REFERENCE BOOKS:

1. Brame, J.S.S. and King, J.G. – Fuels – Solids, Liquids, Gaseous.
2. Francis, W – Fuels and Fuel Technology, Vol. I & II
3. Hobson, G.D. & Pohl.W- Modern Petroleum Technology
4. A.R.Lansdown – Lubrication – A practical guide to lubricant selection – Pergamon press – 1982.
5. Raymond.C.Gunther – Lubrication – Chilton Book Co., - 1971.

ONLINE RESOURCES:

1. http://nptel.ac.in/courses/112102014

COURSE OUTCOMES:

CO1	**Understand** the basic types, manufacturing process and cracking of Lubricants & fuels.
CO2	**Describe** the concepts of friction in lubrication systems.
CO3	**Explain** the concept of oil lubricant mechanism.
CO4	**Know** the concepts of properties and testing of fuels.
CO5	**Analyse** the combustion & fuel rating.
CO6	**Summarize** the basic types of lubrication systems and their applications.

UPL University of Sustainable Technology
Shroff S. R. Rotary Institute of Chemical Technology
B.E. Semester IV
Universal Human Values (BUNVA431)

Teaching Scheme (Hrs./week)				Credit	Examination Scheme				
L	T	P	Total		SEE	CCE	I/TW	V	Total
2	0	0	2	2	50	50	0	0	100

COURSE OVERVIEW:

This course introduces second-year B.E. Course helps the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.

COURSE CONTENT

Sr. No.	Topics	COs	Hrs
	SECTION-A		
1	**Introduction to Value Education :** Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity–the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity–Current Scenario, Method to Fulfill the Basic Human Aspirations.	1	5
2	**Harmony with self: Importance of self-awareness:** Self-reflection. Who am I? – Imagination & Action. Understanding & exploring needs of self and body. Self -Exploration – A Process of Fundamental Human Desires – Happiness, Peace and Contentment for Material, Behavioral and Intellectual well Being. Holistic understanding of mind & body. The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Program to ensure self-regulation and Health	2	5
3	**Harmony in the Family:** Harmony in the Family – the Basic Unit of Human Interaction, Values in Human-to-Human Relationship, Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation.	3	5
	SECTION-B		
4	**Harmony in the Society:** Understanding Harmony in the Society: Resolution, Prosperity, fearlessness (trust) and co-existence asComprehensive human goals, Visualizing a universal harmonious order in society.		5
5	**Harmony in the Nature/ Existence:** Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature,		5

	Realizing Existence as Co-existence at all levels, The Holistic perception of Harmony in Existence.		
6	**Harmony for Global peace:** Understanding global peace. Concept of वसुधैव कुटुम्बकम- one earth one family. Fostering Universal brotherhood and unity, collaborative problem solving, respecting cross cultural communication. Famous anecdote and relevant case studies		5

LIST OF PRACTICALS/TUTORIALS: N/A

TEXT BOOKS:

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

REFERENCE BOOKS:

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

ONLINE RESOURCES:

1. https://www.uhv.org.in
2. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw

COURSE OUTCOMES:

CO1	**Understand and analyze** the concept of value education, self-exploration, and the basic human aspirations of continuous happiness and prosperity along with methods to achieve them.
CO2	**Develop** self-awareness through self-reflection and explore the harmony between self and body for achieving holistic well-being and self-regulation.
CO3	**Inculcate** values such as trust and respect to strengthen harmony in family and interpersonal relationships.
CO4	**Evaluate** the role of individuals in building a harmonious society based on resolution, prosperity, fearlessness and co-existence.

CO5	**Understand** the interconnectedness in nature and apply the principles of mutual fulfillment and co-existence for sustainable living.
CO6	**Develop** a global perspective by promoting universal brotherhood, cultural harmony and collaborative problem-solving for achieving global peace.