Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY
BANGALORE - 56

AIDED BY GOVERNMENT OF KARNATAKA
&
AUTONOMUS INSTITUTION AFFILIATED TO VTU, BELGAUM,

PROPOSED SYLLABUS

For

III & IV Semester

(FOR THE ACADEMIC YEAR 2023-2024)
(Batch 2022) NEP-2

Department of Industrial Engineering & Management

Website: www.drait.edu.in **e-mail id: principal@drait.edu.in**

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BANGALORE - 56

AIDED BY GOVERNMENT OF KARNATAKA
&
AN AUTONOMUS INSTITUTION AFFILIATED TO VTU, BELGAVI,

Vision

- To create Dynamic, Resourceful, Adept and Innovative Technical professionals to meet global challenges.

Mission

- To offer state-of-the-art undergraduate, postgraduate and doctoral programs in the fields of Engineering, Technology And Management
- To generate new knowledge by engaging faculty and students in research, development and innovation.
- To provide strong theoretical foundation to the students, supported by extensive practical training to meet the industry requirements.
- To install moral and ethical values with social and professional commitment.

Department of Industrial Engineering & Management

Objective

- To maintain a Comprehensive curriculum that enables students to become leading engineers and creative researchers in the global marketplace.
- To collaborate with private and public sectors in the search of methodologies and creative solutions to problems that contributes to the advancement of education, technology and professional development.
- To contribute to the profitable growth of industrial economic sectors by using IE analytical tools, effective computational approaches, and systems thinking methodologies.
- To maintain high standards of professional and ethical responsibility.
- To provide a broad education necessary to understand the impact of engineering solutions in a global economic, environmental, a societal context.

Vision:

- To be globally recognized as a leader in industrial engineering education, research and enhance the application of technical knowledge to benefit the society.

Mission:

- To offer globally recognized programs that equip graduates with strong problem solving ability in the design, analysis and implementation of integrated systems in manufacturing and service sectors.
- Create state-of-the-art infrastructure for research and training in Industrial Engineering
- Promoting collaboration with academia, industries and Research organizations at national and international levels for socioeconomic development

Program Outcomes (POs)

1. Ability to apply knowledge of mathematics, science and engineering.

2. Ability to design and conduct experiments related to deterministic or stochastic systems, as well as to analyze and interpret data.

3. Ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
4. Ability to identify, formulate and solve Industrial and Management Systems Engineering problems.
5. Student will be able to use modern industrial Engineering and management tools necessary for engineering practice.
6. Ability to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
7. Understand the major environmental, social and economic drivers pertaining to the necessity of developing sustainable operations.
8. Student will exhibit professionalism and ethical responsibility.
9. Effectively collaborate and function on multidisciplinary teams.
10. Student will be able to communicate orally and verbally with different sections of society.
11. Manage Project and Finance to satisfy customer expectations.
12. Engage in life-long learning and appreciate the need for continual self-development.

Program Educational Objectives

PEO 1: Have a strong foundation in Mathematics, Science and Engineering fundamentals that prepare them for a successful career in Industrial Engineering, Management and allied fields.

PEO 2: Function at a technically competent level in designing a system within realistic constraints such as economic, environmental, social, political, ethical, manufacturability, health and safety and sustainability.

PEO 3: To effectively and economically utilize the resources of the Enterprise using various optimization techniques.

PEO 4: Exhibit professionalism, good oral & written communication skills, team work and develop an attitude for lifelong learning.

Department of Industrial Engineering & Management

Faculty List:

1	**Dr. N Mohan**	**Professor and Head**
2	**Dr. S K Rajendra**	**Associate Professor**
3	**Dr. Rajeshwari P**	**Associate Professor**
4	**Dr. C R Mahesha**	**Assistant Professor**
5	**Mrs. Suprabha R**	**Assistant Professor**
6	**Mr. Chetan N**	**Assistant Professor**
7	**Mrs. Sarvamangala S P**	**Assistant Professor**

Dr.Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education(OBE) and Choice Based Credit System
B.E. Name of the programme: : Industrial Engineering and Management
Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24

III SEMESTER **(NEP-2)**

Sl. No	Course	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week					Examination Marks				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self-study	Total Hours	Duration in hours	CIE	SEE	Total	
					L	T	P	S						
1	PCC	22IMT301	Manufacturing Process	IM	3	0	0	0	03	03	50	50	100	3
2	IPCC	22IMU302	Work study & Ergonomics	IM	3	0	2	0	05	04	50	50	100	4
3	IPCC	22IMU303	Mechanical Measurements and Metrology	IM	3	0	2	0	05	04	50	50	100	4
4	PCC	22IMT304	Mechanics of Materials	IM	3	1	0	0	04	03	50	50	100	3
5	PCCL	22IML305	Material Testing Laboratory	IM	0	0	2	0	02	03	50	50	100	1
6	ESC	22IMT306X	Engineering Materials/ Rapid Prototyping	IM	3	0	0	0	03	03	50	50	100	3
7	UHV	22HST307	Social Connect and Responsibility	Any Dept. (IM)	0	0	2	0	02	02	100	---	100	1
8	AEC/ SEC	22IMT308X or 22IML308X	Concepts of Management/ Industrial Safety and Health	IM	If the course is a Theory: 1	0	0			02	50	50	100	1
					If a course is a laboratory: 0	0	0			00				
9	HS	22CDN309	Aptitude and Verbal Ability Skill-I	Placement Cell	2	0	0			02	50	--	50	PP/NP
10	MC	22NSN310	National Service Scheme (NSS)	NSS coordinator	0	0	2			02	100	---	100	PP/NP
		22PEN310	Physical Education (PE) (Sports and Athletics)	Physical Education Director										
		22YON310	Yoga	Yoga Teacher										
									Total	30 Hrs	600	350	900	20

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L**: Lecture, **T**: Tutorial, **P**: Practical, **S**= Self-Study, **CIE**: Continuous Internal Evaluation, **SEE**:Semester End Evaluation. K: This letter in the course code indicates common to all the streams of Engineering. ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course

Dean (Academic)

PROFESSOR & HOD
Dept. of Industrial Engineering & Management
Dr. Ambedkar Institute of Technology

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching– Learning hours (L: T: P) can be considered as (3: 0: 2) or (2: 2: 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education(PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semesters to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of Degree.

Engineering Science Course (ESC/ETC/PLC) 22XXT306x			
22IMT3061	Engineering Materials	22IMT3062	Rapid Prototyping
Ability Enhancement Course – III 22XXT308x **OR** 2XXL308x			
22IMT3081	Concepts of Management	22IMT3082	Industrial Safety and Health

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B.E. Name of the programme: Industrial Engineering and Management
Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24

IV SEMESTER (NEP-2)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week					Examination Marks				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self - Study	Total	Duration in hours	CIE	SEE	Total	
					L	T	P	S						
1	PCC	22IMT401	Facility Planning and Design	IM	03	01	00	0	03	03	50	50	100	3
2	IPCC	22IMU402	Advanced Manufacturing Technology	IM	02	02	02	0	06	04	50	50	100	4
3	IPCC	22IMU403	Statistics for Engineering	IM	02	02	02	0	06	04	50	50	100	4
4	PCC L	22IML404	Computer Aided Machine Drawing	IM	01	00	02	0	03	03	50	50	100	1
5	ESC	22IMT405X	Mechanism and Machine Theory/ Fluid Mechanics / Engineering Thermodynamics/ Maintenance and Safety Engineering	IM	02	02	00	0	04	03	50	50	100	3
6	AEC/ SEC	22IMT406X or 22IML406X	Design Thinking Lab	TD and PSB: Concerned department	If the course is Theory					00	50	50	100	1
					0	0	0							
					If the course is a lab					02				
					00	00	02							
7	BSC	22BIT407	Biology For Engineers	TD / PSB: BT, CHE,	03	00	00			03	50	50	100	3
8	UHV	22HST408	Universal Human Values	Any Department	01	00	00			01	50	50	100	1
9	HS	22CDN409	Aptitude and Verbal Ability Skill-II	Placement Cell	02	00	00			02	50	--	50	PP/ NP
10	MC	22NSN410	National Service Scheme (NSS)	NSS coordinator	0	0	2			02	100	---	100	PP/ NP
		22PEN410	Physical Education (PE) (Sports and Athletics)	Physical Education Director										
		22YON410	Yoga	Yoga Teacher										
Total										32Hrs	550	400	950	20

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Engineering Science Course (ESC/ETC/PLC) 22XXT405x OR 22XXL405x			
22IMT4051	Mechanism and Machine Theory	22IMT4053	Fluid Mechanics
22IMT4052	Engineering Thermodynamics	22IMT4054	Industrial Safety and Health
Ability Enhancement Course / Skill Enhancement Course – IV 22XXT405x OR 22XXL406x			
22IMT4061	Organizational Behaviour	22IMT4063	Data Base Management System
22IMT4062	Value Engineering	22IMT4064	Digital Marketing

PCC: Professional Core Course, PCCL: Professional Course laboratory, UHV: Universal Human Value Course, MC: Mandatory Course (Non-credit), AEC: Ability Enhancement Course, SEC: Skill Enhancement Course, L: Lecture, T: Tutorial, P: Practical, S= Self-Study, CIE: Continuous Internal Evaluation, SEE:
Semester End Evaluation. K : This letter in the course code indicates common to all the stream of engineering.

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Course Title	**Manufacturing Process**						
Course Code	**22IMT301**						
Category	**Professional Core Course (PCC)**						
Scheme and Credits	**No. of Hours/Week**					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	03	**00**	**00**	**00**	**3**	**40**	**3**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Course Objective :	
1	Outline the importance of manufacturing processes and their industrial applications
2	Describe the concept of metal casting.
3	Define the principles of welding technology.

Unit No	Syllabus	No of Hours
1	**Introduction:** Concept of Manufacturing process and its importance. Classification of Manufacturing processes. Introduction to Casting process & steps involved. Varieties of components produced by casting process. Advantages Limitations and application of casting process. **Patterns:** Definition, functions, Materials used for pattern, Classification of patterns, various pattern allowances and their importance. , BIS color coding of Patterns. **Sand Moulding:** Types of base sand, requirement of base sand. Moulding sand mixture ingredients (base sand, binder & additives) for different sand mixtures. Method used for sand moulding, such as Green sand, dry sand and skin dried moulds. **Binder**: Definition, Types of binder used in moulding sand. **Additives**: Need, Types of additives used. **Cores:** Definition, Need, Types. Method of making cores, Binders used, core sand moulding. **Concept of Gating & Risering.** Principle and types.	8
2.	**Moulding Machines**: Jolt type, Squeeze type, Jolt & Squeeze type and Sand slinger. **Special moulding Process:** Study of important moulding processes, No bake moulds, Flask less moulds, Sweep mould, CO_2 mould, Shell mould, Investment mould. **Metal moulds**: Gravity die-casting, Pressure die casting, Centrifugal casting, Squeeze Casting, Slush casting, Thixocasting and Continuous Casting Processes. **Melting Furnaces:** Classification of furnaces. Constructional features & working principle of coke fired, oil fired and Gas fired pit furnace, Resistance furnace, Coreless Induction furnace, Electric Arc Furnace, Cupola furnace. **Defects In Castings -** Causes and remedies, cleaning and inspection of casting-fettling operations, Non-destructive testing, X-ray radiography, Dye penetrate test, ultrasonic test and magnetic particle inspection.	8
3	**Welding process:** Definition, Principles, Classification, Application, Advantages & limitations of welding. **Arc Welding**: Principle, Metal Arc welding **(MAW)**, Flux Shielded Metal Arc Welding **(FSMAW)**, Tungsten Inert Gas Welding **(TIG & MIG)** Submerged Arc Welding **(SAW)** and Atomic Hydrogen Welding processes. **(AHW)**	8
4	**Gas Welding**: Principle, Oxy – Acetylene welding, Chemical Reaction in Gas welding, Flame characteristics. Gas torch construction & working. Forward and backward welding. **Principles of soldering & brazing:** Parameters involved & Mechanism. Different Types of Soldering & Brazing Methods.	8

Note 1: SEE Question paper contains total seven Questions and student should answer any one question from Unit I and Unit II and student shall answer total five questions.

