SCHEME & SYLLABUS
OF

III & IV Semesters B.E.

INDUSTRIAL ENGINEERING & MANAGEMENT

2023-24

Vision of the Department

To be a distinguished centre for the dissemination of knowledge and promoting research and consultancy in the field of Industrial Engineering and Management and for catering to the needs of the society.

Mission of the Department

1. To practice the philosophy of learning-teaching-learning and adopt the latest tools and techniques for the effective dissemination of knowledge in the field of Industrial Engineering and Management.
2. To collaborate with academic institutions, industry and research organizations to establish Centers of Excellence (COE) in emerging areas and promote research and consultancy.
3. To impart training for the overall development of students and inculcate commitment for social responsibility.

Program Educational Objectives (PEOs)

1. Graduates will excel in their chosen careers and successfully pursue higher education in Industrial Engineering and Management and related fields.
2. Graduates will manage the functioning of organization and enhance its competitiveness using contemporary tools in a socially acceptable way.
3. Graduates will demonstrate professionalism, ethical conduct, and societal responsibility and adapt to current trends by engaging in lifelong learning.

Programme Specific Outcomes (PSOs)

PSO1: Apply broad-based basic engineering and analytical tools for system design, analysis, performance evaluation and decision-making.

PSO2: Apply management concepts and principles for decision making in the area of operations, marketing, finance and human resource and analyse their impact.

PSO3: Apply the knowledge of materials, machining and manufacturing; analyse and evaluate the choices made.

PSO4: Apply the knowledge of industrial engineering for work system design and analyse, evaluate and create cost effective and safer systems and procedures.

Program Outcomes (POs)

Graduates in Industrial Engineering & Management will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

2022-23
Admitted Batch

SIDDAGANGA INSTITUTE OF TECHNOLOGY, TUMAKURU

(An autonomous institution affiliated to VTU, Belagavi, Approved by AICTE, New Delhi, Accredited by NAAC with 'A^{++}' Grade & ISO 9001:2015 Certified)

B.E. in Industrial Engineering and Management

SCHEME OF TEACHING AND EXAMINATION
III Semester

Sl. No.	Course and Course Code		Course Title	Teaching / Paper setting Dept.	Teaching hrs./week				Examination				Credits
					Lecture	Tutorial	Practical/ Drawing	Self-Study Component	Duration in hrs.	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1.	PCC / BSC	S3IM01	Probability & Statistics for Engineers	IEM	3	0	0		3	50	50	100	3
2.	IPCC	S3IMI01	Materials & Manufacturing Process.	IEM	3	0	2		3	50	50	100	4
3.	IPCC	S3IMI02	Metrology and Measurements	IEM	3	0	2		3	50	50	100	4
4.	PCC	S3IM02	Introduction to Industrial Engineering	IEM	3	0	0		3	50	50	100	3
5.	PCCL	S3IML01	Computer Aided Machine Drawing (CAMD)	IEM	0	0	2		3	50	50	100	1
6.	ESC	S3IMEXX	Engineering Science Course / Emerging Technology Course	IEM	3	0	0		3	50	50	100	3
7.	UHV	SHS01	Social Connect and Responsibility	ME	0	0	2		-	100	-	100	1
8.	AEC/ SEC	S3IMAXX	Ability Enhancement Course/ Skill Enhancement Course – III	IEM	If offered as Theory Course				1½	50	50	100	1
					1	0	0						
					If offered as Practical Course				1½				
					0	0	2						
9.	NCMC	SMC01	National Service Scheme (NSS)	NSS Officer	0	0	2			100	-	100	0
		SMC02	Physical Education (PE) (Sports and Athletics)	PED									
		SMC03	Yoga	PED									
			Total							**550**	**350**	**900**	**20**
10.	NCMC	AAP	AICTE Activity Points	40 hours community service to be documented and produced for the examination									

Note: **PCC**: Professional Core Course, **IPCC**: Integrated Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **NCMC**: Non Credit Mandatory Course, **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **ESC**: Engineering Science Course, **ETC**: Emerging Technology Course
L: Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.

Engineering Science Course (ESC/ETC)

S3IME01	Mechanics of Materials	S3IME03	Industrial Hydraulics
S3IME02	Engineering Economics	S3IME04	Industrial safety , Health & Environment Management Systems

Ability Enhancement Course (AEC) – III

S3IMA01	Spread Sheet for Decision Making	S3IMA03	Fundamentals of Mechanical Engineering drawing
S3IMA02	Geometrical Dimensioning & Tolerancing (GD&T)	S3IMA04	Basics of Python Programming

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B.E. in Industrial Engineering and Management

Integrated 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. For more details, the regulation governing the Degree of Bachelor of Engineering (B.E.) 2022-23 may please be referred.

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 semester 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.

2022-23
Admitted Batch

SIDDAGANGA INSTITUTE OF TECHNOLOGY, TUMAKURU

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B.E. in Industrial Engineering and Management

SCHEME OF TEACHING AND EXAMINATION
IV Semester

Sl. No.	Course and Course Code		Course Title	Teaching / Paper setting Dept.	Teaching hrs./week				Examination				Credits
					Lecture	Tutorial	Practical/ Drawing	Self-Study Component	Duration in hrs.	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1.	PCC	S4IM01	Machine Tool Technology	IEM	3	0	0		3	50	50	100	3
2.	IPCC	S4IMI01	Work System Engineering and Ergonomics	IEM	3	0	2		3	50	50	100	4
3.	IPCC	S4IMI02	RDBMS	IEM	3	0	2		3	50	50	100	4
4.	PCCL	S4IML01	Machine Shop	IEM	0	0	2		3	50	50	100	1
5.	ESC	S4IMEXX	Engineering Science Course / Emerging Technology Course	IEM	3	0	0		3	50	50	100	3
6.	BSC	S4CCA01	Biology for Engineers	BT	3	0	0		3	50	50	100	3
7.	UHV	SHS02	Universal Human Values	IEM	1	0	0		1½	50	50	100	1
8.	AEC/ SEC	S4CCA03	Advance Technical Training - Python Lab	IEM	If offered as Theory Course				1½	50	50	100	1
					1	0	0						
					If offered as Practical Course				1½				
					0	0	2						
9.	NCMC	NS	National Service Scheme (NSS)	NSS Officer	0	0	2			100	-	100	0
		PE	Physical Education (PE) (Sports and Athletics)	PED									
		YO	Yoga	PED									
			Total							**500**	**400**	**900**	**20**
10.	NCMC	AAP	AICTE Activity Points	40 hours community service to be documented and produced for the examination									

Note: **PCC**: Professional Core Course, **IPCC**: Integrated Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **NCMC**: Non Credit Mandatory Course, **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **ESC**: Engineering Science Course, **ETC**: Emerging Technology Course
L: Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.

Engineering Science Course (ESC/ETC)

S4IME01	Marketing Management	S4IME03	Theory of Machines
S4IME02	Organizational Behavior	S4IME04	Value Engineering

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. For more details, the regulation governing the Degree of Bachelor of

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B.E. in Industrial Engineering and Management

Engineering (B.E.) 2022-23 may please be referred.

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 semester 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.

III Semester Syllabus

Probability & Statistics for Engineers (S3IM01)

(Professional Core Course)

Contact Hours/ Week	:	3 (L)+0(T)+0(P)	Credits:	3.0
Total Lecture Hours	:	39	CIE Marks:	50
Total Practical Hours	:	0	SEE Marks:	50

Unit-I

Introduction to Statistics: Numerical summary measures such as Measure of central tendency and dispersion, coefficient of variance, Skewness, Kurtosis. Graphical summary such as Frequency distribution and Histogram, Box plot, scatter plot and probability plot and uses of Statistical Software in problem solving.

8-Hours

Unit-II

Discrete Random Variables and Probability Distributions: Discrete probability distributions such as - Binominal distribution, Hyper-geometric, Poisson distribution and their Applications in decision making.

Continuous Random Variables and Probability Distributions: Continuous Probability distributions such as - Normal distribution, Central Limit Theorem, Exponential Distribution and Weibull distribution and their application in engineering decision making and uses of statistical software for problem solving.

8-Hours

Unit-III

Sampling Distributions: Confidence Intervals, Estimation for single, two sample on mean of a Normal distribution, variance known and variance unknown. Confidence interval on variance and standard deviation of normal population. Tests of hypotheses - Tests on the mean of a Normal distribution, Tests of hypotheses on means of two normal distributions variance is known and unknown, hypothesis test on variance and standard deviation, Goodness of fit test and use of Statistical software in problem solving.

8-Hours

Unit-IV

Regression and Correlation : Simple Linear Regression Analysis, correlation coefficient, Karl Pearson and Spearman's coefficients, Coefficient of Determination, Multiple linear Regression with two variables and their engineering application and use of statistical software in problem solving.

8-Hours

Unit-V

Design of Experiments and Big Data: Introduction, terminologies, principles of experimental design, ANOVA.

Introduction to Big Data: Data science, Characteristics of data, Categorization of Analytical methods, Data Visualization, Multivariate Statistics Missing Data analysis, Outliers, Normality, Linearity, and Homoscedasticity (no analytical treatment) use of statistical software in problem solving.

7-Hours

Course Outcomes:

Upon completion of this course the student will be able to:

CO1	:	Collect, organize and analyze the data in the real life situation and represent the data in graphical form.
CO2	:	Apply the correct probability distribution for the given situation to determine the probability
CO3	:	Set up, test and make decisions about hypotheses when uncertainty exists.
CO4	:	Identify the degree and direction of relationship among process variables and develop appropriate regression models for the same.
CO5	:	Perform Analysis of Variance (ANOVA) for simple experimental designs and understand the importance for big data in real world situation

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3											3			
CO2	3	3			3								3			
CO3	3	3	3		3								3			
CO4	3	3	3		3								3			
CO5	3	3	3	3									3			

Text Books:

Sl. No.	Author/s	Title, Publisher, Edition, Year, ISBN
1.	Douglas C. Montgomery, George C Runger	Applied statistics and Probability for Engineers, John Wiley and Sons, 7th Edition, 2019, ISBN-13: 978-1119585596
2.	Richard I Levin, David S Rubin	Statistics of Management, 6th Edition, Prentice Hall India, ISBN-81- 203-0893-X

Reference Book:		
Sl. No.	**Author/s**	**Title, Publisher, Edition, Year, ISBN**
1.	Daniel, Terrell	Business Statistics for Management and Economics, Houghton Mifflin Company, ISBN-0-395-62835-0, 6th Edition.
2.	Schaum's Outlines	Schaum's Outline of Statistics, 5th Edition (Schaum's Outlines) March 14, 2014, ISBN- 13: 978-0071822527 ISBN-10:0071822526.
3.	Walpole & Mayer	Probability and Statistics, MacMillan Publishing Company, 1989.
4.	Richard A. Johnson, Irwin Miller, John Freund.	Probability and Statistics for Engineers. Prentice Hall India Learning Private Limited, 11th Edition, 2011, ISBN-13: 978-8120342132

Materials & Manufacturing Process (S3IMI01)

(Integrated Professional Core Course)

Contact Hours/ Week	:	3(L)+0 (T)+2(P)	Credits:	4.0
Total Lecture Hours	:	39	CIE Marks:	50
Total Practical Hours	:	26	SEE Marks:	50

Unit-I

Plastic Deformation, Fracture, Creep and Fatigue: Plastic deformation of single crystal by Slip and twinning, strain hardening and strain aging, simple problems on stress and strain. Types of fracture, Griffith criteria for brittle fracture, distinguishing features of brittle and ductile fracture. Three stages of creep deformation and creep properties. Types of fatigue loading with examples, mechanism of fatigue, fatigue properties, fatigue testing and SN diagram.