Note 2: Two assignments are evaluated for 5 marks: Assignment – 1 from units 1 and 2.
Assignment - 2 from units 3, 4 and 5.

Outcome:

After the completion of the above course students will be able to

1. Determine various secondary manufacturing processes and metal cutting theory and its applications.
2. Illustrate the characteristics of cutting tool materials.
3. Learns the principles and concepts of welding process
4. Generalize the concepts of special welding process
5. Explain the principles and concepts of gas welding process.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓				✓					
CO2		✓		✓		✓	✓	✓			✓	
CO3		✓		✓		✓	✓	✓			✓	
CO4		✓		✓		✓	✓	✓			✓	
CO5	✓	✓					✓	✓			✓	

Text books:

1. Hajra Choudhury, "Elements of Workshop Technology, Vol. I and II", Media Promotors Pvt Ltd., Mumbai, 2001.
2. S.Gowri, P.Hariharan, and A.Suresh Babu, "Manufacturing Technology 1", Pearson Education, 2008.
3. Nadkarni S.V. "Modern Arc Welding Technology", 1st Edition, IBH Publishing, 2005
4. Kearns W. H, "Welding Hand Book (Welding Processes) " Volume II and III, 7th Edition, AWS, 1984

Course Objectives:	
1	To understand the definition of productivity and the factors affecting productivity.
2	To apply the concept of work study and its related issues.
3	To describe Method study through various charts.

Course Title	**Work study & Ergonomics**						
Course Code	**22IMU302**						
Category	**Integrated Professional Core Course(IPCC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	00	02	00	05	52	04
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

4	To identify work measurement and Time study techniques for better production.
5	To describe the importance and application of ergonomics, man-machine system

Unit No	Syllabus	No. of Hours
1	**PRODUCTIVITY & QUALITY OF LIFE** :Basic needs, Quality of Life & Productivity, What is Productivity, Productivity in individual Enterprise, How is Total time of job made up, Methods to reduce ineffective time **WORK STUDY**: Why Work Study is valuable, Techniques of work study and their relationship, Basic Procedure of work study. **HUMAN FACTOR IN WORK-STUDY**: Work study & Management, Work Study & Supervisor, Work Study & the Worker, Work Study Practitioner.	**07**
2	**METHOD-STUDY**: The approach to Method Study, Selecting the work to be studied, Record the facts, Examine critically, Develop the improved method. MOVEMENT OF WORKWR IN THE WORKING AREA: Movement of workers and material, String Diagram, Worker type Flow process chart , Multiple Activity chart	**07**
3	**METHODS & MOVEMENTS AT THE WORK PLACE :** The principles of Motion Economy, Classification of Movements, Work place layout and simplification of movements, The two handed Process Chart, Micro motion Study, other recording techniques. **WORK MEASUREMENT:** Definition, Purpose of work measurement, Uses of work measurement. Basic Procedure of work measurement, Techniques of work measurement	**07**
4	**TIME STUDY:** What is Time study, Time study equipment, Time Study forms, Selecting the Job, Steps in making the time study, breaking the job into elements, types of elements, Timing each element: stop watch procedure. **RATING:** The qualified worker, average worker, Factors affecting the rate of working, calculation of basic time, Allowances, Standard Time.	**09**
5	**ERGONOMICS:** Introduction, Areas of study under Ergonomics, System approach to Ergonomics model, Man-Machine System. Components of Man-Machine System and Their functions – Workcapabilities of Industrial Worker, Study and Development of Stress inHuman body and their consequences. Computer based ergonomics. **DESIGN OF MAN-MACHINE SYSTEM:** Fatigue in industrial workers. Quantitative, qualitative representation and alphanumeric displays. Controls and their design criteria, control types, relation between controls and displays, layouts of panels and machines. Designof work places, influence of climate on human efficiency. Influence of noise, vibration and light.	

Note 1: Unit 4 and unit 5 will have internal choice

Note 2: Two assignments are evaluated for 5 marks: Assignment -1 from unit 1 and Assignment -1 from Units 3, 4 and 5.

LABORATORY EXPERIMENTS	
1	Recording Techniques: Preparing the following charts and diagrams (Minimum 3 Charts) - Outline process chart, Multiple Activity Chart, Flow process chart and Flow diagram, String diagram.
2	Experiments on the Application of principle of motion economy, Two handed process chart.
3	Exercises on conducting method study for assembling simple components and office work.
4	Development of Layout plans using SLP technique.

5	Rating practice using: walking simulator, pin board assembly, dealing a deck of cards and marble collection activity
6	Determining the standard time for simple operations using stopwatch time study
7	Exercises on estimating standard time using PMTS.
8	Measurement of parameters (heart beat rate, calorie consumption) using walking simulator
9	Measurement of parameters (heart beat rate, calorie consumption, revolutions per minute) using ergometer
10	Effect of Noise, Light, Heat on human efficiency in work environments.

Course Outcome:

After the completion of the above course, students will be able to

1. Describe the concept of productivity and the importance of productivity.
2. Analyze the existing methods of working for a particular job and develop an improvedmethod through questioning technique.
3. Construct the various charts use recording techniques for improving productivity.
4. Provide appropriate allowances for the jobs under analysis.
5. Analyze and calculate the level of risk of the job causing stress, fatigue andmusculoskeletal disorders among the employees of an organization.

Cos	Mapping with Pos
CO1	PO3,PO6,PO8PO10
CO2	PO3,PO4,PO7,PO10,PO11
CO3	PO3,PO4,PO7,PO10,PO11
CO4	PO6,PO10,PO11
CO5	PO6,PO8,PO10

TEXT BOOKS

1. **ILO, Introduction to work study** - III Revised Edition, 1981
2. **Motion and Time study** - Ralph M Barnes; John Wiley, 8th Edition, 1985.
3. **Engineered work Measurement** - Wledon, ELBS , 1991

REFERENCE BOOKS

1. Human Factors in Engineering Design - S Sanders and E J McCormick, 6th Graw Hill Edition, Mc
2. Work Study and Ergonomics - S Dalela and Sourabh, – Chand Publishers, 3rd edition.
3. Industrial Engineering Hand book Maynard

Course Title	**MECHANICAL MESUREMENTS AND METROLOGY**		
Course Code	**22IMU303**		
Category	**Integrated Professional Core Course (IPCC)**		
Scheme and	No. of Hours/Week	Total	Credits

Credits	L	T	P	SS	Total	Teaching Hours	
	03	**00**	**02**	**00**	**05**	**52**	**4**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Course Objectives:	
1	To understand the Measurement standards and systems.
2	To understand and apply the calibration procedure of different instruments.
3	To classify various types and use of gauges, projectors, comparators and transducers

Unit No.	Syllabus	No. of Hours
I	**MEASUREMENTS AND MEASUREMENT SYSTEMS:** Definition, significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response-times delay. Errors in measurement, classification of errors. Transducers, transfer efficiency, primary and secondary transducers, Mechanical Transducers: Spiral springs, Torsion Bars, Diaphragms & Bellows, Electrical Transducer: Resistive Transducer, Electronic Transducer, advantages of each transduce.	**08**
II	**MEASUREMENT OF FORCE, TORQUE AND PRESSURE:** Principle, analytical balance, platform balance, proving ring. Torque measurement, Prony brake, hydraulic dynamometer. Pressure measurements, principle, use of elastic members, McLeod gauge. **TEMPERATURE AND STRAIN MEASUREMENT:** Resistance thermometers, thermocouple, law of thermocouple, materials used for construction, Total radiation pyrometer, Optical Pyrometer, Strain measurement, Mechanical strain gauge, preparation and mounting of strain gauges, gauge factor, Basic Wheatstone resistance bridge and methods of strain measurement (Deflection method and null method).	**08**
III	**STANDARDS OF MEASUREMENT:** Definition and Objectives of metrology, Standards of length-International prototype meter, Imperial standard yard, Wave length standard, subdivision of standards, line and end standard, calibration of end bars (Numerical), Slip gauges, Wringing phenomena, Indian Standards (M-81, M-112), Numerical problems on building of slip gauges.	**08**
IV	**SYSTEM OF LIMITS, FITS, TOLERANCE AND GAUGING:** Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly limits of size, Indian standards, concept of limits of size and tolerances, compound tolerances, accumulation of tolerances, definition of fits, types of fits and their designation (IS919-1963), geometrical tolerance, positional tolerances, hole basis system, shaft basis system, classification of gauges, brief concept of design of gauges (Taylor's principles), Types of gauges: plain plug gauge, ring gauge, snap gauge, limit gauge and gauge material, simple problems on limits & fits	**08**
V	**COMPARATORS AND ANGULAR MEASUREMENT:** Introduction to comparators, characteristics, classification of comparators, mechanical comparators Johnson Microkator, dial indicator, optical comparator-principle, Zeiss ultra-optimeter, electric comparator-principles, LVDT,. Angular measurements, bevel protractor, sine principle and use of sine bars, sine center, use of angle gauges (numerical on building of angles).	**08**

Web links and Resources:	
1	Engineering Metrology, by Prof. J. Ramkumar, Prof. Amandeep Singh, IIT Kanpur, https://onlinecourses.nptel.ac.in/noc22_me75/preview
2	Engineering Metrology, R.K. Jain, Khanna Publishers, 1994.
3	Mechanical Measurements, R.K. Jain

	INTERFEROMETER AND SCREW THREAD, GEAR MEASUREMENT: Interferometer, interferometry, autocollimator. Optical flats. Terminology of screw threads, measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2-wire and 3-wire methods, best size wire.	

Expt. No	LABORATORY EXPERIMENTS:	No. of Hours
1	Calibration of Pressure Gauge	**10**
2	Calibration of Thermocouple	
3	Calibration of LVDT	
4	Calibration of Load cell	
5	Determination of modulus of elasticity of a mild steel specimen using strain gauges	
6	Measurements using Optical profile Projector and Toolmaker Microscope.	
7	Measurement of straightness using Autocollimator, measurement of angle using Sine Center / Sine bar / bevel protractor	
8	Measurement of Screw threads Parameters using Two wire or Three-wire method.	
9	Measurement of surface roughness using Talysurf. Linear measurements using Mechanical Comparator, Electronic comparator.	
10	Measurement of gear tooth profile using gear tooth Vernier /Gear tooth micrometer	
11	Calibration of Micrometer using slip gauges	
12	Measurement using Optical Flats	

Course Outcomes: At the end of the course the student will be able to	
1	Define and classify Measurements and measurement systems
2	Distinguish and sketch different measurement of force, torque, pressure and temperature, strain-measuring instruments.
3	Define standards of measurement and solve problems on building of slip gauges.
4	Illustrate and define Indian Standards, principles of limits of size and tolerances and solve problems on limits and fits.
5	Classify comparators, determine gear parameters, and solve problems on building of angles.

Teaching Learning Process: These are sample Strategies, which the teacher can use to accelerate the attainment of the various course outcomes.	
1	Power point Presentation, Video.
2	Video tube, NPTEL materials.
3	Quiz/Assignments/Open book test to develop skills.
4	Adopt problem based learning (PBL) to develop analytical and thinking skills.
5	Encourage collaborative learning in the class with site visits related to the subject and impart practical knowledge.

Text Book(s):	
1	Mechanical Measurements, Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2006.

Reference Book(s):	
1	Engineering Metrology, I.C. Gupta, Dhanpat Rai Publications, Delhi
2	Industrial Instrumentation, Alsutko, Jerry. D. Faulk, Thompson Asia Pvt. Ltd.2002.
3	Industrial Instrumentation, Alsutko, Jerry. D. Faulk, Thompson Asia Pvt. Ltd.2002.

Practical Based Learning (Suggested Activities in Class)/ Practical Based learning:

Seminars / Quiz (to assist in GATE preparations).
Demonstrations in the lab.
Self-Study on simple topics.
Virtual lab experiments.

Process of Ascertaining (both CIE and SEE):

50% weightage given for each Continuous Internal Evaluation (CIE) and Semester End Exam (SEE).
A student shall be considered to have fulfilled the academic requirements and earned the credits allotted to each subject / course by securing not less than 35% (36 Marks out of 100) in the semester End examination (SEE), and a minimum of 40% (20 marks out of 50) in the sum total of the Continuous Internal Evaluation (CIE) taken together.

Continuous Internal Evaluation (CIE):

Two Tests each of **20 Marks (duration 01 hour**) has been conducted in each semester.
First test at the end of 5th week of the semester and Second test at the end of the 10th week of the semester. The Makeup test at the end of the 15th week of the semester given for the students for whom are not attended the test One and Two due to genuine (medical, participating in academic or extracurricular activities, sport etc.) reason.
Two assignments each of **05 Marks (taken average at the end)**
First assignment at the end of 4th week and Second assignment at the end of 9th week of the semester.
Group discussion / Activities / Seminar / Quiz **05 Marks** (**duration 01 hours**)
CIE, Assignments and Group discussion / Activities / Seminar / Quiz will be planned suitably to attain the CO^{s} and PO^{s} and PSO^{s}.
At the end of the 13th week of the semester, the sum of two tests, two assignments, and Group discussion / Activities / Seminar / Quiz will be **scaled** out of 50 marks.
(For each CIE, the portion of the syllabus should not be common / repeated). **CIE methods / question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

Semester End Examination (SEE):

Theory SEE will be conducted by Institute as per the scheduled timetable, with common question papers for the subject of **duration 03 hours**.
The question paper will have ten questions. Each question is set for 20 marks and there will be 2 questions from each units / module. Each of the two questions under a unit / module should have a maximum of 3 sub-questions, **should have a mix of topics** under that unit / module. The students have to answer 5 full questions, selecting one full question from each unit / module.

CO-PO Mapping															
CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O 2	PS O3
CO1		✓	✓		✓							✓			
CO2	✓	✓					✓					✓			
CO3	✓	✓					✓					✓			

Course Title	**MECHANIC OF MATERIALS**
Course Code	**22IMT304**
Category	**Professional Core Course (PCC)**

Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	03	**01**	**00**	**00**	**04**	**52**	**3**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Course Learning Objectives:	
1	Understand the Mechanics of deformable bodies and apply them in analysis and design.
2	Evaluate the shear force and bending in beams subjected to different loading conditions.
3	Analyze a body subjected to two dimensional and three dimensional stress systems.
4	Interpret the torsional behavior of structural members.
5	Examine the stresses in thin and thick cylinders subjected to loads.

UNIT No.	**Syllabus**	**No. of hours**
1	**DEFORMATION, STRESSES AND STRAIN**	**08**
	Extension / Shortening of a bar, bars with cross sections varying in steps, bars with continuously varying cross sections (circular and rectangular), Elongation due to self-weight, Principle of super position. Stress in Composite Section. Volumetric strain, expression for volumetric strain, elastic constants, simple shear stress, shear strain, temperature stresses (Excluding compound bars).	
2	**BENDING MOMENT, SHEARING FORCE IN BEAMS**	**08**
	Introduction, Types of beams, loads and reactions, shear forces and bending moments, rate of loading, sign conventions, relationship between shear force and bending moments. Shear force and bending moment diagrams for different beams subjected to concentrated loads, uniformly distributed load (UDL), uniformly varying load (UVL) and couple for different types of beams.	
3	**BENDING AND SHEAR STRESSES IN BEAMS**	**08**
	Bending and Shear Stresses in Beams: Introduction, Theory of simple bending, assumptions in simple bending. Bending stress equation, relationship between bending stress, radius of curvature, relationship between bending moment and radius of curvature. Moment carrying capacity of standard sections. Shearing stresses in beams, shear stress across rectangular, circular, symmetrical I and T sections.	
4	**TORSION OF CIRCULAR SHAFTS**	**08**
	Introduction. Pure torsion, assumptions, derivation of torsional equations, polar modulus, torsional rigidity / stiffness of shafts. Power transmitted by solid and hollow circular shafts columns	
5	**THICK AND THIN CYLINDERS**	**08**
	Stresses in thin cylinders due to internal pressure, circumferential stresses & longitudinal stresses. Deformation in thin cylinders, stresses due to internal pressure of thick cylinders, Lame's theory and numerical problems.	

Course Outcomes:	
1	Calculate stresses, strains applied to mechanical members under different loading and material properties.
2	Plot and analyze SFD and BMD of simply supported and cantilever beams for different types of loading

	and support conditions
3	Analyze Shear stresses in beams of different cross sections, analyze the deflection in beams and estimate the strain energy in mechanical elements.
4	Use torsion equation to calculate power transmission in shafts and analyze buckling and bending phenomenon in columns, struts and beams
5	Analyze and design thin, thick cylinders

Course Outcomes Mapping with Programme Outcomes & Programme Specific Outcomes

Course Out Comes	Level of CO	Program Outcomes												Programme specific outcomes		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1		3	3	3	3	2	0	0	0	0	0	2	0	3	0	0
CO2		3	3	3	3	2	0	0	0	0	0	2	0	3	0	0
CO3		3	3	3	3	2	0	0	0	0	0	2	0	3	0	0
CO4		3	3	3	3	2	0	0	0	0	0	2	0	3	0	0
CO5		3	3	3	3	2	0	0	0	0	0	2	0	3	0	0

Text Books.

1	**"Strength of Materials",** S.S. Rattan, Tata ,Second Edition, McGraw Hill Education India
2	**"Strength of Materials",** S. Ramamrutham, Twentieth Edition

Web Links.

https://onlinecourses.nptel.ac.in/noc22_ce46/preview

Reference Text Books.

1	**"Mechanics of Materials",** James. M. Gere, Thomson, Fifth edition 2004.
2	**"Mechanics of Materials",** in S.I. Units, Ferdinand Beer & Russell Johnstan, TMH.
3	**"Strength of Materials",** S.S.Bhavikatti, Vikas pub. House -1 Pvt. Ltd., 2nd Ed., 2006.
4	**"Advanced Mechanics of Solids",** L S Srinath, McGraw Hill Education India,2009

Assessment Details both (CIE and SEE)				
The weightage of Continuous Internal Evaluation (CIE) and Semester End Exam (SEE) is 50% each. The students have to obtain a minimum of 40% marks individually both in CIE and SEE to pass. **CIE:** The CIE has two components – CIE - theory component and CIE – laboratory component. Students have to score a minimum of 40% Marks in the total of CIE - theory and CIE – laboratory components put together, provided students have to score a minimum of 40% marks in CIE laboratory component alone to qualify to take SEE. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration) and reduced to 50 Marks.				
CONTINUOUS INTERNAL EVALUATION (CIE)		**Max Marks**		**Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)**
Theory	**Weightage of CIE1 and CIE2 Tests or CIE3**	**30**		**12**
Laboratory components	**Lab demonstration components:** Rubrics for each lab component are added, then taken average (more emphasized on demonstration topics)	**10**	**20**	**08**
	Lab CIE	**10**		
TOTAL		**50**		**20**

CONTINUOUS INTERNAL EVALUATION (CIE)		Max Marks	Minimum Marks to be scored in CIE, to qualify to take SEE (40% individually)	
Theory	**Weightage of CIE1 and CIE2 Tests or CIE3**	**30**	**12**	
Laboratory components	**Lab demonstration components:** Rubrics for each lab component are added, then taken average (more emphasized on demonstration topics)	**10**	**20**	**08**
	Lab CIE	**10**		
TOTAL		**50**	**20**	

Course Title	Materials Testing Laboratory						
Course Code	22IML305						
Category	Professional Core Course Laboratory (PCCL)						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	S	Total		
	00	00	02	00	02	26	1
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100		Duration of SEE: 03 Hours		

Objective
1. To learn and demonstrate the basic principles in the area of strength and mechanics of materials through a series of experiments. 2. To provide hands on experience in measuring loads, deflection and strains.

Expt. No	Description
1	Preparation of specimen for Metallographic examination of different engineering materials. Identification of microstructures of plain carbon steel, tool steel, gray C.I, SG iron, Brass, Bronze & composites. **(Only Demonstration)**
2	Heat treatment: Annealing, normalizing, hardening and tempering of steel. Hardness studies of heat-treated samples. **(Only Demonstration)**
3	To study the wear characteristics of ferrous, non-ferrous and composite materials for different parameters. **(Only Demonstration)**
4	Non-destructive test experiments like, **(Only Demonstration)** (a). Ultrasonic flaw detection (b). Magnetic crack detection (c). Dye penetration testing. To study the defects of Cast and Welded specimens.
5	Tensile, shear and compression tests of metallic and non-metallic specimens using Universal Testing Machine
6	Torsion Test
7	Bending Test on metallic and nonmetallic specimens.
8	Izod and Charpy Tests on M.S, C.I Specimen.
9	Brinell, Rockwell and Vickers's Hardness test.

Outcome:
After the completion of the above course students will be able to use 1. Demonstrate the Nondestructive testing methods 2. Experiment and compute loads, deflection, strains and hardness and various other parameters using basic material testing equipment's. 3. Evaluate the strengths of metallic specimens using UTM

Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation (CIE):

- ✓ CIE marks for the practical course is 50 Marks.
- ✓ The split-up of CIE marks for record/ journal and test are in the ratio 60:40.
- ✓ Each experiment to be evaluated for conduction with observation sheet and record write- up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- ✓ Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- ✓ Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- ✓ Weightage to be given for neatness and submission of record/write-up on time.
- ✓ Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- ✓ In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- ✓ The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- ✓ The average of 02 tests is scaled down to 20 marks (40% of the maximum marks).
- ✓ The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

CO & PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓								✓
CO2	✓	✓										✓
CO3	✓	✓										✓
CO4	✓	✓		✓								✓

Course Title	**Engineering Materials**

Course Code	**22IMT3061**						
Category	**Engineering Science Course (ESC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	03	**01**	**00**	**00**	**04**	**50**	**3**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Course Objective :

1. To classify different materials and state their properties
2. To identify the structure of materials and imperfections with different mechanisms
3. To study different types of material testing methods and heat treatment process
4. To understand the characteristics and applications of composite and Nano materials process

Unit No	Syllabus	No of Hours
1	**Introduction to Materials**: Ferrous and Non-Ferrous Materials and Alloys,Metals, Production, General Properties, and Applications. **Crystal Structure:** BCC, FCC and HCP Structures, coordination number andatomic packing factors, crystal imperfections -point line and surface imperfections. (Problems) **Atomic Diffusion:** Phenomenon, Flick's I & II laws of diffusion, and Factorsaffecting diffusion. (Problems) . **Mechanical Behavior of Materials:** Stress-strain diagram showing ductile andbrittle behavior of materials, linear and non-linear elastic behavior and properties. **Mechanical Properties of Materials:** Yield Strength, Offset Yield Strength, Ductility, Malleability, Stiffness, Resilience, Rigidity, Ultimate tensile strength and Toughness.	10
2.	**Testing of Materials-** Tensile and Compression testing, **Impacttesting-** Izod and Charpy Impact testing. **Fatigue testing-** Fatigue: Types of fatigue loading with examples, Mechanism of fatigue, fatigue properties, fatigue testing and SN diagram Torsion Testing: Types of Torsion failure. **Creep**: Description of the phenomenon with examples. Three stages of creep, creep properties, stress relaxation, other related testing methods. Hardness Testing: Brinell hardness, Rockwell hardness and Vickers hardness testing of materials, Micro hardness and Nano indentation. **Fracture of Materials**: Fundamentals of fracture, Brittle, Ductile and shear type of fracture (Type I, Type II and Type III). (Problems)	10
3	**Phase Diagram I:** Solid solutions and its types and intermediate phases - HumeRothery's rule - solidification of metals and alloys, cooling curves, concepts of phase diagrams. Gibbs Phase rule. Coring and segregation as applied to variousbinary systems, ternary systems. **Phase Diagram II:** Construction of equilibrium diagrams involving complete and partial solubility, Lever rule. Iron-carbon equilibrium diagram description ofphases. (Problems)	07
4	**Heat-treatment of steels**: TTT curves, Continuous Cooling Transformation Curves (CCT) diagrams, bainitic transformation, martensitic transformation. Annealing and its types. Normalizing, Hardening, Tempering, Mar tempering, Austempering, Harden ability. Surface hardening: Carburizing, Cyaniding, Nitriding, Flame hardening and Induction hardening.	06

5	**Advanced Material Processing Technology:** Introduction to Composite material, FRP composites – Fiber types-, properties, Strength and Elastic Modulus of Reinforced Plastics ,Rule of Mixtures and Problems Matrices: Matrices type and properties, lamina, laminate. Introduction, properties and applications- Metal matrix composites , Ceramic matrix composites, Nano Material, shape memory alloys, High strength alloys, Super alloys. (Problems).	06

Outcome:

After the completion of the above course students will be able to

1. Distinguish between different materials and their properties
2. Test materials for impact, fatigue, torsion, creep, hardness and fracture
3. Construct phase diagrams
4. Explain different types of heat treatment processes
5. Discuss advanced material processing technology, characterization techniques.

Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation (CIE):

- ✓ CIE marks for the practical course is 50 Marks.
- ✓ The split-up of CIE marks for record/ journal and test are in the ratio 60:40.
- ✓ Each experiment to be evaluated for conduction with observation sheet and record write- up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- ✓ Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- ✓ Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- ✓ Weightage to be given for neatness and submission of record/write-up on time.
- ✓ Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- ✓ In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- ✓ The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- ✓ The average of 02 tests is scaled down to 20 marks (40% of the maximum marks).
- ✓ The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Cos	**Mapping with POs**
CO1	PO3,PO6,PO8,PO10
CO2	PO3,PO4,PO7,PO10,PO11
CO3	PO3,PO4,PO7,PO10,PO11
CO4	PO6,PO10,PO11
CO5	PO6,PO8,PO10

Text books:

1. Raghavan V., „Physical Metallurgy - Principles and Practice", 2nd Edition, Prentice - Hallof India, 2007.
2. Avner S.H., „Introduction to Physical Metallurgy", 2nd edition, Tata McGraw Hill, 2008
3. Derek Hull, „Introduction to Dislocations", Pergamon, 2nd Edition, 1981

Reference books: 1. Dieter G. E., „Mechanical Metallurgy", 1st Edition,McGraw Hill Co-Koga, 2002

2. Suryanarayana AVK, „Testing of Metallic Materials", 2nd Edition, BS Publications, 2007. 3. Mein Schwartz., "Composite Materials Handbook",McGraw Hill, 1992

4. Autar K.Kaw, "Mechanics of Composite Materials", CRC Press, 2005.
5. "ASM Hand book on Composites", Volume 21, 2001
6. Vanviack L.H, "Physical Ceramics for Engineers", Addison WesleyPublication, 1964.
7. Schwartz. M. M., „Composite Materials", Prentice Hall, 1977
8. Broutman K. J., Krock R.H., „Modern Composite Materials", Addison WeslyPublishing, 1967
9. Billmeyer F., „Textbook of Polymer Science", Wiley Interscience, 1994
10. Manufacturing Engineering and Technology, Serope Kalpakjian &Steven R. Schmi

Course Title	**RAPID PROTOTYPING**						
Course Code	**22IMT3062**						
Category	**Engineering Science Course (ESC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	03	**01**	**00**	**00**	**04**	**50**	**3**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Objectives:

1. To explore concepts of advanced manufacturing technologies that is affecting contemporary design for manufacture
2. Describe various CAD issues for rapid prototyping and related operations for STL model manipulation
3. Describe and review the principles and key characteristics of RP technologies and commonly used RP systems.
4. Describe and review typical rapid tooling processes for quick batch production of plastic and metal parts.

Unit No.	Syllabus Content	No of Hours
1	**Introduction:** definition of prototype, types of prototype, need for the compression in product development, history of RP system, classification of RP systems, process chain of RP.	**06**
2	**Liquid based rapid prototyping system:** Stereo lithography systems – Principles, process specification and materials, advantages and disadvantages. Rapid freeze prototyping – principles, process specification and materials, advantages and disadvantages	**09**
3	**Solid based rapid prototyping system:** Fused deposition modeling (FDM): principle, process specification and materials, advantages and disadvantages. **Laminated object Manufacturing (LOM**): principle, LOM specification and materials, advantages and disadvantages.3D system's Multi-Jet modeling system (MJM): Principle, process specification and advantages and disadvantages.	**10**
4	**Powder based rapid prototyping system:** Selective laser sintering (SLS): Principle of operation, process parameters, advantages and disadvantages. Laser Engineering Net shaping (LENS): Principle of operation, process parameters, advantages and disadvantages. 3-D printer: Principles of operation, Process parameters, advantages and disadvantages.	**08**
5	**Rapid prototyping data formats and applications:** **Data formats:** SRL format, STL file problems, and consequences of building valid and invalid tessellated models, STL file repair. **Applications**: Materials relationship, Finishing processes, Design, Manufacturing and Tools Automotive Industry, Jeweler Industry, Coin Industry, Tableware Industry, Arts and Architecture.	**06**

Note 1: Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit.
Note 2: Two assignments are evaluated for 5 marks.

Outcomes:

1. Determines the limitations of RP,RT and RE technologies for product development
2. Establish the potential applications, setups, uses and operations associated with additive and rapid manufacturing processes.
3. Analyses appropriate technology for a given applications.
4. Evaluate various rapid prototyping and manufacturing technologies.
5. Using the principles of rapid prototyping, rapid tooling and reverse engineering technologies in product manufacturing.

Cos	Mapping with POs
CO1	PO2,PO8,PO12
CO2	PO3,PO5,PO11
CO3	PO2,PO8,PO12
CO4	PO3,PO5,PO11
CO5	PO2,PO8,PO11,PO12

TEXT BOOKS:

1. Mikel P Grover , Mitchell Weiss, Roger N Nagel & Nicholas G Odrey "Industrial Robotics Technology, Programming and applications", McGraw-Hill book company,edition 2008, ISBN No. 13:978-0-07-026509-7
2. John J Craig, "Introduction to Robotics- Mechanics and control", III Edition, Pearson Education south Asia, 5th Impression – 2011, ISBN 978-81-3127-1836-0
3. Richard David Klafter , Thomas A Chmielewski Michel Negin, "Robotics Engineering – An Integrated approach", Prentice Hall of India Pvt. Ltd. Edition 1989 Print 2005 ISBN 81-203-0842-5.

22HST307 – Social Connect and Responsibilities

Dr Ambedkar Institute of Technology, Bengaluru-56
Department of Humanities & Social Sciences
Scheme and Syllabus – OBE - CBCS – 2022 -2023

Course Title	SOCIAL CONNECT & RESPONSIBILITIES						
Course Code	21HST306						
Category	Humanities & Social Sciences (HS)						
Scheme and Credits	No. of Hours/Week					Total Hrs./semester	Credits
	L	T	P	SS	Total		
	0	0	1	-	01	13	01
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100		Duration of SEE: 02 Hours		

COURSE OBJECTIVE: The course will:

1. Provide a formal platform for students to communicate and connect to the surrounding.
2. Enable to create a responsible connection with the society.

UNIT I **hours**

Plantation and adoption of a tree: plantation of a tree that will be adopted for four years bya group of B.tech students. They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folkloreand literature.

UNIT II **hours**

Heritage walk and crafts corner: Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms.

UNIT III **hours**

Organic farming and waste management: usefulness of organic farming, waste management, wet waste management in neighbouring villages, and implementation in the campus.

UNIT IV **hours**

Water conservation: Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photo blog presenting the current practices

UNIT V **hours**

Food walk: City's culinary practices, food lore, and indigenous materials of the region used in cooking.

Activities:

Conducting a rural camp(about awareness) for one or two days or Community camp(So responnsility)Jamming session, open mic, and poetry: Platform to connect to others. Share life stories v others. Exhibit the talent like playing instruments, singing, one act play , art-painting, fine art

A total of 14 hrs engagement per semester is required for the 3rd semester of the B.E./ B.Tech. program. students will be divided into 10 groups of 35 each. Each group will be handled by two faculty mentors.

Faculty mentors will design the activities (particularly-Jamming session, open mic and poetry)

Faculty mentors has to design the evaluation system

(eg: For activities that mentioned in 05 modules –students shall submit the brief report with photographs of activities.)

COURSE OUTCOMES: The students are expected to have the ability to:

1. Understand social responsibility
2. Practice sustainability and creativity
3. Showcase planning and organizational skills

Dean (Academic)
Dr. Ambedkar Institute of Technology
Bengaluru-560 056.

Course Title	**CONCEPTS OF MANAGEMENT**						
Course Code	**22IMT3081**						
Category	**Ability Enhancement Course (AEC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	01	**00**	**00**	**00**	**01**	**13**	**1**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Objectives:
1. To learn the principles and fundamentals of management practices 2. To learn Management approaches and Organization development 3. A brief insight towards Product life cycle and Technology Management 4.

UNIT	Description	No. of Hours
I	**Engineering and Management** Management – Management Definition, Management Levels, Managerial Skills, What Managers Do, Functions of Managers **Management Philosophies** Scientific Management –, Frederick W. Taylor, The Gilbreths	**3**
II	**Management and organization Development** Need for effective Manager Development, Manager Development process and training, Approaches to manager development – on the job training, internal and external training	**3**
III	**Managing technology through product life cycle** Product and Technology life cycles, Nature of Research and Development, R&D Projects – Need for selection, Initial screening.	**3**
IV	**Perception** Perception: Factors influencing perception, application in organizationLearning: – implications for performance and satisfaction. Motivation: Theories of motivation - implications for performance and satisfaction in Organizations.	**3**
V	**Personality and individual Decision Making** Personality: Concept, Theories, Major personality attributes influencing OB, Values attributes and job satisfaction.	**3**

COURSE OUTCOMES:	
1	Develop Technocrats with the skills required for an Organization
2	Equip students with Principles and traits of Management practices for their future endeavors

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animation videos

CO & PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				□			□	□		□		□
CO2				□			□	□		□		□

TEXT BOOKS

1. Managing Engineering and Technology, 3rd Edition, Daniel L. Babcock & Lucy C.Morse
2. Principles of Management, Harold Koontz, Heinz Weihrich, A Ramachandra Aryasri
3. Management, 9th Edition, Harold Koontz, Heinz Weihrich
4. Project Management a Life cycle approach, Prentice hall of India

REFERENCE BOOKS

1. Entrepreneur development S S Khanna, S Chand & co Ltd.1999
2. Management – A Functional approach, Joseph M Putti, McGraw Hill,1997

Process of Ascertaining (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous internal Examination (CIE)

Two Tests (preferably in MCQ pattern with 20 questions) each of 20 Marks (duration 01 hour)

1. First test at the end of 5thweek of the semester
2. Second test at the end of the 10thweek of the semesterTwo assignments each of 10 Marks
1. First assignment at the end of 4thweek of the semester
2. Second assignment at the end of 9thweek of the semester

Group discussion / Activities /Seminar/ Quiz 05 Marks (duration 01 hours), and it is suitably planned toattain the COs and POs for 20 Marks (duration 01 hours)

The sum of total marks of two tests, two assignments, and Group discussion / Activities /Seminar/ Quizwill be for50 marks and shall be scaled for the same.

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ(multiple choice questions). The time allotted for SEE is 01 hour. The student has to secure minimum of

35% of the maximum marks meant for SEE.