8- Hours

Unit-II

Solidification and Phase Diagrams: Definitions and basic concepts: solubility limit, phases, microstructure, phase equilibrium, one-component (or unary) Phase diagrams, binary phase diagrams. Solid solutions Hume Rothary rule substitutional and interstitial solid solutions, intermediate phases, Gibbs phase rule. Different types invariant reactions – Eutectic, Eutectoid, Peritectic, Peritectectoid reactions. Numerical on binary phase diagram.

8- Hours

Unit-III
Iron Carbon Equilibrium Diagram and Heat Treatment: The iron–iron carbide (fe–fe3c) phase diagram, Heat treating of metals: TTT curves, continuous cooling curves, description of the following heat treatment processes with industrial applications: annealing and its types. Normalizing, hardening, tempering, martempering, austempering, hardenability, surface hardening methods like carburizing, cyaniding, nitriding, flame hardening and induction hardening, and age hardening
8- Hours
Unit-IV
Moulding and Casting Processes: Introduction, Concept of manufacturing process, its importance. Classification of manufacturing processes and list different material handling methods. Introduction to casting process & steps involved. Patterns: Definition, functions, materials used for pattern, various pattern allowances and their importance. Classification of patterns, BIS color coding of patterns. Sand molding: Sand, Types of base sand, requirement of base sand, molding sand mixture, ingredients for different sand mixtures. Casting processes: Gravity die-casting, pressure die casting, centrifugal casting, and continuous casting processes. Casting defects: Causes, features and remedies.
8- Hours
Unit-V
Mechanical Working of Metals: Introduction to metal forming processes & classification of metal forming processes. Hot working & cold working of metals. Forging: Smith forging, drop forging & press forging. Forging Equipment, Defects in forging. **Rolling:** Rolling process, Angle of bite, Types of rolling mills, Variables of rolling process, Rolling defects. **Drawing & Extrusion:** Drawing of wires, rods & pipes, Variables of drawing process. Difference between drawing & extrusion. Various types of extrusion processes. Sheet Metal Operations: Blanking, piercing, and punching.
7- Hours

Laboratory Component

PART A (Foundry Laboratory)	
1.	Determination of Tensile strength of core sand
2.	Determination of Compression strength of moulding sand
3.	Determination of Shear strength of moulding sand
4.	Determination of Permeability of moulding sand
5.	Determination of Grain fineness number
6.	Determination of Clay content of Base sand
PART B (Material Testing Laboratory)	
7.	Conduction of Tensile test on a Mild Steel specimen
8.	Conduction of Compression test on a Mild Steel specimen
9.	Conduction of Torsion test on a Mild Steel specimen
10.	Conduction of Bending test on a Mild Steel specimen
11.	Conduction of Shear test on a Mild Steel specimen
12.	Conduction of Impact test on a Mild Steel specimen
13.	Determination of Brinell's & Rockwell Hardness Number of different materials

Course Outcomes:

Upon completion of this course the student will be able to:

CO1	:	Analyze the various types of fracture, stages of creep and fatigue failure
CO2	:	Describe mechanism of solidification, cast metal structure and rules for formation of solid solution. analyze and interpret phase diagrams and their relationship to material properties.
CO3	:	Develop a comprehensive understanding of the iron and iron carbon system, including heat treatment and its effect on material properties
CO4	:	Explain different manufacturing process, patterns, moulding process, machines and discuss different casting processes and defects.
CO5	:	Describe the concepts of mechanical working of metals, forging, rolling, drawing, extrusion, and sheet metal operations.

CO – PO Mapping:																
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3														3	
CO2	3	3													3	
CO3	3	3													3	
CO4	3	3													3	
CO5	3	3													3	

Text Books:		
Sl No.	**Author/s**	**Title, Publisher, Edition, Year, ISBN**
1.	Smith	Foundations of Materials Science and Engineering, McGraw Hill, 6th Edition, 2018, ISBN-13: 978-1260092035
2.	Shackleford and M. K. Muralidhara	Introduction to Materials Science for Engineers, Pearson Publication, 6th Edition, 2017, ISBN-13: 978-8131700907
3.	Dr. K. Radhakrishna	Manufacturing Process-I & II, Sapna Book House, 5th Revised Edition, 2009.
4.	P.N. Rao	Manufacturing & Technology: Foundry Forming and Welding, TMH, 4th Edition, 2013, ISBN-13: 978-9383286614

Reference Book:		
Sl No.	**Author/s**	**Title, Publisher, Edition, Year, ISBN**
1.	William F. Smith, Javad Hashemi, Ravi Prakash	Material Science and Engineering (In SI Units), McGraw Hill, 5th Edition, 2013, ISBN: 978-1-25-906275-9
2.	William D. Callister	Materials Science and Engineering, John Wiley & Sons, Inc. 7th Edition, 2006, ISBN-10: 0-471-73696-1
3.	V. Raghavan	Materials Science and Engineering: A First Course, PHI learning Pvt. Ltd., 6th Edition, 2015, ISBN-13: 978-8120350922.
4.	Roy A Lindberg	Process and Materials of Manufacturing, Pearson India Education Services Pvt. Limited, 4th Edition, 2015, ISBN: 9780205118175
5.	Heine, Richard W., Carl R. Loper, Jr. & Philip C. Rosenthal	Principles of Metal Casting, McGraw-Hill, New York, Indian Edition, 1976, ISBN-I3: 978-0-07-099348-8
6.	Hosford, WF and Caddell R.M	Metal Forming: Mechanics and Metallurgy, Cambridge Publishing House, 4th Edition, 2011, ISBN: 978-1-107-00452-8

Metrology and Measurements (S3IMI02)

(Integrated Professional Core Course)

Contact Hours/ Week	:	3(L)+0 (T)+2(P)	Credits:	4.0
Total Lecture Hours	:	39	CIE Marks:	50
Total Practical Hours	:	26	SEE Marks:	50

Unit-I
Standards Of Measurement-Definition 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).
8- Hours
Unit-II
Limits Fits and Tolerance- System of Limits, Fits, Tolerance, Principle of Interchangeability and Selective Assembly, Limits of Size, Indian Standards, Definition of Fits, Types of Fits, Hole Basis System, Shaft Basis of 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. Numerical on limits, fits and gauge design
8- Hours
Unit-III
Comparators And Angular Measurement- Introduction to Comparator, Characteristics and Classification of Comparators, Mechanical Comparators, Electrical, Optical, Pneumatic Comparators, Back Pressure Gauges, Solex Comparators. Angular Measurements (Simple Numerical), Bevel Protractor, Use of Sine Bars & Sine Center, Use of Angle Gauges.
8- Hours
Unit-IV
Measurements and Measurement Systems - Generalized Measurement System, Accuracy, Precision, Calibration, Sensitivity, Hysteresis, Repeatability, Linearity, and Classification of Errors. Transducer Transfer Efficiency, Primary and Secondary Transducers, CMM-types.
8- Hours
Unit-V
Measurement of Force, Torque and Pressure - Principle, Proving Ring,

Torque Measurement, Prony Brake, Hydraulic Dynamometer, Pressure Measurements, Bridgeman Gauge, Macleod Gauge, Temperature and Strain Measurement, Resistance Thermometers, Methods of Strain Measurement.
7- Hours

Laboratory Component

PART A (Metrology)	
1.	Study and use of Slip & limit Gauges.
2.	Calibration of External Micrometer for periodic & progressive pitch error.
3.	Measurement of Taper Using Sine bar / sine center.
4.	Measurement of straightness by wedge method / Spirit Level/Autocollimator.
5.	Measurement of Flatness by using Monochromatic check light.
6.	Experiment to demonstrate the use of Profile Projector.
PART B (Measurement)	
7.	Calibration of L.V.D.T. and measurement of unknown thickness of the given work piece
8.	Calibration of Pressure Transducer and measurement of unknown pressure
9.	Calibration of Force Transducer and measurement of unknown force.
10.	Measurement of Temperature using different Thermocouples.

Course Outcomes:

Upon completion of this course the student will be able to:

CO1	:	Explain the standards of measurement and differentiate between line and end standards
CO2		Explain the systems of limits, fits, tolerance systems and design the gauges
CO3	:	Explain the working principles of various comparators used for linear and angular measurements in manufacturing
CO4	:	Discuss the basic engineering concepts of generalized measurement systems
CO5	:	Identify and explain the working principles of various measuring instruments used for measuring force, torque and pressure

CO – PO Mapping:																
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3		2												3	
CO2	3		2												3	
CO3	3														3	
CO4	3														3	
CO5	3														3	

Text Book:		
Sl No.	**Author/s**	**Title, Publisher, Edition, Year, ISBN**
1.	Jain R.K.	Engineering Metrology, Khanna Publishers, 21st Edition, 2017, ISBN: 9788174091536, 817409153X.

Reference Books:		
Sl No.	**Author/s**	**Title, Publisher, Edition, Year, ISBN**
1.	Sirohi and Radhakrishna	Mechanical Measurements. John Willey, 3rd Edition, 1993, ISBN-13: 978-0470219539, ISBN-10: 047021953X
2.	Thomas G Beckwith	Mechanical Measurements, Pearson Education, 6th Edition, 2013, ISBN-10: 9332518521, ISBN-13: 978-9332518520
3.	N V Ragvendra & L krishnamurthy	Nano Impact on Metrology, Oxford Press, 1st Edition, 2013, ISBN-13: 978-0-19-808549-2, ISBN-10: 0-19-808549-4**.**

Introduction to Industrial Engineering (S3IM02)

(Professional Core Course)

Contact Hours/ Week	:	3(L)+0 (T)+0(P)	Credits:	3.0
Total Lecture Hours	:	39	CIE Marks:	50
Total Practical Hours	:	--	SEE Marks:	50

Unit-I

Industrial Engineering – Past, Present and Future: Evolution of industrial engineering; Pioneers of industrial engineering; the Hawthorne experiment; Definition of Industrial Engineering; the role and career of the industrial engineer in the modern organization; industrial engineering tools, methods, and procedures and their application areas; the future of industrial engineering. Career opportunities.

8- Hours

Unit-II

Productivity and Engineering Ethics: Total time of a Job, Management techniques to reduce ineffective time; The concept and importance of productivity; Total productivity Management; Productivity Audit, Productivity Measurement Models, Factors Influencing Productivity, Causes of Low Productivity, Productivity Improvement Techniques; Why should industrial engineers be concerned about ethics, engineering ethics as applied ethics, an ethical framework, risk assessment as an important industrial engineering tool; GDP and GNP.

8- Hours

Unit-III

Job Evaluation and Merit Rating: Objectives, Principles and steps in Job Evaluation; Methods for job evaluation: Non-quantitative methods (Ranking technique, Classification method); Quantitative methods (Factor comparison, Point rating). Objectives and methods of Merit rating.

7- Hours

Unit-IV

Wages and Salary Administration: Difference between wage and salary, Base Pay, Variable Pay Benefits and Indirect Compensation and Fringe benefits; Minimum wages act and wage payment act; Incentives Different incentive schemes, Pre-Requisites of Effective Incentive system, Types of Incentive Schemes: Schemes where the workers' earnings vary in the same proportion as output; Schemes where earnings vary proportionately less than output; Schemes where earnings vary proportionately more than output; Schemes

where earnings differ at different levels of output.

8- Hours

Unit-V

Labor Relations and Factories Act – 1948: The roles of industrial engineers and unions, Challenges for the Industrial Engineering Manager, Leadership Skills, Problem-Solving Process Skills, Decision Making process skills; Planning process skills required by an Industrial Engineer. Industrial disputes, settlement of industrial disputes, trade unions, industrial dispute act 1947; Conflict management in organizations; Factories act 1948 – Definition of Factory, Manufacturing process, worker; Provisions relating to the health of the workers in a factory (section 11 to 20); Provisions relating to welfare(section 42 to 50).

7- Hours

Course Outcomes:

Upon completion of this course the student will be able to:

CO1	:	Explain the evolution of Industrial Engineering and role of Industrial Engineers and career opportunities
CO2	:	Manage Productivity improvement in organizations and practice the engineering ethics.
CO3	:	Preform job evaluation and merit rating
CO4	:	Manage wages and salary administration
CO5	:	Establish good relations with workers in any organization
CO6	:	Explain various acts as available in Factory act 1948

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3															3
CO2	3															3
CO3	3	2														3
CO4	3	2														3
CO5	3	2														3
CO6	3															3

Text Books		
Sl No.	**Author/s**	**Title, Publisher, Edition, Year, ISBN**
1.	Kjell B. Zandin	Maynard's Industrial Engineering Handbook, McGraw-Hill, 5th Edition, 2001, ISBN-13: 978-0070411029 (Unit-I and Unit-II)
2.	George Kanawaty	Introduction To Work Study, International Labor Office Geneva, 4th (revised) Edition, 1992, ISBN-13: 978-9221071082 (Unit-II)
3.	George Milkovich and Jerry Newman	Compensation, McGraw Hill Education, 12th Edition, 2020, ISBN-13: 978-9390185672 (Unit-IV and Unit-V).
4.	Arun Monappa and Mirza S. Saiyadain	Industrial Relations and Labor Laws, Tata McGraw-Hill Education, 2nd Edition, 2012, ISBN-13: 978-1-25-900492-6 (Unit-III and Unit-V).
5.	LexisNexis	The Factories Act 1948, Universal LexisNexis, Latest Edition, 2023(Unit-III and Unit-V).

Computer Aided Machine Drawing (S3IML01)

(Professional Core Course Lab)

Contact Hours/ Week	:	0(L)+0 (T)+2(P)	Credits:	1.0
Total Lecture Hours	:	--	CIE Marks:	50
Total Practical Hours	:	26	SEE Marks:	50

Part -A

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.

03-Hours

Orthographic Views: Conversion of pictorial view into orthographic views of simple machine parts with or without section. (Bureau of Indian Standards conventions are to be followed for the drawings) Hidden line conventions.

06-Hours

Sectional views: introduction to sections, hatching of sections, cutting planes, revolved or removed sections, half section, full section, local section, arrangement of successive sections.

03-Hours

Part -B

Assembly Drawings

- Couplings–Flange, Universal.

- Joints– Knuckle, Cotter with socket and spigot.

14-Hours

Open end drawings have to be given from each Unit for each student (only for C.I.E)

- Screw jack (bottle type),
- Plummer block (Pedestal Bearing)

Course Outcomes:

Upon completion of this course the student will be able to:

CO1	:	Apply the principles of orthographic projections and develop the 2D drawings using computer-aided design (CAD) software.
CO2	:	Create and interpret sectional views and understand the importance of these views in the design of mechanical components and assemblies.
CO3	:	Apply the principles of modeling and create 3D models using CAD software.
CO4	:	Develop the ability to create and edit assembly drawings and understand the importance of assembly drawings in the design of mechanical systems.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3												3			
CO2	3	2											3			
CO3	3	2	2										3			
CO4	3	3	2										3			

Text Books

Sl No.	Author/s	Title, Publisher, Edition, Year, ISBN
1.	N.D.Bhat & V.M.Panchal,	Machine Drawing, Charotar Publishing House, 48th Edition, 2013, ISBN-13: 978-9380358697
2.	K.R. GopalaKrishna,	Machine Drawing, Subhas Publication, 23rd Edition, 2017, ISBN-13: 5551234102674
3.	N. Siddeshwar, P. Kanniah, V.V.S. Sastri,	Machine Drawing, Tata- McGrawHill, 2017, ISBN-13: 978-0074603376

Reference Books		
Sl. No.	**Author/s**	**Title, Publisher, Edition, Year, ISBN**
1.	Goutam Pohit & Goutham Ghosh,	Machine Drawing with Auto CAD, 1st Indian print, Pearson Education, 2004, ISBN-13: 978-8131706770
2.	Gooldy G.	Dimensioning, Tolerancing and Gaging applied, Englewood Cliffs, NJ: Prentice Hall, 1998, ISBN 13: 9780137916009

Mechanics of Materials (S3IME01)

(Engineering Science Course)

Contact Hours/ Week	:	3(L)+0 (T)+0(P)	Credits:	3.0
Total Lecture Hours	:	39	CIE Marks:	50
Total Practical Hours	:	--	SEE Marks:	50

Unit-I

Simple Stress and Strain: Introduction, stress, strain, mechanical properties of materials, Linear elasticity, Hooke's Law and Poisson's ratio, stress-strain relation, behavior in tension for Mild Steel and non-ferrous metals. Extension /shortening of a bar, bars with cross sections varying in steps & continuously varying cross sections (no derivation), the principle of superposition, volumetric strain, an expression for volumetric strain, elastic constants (derivation of relation between elastic constants not included), simple shear stress, shear strain, stress in compound bars and composite section (problems on bolts and nuts not included), temperature stresses (no problems on Thermal stresses).

8- Hours

Unit-II

Compound Stresses: Introduction, plane stress, stresses on inclined sections, principal stresses and maximum shear stresses, Mohr's circle for plane stress.

Thick and thin cylinders: Stresses in thin cylinders, changes in dimensions of cylinder (diameter, length and volume), thick cylinders subjected to internal and external pressures (No derivation of Lame's equation, compound cylinders not included).

8- Hours

Unit-III

Shear Force and Bending Moment Diagrams: 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, uniform distributed load (UDL), for different types of beams.
8- Hours
Unit-IV
Bending Stresses In Beams: Introduction, theory of simple bending, assumptions in simple bending, the relationship between bending stresses and radius of curvature, the relationship between bending moment and radius of curvature, and moment carrying capacity of a section. Bending stresses in beams. (Problems on shear stresses not included). **Deflection of beams:** Introduction, the differential equation for deflection, Slope and moments, only Macaulay's method for cantilever and simply supported beams for point load, UDL.
8- Hours
Unit-V
Torsion of Circular Shafts and Elastic Stability of Columns: Introduction, pure torsion, assumptions, derivation of torsional equations, polar modulus, torsional rigidity/stiffness of shafts, power transmitted by solid and hollow circular shafts. Introduction to columns, Euler's theory for axially loaded elastic long columns, Euler's load for various end conditions (Derivation of Euler's load only for hinged at both ends), limitations of Euler's theory, Rankine's formula.
7- Hours

Course Outcomes: Upon completion of this course the student will be able to:		
CO1	:	Explain the concepts of stress and strain acting on deformable bodies and compute stresses and strains produced under axial and shear loads in homogenous and composite bars using stress-strain relationships.
CO2	:	Apply the stress transformation equations and Mohr's circle to calculate the principal stresses and the max in-plane shear stress for plane stress, also analyze stresses and strains associated with cylindrical pressure vessels.
CO3	:	Analyze the determinate beams under bending and draw shear and bending moment diagrams.
CO4	:	Determine the deflection of beams under flexural loading and calculate stresses resulting from combined loads.
CO5	:	Design simple circular shafts for safe loads and analyze long columns subjected to axial loads.

CO – PO Mapping:																
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3											3			
CO2	3	3											3			
CO3	3	3											3			
CO4	3	3											3			
CO5	3	3	3										3			

Text Books		
Sl No.	**Author/s**	**Title, Publisher, Edition, Year, ISBN**
1.	Ferdinand Beer & Russell Johnston	Mechanics of Materials, Tata McGraw-Hill, 5th Edition, 2009, ISBN- 9780071284226.
2.	Jayram M.A.	Strength of Materials - A Fundamental Approach, Sapna Book House, 6th Edition, 2012, ISBN-9788128001765.

Reference Books		
Sl No.	**Author/s**	**Title, Publisher, Edition, Year, ISBN**
1.	Bhavikatti S.S.	Strength of Materials, Vikas Publications House, 3rd Edition, 2009, ISBN-9788125927914.
2.	S S Rathan	Strength of Materials, Tata McGraw-Hill, 1st Edition, 2008, ISBN- 9780070668959.

Engineering Economics (S3IME02)

(Engineering Science Course)

Contact Hours/ Week	:	3(L)+0 (T)+0(P)	Credits:	3.0
Total Lecture Hours	:	39	CIE Marks:	50
Total Practical Hours	:	--	SEE Marks:	50

Unit-I

Introduction to Engineering Economics: Origin & Principles of Engineering Economy, Engineering and economy, Problem solving, Role of engineers in Decision making, Law of demand and supply, Law of returns.