Course Title	**INDUSTRIAL SAFETY AND HEALTH**						
Course Code	**22IMT3082**						
Category	**Ability Enhancement Course (AEC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	01	**00**	**00**	**00**	**01**	**13**	**1**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Objectives:	
1	To gain an historical, economic, and organizational perspective of industrial safety and health.
2	To investigate current Industrial safety and health problems and solutions by First aid and medical care
3	To identify the forces that influence Industrial Ergonomics
4	To demonstrate the knowledge and skills needed to identify Health care management
4	To understand the legal aspect of Health and safety

Unit No	Syllabus Content	No of Hours
1	**Industrial safety and Work Environment** Industrial Psychology, Fatigue (i) Elimination of unnecessary fatigue (ii) Working conditions, House keeping Noise and Vibration, Air contamination and Ventilation, Illumination (Lighting), Thermal radiation/ Hot work in Confined Spaces, Cold Weather, Water Supply, Drainage and Sanitation, Safety working Condition at work place, Waste Disposal and Industrial Hygiene	**3**
2	**First Aid Medical care** Introduction, Occupational Health Centres (i) Construction Medical Officer (ii) Ambulance Room (iii) Ambulance van (iv) Emergency Care Services or Emergency Treatment, First Aid facilities (i) First Aid Boxes (ii) Golden Rule of First Aid (iii) Procedure in case of Accidents, Electrical Injuries (i) Electric Shock Effects (ii) Treatment for Electrical Injury (Rescue and First Aid) (iii) Artificial Respiration, guard against further Accidents, Treatment of Shock, Treatment of Wounds and Bleeding, Burns Treatment, Unconsciousness, Poisoning, Broken Bones, Treatment for Heart Attack and External Cardiac Massage, Immediate actions in various other cases.	**3**
3	**Ergonomics** Introduction, Objectives, Problem due to Poor Ergonomics, Solution to the poor Ergonomic problems, Applications of Ergonomics, Ergonomic Principles in the design of work systems, Ergonomic Risk and Hazards, Ergonomics and Health, Ergonomic Requirements for Earth moving Machinery	**3**
4	**Healthcare and Management** Introduction, Health care (i) Factors affecting Health (ii) Tips to Improve Occupational Health (iii) Prevention of diseases, Healthcare and nature, Exercises for Health, Back-ache, Stress management, Health Management (i) Prevention of Diseases (ii) Occupational Health Department (iii) Medical Surveillance (MSP) (iv) Medical examination, Healthy Living, Industrial/ Occupational Hygiene (i) Types of Hygiene, Community Health/ Construction camps.	**3**
5	**Legal Aspects of Health** Indian factories Act, 1948, Workmen's Compensation act, 1923, The building and other Construction Worker's (Regulation of Employment and Conditions of Service) Central Rules, 1998	**1**

Note 1: **Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit.**
Note 2: **Two assignments are evaluated for 5 marks.**

Course Outcomes: The students will be able to	
1	Acquire knowledge on Industrial Health policies, Laws and regulations.
2	Identify hazards in the workplace that pose a danger or threat to the safety or health, or that of others.
3	Control unsafe or unhealthy hazards and propose methods to eliminate the hazards.
4	Discuss the role of health and safety in the workplace and effects of industries on environment.
5	Identify workplace hazards, safety considerations and roles and responsibilities of workers, supervisors and managers.

Text Books:	
1	
2	Goetsch D. L., (1999), "Occupational Safety and Health for Technologists, Engineers and Managers", Prentice Hall.
3	Heinrich H.W., (2007), "Industrial Accident Prevention- A Scientific Approach", McGraw-Hill Book Company National Safety Council and Associate (Data) Publishers Pvt. Ltd., (1991).
	Industrial Safety and Pollution Control Handbook.

Reference Books:	
1	Colling D.A., (1990), "Industrial Safety Management and Technology", Prentice Hall, New Delhi.
2	Della D.E., and Giustina, (1996), "Safety and Environmental Management", Van Nostr and Reinhold International Thomson Publishing Inc.

Additional Books:	
1	Industrial safety, health and environmental management. R K Jain, Sunil S Rao, Khanna Publications.
2	Safety, occupational health and environmental management in construction. S E Sharma, Vineeth Kumar, Khanna Publications.
3	Labour laws, Commercial law publishers India Pvt Ltd.
4	The occupational Safety, health & working conditions code. Commercial law publishers 2020.
5	Occupational health and safety management - A practical approach by Charles-De-Reese.
6	Occupational ergonomics, theory and applications by Amith Battacharya & James D Mc Glotthin.
7	Occupational Safety and health law handbook. Mc Dermott will & Enercy LLP.
8	Occupational health and safety management. Lambert Academic Publishing.
9	Fundamentals of Industrial Ergonomics - Babur Musthaffa (Google books).
10	Global occupational safety health and management handbook. Thomas Fuller, CAC press.
11	Introduction to Industrial Ergonomics.
12	Ergonomics and practical manual for beginners. Manjith Kaur Chauhan.

IV SEMESTER

Course Title	**FACILITIES PLANNING AND DESIGN**						
Course Code	**22IMT401**						
Category	**Professional Core Course (PCC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	03	**01**	**00**	**00**	**04**	**50**	**3**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Objectives:

1. Explain the concepts of plant layout, layout planning and designing efficient facilities
2. Solve location and layout problems by considering the entire manufacturing and/or service systems within their supply chains.
3. Assess the role of facilities planning in reducing costs and increasing productivity and service level through selection of better material handling.
4. Elaborate on the concepts of computer-aided layout designs better facility design.

Unit No.	Syllabus Content	No of Hours
1	**PLANT LOCATION:** Factors influencing plant location, Theories of plant location and location economics. Location models: Selection of site by Break even analysis, Factor Rating method, Centre of gravity method (problems) **Plant layout**-Objectives of plant layout, Principles of plant layout, types of plant layout, and their merits and demerits **PLANT DESIGN:** Layout procedures: Immer, Nadler, Muther, Apple and Reed's approaches, systematic layout planning.	**10**
2	**MATERIAL HANDLING:** Objectives and principles of Material handling, Unit load concept, Material handling equipments, Selection of material handling equipments, Production line balancing.	**10**
3	**COMPUTERIZED LAYOUT PLANNING:** CRAFT, COFAD, PLANET, CORELAP, ALDEP	**08**
4	**SPACE DETERMINATION AND AREA ALLOCATION:** Factors for consideration in space planning, receiving, storage, production, shipping, tool room and tool crib, other auxiliary service actions, Establishing total space requirement, area allocation factors to be considered, expansion, flexibility, aisles column, area allocation procedure, the plot plan. **CONSTRUCTION OF THE LAYOUT:** Methods of constructing the layout, evaluation of layout, efficiency indices.	**12**
5	**QUANTITATIVE APPROACHES TO FACILITIES PLANNING:** Deterministic models single and multi-facility location models, Location allocation problems – quadratic assignment problem, Warehouse layout models, Evaluation, selection and implementation of facilities plan.	**12**

Note 1: Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit.
Note 2: Two assignments are evaluated for 5 marks.

Outcomes:

By the end of the course students will be able to

1. Solve facility location problems and prepare a facilities layout for the efficient flow of materials through a facility
2. Analyze material handling systems through different material handling equipment and material handling principles used in the warehousing, manufacturing
3. Plan the layout and evaluate facilities related problems using different layout planning algorithms
4. Identify activity, relationships and space requirements for various departments
5. Evaluate and select facilities plan

Cos	**Mapping with POs**
CO1	PO3,PO4
CO2	PO3,PO6
CO3	PO5,PO6
CO4	PO4,PO7
CO5	PO3,PO4,PO7

TEXT BOOKS:

1. Plant Layout and Material handling - James M Apple, 2nd Edition, John, Wiely and Sons
2. Facility layout and Location- Francies R L and White J A, Mc- Graw Hill 2nd edition

REFERENCE BOOKS:

1. Practical layout- Muther Richard, Mc- Graw Hill-1955.
2. Facilities Design, Sunderesh Heragu, PWS Publishing Company, ISBN-0-534-95183.
3. Plant Layout Design - James M Moore, Mc Millon Co.1962 LCCCN61- 5204.

Course Title	**ADVANCED MANUFACTURIENG TECHNOLOGY**						
Course Code	**22IMU402**						
Category	**Integrated Professional Core Course (IPCC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	02	**01**	**02**	**00**	**05**	**52**	**4**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Course Objectives:	
1	Basic concepts of Metal cutting and cutting tool parameters.
2	Importance of conventional and semiautomatic machining processes.
3	Two and three axis machine tools machining process.
4	Concepts of CNC-CAD-CAM and DNC Process.
5	Introduction to Smart Manufacturing and Digital Manufacturing

Unit No	**Syllabus**	**No of Hours**
1	**Theory of Metal Cutting**: Single point cutting tool nomenclature geometry. Rake angle, Mechanics of Chip Formation, Types of Chips. Marchant's Circle analysis of cutting force to determine various forces in cutting zone, problems on Merchant's analysis. Shear angle relationship, General Tool Wear and Geometry of tool wear, Tool failure, and Tool life. Effects of cutting parameters on tool life. Tool Failure Criteria, Taylor's Tool Life equation. Problems on tool life evaluation.	8
2.	**Cutting Tool Materials:** Desired properties and types of different cutting tool materials- Heat generation in metal cutting operation, factors affecting heat generation. **Cutting fluids:** Desired properties, types and selection **Machinability:** Concepts of Machinability and its improvement	8
3	**Production Lathes:** Classification, constructional features of Engine Lathe, Turret and Capstan type of lathe advantages and applications. **Drilling Machine**s: Classification, applications, constructional features, drilling. Types of drill & drill bit nomenclature- Drill materials Problems on calculation of machining time, reaming operation. Interlocution to CNC,CAD,CAM and DNC Process.	8
4	**Shaping Machine C**lassifications, constructional features, specifications, driving mechanisms- Crank and slotted lever, whit worth quick return and Hydraulic mechanism. Tool & work holding devices Problems on calculation of machining time. **Planing Machine**: Classifications, constructional features, driving mechanisms, planing operations. Tool and work holding devices. Problems on calculation of machining time.	8
5	**Milling machine**s: Classification, constructional features, specifications, milling cutters nomenclature, various milling operations, up milling and down milling concepts. Purpose of indexing, indexing methods. **Grinding machines:** Types of Abrasives, Bonding process, classification, constructional features of surface, cylindrical and centreless grinding machines, honing, lapping, super finishing, polishing and buffing operations. Introduction to Smart Manufacturing and Digital Manufacturing Process.	8

Expt. No	MANUFACTURING TECHNOLOGY LABORATORY	No. of Hours
	PART-1 EXPERIMENTS ON FOUNDRY & SAND TESTING	
1	Use of foundry tools and other equipment's.	4
2	Preparation of moulds using two molding boxes using patterns or without patterns. (Split pattern, Match plate pattern and Core boxes).	
3	Preparation of one casting (Aluminum or cast iron-Demonstration only)	
Preparation of sand specimens and conduction of the following tests:		
1	Compression, Shear and Tensile tests on Universal Sand Testing Machine.	
2	Permeability test	
3	Core hardness & Mould hardness tests.	
4	Sieve Analysis to find Grain Finest number of Base Sand	
5	Clay content determination in Base Sand	
	PART-2 EXPERIMENTS ON FORGING	2
1	Calculation of length of the raw material requited to do the model.	
2	Preparing minimum two forged models involving upsetting, drawing and bending operations.	
3	Out of these three models, at least one model is to be prepared by using Power Hammer	
	PART-3 EXPERIMENTS ON METAL CUTTING OPERATIONS	
1	Preparation of two models on lathe involving Plain turning, Taper turning, Step turning, Thread cutting, Facing, Knurling, Drilling, Boring, Internal Thread cutting and Eccentric turning. (Demonstration only)	4
2	Cutting of V Groove/ dovetail / Rectangular groove using a shaper. (Demonstration only)	
3	Cutting of Gear Teeth using Milling Machine. (Demonstration only)	
4.	Demonstration of Surface grinding, (Demonstration only)	

Course Outcomes: At the end of the course the student will be able to	
1	Describe the primary and secondary manufacturing processes and industrial applications in different sectors.
2	Explain the concepts of sand moulding methods and metal melting process and testing of casting and to produce defect free products.
3	Illustrate the characteristics of cutting tool materials and calculation of forces acting on cutting tool and machine time.
4	Learns the principles and concepts of different metal cutting operations

Teaching Learning Process: These are sample Strategies, which the teacher can use to accelerate the attainment of the various course outcomes.	
1	Power point Presentation, Video.
2	Video tube, NPTEL materials.
3	Quiz/Assignments/Open book test to develop skills.
4	Adopt problem based learning (PBL) to develop analytical and thinking skills.
5	Encourage collaborative learning in the class with site visits related to the subject and impart practical knowledge.

Text Book(s):	
1	Elements of Workshop Technology, Hajra Choudhury, Vol. I and II", Media Promotors Pvt Ltd., Mumbai, 2018.
2	Manufacturing Technology 1&2 ", Gowri, P.Hariharan, and A.Suresh Babu,S., Pearson Education, 2008. 3. Nadkarni S.V. "Modern Arc Welding Technology", 1st Edition, IBH Publishing, 2005
3	Production Technology, R.K.Jain, Khanna Publications, 2003.
4	Production Technology, HMT, Tata McGraw Hill, 2001.
5	A text book of Manufacturing Technology, Rajput R.K, Lakshmi Publications, 20074.
6	A text book of Manufacturing Technology, Rajput R.K, Lakshmi Publications, 20074.