Interest and Interest Factors: Interest & Time value of money, Simple and compound interest, Nominal and Effective interest rates, Cash Flow Diagrams, Compound interest rate factors - single payment series and uniform payment series, Problems

8- Hours

Unit-II
Present Worth Comparisons: Conditions for present worth comparisons, Basic Present worth comparisons, Present worth equivalence, Net Present worth, Assets with unequal lives, infinite lives, Future worth comparison, Bonds, Stocks, their types and valuation, Pay back comparison methods, Simple & discounted pay-back period, problems.
8- Hours
Unit-III
Equivalent Annual Worth Comparisons: Equivalent Annual Worth Comparison methods, Situations for Equivalent Annual Worth Comparison, Consideration of asset life, Comparison of assets with equal and unequal lives, Use of sinking fund method, Problems. **Rate of Return Calculations:** Rate of return, Minimum acceptable rate of return, IRR, ERR; Problems on Rate of return calculation.
8- Hours
Unit-IV
Depreciation: Causes of Depreciation, Basic methods of computing depreciation charges: Straight line method of depreciation, Declining and double declining balance method, Sum of year's digits method and Sinking fund method.
7- Hours
Unit-V
Replacement Analysis: Replacement studies of Defender and Challenger, Defenders & challengers with Unequal Lives, Economic life for cyclic replacements, Assumption of Zero interest Rate, Cyclic Replacement Analysis with Non zero interest Rate, Economic life for cycle replacements, group & individual replacement, Problems
8- Hours

Course Outcomes: Upon completion of this course the student will be able to:		
CO1	:	Identify the role of engineering economy in the decision-making process for engineering applications and apply discounted cash-flow analysis to evaluate proposed capital investments.
CO2	:	Compare competing alternative choices with equal, unequal, and infinite project lives using present worth, and Future worth Comparisons to choose the best one and draw substantial conclusions.
CO3	:	Analyze the mutually exclusive alternatives using Annual Worth Comparison and apply the Rate of Return concepts in selection of the best alternative project among the many.
CO4	:	Apply Classical depreciation methods to calculate the annual depreciation charge and book value over the asset's life and examine the effects of changes in selling prices, cost and volumes on profit using BEA.
CO5	:	Apply the replacement analysis techniques to identify optimal life of assets and apply costing principles to perform costing.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3											3			
CO2	3	3											3			
CO3	3	3	3										3			
CO4	3	3											3			
CO5	3	3	3										3			

Text Books

Sl No.	Author/s	Title, Publisher, Edition, Year, ISBN
1.	Riggs J.L.	Engineering economy, McGraw Hill, 4th Edition, 2004, ISBN-13: 978-0079122483.
2.	R Paneerselvam	Engineering Economics, PHI, Eastern Economy, 2nd Edition, 2013, ISBN-13: 978-8120348370.

Reference Books

Sl No.	Author/s	Title, Publisher, Edition, Year, ISBN
1.	William G Sullivon	Engineering Economy, Pearson Publisher, 17th Edition, 2018, ISBN-13:9780134870069.
2.	Tuesen G	Engineering Economy, PHI, 9th Edition, 2009, ISBN-13: 978-0130281289.

Industrial Hydraulics (S3IME03)

(Engineering Science Course)

Contact Hours/ Week	:	3(L)+0 (T)+0(P)	Credits:	3.0
Total Lecture Hours	:	39	CIE Marks:	50
Total Practical Hours	:	--	SEE Marks:	50

Unit-I
Fluid Power Principles: Introduction to Fluid power – Advantages and Applications – Fluid power systems – Types of fluids - Properties of fluids and selection – Basics of Hydraulics – Pascal's Law – Principles of flow - Friction loss – Work, Power, and Torque- Problems
7- Hours
Unit-II
Sources of Hydraulic Power: Pumping Theory-– Pump Classification – Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criteria of pumps – Fixed and Variable displacement pumps – Problems
7- Hours
Unit-III
Hydraulic Actuators: Cylinders – Types and construction, Application, Hydraulic cushioning – Rotary Actuators-Hydraulic motors– Problems
7- Hours
Unit-IV
Control Components: Direction Control, Flow control, and pressure control valves –Types, Construction and Operation – Accessories: Reservoirs, Pressure Switches –Filters –types and selection- Applications – Fluid Power ANSI Symbols – Problems
9- Hours
Unit-V
Accumulators, Intensifiers, Industrial Hydraulic Circuits: Regenerative, Pump Unloading, Double-Pump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-Safe, Speed Control, Deceleration circuits, Sizing of hydraulic systems, Hydrostatic transmission, Electro-hydraulic circuits, Servo and Proportional valves – Applications- Mechanical, hydraulic servo systems.
9- Hours

Course Outcomes: Upon completion of this course the student will be able to:		
CO1	:	Describe the working principles of Fluid Power Systems.
CO2	:	Explain various sources of hydraulic power and describe the working of Hydraulic Pumps.
CO3	:	Discuss the fluids and components used in modern Industrial Fluid Power System
CO4	:	Analyze the working of Hydraulic Actuators
CO5	:	Design Fluid Power Circuits and explain its construction and its operation

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3														3	
CO2	3														3	
CO3	3														3	
CO4	3														3	
CO5	3	2	2												3	

Text Books

Sl. No.	Author/s	Title, Publisher, Edition, Year, ISBN
1.	Anthony Esposito,	Fluid Power with Applications, Pearson, 7th Edition, 2013, ISBN-13: 978-1292023878
2.	James A. Sullivan	Fluid Power Theory and Applications, Prentice Hall, 4th Edition, 1997

Reference Books

Sl No.	Author/s	Title, Publisher, Edition, Year, ISBN
1.	Majumdar, S.R	Oil Hydraulics Systems – Principles and Maintenance, Tata McGraw Hill, 1st Edition, 2017, ISBN-13: 978-0074637487
2.	Shanmugasundaram.K	Hydraulic and Pneumatic Controls.1st Edition, S Chand & Co, 2006, ISBN-13: 978-8121926355
3.	Srinivasan. R	Hydraulic and Pneumatic Controls, Vijay Nicole Imprints, 3rd Edition, 2019

Industrial Safety, Health & Environment Management Systems (S3IME04)

(Engineering Science Course)

Contact Hours/ Week	:	3(L)+0 (T)+0(P)	Credits:	3.0
Total Lecture Hours	:	39	CIE Marks:	50
Total Practical Hours	:	--	SEE Marks:	50

Unit-I
Fundamentals of safety, Accidents, causes, classification, Investigation reports, preventive action, Legal aspects of safety – Factories Act 1948. Work permit systems – Types of permit with details of each, Personal Protective Equipment's, Hazard Analysis.
7- Hours
Unit-II
Risk Assessment, Emergency Control Plan – Safety Policy, Proper usage & maintenance of tools, Industrial psychology. Properties of Hazardous, toxic, flammable materials, Handling, transportation, and usage of chemicals hazardous to humans.
8- Hours
Unit-III
Risks in confined places – Control measures & PPEs to be used, Threshold limits of hazardous materials/gases & flammable limits of inflammable, Handling, storage, and usage of high-pressure gas cylinders – Risks & precautions. OHSAS – 18001 and OSHA – Introduction – OH & S Policy – Process Safety Management (PSM) as per OSHA performance measurements to determine the effectiveness of PSM.
9- Hours
Unit-IV
Definition, need for occupational health, monitoring, Ergonomics – study. Occupational-related common diseases, ailments, and control actions needed – management obligations – Legal aspects
8- Hours
Unit-V
Industrial lighting and ventilation, the Importance of industrial hygiene, good housekeeping, Emergency planning, and response. Basic First aid for common on- site ailments/injuries, Proper care of ears, eyes, throat, teeth, and skin,

Community Health.
7- Hours

Course Outcomes: Upon completion of this course the student will be able to:		
CO1	:	Describe the safety measures and application of protective equipment used in industries
CO2	:	Discuss the risk assessment and importance of hazardous material handling in industries
CO3	:	Explain the risks in a confined place and introduce OSHAS 18001 standards
CO4	:	Introduce the concept of occupational health monitoring
CO5	:	Discuss the importance of lighting and ventilation in industrial safety and hygiene

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3															3
CO2	3	2														3
CO3	3	2														3
CO4	3	3														3
CO5	3	3	2													3

Text Books

Sl No.	Author/s	Title, Publisher, Edition, Year, ISBN
1.	R.K Jain and Sunil S. Rao	Industrial Safety Health and Environmental Management System, Khanna Publishers, Latest Edition, 2000, ISBN-13: 978-8174092106

Reference Book:

Sl No.	Author/s	Title, Publisher, Edition, Year, ISBN
1.	Singh U. K	Safety, Security, and Risk Management, Ashish, 2011, ISBN-13: 978-8170247883
2.	L. M. Deshmukh	Industrial Safety Management Publication: Tata Mc Graw-Hill Publishing Company Ltd, 1st Edition, 2005, ISBN-13: 978-0070617681
3.	Herbert William Heinrich.	Industrial Accident Prevention, Mc Graw-Hill Inc., US, 5th Edition, 1980, ISBN-13: 978-0070280618

Spread Sheet for Decision Making (S3IMA01)

(Ability Enhancement Course – III)

Contact Hours/ Week	:	0(L)+0 (T)+2(P)	Credits:	1.0
Total Lecture Hours	:	--	CIE Marks:	50
Total Practical Hours	:	26	SEE Marks:	50

	Decision making using Microsoft Spread Sheet
1.	Determining the measures of central tendency and dispersion of a given process.
2.	Graphical/ Pictorial representation of data – Histogram, Ogive curve, Bar Chart, Column chart, Pie chart, Line chart.
3.	Perform Simple Linear Regression Analysis, Construction of Scatter Plot and determination of Karl Pearson's Correlation Coefficient
4.	Interval estimation and hypothesis testing on single population mean
5.	Determine Economic Order Quantity
6.	Perform ABC analysis: Classification of items based on Annual Usage Value
7.	Perform Break-even analysis.
8.	Construct a Pareto chart and analyze
9.	Depreciation analysis using Various methods of Depreciation
10.	Project schedule using Gantt chart

Course Outcomes:

Upon completion of this course the student will be able to:

CO1	:	To analyze the break-even volumes from cost data.
CO2	:	To determine economic order quantities from Inventory data.
CO3	:	To perform regression analysis.
CO4	:	To classify A, B, and C class items.
CO5	:	To construct a Pareto chart, various graphical representation, Gantt chart
CO6	:	To calculate depreciation of assets.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1		3	3		2								3	3		
CO2		3	3		2								3	3		
CO3		3	3		2								3	3		
CO4		3	3		2								3	3		
CO5		3	3		2								3	3		
CO6		3	3		2								3	3		

Geometrical Dimensioning & Tolerancing (GD&T) (S3IMA02)

(Ability Enhancement Course – III)

Contact Hours/ Week	:	1(L)+0 (T)+0(P)	Credits:	1.0
Total Lecture Hours	:	15	CIE Marks:	50
Total Practical Hours	:	--	SEE Marks:	50