Reference Book(s):	
1	Manufacturing Technology: Foundry Forming and Welding, P.N. Rao, 2nd Edition, 1998,TMH, ISBN: 0-07-463180-2.
2	Manufacturing Processes, J.P.Kaushish, 2nd Edition, 2010, PHI Learning Pvt. Ltd, ISBN: 978- 81-203-4082-4
3	Fundamentals of Metal Machining & Machine Tools, G. Boothroyd, 3nd Edition 2004, Mc Graw Hill, ISBN: 978-1-5-7442659 -3.
4	Production Technology, HMT, 5th Edition, 2004,Tata McGraw Hill, ISBN: 0-07-096443-2
5	Roy A Lindberg, Process and Materials of Manufacturing, 4th Ed. Pearson Edu. 2006.
6	Serope Kalpakjian, Steuen. R. Sechmid "Manufacturing Technology",Pearson Education Asia, 5th Ed. 2006.
7	P N Rao, Manufacturing Technology – "Foundry, Forming, and Welding", 4th edition, McGraw Hill Education (India) Private Limited, 2013, ISBN-13: 978-1- 25-9606257-5 and ISBN-10: 1-25-906257-0
8	Mikell P. Groover, "Fundamentals of modern manufacturing: materials, processes and systems", JOHN WILEY & SONS, INC., 4th Edition, 2010, ISBN: 978-0470- 467002 5. G.S Sawhney, "Manufacturing Science – I, Forming, Casting and Welding", 2015, I.K. International Publishing House Pvt. Ltd. ISBN: 978-93- 82332-53
9	Amitabha Ghosh and Mallik, Manufacturing Science, affiliated East West Press, 2003.
10	G. Boothroyd, Fundamental Machining and Machine Tools, McGraw Hill, 2000

11	P.N. Rao "Manufacturing Technology", Metal Cutting and Machine Tools, Tata McGraw
12	– Hill, New Delhi, 2003.
13	P.C. Sharma, "A Text Book of Production Engineering", S.Chand and Company Ltd, Fourth Edition, 1993.
14	Milton C.Shaw, "Metal Cutting Principles", Oxford University Press, 2nd Edition, 2005.
15	Philip F.Ostwald and Jairo Munoz, "Manufacturing Processes and systems", John Wiley and Sons, 9th Edition, 2002

Web links and Resources:	
1	Metal Casting web course by IIT Roorkee NPTEL : Manufacturing Processes I (Mechanical Engineering) (digimat.in)
2	Metal Casting web course by IIT Roorkee NPTEL : Manufacturing Processes I (Mechanical Engineering) (digimat.in)
3	Welding web course by IIT Roorkee NPTEL : Manufacturing Processes I (Mechanical Engineering) (digimat.in)
4	Theory of Metal cutting course by IIT Roorkee NPTEL : Manufacturing Processes II (Mechanical Engineering) (digimat.in)
5	Machining Process web course by IIT Roorkee NPTEL : Manufacturing Processes I (Mechanical Engineering) (digimat.in)
6	Machining Process web course by IIT Roorkee NPTEL : Manufacturing Processes I (Mechanical Engineering) (digimat.in)
7	CAD/CAM & CNC web course by IIT Roorkee NPTEL : Computer Aided Design and Manufacturing (Mechanical Engineering) (digimat.in)

Practical Based Learning (Suggested Activities in Class)/ Practical Based learning:

Seminars / Quiz (to assist in GATE preparations).
Demonstrations in the lab.
Self-Study on simple topics.
Virtual lab experiments.

Process of Ascertaining (both CIE and SEE):

50% weightage given for each Continuous Internal Evaluation (CIE) and Semester End Exam (SEE).
A student shall be considered to have fulfilled the academic requirements and earned the credits allotted to each subject / course by securing not less than 35% (36 Marks out of 100) in the semester End examination (SEE), and a minimum of 40% (20 marks out of 50) in the sum total of the Continuous Internal Evaluation (CIE) taken together.

Continuous Internal Evaluation (CIE):

Two Tests each of **20 Marks (duration 01 hour**) has been conducted in each semester.
First test at the end of 5th week of the semester and Second test at the end of the 10th week of the semester. The Makeup test at the end of the 15th week of the semester given for the students for whom are not attended the test One and Two due to genuine (medical, participating in academic or extracurricular activities, sport etc.) reason.
Two assignments each of **05 Marks (taken average at the end)**
First assignment at the end of 4th week and Second assignment at the end of 9th week of the semester.
Group discussion / Activities / Seminar / Quiz **05 Marks** (**duration 01 hours**)
CIE, Assignments and Group discussion / Activities / Seminar / Quiz will be planned suitably to attain the CO^{s} and PO^{s} and PSO^{s}.
At the end of the 13th week of the semester, the sum of two tests, two assignments, and Group discussion / Activities / Seminar / Quiz will be **scaled** out of 50 marks.
(For each CIE, the portion of the syllabus should not be common / repeated). **CIE methods / question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

Semester End Examination (SEE):

Theory SEE will be conducted by Institute as per the scheduled timetable, with common question papers for the subject of **duration 03 hours**.
The question paper will have ten questions. Each question is set for 20 marks and there will be 2 questions from each units / module. Each of the two questions under a unit / module should have a maximum of 3 sub-questions, **should have a mix of topics** under that unit / module. The students have to answer 5 full questions, selecting one full question from each unit / module.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										
CO2	✓	✓		✓	✓							
CO3		✓	✓									
CO4			✓									
CO5			✓		✓							

Course Title	**STATISTICS ENGINEERING**						
Course Code	**22IMU403**						
Category	**Integrated Professional Core Course (IPCC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	02	**01**	**02**	**00**	**05**	**52**	**4**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Objective:

1. Apply the basic fundamental concepts of Statistics to engineering problems and the importance of Data summary and Display.
2. Evaluate the application of discrete probability distribution to various manufacturing problems.
3. Calculate Continuous probability distribution to various manufacturing problems.
4. Explain the hypothesis to random experiments of manufacturing processes.
5. Test the statistical parameters by regression and correlation. and test for variance

Unit No.	Syllabus Content	No of Hours
1	**THE ROLE OF STATISTICS IN ENGINEERING (DATA SUMMARY AND PRESENTATION):** Statistical Thinking, Collecting data, Statistical Modeling Frame work, measure of central tendency and variance, Importance of Data summary and Display, Tabular and Graphical display	08
2	**DISCRETE RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS:** Discrete Random variables, Probability distributions and Probability mass functions, Cumulative distribution functions, Mean and Variance of a discrete random variable, Discrete uniform distribution, Binominal distribution, Hyper Geometric distribution, Poisson distribution and their Applications.	08+ 02(T)
3	**CONTINUOUS RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS:** Continuous random variables, Probability distributions and probability density functions, cumulative distribution functions, Mean and Variance of a continuous random variable, uniform distribution, Normal distribution, Normal approximation to Binominal and Poisson distribution, Exponential distribution and their Applications.	08+ 02(T)
4	**ESTIMATION THEORY:** Statistical Inference, Random sampling, Properties of Estimators, Sampling distribution, Sampling distribution of mean, variance and proportion. Introduction to confidence intervals. **STATISTICAL INFERENCE FOR A SINGLE SAMPLE AND TWO SAMPLES:** Hypothesis testing, Inference on the mean of a population (variance known and unknown), Inference on the variance of a normal population, Inference on a population proportion. Testing for Goodness of Fit, Inference for a difference in Means, Variances known, Inference for a difference in means of two normal distributions, Variances unknown, Inference on the Variances of two normal populations, Inference on two population proportions.	10+ 02(T)

5	**SIMPLE LINEAR REGRESSIONS AND CORRELATION:** Simple Linear Regression, Properties of Least square Estimators and Estimation of variances, Common abuses of regression, Prediction of new observations, Assessing the adequacy of regression model, Transformations to a straight line, Introduction to multiple regression (no problems), Correlation. **DESIGN OF EXPERIMENTS:** Strategy of experimentation, completely randomized single - factor experiment, Tests on individual treatment means, the random effects model, the randomized complete block design, one way analysis of variance and two way analysis of variance.	10+2(T)

Note 1: Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit.
Note 2: Two assignments are evaluated for 5 marks.

Outcome:

By the end of the course students will be able to

1. Apply the statistical data in the form of Tabular and Graphical display.
2. Identify discrete type of probability and solve the various engineering problems.
3. Solve Continuous type of probability and solve the various engineering problems
4. Estimate the hypothesis and give inference to random experiments.
5. Evaluate the statistical parameters by estimation.

Cos	Mapping with POs
CO1	PO1,PO2,PO12
CO2	PO1,PO2,PO3,PO12
CO3	PO1,PO2,PO3,PO12
CO4	PO1,PO2,PO3,PO4,PO12
CO5	PO1,PO2,PO3,PO5,PO9,PO12

TEXT BOOKS:

1. **Applied statistics and Probability for Engineers** – Douglas C Montgomery, George C Runger, 2nd Edn, John Wiley and Sons, ISBN-0-471-17027-5
2. **Statistics for Management** - Richard I Levin, David S Rubin, 6th Edn, Prentice Hall India, ISBN-81-203-0893-X

REFERENCE BOOKS:

1. **Probability and Statistics in Engineering** - William W Hines, Douglas C Montgomery, 2nd Edn, John Wiley and Sons
2. **Business Statistics for Management and Economics** - Daniel, Terrell, 6th Edn, Houghton Mifflin Company, ISBN-0-395-62835-0
3. **Probability and Statistics** - Walpole & Mayer, MacMillan Publishing Company, 1989.

Course Title	**Computer Aided Machine Drawing**						
Course Code	**22IML404**						
Category	**Integrated Professional Core Course (PCCL)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	01	**00**	**02**	**00**	**03**	**26**	**1**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Objective:

1. To visualize an object and convert it into a drawing.
2. To train the students to use commercial solid modeling software package
3. To explain the basic concept and to draw the views of section of solids, orthographic projections and threaded fasteners
4. To gain knowledge of conventional representation of mechanical Components
5. This course will give an insight to design, creation of an assembly and detailed drawing of machine components

Unit No	Syllabus	No of Hours
1	**Introduction:** Review of graphic interface of the software. Review of basic sketching commands and navigational commands. Starting a new drawing sheet. Sheet sizes. Naming a drawing, Drawing units, grid and snap. **Sections of Solids:** Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting only on their bases (No problems on, axis inclinations, spheres and hollow solids). True shape of sections. **Orthographic Views:** Conversion of pictorial views into orthographic projections. of simple machine parts with or without section. (Bureau of Indian Standards conventions are to be followed for the drawings) Hidden line conventions. Precedence of lines.	8
2	**Geometric Dimensions and Tolerances:** Drafting, tolerance and geometrical symbols used in machine drawing. **Fasteners:** Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) **Riveted Joints:** Single and double riveted lap joints, butt joints with single/double cover straps (Chain and Zigzag, using snap head rivets).	08
3	Assembly Drawings(Part drawings should be given) 1. Screw jack (Bottle type) 2. Machine vice 3. Plummer block 4. I.C. Engine connecting rod	18

Note 1: SEE Question paper contains total six Questions (two questions from each unit) and student should answer any one question from Unit I and Unit II and III (student shall answer total 3 questions).

Course Outcomes:

After the completion of the above course students will have the

1. Ability to use standard software tools to create part assemblies
2. Ability to create fully constrained solid models that can be quickly modified using standard software tools
3. Ability to identify and explain standard features in solid modeling including protrusion, revolution, cutouts and patterns.
4. Ability to use standard software tools to create engineering drawings to describe the geometries and dimensions of parts
5. Ability to create computer aided drawings by interpreting and applying drafting standards.

Cos	Mapping with POs
CO1	PO2,PO11
CO2	PO2,PO11
CO3	PO2,PO3,PO11
CO4	PO2,PO3,PO11
CO5	PO2,PO3,PO11

Text books:

1. **'Machine Drawing'**, K.R. Gopala Krishna, Subhash Publication
2. **'Machine Drawing'**, N.D. Bhat & V.M.Panchal

Reference books:

1. **'A Primer on Computer Aided Machine Drawing - 2007'**, Published by VTU, Belgaum.