Unit-I
Introduction: Geometric product definition principles; verification of position with open setup; geometric characteristic symbols Geometric Dimensioning and Tolerancing: an explanation of tolerance zone conversion; surfaces, features, features of size, datum features.
3- Hours
Unit-II
Datum features of size, and datum's; tolerances; components common to geometrically dimensioned & tolerance drawing; fits & allowances, advantages of GD&T MMC, LMC & RFS: Maximum Material Condition (meaning & use); Least Material Condition (meaning & use); Regardless of Feature Size How to read a Feature Control Frame.
3- Hours
Unit-III
Size Control Form: The Taylors principle; Gauging size limits. Rules, concepts, Characteristics, and Intolerance Dimensions: individual or related Datum's, Material Conditions; untoleranced dimensions Datums
3- Hours
Unit-IV
Datum features; oddly configured & curved surfaces as datum features; equalizing datum's; datum feature symbols; flexible parts; Direct vs Indirect Tolerancing. MMC and its ramifications, calculation.
3- Hours
Unit-V
Relations between individual features, Virtual Condition and Resultant condition Boundaries: Virtual condition (MMC concept & a functional boundary). Effect of LMC; wall thickness
3- Hours

Course Outcomes: Upon completion of this course the student will be able to:		
CO1	:	Explain the fundamental principles and concepts of GD&T, including datums, geometric controls, tolerances, and the relationship between part features.
CO2	:	Develop the ability to interpret and apply GD&T symbols correctly, understanding their meaning and implications on part geometry and tolerances.
CO3	:	Gain proficiency in applying the ASME Y14.5 or ISO 1101 standards, which provide guidelines for GD&T usage. They should be able to create technical drawings with appropriate GD&T callouts
CO4	:	Apply GD&T principles in the design process to ensure functional requirements are met, while considering manufacturing capabilities and cost constraints
CO5	:	Describe how GD&T impacts manufacturing feasibility and its cost.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3												3			
CO2	3	2											3			
CO3	3	2	2										3			
CO4	3	2	2										3			
CO5	3	2	2										3			

Text Books

Sl No.	Author/s	Title, Publisher, Edition, Year, ISBN
1.	James D Meadows	Geometric Dimensioning and Tolerancing: Applications, Analysis & Measurement, James D Meadows & Assoc Inc, 2nd Revised Edition, 2010, ISBN-13: 978-0971440166
2.	P S Gill	Geometric Dimensioning and Tolerancing, S K Kataria & Sons, 3rd Edition, 2019, ISBN: 978-93-5014-378-0

Reference Books

Sl. No.	Author/s	Title, Publisher, Edition, Year, ISBN
1.	Paul J. Drake	Dimensioning and Tolerancing Handbook", McGraw Hill, 1st Edition, 1999, ISBN-13: 978-0070181311
2.	Bruce A. Wilson	GD&T: Application and Interpretation, Goodheart-Willcox Publishing, 5th Edition, 2009, ISBN-13: 978-1605252490

Fundamental of Mechanical Engineering drawing (S3IMA03)

(Ability Enhancement Course – III)

Contact Hours/ Week	:	0(L)+0 (T)+2(P)	Credits:	1.0
Total Lecture Hours	:	0	CIE Marks:	50
Total Practical Hours	:	26	SEE Marks:	50

Unit-I
Introduction to AutoCAD, Coordinate systems, drawing units, Sheet setup, Draw commands – line, spline, arc, circle, polygons, ellipse, Block, hatch, text, point, region, Revcloud
5- Hours
Unit-II
Modify commands- erase, copy, move, array, stretch, mirror, rotate, scale, trim/extend, fillet/chamfer, offset, break, break at point, explode. Select tools, Zooming and Panning, Practicing 2D Mechanical drawings.
5- Hours
Unit-III
Parametric relationships- Parallelism, Perpendicularity, Angularity, linearity, concentricity, circularity, equal, Straightness, Symmetry, lock.
5- Hours
Unit-IV
Dimensioning Tools- linear, aligned, angular, radius, diameter, logged. Dimension Styles, Editing Dimensions, dimensioning a Mechanical Drawings, layer tools, save and export.
5- Hours
Unit-V
Isometric views, Isometric diagram practices, Mechanical diagrams- knuckle joint, flange coupling, cotter joints, universal couplings and other mechanical diagrams.
6- Hours

Course Outcomes: Upon completion of this course the student will be able to:		
CO1	:	Demonstrate proficiency in using AutoCAD software to create accurate and precise 2D drawings
CO2	:	Gain proficiency in understanding various drawing views, symbols, and annotations commonly used in engineering drawings.
CO3	:	Select appropriate tools and commands, and efficiently create, modify, and document 2D drawings using AutoCAD.

CO – PO Mapping:																
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3		3								3			
CO2	3	3	3		3								3			
CO3	3	3	3		3								3			

Text Books		
Sl No.	**Author/s**	**Title, Publisher, Edition, Year, ISBN**
1.	Randy H. Shih	AutoCAD 2022 Tutorial First Level 2D Fundamentals, SDC Publications, 1st Edition, 2021, ISBN-13: 978-1630574383
2.	George Omura and Brian C. Benton	Mastering AutoCAD 2022 and AutoCAD LT 2022, Sybex, 2nd Edition, 2021, ISBN-13: 978-1119715351
3.	Munir Hamad	AutoCAD 2022 Beginning and Intermediate, Mercury Learning & Information, 2021, ISBN-13: 978-1683927242

Basics of Python Programming (S3IMA04)

(Ability Enhancement Course – III)

Note: Students who have studied Introduction to Python Programming (PLC2) are not permitted to take this course

Contact Hours/ Week	:	0(L)+0 (T)+2(P)	Credits:	1.0
Total Lecture Hours	:	--	CIE Marks:	50
Total Practical Hours	:	26	SEE Marks:	50

Unit-I
Python Basics: Entering Expressions into the Interactive Shell, Compilation, Data types, Variables, Different types of Operators, Multi- line Statements, Comment Line, built-in functions.
5- Hours

Unit-II
Control Statements and Decision Making (Contd.): While Loop, Break and Continue statements to control the flow of execution of program.
5- Hours
Unit-III
Data Types: Creating and Working with Strings, Lists, Tuples, Dictionaries, Sets.
5- Hours
Unit-IV
Data Types: Creating and Working with Strings, Lists, Tuples, Dictionaries, Sets.
6- Hours
Unit-V
File Operations: Open & Close File, Read & Write operations, Methods **Python OOPS Concepts**: Classes & Objects
5- Hours

Course Outcomes:

Upon completion of this course the student will be able to:

CO1	:	Develop and implement algorithms that use basic programming concepts like expressions, variables, operators and functions
CO2	:	Develop and implement conditional statements and loops
CO3	:	Identify and implement the methods to create and manipulate lists, strings, sets, tuples and dictionaries.
CO4	:	Develop programs for file handling and implement OOPS concepts

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2										3			
CO2	3	2	2										3			
CO3	3	2	2										3			
CO4	3	2	2										3			

Text Books

Sl No.	Author/s	Title, Publisher, Edition, Year, ISBN
1.	Al Sweigart	Automate the Boring Stuff with Python, William Pollock, 2015, ISBN: 978 1593275990.
2.	Allen B. Downey	Think Python: How to Think Like a Computer Scientist, 2nd Edition, Green Tea Press, 2015, ISBN-13: 978-1491939369

Social Connect & Responsibilities (SHS01)

Contact Hours/ Week	:	0(L)+0 (T)+2(P)	Credits:	1.0
Total Lecture Hours	:	--	CIE Marks:	50
Total Practical Hours	:	26	SEE Marks:	50

Objectives: The Course will

- Enable the student to do a deep drive into societal challenges being addressed by NGO(s), social enterprises & the government and build solutions to alleviate these complex social problems through immersion, design & technology.
- Provide a formal platform for students to communicate and connect with their surroundings.
- Enable to create of a responsible connection with society.

Contents: The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellow human beings, nature, society, and the world at large. The course will engage students in interactive sessions, reading groups and semester-long activities conducted by faculty mentors. In the following a set of activities planned for the course have been listed:

Unit-I

Plantation and adoption of a tree: Plantation of a tree by Miyawaki Method that will be adopted by entire semester by a group of students. They will also make an excerpt either as a documentary or a photoblog describing the plant's origin, its usage in daily life, and its appearance in folklore and literature.

6- Hours

Unit-II

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, photoblog and documentary on evolution and practice of various craft forms.

6- Hours

Unit-III

Organic farming: Definition of organic farming, Organically grown crops in India, Differentiate between conventional farming and organic farming, Necessity of organic farming, Key characteristics of organic farming, Four principles of organic farming(principle of Health, principle of ecology, principle of

fairness and principle of care),Types of organic farming: 1) Pure organic farming, 2) Integrated farming (Integrated nutrient management and Integrated pest management), objectives of organic farming, benefits of organic farming, Basic steps in organic farming and limitations of organic farming.

4- Hours

Unit-IV

Water Conservation: Global Water Scarcity - Global water crisis and its implications; Rainwater Harvesting - Concept and benefits of rainwater harvesting; Water Audit – An approach to water conservation; Efficient Water Use - Optimizing water consumption in daily life.

6- Hours

Unit-V

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

4- Hours

Course Outcomes:

Upon completion of this course the student will be able to:

CO1	:	Understand social responsibility
CO2	:	Practice sustainability and creativity
CO3	:	Showcase planning and organizational skills

Activities:

1. **Plantation and adoption of a tree:** Select suitable species in consultation with horticulture, forest or agriculture department. Interact with NGO/Industry and community to plant Tag the plant for continuous monitoring
2. **Heritage walk and crafts corner:** Survey in the form of questioner by connecting to the people and asking. Questions during survey can be asked in local language but report language is English.
3. **Organic farming:** Collect data on organic farming in the vicinity. Like types of crop, methodology etc.,
4. **Water Conservation:** Report on traditional water conservation practices (to minimize wastage)
5. **Food Walk**: Survey local food centres and identify its specialty, Identify and study the food ingredients, Report on the regional foods, Report on Medicinals values of the local food grains, and plants.

PEDAGOGY:

The pedagogy will include interactive lectures, inspiring talks by various departments, field visits, social immersion. Applying and synthesizing information from these sources to define the social problem with your group.

Social immersion with NGOs/social sections will be a key part of the course.

COURSE TOPICS:

The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversional will culminate in developing an actual, idea for problem-based intervention, based on an in-depth understanding of a key social problem.

A total of 26 hours engagement per semester for this course in 3rd semester of the B.E. program. The students will be divided into 1 group of 60 each. Each group will be handled by one faculty mentor.

Guideline for Assessment Process:

Continuous Internal Evaluation (CIE)

- Student shall keep a separate dairy and prepare report in consultation with the mentor/s to indicate what he has observed and learned in the social connect period.
- Report shall be handwritten or blog with paintings, sketches, poster, video and/or photograph with Geo tag.
- The report should be signed by the mentor.
- The report shall be evaluated on the basis of the following criteria (see Table below) and/or other relevant criteria pertaining to the activity completed.
- Each module is evaluated for 35 Marks and final presentation will be for 15 marks.