Scheme of Examination:

ONE question from Unit 1	10 Marks
ONE question from Unit 2	10 Marks
ONE question from Unit 3	30 Marks
Total	50 Mark

Course Title	**MECHANISM AND MACHINE THEORY**						
Course Code	**22IMU4051**						
Category	**Engineering Science Course (ESC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	02	**02**	**00**	**00**	**04**	**52**	**3**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Objective:

1. To define the layout of linkages in the assembly of a system/machine
2. To identify various principles involved in assessing the displacement, velocity and acceleration at any point in a link of a mechanism
3. To analyze the motion resulting from a specified set of linkages in a mechanism.
4. To illustrate the design and application of gears
5. To evaluate the design and application of cams

Unit No	Syllabus	No of Hours
1	**Introduction:** Definitions Link or element, kinematic pairs, Degrees of freedom, Grubler's criterion (without derivation), Kinematic chain, Mechanism, Structure, Mobility of Mechanism, Inversion, Machine. **Kinematic Chains and Inversions**: Inversions of Four bar chain; Single slider crank chain and Double slider crank chain.	8+2(T)
2	**Mechanisms:** Quick return motion mechanisms-Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism. Straight-line motion mechanisms Peaucellier's mechanism and Robert's mechanism. Intermittent Motion mechanisms -Geneva wheel mechanism and Ratchet and Pawl mechanism. Toggle mechanism, Pantograph.	8+2(T)
3	**Spur Gears:** Gear terminology, law of gearing, Characteristics of involute action, Path of contact. Arc of contact, Contact ratio of spur, helical, bevel and worm gears, Interference in involute gears. Methods of avoiding interference, Back lash. Comparison of involute and cycloidal teeth.	8+2(T)
4	**Gear Trains:** Simple gear trains, Compound gear trains for large speed reduction, Epicyclical gear trains, Algebraic and tabular methods of finding velocity ratio of epicycle gear trains(Simple Problems with tabular column method only). Tooth load and torque calculations in epicyclic gear trains. **Velocity Analysis by Instantaneous Center Method:** Definition, Kennedy's Theorem, Determination of linear and angular velocity using instantaneous center method	9+2(T)
5	**Klein's Construction**: Analysis of velocity and acceleration of single slider crank mechanism. **Cams:** Types of cams, Types of followers. Displacement, Velocity and, Acceleration time curves for cam profiles. Disc cam with reciprocating follower having knife-edge, roller and flat-face follower, Disc cam with oscillating roller follower. Follower motions including SHM, Uniform velocity, uniform acceleration and retardation and Cycloidal motion.	9+2(T)

- Graphical Solutions may be obtained either on the Graph Sheets or on the Answer Book itself

Note 1:

- **SEE question paper shall contain 10 questions having internal choice in each unit.**
- **Students shall answer one question from each unit.**

Note 2:

- **Assignments are evaluated for 5 marks.**
- **CIE shall be evaluated for 20 marks**

Outcome:

After the completion of the above course students will be able to

1. Discuss the common mechanisms used in machines and everyday life.
2. Calculate mobility (number of degrees-of-freedom) and enumerate rigid links and types of joints within mechanisms.
3. Analyze the complete (translational and rotational) mechanism velocity and acceleration graphically.
4. Classify gear mechanism and analyze gear train, and interpret gear standards and specification in design.
5. Explain cam mechanism and cam motion profiles, and calculi the velocity and acceleration of cam.

Cos	**Mapping with POs**
CO1	PO1,PO2,PO3
CO2	PO1,PO2,PO3
CO3	PO1,PO2,PO3
CO4	PO2,PO3,PO5,PO8,PO9,PO12
CO5	PO2,PO3,PO5,PO8,PO9,PO12

TEXT BOOKS:

1. **"Theory of Machines",** Rattan S.S, Tata McGraw-Hill Publishing Company Ltd., New Delhi, and 3rd edition - 2009.
2. **"Theory of Machines",** Sadhu Singh, Pearson Education (Singapore) Pvt. Ltd, Indian Branch New Delhi, 2nd Edi. 2006
3. **"Theory of mechanisms and machine" Amithaba Gose and Asok kumar malik Third edition, east west press, 2006**

REFERENCE BOOKS:

1. **"Theory of Machines & Mechanisms**", J.J. Uicker, G.R. Pennock, J.E. Shigley. OXFORD 3rd Ed. 2009.
2. **Mechanism and Machine theory**, Ambakar. A G ,PHI learning 2007
3. **Theory of machine,** Joseph Edward Shigley, OXFORD PRESS.

Course Title	**ENGINEERING THERMODYNAMICS**						
Course Code	**22IMT4052**						
Category	**Engineering Science Course (ESC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	02	**02**	**00**	**00**	**04**	**52**	**3**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

	Course Objectives:
1	To understand the basic tools and methodologies for carrying out thermodynamic analysis of engineering systems.
2	Understand the nature and role of the following thermodynamic properties of matter: internal energy, enthalpy, entropy, temperature, pressure and specific volume
3	Recognize and understand the different forms of energy and restrictions imposed by the first law of thermodynamics on conversion from one form to another
4	Understand implications of the second law of thermodynamics and limitations placed by the second law on the performance of thermodynamic systems
5	To understand the working of Internal combustion engines and their performance analysis, understanding of air standard cycles and their importance

Unit No.	Syllabus	No. of Hours
I	**FUNDAMENTAL CONCEPTS & DEFINITIONS:** Microscopic and Macroscopic approaches. Engineering thermodynamics; definition, some practical applications of engineering thermodynamic. System (Closed system) and Control Volume (open system); Characteristics of system boundary and control surface, examples. Thermodynamic properties; intensive and extensive properties. Thermodynamic state, state point, state diagram, path and process, cyclic and non-cyclic preesses; Thermodynamic equilibrium; diathermic wall, Zeroth law of thermodynamics, **TEMPERATURE:** concepts, scales, measurement.	6+4(T)
II	**WORK AND HEAT:** Thermodynamic definition of work; examples, sign convention. Displacement work; at part of a system boundary, at whole of a system boundary, expressions for displacement work in various processes through p-v diagrams. Heat; definition, units and sign convention, misconceptions about heat	6+4(T)
III	**FIRST LAW OF THERMODYNAMICS:** Joules experiments, equivalence of heat and work. Statement of the First law of thermodynamics, extension of the First law to non - cyclic processes, energy, energy as a property, modes of energy, pure substance; definition, two-property rule, Specific heat at constant volume, enthalpy, specific heat constant pressure. Extension of the First law to control volume; steady state-steady flow energy equation, important applications.	8+4(T)
IV	**SECOND LAW OF THERMODYNAMICS:** Thermal reservoir. Direct heat engine; schematic representation and efficiency. Devices converting work to heat in a theromodynamic cycle; reversed heat engine, schematic representation, coefficients of performace. Keivin - Planck statement of the Second law of Thermodynamics; PMM I and PMM II, Clasius statement of Second law of Thermodynamics; Equivalence of the two statements; Reversible and irrevesible processes; factors that make a process irreversible, reversible heat engines, Carnot cycle, Corollories of Carnot cycle (only statement).	6+4(T)
V	**GAS POWER CYCLES:** Air Standard cycles: Carnot, Otto, Diesel, Dual and Stirling cycles, P-V and T-S diagrams, description, efficiencies and mean effective pressures, Comparision of Otto and Diesel cycles.	6+4(T)

	I.C.ENGINES: Testing of two stroke and four stroke SI and CI engines for performance Related numerical problems, heat balance, Morse test.	

Note 1: Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit.
Note 2: Two assignments are evaluated for 5 marks.

Course Outcomes: At the end of the course the student will be able to	
1	Represent a thermodynamic system by a control mass or control volume, distinguish the system from its surroundings, and identify work and/or heat interactions between the system and surrounding
2	Estimate the various thermodynamic properties, work transfer and heat transfer.
3	Analyze the different forms of energy and restrictions imposed by the first law of thermodynamics on conversion from one form to another.
4	Analyze the performance of refrigeration and heat pump systems.
5	Assess the working of internal combustion engines and their performance analysis.

COs	**Mapping with POs**
CO1	PO1,PO2,PO5,PO6,PO10
CO2	PO1,PO2,PO5,PO8
CO3	PO1,PO4,PO5,PO6
CO4	PO1,PO2,PO3
CO5	PO2,PO5,PO6,PO9

TEXT BOOKS:

1. **Basic and Applied Thermodynamics**, P. K. Nag, Tata McGraw-Hill Education Pvt. Ltd, 2nd Edition, 2010
2. **Thermodynamics: An Engineering Approach**, Yunus A. Cengel, Michael A. Boles, McGraw Hill Education, 8th Edition, 2015
3. **Applications of Thermodynamics,** V. Kadambi, T. R. Seetharam and K. B. Subramanya Kumar, Wiley, 1st Edition, 2019.

Course Title	**FLUID MECHANICS**						
Course Code	**22IMU4053**						
Category	**Engineering Science Course (ESC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	02	**02**	**00**	**00**	**04**	**52**	**3**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Course Objective:	
1	Explain the basic concepts of fluid mechanics and recognize the various types of fluid flow problems encountered in practice.
2	Determine the basic properties of fluids and understand the continuum approximation.
3	Define viscosity and the consequences of the frictional effects it causes in fluid flow.
4	Classify different velocity and flow rate measurement techniques

No	Syllabus	No of Hours
1	**Properties of Fluids:** Introduction, Properties of fluids, viscosity, thermodynamic properties, surface tension, capillarity, vapour pressure and cavitations	6+4(T)
2	**Fluid Statics:** Fluid pressure at a point, Pascal's law, pressure variation in a static fluid, absolute, gauge, atmospheric and vacuum pressures, simple manometers and differential manometers. Total pressure and center of pressure on submerged plane surfaces; horizontal, vertical and inclined plane surfaces submerged in liquid.	6+4(T)
3	**BUOYANCY AND FLUID KINEMATICS:** Buoyancy, center of buoyancy, metacentre and metacentric height, conditions of equilibrium of floating and submerged bodies, determination of Metacentric height experimentally and theoretically. **KINEMATICS:** Types of fluid flow, continuity equation in 2D and 3D (Carversian Co-ordinates only, velocity and acceleration, velocity potential function and stream function.	8+4(T)
4	**FLUID DYNAMICS:** Introduction equation of motion, Euler's equation of motion, Bernoulli's equation from first principles and from Euler's equation, limitations of Bernoulli's equation. **FLUID FLOW MEASUREMENTS:** Venturimeter, orificemeter, pitot-tube.	6+4(T)
5	**FLOW THROUGH PIPES:** Minor losses through pipes. Darcy's and Chezy's equation for loss of head due to friction in pipes. HGL and TEL	6+4(T)

Note 1: Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit.
Note 2: Two assignments are evaluated for 5 marks.

Course Outcomes: At the end of the course the student will be able to	
1	Estimate the various properties of fluids.
2	Determine the forces exerted by a fluid at rest on plane or curved submerged surface.
3	Recognize the various types of flow.
4	Apply Bernoulli equation to solve a variety of fluid flow problems.
5	Determine the flow through pipes considering major and minor losses.