Sl. No.	Particulars (for each module)	Maximum Marks
1	Planning and scheduling the social connect	10
2	Information/Data collected during the social connect	10
3	Report writing	15
4	Final Presentation from the group	15
	Total	**50**

IV Semester Syllabus

Machine Tool Technology (S4IM01)

(Professional Core Course)

Contact Hours/ Week	:	3(L)+0 (T)+0(P)	Credits:	3.0
Total Lecture Hours	:	39	CIE Marks:	50
Total Practical Hours	:	--	SEE Marks:	50

Unit-I

Theory of Metal Cutting: Introduction to manufacturing processes and classification of manufacturing processes. Orthogonal and Oblique cutting processes. Single point cutting tool nomenclature, geometry, Merchants circle diagram and analysis, shear angle relationship, tool life, tool wear and tool failure, effects of cutting parameters on tool life, tool failure criteria, Taylor's tool life equation, tool life evaluation. Cutting tool materials: Desired properties, types of cutting tool materials – HSS, carbides, coated carbides and ceramics. Cutting fluids, desired properties, types and selection.

Numericals on: Merchants circle diagram, tool life evaluation.

8- Hours

Unit-II

Lathe and Operations: Classification, lathe parts and their functions, feed mechanisms, thread cutting mechanisms, lathe accessories and attachments, lathe operations, Turret and capstan lathe: Introduction, differences between Turret and capstan lathe, parts of Turret and capstan work and tool holding devices, tool layouts and operations. CNC Turning Center: Introduction working principles, constructional features and its operation advantages and applications.

Numericals on: taper turning, thread cutting and machining time calculations.

8- Hours

Unit-III

Reciprocating Machine Tools: Shaper -Principal parts, Classification, Specification of shaper, Shaper Mechanisms, Types Hydraulic shaper. Cutting Speed, Feed, Depth of cut & machining time-Various shaper operations-Introduction to Planer -Principal parts and working of Double housing Planer, Principal parts of Slotter-Working of Slotter

8- Hours

Unit-IV

Drilling Machines: Classification, constructional features, drilling & related operations, types of drill & drill bit nomenclature, drill materials.

Milling Machines: Classification, constructional features, milling cutters

nomenclature, milling operations, up milling and down milling concepts. Indexing: Simple, compound, differential and angular indexing.

7- Hours

Unit-V

Grinding Machines: Types of abrasives, bonding process, classification, constructional features (cylindrical and surface grinding), and selection of grinding wheel. Lapping and honing machines: Principles of operation, construction, and applications

Super Finishing Process: Buffing, Lapping, Broaching, Honing process-Equipment, working principles and industrial applications

8- Hours

Course Outcomes:

Upon completion of this course the student will be able to:

CO1	:	Explain fundamental principles of metal cutting, including the mechanics of chip formation, cutting forces and tool wear.
CO2	:	Develop the ability to analyze and interpret cutting parameters and their effect on machining performance.
CO3	:	Explain the principles of operation and safe use of turning, shaping and planning machines, including setup and tool selection.
CO4	:	Explain the principles of operation and safe use of drilling and milling machines, including tool selection.
CO5	:	Describe the principles of operation and safe use of grinding machines, wheel selection and coolant management.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3													3	
CO2	3	3													3	
CO3	3														3	
CO4	3														3	
CO5	3														3	

Text Books

Sl. No.	Author/s	Title, Publisher, Edition, Year, ISBN
1.	Kesthuri Praveen	Manufacturing Process I & II, Suggi Publications, Bangalore, 2018
2.	Hazara Choudhry	Elements of Workshop Technology Vol-II Machine Tools, Indian Book Distributing Co. Calcutta, 15th Edition, 2010, ISBN-13: 978-8185099156

3.	Mikell P Groover	Fundamentals of modern manufacturing, Wiley India, 2nd Edition, 2001, ISBN-13: 978-0471400516

Reference Books		
Sl. No.	**Author/s**	**Title, Publisher, Edition, Year, ISBN**
1.	Serope kalpakjian and Steven Schmidt	Manufacturing Engineering & Technology, Pearson, 7th Edition, 2018, ISBN-13: 978-9332587908
2.	Amitabh Ghosh and Mallik	Manufacturing Science, OAFFO, 2nd Edition, 2010, ISBN-13: 978-8176710633
3.	G. Boothroyd	Fundamentals of Metal Machining and Machine Tools, CRC press, 3rd Edition, 2005, ISBN-13: 978-1574446593

Work System Engineering and Ergonomics (S4IMI01)

(Integrated Professional Core Course)

Contact Hours/ Week	:	3(L)+0(T)+2(P)	Credits:	4.0
Total Lecture Hours	:	39	CIE Marks:	50
Total Practical Hours	:	26	SEE Marks:	50

Unit-I

Work-Study- Human factor in work-study, Qualities required for work-study man, Basic steps in work-study, Techniques of work-study and their relationship **Method Study**- Definition, objective, scope, and basic procedure of method study; selection of job, various recording techniques like outline process charts, flow process charts, man-machine charts, and multiple activity charts. Flow diagram, string diagram, travel chart.

8- Hours

Unit-II

Method Study- Charts to record movements at the workplace –two-handed process chart. Critical examination, development and installation of improved method; Micro motion study: use of micro-motion study, micro-motion study equipment, film analysis, definition and use of Therbligs, Classification of movement, Principles of motion economy.

8- Hours

Unit-III

Work Measurement - Definition, objective, and benefit of work measurement. Work Measurement Techniques. Conducting a study with simple problems.

Stop Watch Time Study- Definition, time study equipment, steps in time study, selection of job Breaking jobs into elements, recording information. Rating & standard Rating, Rating scales, allowances and standard time determination. Predetermined motion time study – Methods Time Measurement (MTM).

8- Hours

Unit-IV

Applied Anthropometry, Work-Space Design, and Seating: Anthropometry, use of anthropometric data, workspaces, design of work surfaces, and the science of seating, video display terminal (VDT) workstation.

Arrangement of components within a Physical space: principles of arranging components, methodologies for arranging components, general location of controls and displays Within the workspace, the specific arrangement of controls and displays Within the workspace, general guidelines in designing individual Workplaces.

7- Hours

Unit-V

Muscular work: Physiological basics, Fatigue, and recovery, Use of muscle strength data in design.

Body strength: Static and dynamic strength exertions, Maximal or minimal strength exertion, Hand strength, Foot strength, Design for use preferences.

Effect of Heat, Noise and Ventilation and Lighting on the performance of the operator.

8- Hours

Laboratory Component

PART A (Method Study)	
1.	Use of various recording techniques like Outline Process Chart, Flow Process Chart, Two-Handed Process Chart, Multiple activity chart – for various activities
2.	Method study on Pin board assembly
3.	Principles of Motion Economy & Method Study for mailing of letters
4.	Method Study on Bolt, Washer & Nut Assembly
PART B (Work Measurement & Layout Design)	
5.	Performance Rating - Walking Simulator, Marble Collection and Playing Cards
6.	Time Study on 5- Amp plug assembly and Pen Torch Assembly
7.	Advanced Work Measurement using MTM – Marble collection, Document signing and Inspection of Bore using Plug gauge

8.	Layout Planning and measuring the distance travelled using String Diagram
	For Demonstration Only
9.	Effect of Light and Noise on Human Efficiency in Work Environments
10.	Measurement of variation in body parameters during work cycles

Course Outcomes: Upon completion of this course the student will be able to:		
CO1	:	Apply productivity concepts and work-study principles in industries.
CO2	:	Study the existing process, analyze, evaluate, design, and develop proposed practices using Methods of Engineering Techniques.
CO3	:	Estimate the standard time for any given operation.
CO4	:	Analyze various factors considered in Design of work system.
CO5		Analyze the ability of body member in performing tasks and related hazards (Musculoskeletal disorders).

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2														3
CO2	3	2	2													3
CO3	3	2	2													3
CO4	3	2														3
CO5	3	2														3

Text Books

Sl No.	Author/s	Title, Publisher, Edition, Year, ISBN
1.	I L O	Introduction to work study: Indian adaption. Oxford and IBH Publishing 3rd Edition -2008. ISBN-10: 8120406028.
2.	Ralph M Banes, John Wiley & Sons	Motion and Time study, 7th Edition, 2009. ISBN-10: 8126522178, ISBN-13: 978-8126522170.
3.	Mark S. Sanders and Ernest J McCormick	Human Factors in Engineering and Design, McGraw-Hill and Co., Singapore, 7th Edition, 1992, ISBN 0-07-112826-3.
4.	Karl H.E. Kroemer	Fitting the Human Introduction to Ergonomics / Human factors engineering, CRC press, 7th Edition, 2017, ISBN-13: 978-1498746892

Reference Books		
Sl No.	**Author/s**	**Title, Publisher, Edition, Year, ISBN**
1.	Dr. A.K.Singh	Time and Motion study, Jaico publishing house.
2.	S Dalela and Sourabh	Work Study and Ergonomics, Standard Publisher and Distributor, 2009 ISBN-13: 978-8180141331

Relational Data-Base Management System (RDBMS) (S4IMI02)

(Integrated Professional Core Course)

Contact Hours/ Week	:	3(L)+0(T)+2(P)	Credits:	4.0
Total Lecture Hours	:	39	CIE Marks:	50
Total Practical Hours	:	26	SEE Marks:	50

Unit-I

Introduction: Characteristics of Database approach; Actors on the screen; Workers behind the scene; Advantages of using DBMS approach; A brief history of database applications; when not to use a DBMS. Data models, schemas and instances; Three-schema architecture and data independence; Database languages and interfaces; The database system environment; Centralized and client-server architectures; Classification of Database Management systems.

Entity-Relationship Model: Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types; Refining the ER Design; ER Diagrams, Naming Conventions and Design Issues; Relationship types of degree higher than two.

8- Hours

Unit-II

Relational Model and Relational Algebra: Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations, Transactions and dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations : JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra; Relational Database Design Using ER- to-Relational Mapping.

8- Hours

Unit-III

SQL: SQL Data Definition and Data Types; Specifying constraints in SQL; Schema change statements in SQL; Basic queries in SQL; More complex SQL Queries. Insert, Delete and Update statements in SQL; Specifying general

constraints as Assertions and Triggers; Views (Virtual Tables) in SQL; Additional features of SQL.

8- Hours

Unit-IV

Database Design: Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form. Properties of Relational Decompositions; Algorithms for Relational Database Schema Design, Multi valued Dependencies and Fourth Normal Form; Join Dependencies and Fifth Normal Form; Inclusion Dependencies; Other Dependencies and Normal Forms.

7- Hours

Unit-V

Transaction Management : The ACID Properties; Transactions and Schedules; Concurrent Execution of Transactions; Lock- Based Concurrency Control; Performance of locking; Transaction support in SQL; Introduction to crash recovery. 2PL serializability and recoverability; Introduction to lock management; Lock conversions; Dealing with Deadlocks; specialized locking techniques Concurrency control without locking to ARIES; The log; Other recovery – related data structures; The write –ahead Log protocol; Check pointing; recovering from a system crash; Media recovery; Other algorithms and Interaction with concurrency control.