CO's	**Mapping with POs**
CO1	PO1,PO3
CO2	PO3,PO4
CO3	PO3,PO4
CO4	PO1,PO2,PO3
CO5	PO3,PO4,PO5

TEXT BOOKS:

1. **A Textbook of Fluid Mechanics and Hydraulic Machines**, Dr. R.K Bansal, Lakshmi Publications, Revised 9th Edition, 2015
2. **Fluid Mechanics,** Frank M. White, McGraw Hill Publications (SIE), 9th Edition, 2022.
3. **Fluid Mechanics: Fundamentals and Applications**, John. M. Cimbala, Yunus A. Cengel 4th edition, 2019

Course Title	**Maintenance and Safety Engineering**						
Course Code	**22IMU4054**						
Category	**Engineering Science Course (ESC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	03	**00**	**00**	**00**	**03**	**39**	**3**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Objectives:

1. To explain the basic concepts of maintenance system and maintenance of machinery.
2. To elucidate the economics of Maintenance and importance of computers in Maintenance management.
3. To describe the significance of Industrial Safety, fire prevention, and protection
4. To elaborate the importance of Industrial pollution control and to Define about the types and sources of Industrial pollution

Unit No	Syllabus	No of Hours
1	**INTRODUCTION TO MAINTENANCE SYSTEM:** Definition, Scope, Objective, Importance of maintenance system, Type of maintenance system, Break Down Maintenance system, Preventive Maintenance, Predictive Maintenance, design out Maintenance, corrective Maintenance, Planned Maintenance, total productive Maintenance, conditioning Maintenance.	7
2	**MAINTENANCE OF MACHINERY:** Causes of machine failure, performanceevaluation, complete overhauling of lathes, Drilling machines, Drilling machines, Milling machines, shapers and Grinding machines, maintenance planning and scheduling, Repair order control man power equipment, Maintenance job analysis, spare parts control.	10
3	**ECONOMICS IN MAINTENANCE:** repair, replacement, Repair complexity, Finding out most optimal preventive frequency. **COMPUTERS IN MAINTENANCE MANAGEMENT:** File data bank, storage of data such as break downs, spare parts, lubricating point, drawing of machine parts.	6
4	**INDUSTRIAL SAFETY:** Economic importance of accidents, Types of safety organizations, Analysis of accident safety standard for- Mechanical equipment, Electrical equipment and systems, Chemical hazards, Material Handling, exhaust systems, Plant housekeeping, building, Aisles passages, floors, tool cribs, washrooms.	6
5	**FIRE PREVENTION AND PROTECTION:** Condition favouring fire breakdown, preventing of firing methods, fire protection- Classification of fires, fire extinguishing system,fire alarms,fire fighting equipments, mock drills, emergency, response time. **INDUSTRIAL POLUTION CONTROL:** Dust control- Fiber collectors, mechanical dust collectors, wet type collectors, Electro static precipitators, Noise pollution control-Noise measurement and control, Industrial vibration and its control, ILO conventions, Risk assessment.	10

Note 1: Each unit has internal choice. A total of 10 questions i.e. 2 full questions from each unit.Note 2: Two assignments are evaluated for 5 marks.

Outcomes:

1. Able to memorize types of maintenance systems
2. Able to evaluate machine failure and performance of the machines
3. Able to evaluate the economics of maintenance and express the use of computers in maintenance
4. Demonstrate and outline the Industrial safety through proper safety standards to reduce accidents.
5. Demonstrate and outline the Industrial pollution control and fire prevention and protection.

Cos	**Mapping with POs**
CO1	PO7,PO11,PO12
CO2	PO1,PO2,PO3,PO4,PO11,P12
CO3	PO1,PO2,PO3,PO4,PO11,P12
CO4	PO5,PO6,PO9,PO10,P12
CO5	PO6,PO9,PO10,P12

TEXT BOOKS:

1. Staniar-plant Engineering hand Book, 2nd Edition, Mc Graw Hill
2. Morrow, Lindley. R and Higgins-Maintenance Engineering hand Book, 3rd Edition McGrawHill-2001

REFERENCE BOOKS:

1. Frank Herbaty-Hand book of maintenance management, Crest Publishing house-2004
2. W. Grant Lerson & Eugene L. Grant-Hand book of Industrial Engg & Management, Prentice Hall
3. of India, 2nd Edition-1988
4. Herbert. F. Lund-Industrial Pollution control Hand Book, Mc Graw Hill
5. H. P. Garg-Industrial Maintenance, 3rd Edition-S.Chand publishers

Course Title	**DESIGN THINKING LAB**						
Course Code	**22IML4061**						
Category	**Professional Core Course Laboratory (PCCL)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	0	**0**	**2**	**0**	**2**	**13**	**1**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Course Objectives: To enable the students to:	
1	**Knowledge Application:** Acquire the ability to make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to applythese skills to provide solutions of societal concern
2	**Communication:** Acquire the skills to communicate effectively and to present ideas clearly and coherently to a specific audience in both the written and oral forms.
3	**Collaboration:** Acquire collaborative skills through working in a team to achieve common goals.
4	**Independent Learning:** Learn on their own, reflect on their learning and take appropriate action to improve it.

Guidelines for Design Thinking Lab:

1. The Design Thinking Lab (DTL) is to be carried out by a team of two-three students.
2. Each student in a team must contribute equally in the tasks mentioned below.
3. Each group has to select a theme that will provide solutions to the challenges of societal concern. Normally three to four themes would be identified by the by the department
4. Each group should follow the stages of Empathy, Design, Ideate, prototype and Test for completion of DTL.
5. After every stage of DTL, the committee constituted by the department along with the coordinators would evaluate for CIE. The committee shall consist of respective coordinator & two senior faculty members as examiners. The evaluation will be done for each student separately.
6. The team should prepare a Digital Poster and a report should be submitted after incorporation of any modifications suggested by the evaluation committee

The Design Thinking lab tasks would involve:

1. Carry out the detailed questionnaire to arrive at the problem of the selected theme.The empathy report shall be prepared based on the response of the stake holders.
2. For the problem identified, the team needs to give solution through thinking out of thebox innovatively to complete the ideation stage of DTL
3. Once the idea of the solution is ready, detailed design has to be formulated in the Design stage considering the practical feasibility.
4. If the Design of the problem is approved, the team should implement the design and come out with prototype of the system.
5. Conduct thorough testing of all the modules in the prototype developed and carry out integrated testing.
6. Demonstrate the functioning of the prototype along with presentations of the same.
7. Prepare a Digital poster indicating all the stages of DTL separately. A Detailed projectreport also should be submitted covering the difficulties and challenges faced in each stage of DTL.
8. Methods of testing and validation should be clearly defined both in the Digital poster as well as the report.

The students are required to submit the Poster and the report in the prescribed formatprovided by the department.

Course Outcomes: After completing the course, the students will be able to	
CO 1:	Interpreting and implementing the empathy, ideate and design should be implemented by applying the concepts learnt.
CO 2:	The course will facilitate effective participation by the student in team work anddevelopment of communication and presentation skills essential for being part of any of the domains in his / her future career.
CO 3:	Appling project life cycle effectively to develop an efficient prototype.
CO 4:	Produce students who would be equipped to pursue higher studies in a specialized area or carry out research work in an industrial environment.

Scheme of Evaluation for CIE Marks:

Evaluation will be carried out in three phases:

Phase	Activity	Weightage
I	Empathy, Ideate evaluation	10M
II	Design evaluation	15M
III	Prototype evaluation, Digital Poster presentation and report submission	25M
	Total	**50M**

Scheme of Evaluation for SEE Marks:

Sl. No.	Evaluation Component	Marks
1.	Written presentation of synopsis: Write up	5M
2.	Presentation/Demonstration of the project	15M
3.	Demonstration of the project	20M
4.	Viva	05M
5.	Report	05M
	Total	**50M**

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**H**	**H**	**H**	**M**	**M**	**L**	**M**	**M**	**M**	**M**	**M**
CO2	**H**	**H**	**H**	**H**	**M**	**M**	**L**	**M**	**M**	**M**	**M**	**M**
CO3	**H**	**H**	**H**	**H**	**M**	**M**	**L**	**M**	**M**	**M**	**M**	**M**
CO4	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**M**	**L**	**M**	**L**	**L**

Coourse Title	**BIOLOGY FOR ENGINEERS**						
Course Code	**22BIT407**						
Category	**Course (AEC)**						
Scheme and Credits	No. of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	3	**0**	**0**	**0**	**3**	**50**	**3**
CIE Marks: 50	**SEE Marks: 50**		**Total Max. Marks: 100**		**Duration of SEE: 03 Hours**		

Course Title	**BIOLOGY FOR ENGINEERS**						
Course Code	**21XXT406**						
Category	Ability Enhancement Course (AEC)						
Scheme and Credits	No of Hours/Week					Total Teaching Hours	Credits
	L	T	P	SS	Total		
	02	00	00	00	02	26	2
CIE Marks:50	**SEE Marks:50**		**Total Max.marks=100**		**Duration of SEE:02 Hours**		

COURSE OBJECTIVES:

1. To convey that Biology is as important a scientific discipline as Physics, Chemistry and Mathematics.
2. To know about the classification underlying criteria of biology, such as morphology, biochemical, or ecological.
3. To study Genetics, Bio-molecules, Enzymes and Metabolism.
4. To understanding the macro molecular analysis.
5. To learn microbiology and its industrial applications.

UNIT No	Syllabus Content	No of Hours
1	**Introduction:** Science and Engineering, Biology and its application. Cell: The Basic Unit of Life , Cell theory, Cell shapes, structure of a Cell, prokaryotic and eukaryotic Cells. **Classification:** Brief introduction to five kingdoms of classification. Viruses.	5
2	**Bio-molecules:** Carbohydrates, Amino acids and Proteins, Lipids-classification , functions. **Enzymes:** Enzymes, properties and classification. Mechanism of enzyme action. Enzymes and their application in Industry.	5
3	**Genetics:** Mendelian Law, Laws of inheritance. gene interaction, genetic disorders. **Information transfer**: Nucleic acid, replication of DNA, types of RNA,transcription, genetic code.	6
4	**Metabolism** - Concepts, metabolic basis for living, non-equilibrium and steaty state. Photosynthesis ,glycolysis ,fermentation and Krebs cycle.	5
5	**Microbiology** – Microorganism, growth kinetics, culture media, microscopy, applications of microbiology, immunology and immunity.	5

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Dr Ambedkar Institute of Technology, Bengaluru-56
Department of Humanities & Social Sciences
Scheme and Syllabus – OBE - CBCS – 2022 -2023

Course Title	**UNIVERSAL HUMAN VALUES**						
Course Code	**21HST409**						
Category	**Humanities & Social Sciences (HS)**						
Scheme and Credits	No. of Hours/Week					Total Hrs./semester	Credits
	L	T	P	SS	Total		
	0	0	1	-	01	13	01
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100		Duration of SEE: 02 Hours		

COURSE OBJECTIVE: **Unit 1- Self -reflection and development as a human being**

Unit 2 – Understanding harmony and its need holistically

Unit 3 – Learn to trust and have values as a part of family and society.

Unit 4 – Getting connected to Nature and be in harmony with it.

Unit 5 – Acceptance of values, possession of ethics as humans & Engineers.

UNIT I	**5 hours**
Purpose and motivation for the course: review from Universal Human Values, Self-Exploration–what is it? Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority.	
UNIT II	**5 hours**
Harmony in the Human Being: Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.	
UNIT III	**6 hours**
Understanding Harmony in the Family and Society: Understanding values in human-human relationship. Trust and Respect as the foundational values of relationship. Understanding the harmony in the society (society being an extension of family). universal harmonious order in society- Undivided Society, Universal Order- from family to world family.	
UNIT IV	**5 hours**
Understanding Harmony in the Nature and Existence - Whole existence as Coexistence Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature.	

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UNIT V	5 hours
Implications of the above Holistic Understanding of Harmony on Professional Ethics Natural acceptance of human values, Ethical Human Conduct, Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organization	
TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, videos	

COURSE OUTCOMES:

Unit 1 – The students will learn to become aware of oneself, be responsible in life and handle situations, balancing relationships.

Unit 2 – The students will learn how to develop harmony with oneself as apart of the society.

Unit 3 – Values and trust have a great importance to learn to have an accord with the family and then the society. This will be acquired.

Unit 4 – Nature is the master for itself. One has to have an agreement with nature to understand and live in harmony with it.

Unit 5 – Human conduct will be amended to fit to the ethical behaviour with the help of Values one has learnt.

TEXT BOOKS

1. A foundation course in HUMAN VALUES and professional ethics; presenting approach to value education-through self-exploration by R R Gaur, R Sangal & GP Bagaria, Excel books Pvt. Ltd.
2. Professional Ethics & Human Values: Prof D.R.Kiran, TATA Mc Graw Hill Education.

REFERENCE BOOKS

1. 1 Human Values: A.N.Tripathy (2003, New Age International Publishers)
2. Ethics in Engineering Mike W.Martin, Department of Philosophy, Chapman University and Roland Schinzinger, School of Engineering, University of California, Irvine.
3. Fundamentals of Ethics, Edmond G Seebauer & Robert L.Barry, Oxford University Press.

SCHEME FOR EXAMINATIONS **Theory Question Paper Pattern:**

CIE- Objective type (Max. marks: 25 marks)
SEE- Objective type (Max. marks: 50 marks)

MAPPING of COs with POs

Ss	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
Strength of correlation: Low-1, Medium- 2, High-3												

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