8- Hours

Laboratory Component

Consider the following Employee database.

- Department (Deptno, Deptname, Location)
- Employee (EmpNo, EmpName, Job, Manager, HireDate, Salary, Commission, Deptno)
- SalaryGrade (Grade, LowSalary, HighSalary)
- Create the above tables by properly specifying the primary keys and the foreign keys
- Enter at least ten tuples for each relation.

Write the queries for the following requirements :

Practicals – 1 : (Simple Queries)

1. List the names of analysts and salesmen.
2. List names of employees who are not managers.

3. List the names of employees whose employee numbers are 7369, 7521, 7839, 7934, 7788.
4. List employees not belonging to department 30, 40, or 10.
5. List employee names for those who have joined between 30 June and 31 Dec. '81.
6. List the different designations in the company.
7. List the names of employees who are not eligible for commission.
8. List the employees not assigned to any department.
9. List the employees who are eligible for commission.
10. List employees whose names either start or end with "S".
11. List names of employees whose names have "i" as the second character.
12. List details of employees who have joined before 30 Sep 81.

Practicals – 2 : (Based on Order by and Like Operators)

1.List all details from salgrade table.
2.Display different job types without duplicating
3.List employees in department 10 and 30 in alphabetical order of names
4.List clerks in department 20
5.List employees having 'LL' or 'TH' in their names
6.List employees who do not have manager.
7. List employees hired during any 2 dates (use substitution variable).
8. List all clerks earning less than 1000.
9. List employees having annual remuneration > 30000

Practicals – 3 : (Based on Aggregate functions)

1. List the number of employees working with the company.
2. List the number of designations available in the EMP table.
3. List the total salaries paid to the employees.
4. List the maximum, minimum and average salary in the company.
5. List the maximum salary paid to a salesman.
6. List the number of employees and average salary for employees in department 20.
7. List names of employees who are more than 26 years of experience in the company.
8. List the employee details in the ascending order of their basic salary.

Practicals – 4 : (Based on Joining tables type)

1. To display ename, job, dname who are working in a SALES department .
2. Toisplay ename, job, dname who are working either in ACCOUNTING or RESEARCH department .
3. To display ename, job, dname, sal who are working in a ACCOUNTING department and drawing salary greater than 1500.

4. To display ename, job, dname who are working in a SALES department as SALESMAN.
5. To display ename, job, dname who are working at a location DALLAS .
6. To display ename, job, dname who are working in a SALES department and drawing salary in the range of 1200 and 1700.
7. To display the dname in which no employee is working.

Practicals – 5 : (Based on Group by Clause and Aggregate functions)

1. List the department numbers and number of employees in each department.
2. List the department number and total salary payable in each department.
3. List the jobs and number of employees in each job.
4. List the total salary, maximum and minimum salary and average salary of the employee's job wise.
5. List the total salary, maximum and minimum salary and average salary of the employees, for department 20.

Practicals-6:

Consider the following database of student enrollment in courses and books adopted for each course.

STUDENT (USN, StudentName, Dob, Gender, Class)
COURSE (CourseNo, CourseName, Department)
TEXT (BookId, BookTitle, Publisher, Author)
ENROLL (USN, CourseNo, Semester, Marks)
BOOK_ADOPTION (CourseNo, BookId, Semester)

Create the above tables by properly specifying the primary keys and the foreign keys

Enter at least 10 records to each table.

Execute SQL queries for the following requirements:

1) List the student details and their course details for a particular semester.
2) List the student details under a particular department whose name is ordered in an ascending order.
3) List all the book details under a particular course.
4) List the courses in which number of students enrolled will be more than
5) List the publisher who has published more than 2 books.

Practicals-7:

Consider the following above database:

Execute SQL queries for the following requirements:

1) List the author details who has authored more than 2 books.
2) List the author details who have written book for I semester, computer

science course.
3) List only the girls student details whose total number of months starting from their
date of birth is more than 200.
4) Update the marks by giving grace marks of 15 % to the boys student who has scored lowest in his class of a particular course.
5) List the course to which maximum number of students have joined

Course Outcomes:

Upon completion of this course the student will be able to:

CO1	:	Identify the fundamentals of database technologies and its different architectures.
CO2	:	Analyse the Entity Relational model concepts and Design relational algebraic expressions for SQL queries
CO3	:	Illustrate the various concepts of SQL and Develop Queries to perform CRUD (Create, Retrieve, Update and Delete) operations on database
CO4	:	Apply the database design with Normalization concepts.
CO5		Analyze the criteria's of transaction management, concurrency control algorithms and crash recovery systems.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3												3			
CO2	3	3											3			
CO3	3	3	3										3			
CO4	3	3	3										3			
CO5	3	3	3										3			

Text Books

Sl No.	Author/s	Title, Publisher, Edition, Year, ISBN
1.	Elmasri and Navathe	Fundamentals of Database Systems, Addison-Wesley, 5th Edition, 2007
2.	Raghu Ramakrishnan and Johannes Gehrke	Database Management Systems, McGraw-Hill, 3rd Edition, 2003, ISBN-13: 9780072465631

Reference Books		
Sl No.	**Author/s**	**Title, Publisher, Edition, Year, ISBN**
1.	Silberschatz, Korth and Sudharshan	Data base System Concepts, Mc-GrawHill, 5th Edition, 2005, ISBN-13: 978-0071244763
2.	C.J. Date, A. Kannan, S. Swamynatham	A Introduction to Database Systems, Pearson India, 8th Edition, 2006, ISBN-13: 978-8177585568

Machine Shop (S4IML01)

(Professional Core Course laboratory)

Contact Hours/ Week	:	0(L)+0 (T)+2(P)	Credits:	1.0
Total Lecture Hours	:	--	CIE Marks:	50
Total Practical Hours	:	26	SEE Marks:	50

Part- A
Preparation of three models on lathe involving Plain turning, Taper turning, Step turning, Thread cutting, Facing, Knurling, Drilling, Boring and Eccentric turning.
Part-B
Cutting of V Groove/ dovetail / Rectangular groove using a Shaper and Cutting of Gear Teeth using Milling Machine.
Part-C
For demonstration Demonstration of formation of cutting parameters of single point cutting tool using bench grinder / tool & cutter grinder. Demonstration of surface milling /Slot milling.

Course Outcomes:

Upon completion of this course the student will be able to:

CO1	:	Perform turning, facing, knurling, thread cutting, tapering, eccentric, turning and allied operations.
CO2	:	Perform keyways / Slots, grooves etc. using shaper.
CO3	:	Perform gear tooth cutting using Milling machine.
CO4	:	Explain the formation of cutting tool parameters of single point cutting tool using bench grinder / tool and cutter grinder.
CO5	:	Demonstrate precautions and safety norms followed in Machine Shop.

	CO – PO Mapping:															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3													3	
CO2	3	3													3	
CO3	3	3													3	
CO4	3	3													3	
CO5	3														3	

Marketing Management (S4IME01)

(Engineering Science Course)

Contact Hours/ Week	:	3(L)+0 (T)+0(P)	Credits:	3.0
Total Lecture Hours	:	39	CIE Marks:	50
Total Practical Hours	:	--	SEE Marks:	50

Unit-I

Marketing Management- Definition, Core concepts and Scope, Company orientation towards market place: Production concept, Product concept, Selling concept, Marketing concept, Societal Marketing concept. Levels in the marketing environment of a company.

Consumer Markets And Buying Behavior- Classification of consumer products, Participants in the consumer buying decision, Factors influencing consumer buying behavior, Major stages in buying process.

8- Hours

Unit-II

Marketing Information Systems and Research - Components of marketing information system, benefits and uses, marketing research system, marketing research procedure, Measurement of market demand.

Product Planning And Development - The concept of a product, Features of a product, Classification of products, Major Stages in the new product development, Product policies- Product planning and development, Product line, product mix- factors influencing change in product mix, Product mix strategies.

8- Hours

Unit-III

Branding, Packaging and Labelling: Branding- Reasons for branding, Types of brands, Functions of branding, features, Labeling - Types, Functions, advantages & disadvantages; Packaging - Meaning, Growth of Packaging, Kinds of packaging.

Pricing- Importance of Price, Pricing objectives, Factors affecting pricing decisions, Procedure for price determination, Kinds of pricing, pricing strategies and decisions.

Distribution - Marketing Channels – Functions, Types of Channels of distribution, number of channel levels, Physical distribution importance, total systems concept, strategies, and uses of physical distribution, Direct marketing.

8- Hours

Unit-IV

Advertising And Sales Promotion- Objectives of advertisement, functions of advertising, classification of advertisement copy, Advertisement media-kinds, Advantages of advertising, Objectives of sales promotion, advantages of sales promotion.

Personal Selling- Objectives of personal selling, Establishing sales force objectives, sales-force strategies, sales force structure and size, salesmanship, Qualities of a good salesman, types of sales man, Major steps in effective selling.

7- Hours

Unit-V

Digital Marketing: Introduction to Digital Marketing, Social Media Marketing, SEO Optimization, Introduction to Web Analytics, Mobile Marketing, Email Marketing, Product Marketing (Facebook, Instagram, Google Ads),Digital Marketing Budgeting, Planning & Forecast, Website Data Analytics, Neuro-Marketing Fundamentals, Competitor and Website Analysis, Content Creation, Management & Promotion.

8- Hours

Course Outcomes:

Upon completion of this course the student will be able to:

CO1	:	Apply core marketing management concepts and principles to carryout marketing functions & Analyze the market based on consumer buying behavior.
CO2	:	Develop marketing research procedure & Develop marketing strategies for new product development.
CO3	:	Develop marketing strategies for Product mix, branding, labeling, packing & Design, develop and derive strategies pricing and distribution network.
CO4	:	Identify, apply and Choose appropriate media for advertising and Explain the concept of personal selling.
CO5	:	Apply Digital marketing concepts and principles to carryout marketing functions.

CO – PO Mapping:																
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2												3		
CO2	3	3												3		
CO3	3	2												3		
CO4	3	2												3		
CO5	3	2												3		

Text Books		
Sl No.	**Author/s**	**Title, Publisher, Edition, Year, ISBN**
1.	Philip Kotler et al.	Marketing Management: A south Asian Perspective, Pearson Prentice Hall, 13th Edition, 2009, ISBN 10: 0131001353 / ISBN 13: 9780131001350.
2.	Puneet Bhatia	Fundamentals of Digital Marketing, Pearson Education, 2nd Edition, 2019, ISBN-10: 9353435145/ISBN-13: 978-9353435141

Reference Books		
Sl No.	**Author/s**	**Title, Publisher, Edition, Year, ISBN**
1.	Philip Kotler	Marketing Management, Prentice Hall, 11th Edition, 2002.
2.	Michael J Etzel et al.	Marketing, McGraw Hill/Irwin, 13th Edition, 2004, ISBN-10: 0072526505, ISBN-13: 978-0072526509
3.	Seema Gupta	Digital Marketing McGraw Hill, 3rd Edition, 2022, ISBN-10: 935532040X/ISBN-13: 978-9355320407

Organisational Behaviour (S4IME02)

(Engineering Science Course)

Contact Hours/ Week	:	3(L)+0 (T)+0(P)	Credits:	3.0
Total Lecture Hours	:	39	CIE Marks:	50
Total Practical Hours	:	--	SEE Marks:	50

Unit-I

Focus and Purpose: Definition, need and importance of organizational behaviour – Nature and scope – Frame work – Organizational behavior models, Organization and the environmental factors.

Organizational Theory, Organizational behavior modification. Misbehavior – Types

8- Hours

Unit-II

Individual Behaviour: Personality – Types – Factors influencing personality – Theories.

Learning – Types of learners – The learning process – Learning theories.

Attitudes – Characteristics – Components – Formation – Measurement- Values.

Perceptions – Importance – Factors influencing perception – Interpersonal perception- Impression Management. Emotions and Moods in workplace

8- Hours

Unit-III

Group Behaviour: Organization structure – Formation – Groups in organizations – Influence – Group dynamics –Interpersonal Communication.

Team building - Interpersonal relations – Group decision making techniques. Meaning of conflict and its types, Conflict Redressal process

7- Hours

Unit-IV

Leadership and Power: Leadership – Meaning, importance, traits, styles and Theories. Leaders Vs Managers. Sources of power – Power centers – Power and Politics. Motivation at work – importance, need, types and its effects on work behavior. Motivation Theories: Maslow's, Herzberg, etc.

8- Hours

Unit-V

Dynamics of Organizational Behaviour

Organizational culture and climate – Factors affecting organizational climate – Importance.

Organizational change – Importance – Stability Vs Change – Proactive Vs Reaction change – the change process – Resistance to change – Managing change.

Stress – Work Stressors – Prevention and Management of stress – Balancing work and Life. Organizational Development – Characteristics & objectives, Organizational effectiveness.

7- Hours

Course Outcomes: Upon completion of this course the student will be able to:		
CO1	:	Discuss the development of the field of organizational behavior and explain the micro and macro approaches
CO2	:	Analyze and compare different models used to explain individual behavior related to motivation and reward
CO3	:	Explain group dynamics and demonstrate skills required for working in groups (team building)
CO4	:	Identify the various leadership styles and the role of leaders in a decision making process.
CO5	:	Explain organizational culture and describe its dimensions and to examine various organizational designs
CO6		Discuss the implementation of organizational change.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2												3		
CO2	3	3												3		
CO3	3	3												3		
CO4	3	2												3		
CO5	3	2												3		
CO6	3	2												3		

Text Books

Sl No.	Author/s	Title, Publisher, Edition, Year, ISBN
1.	Keith Devis	Human Behavior at work, McGraw-Hill Education, 12th Edition, 2006, ISBN: 978-0071254304
2.	K. Aswathapa	Organisational Behavior, Himalaya Publication House, 12th Edition, 2017, ISBN: 978-9352020652

Reference Books

Sl No.	Author/s	Title, Publisher, Edition, Year, ISBN
1.	Stephen Robbins	Organisational Behaviour, Pearson Education, 18th Edition, 2018, ISBN: 978-9353067038
2.	Fred Luthans	Organisational Behaviour, McGraw-Hill Education, 12th Edition, 2010, ISBN: 978-0071289399

Theory of Machines (S4IME03)

(Engineering Science Course)

Contact Hours/ Week	:	3(L)+0 (T)+0(P)	Credits:	3.0
Total Lecture Hours	:	39	CIE Marks:	50
Total Practical Hours	:	--	SEE Marks:	50

Unit-I

Introduction: Link or element, kinematic pairs, degrees of freedom, Grubler's criterion, Kinematic chain, Mechanism, structure, Inversion, Machine. Kinematic Chains and their Inversions - Inversions of Four bar chain; Single Slider crank chain (Whitworth quick return motion mechanism and Crank and slotted lever mechanism) and double Slider crank chain. Intermittent Motion mechanisms – Geneva mechanism and Ratchet and Pawl mechanism, Law of pure steering, Ackerman steering gear mechanism.

8- Hours

Unit-II

Velocity and Acceleration Analysis of Mechanisms (Graphical Methods): Introduction, Velocity and acceleration analysis of Four Bar mechanism, Slider crank mechanism by vector polygons: Definition of Kennedy's Theorem. Instantaneous centres, classification of instantaneous centres, Number of instantaneous centers in a given mechanism. Determination of linear and angular velocity using the instantaneous center method, Klein's Construction: Analysis of velocity and acceleration of single Slider crank mechanism.

8- Hours

Unit-III

Spur Gears: Introduction**,** Classification of gears and their applications**,** Gear terminology, law of gearing, Characteristics of involute action, Path of contact, Arc of contact, contact ratio (simple problems) Interference in involute gears, Methods of avoiding interference, Backlash, Comparison of involute and cycloidal teeth.

Gear Trains: Simple gear trains, Compound gear trains for large speed reduction, reverted gear trains, Epicyclic gear trains, calculation of velocity ratio, Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains.

8- Hours

Unit-IV

Cams and Followers: Introduction, applications, Types of cams, Types of followers, nomenclature, displacement, Velocity and Acceleration time curves for cam profiles. Disc cam with reciprocating follower having knife -edge, roller and

flat-faced follower, Disc cam with oscillating roller follower. Construction of cam profiles for different follower motions such as Uniform velocity, Simple Harmonic Motion (SHM), Uniform Acceleration and Retardation motion (UARM) and Cycloidal Motion.

8- Hours

Unit-V

Friction, Bearings, Belt Drives and Mechanical Vibrations

Friction: Definition, types and laws of friction

Bearings: classifications of bearings, journal bearings, thrust bearings and antifriction bearings. Friction in Pivot and Collar Bearings (problems).

Belt Drives: Belt Drives applications, advantages and disadvantages, Flat Belt Drives, percentage of Slip, length of open and cross belt drive, Ratio of Belt Tensions, Centrifugal Tension, and Power Transmission.

Mechanical Vibrations- Introduction, types of vibrations, equations of motions and natural frequency (problems on bars and beams).

7- Hours

Course Outcomes:

Upon completion of this course the student will be able to:

CO1	:	Describe various links, kinematic pairs, kinematic chains, and mechanisms with degrees of freedom for the construction of machines and automobile parts.
CO2	:	Calculate the velocity and acceleration of different links in various mechanisms during the motion or power transmission using vector polygons and Instantaneous Center Methods.
CO3	:	Describe the different types of gears and gear trains for mechanical power transmission.
CO4	:	Develop different types of cam profiles for various follower motions to achieve intermittent motion in various mechanical applications.
CO5	:	Describe the different types of vibration in mechanical members and compute stresses in various bearings and belt drives.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2											3			
CO2	3	3	2										3			
CO3	3	3	2										3			
CO4	3	3	2										3			
CO5	3	2	2										3			

Text Books		
Sl. No.	**Author/s**	**Title, Publisher, Edition, Year, ISBN**
1.	Rattan S. S.	Theory of Machines, Tata McGraw-Hill Publishing, 52th Edition, 2019, ISBN-13: 978-9353166281
2.	Joseph Edward Shigley and John Joseph Uicker	Theory of Machines & Mechanisms, Oxford University Press, 4th Edition. 2014, ISBN-13: 978-0199454167
3.	R S Khurmi and J K Gupta	Theory of Machines, S Chand, 14th Revised Edition, 2020, ISBN-13: 978-8121925242

Reference Books		
Sl. No.	**Author/s**	**Title, Publisher, Edition, Year, ISBN**
1.	Dr. R. K. Bansal	Theory of Machines, Laxmi Publications (P) Ltd, 2016, ISBN-13: 978-8131808054
2.	Robert William Angus.	Theory of Machines, Sudha Publications, 5th Edition, 2022, ISBN-13: 978-9355280619

Value Engineering (S4IME04)

(Engineering Science Course)

Contact Hours/ Week	:	3(L)+0 (T)+0(P)	Credits:	3.0
Total Lecture Hours	:	39	CIE Marks:	50
Total Practical Hours	:	--	SEE Marks:	50

Unit-I
Introduction: Value engineering concepts, advantages, applications, problem recognition, and role in productivity, criteria for comparison, element of choice. Organization: Level of value engineering in the organization, size, and skill of VE staff, small plant, VE activity, unique and quantitative evaluation of ideas.
8- Hours
Unit-II
Value Engineering Job Plan: Introduction, orientation, information phase, speculation phase, analysis phase. Selection and Evaluation of value engineering Projects, Project selection, methods selection, value standards, and application of value engineering methodology
8- Hours

Unit-III
Analysis Function: Anatomy of the function, use esteem and exchange values, basic vs. secondary vs. unnecessary functions. The approach of function, Evaluation of function, determining function, classifying function, evaluation of costs, evaluation of worth, determining worth, and evaluation of value
8- Hours
Unit-IV
Value Engineering Techniques: Selecting products and operations for value engineering action, value engineering programs, determining and evaluating function(s), assigning rupee equivalents, developing alternate means to required functions, decision-making for optimum alternatives, use of decision matrix, queuing theory, and Monte Carlo method make or buy, measuring profits, reporting results, Follow up, Use of advanced techniques like Function Analysis System.
7- Hours
Unit-V
Versatility of Value Engineering: Value engineering operation in maintenance and repair activities, value engineering in non-hardware projects. Initiating a value engineering program Introduction, training plan, and career development for value engineering specialties. Fast diagramming: cost models, life cycle costs.
8- Hours

Course Outcomes:

Upon completion of this course the student will be able to:

CO1	:	Discuss the concepts of value engineering, and identify the advantages and applications.
CO2	:	Discuss various phases of value engineering, Analyze the function, approach of function, and evaluation of function, Determine the worth and value
CO3	:	Discuss queuing theory
CO4	:	Appraise the value engineering operation in maintenance and repair activities

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3															3
CO2	3	3	2													3
CO3	3															3
CO4	3	2														3

Text Books		
Sl No.	**Author/s**	**Title, Publisher, Edition, Year, ISBN**
1.	Anil Kumar Mukhopadhyaya	Value Engineering: Concepts Techniques and applications, SAGE Publications, 1st Edition, 2003, ISBN-13: 978-0761997894

Reference Books		
Sl No.	**Author/s**	**Title, Publisher, Edition, Year, ISBN**
1.	Alphonse Dell'Isola	Value Engineering: Practical Applications for Design, Construction, Maintenance & Operations, R S Means Co., 1st Edition, 1997, ISBN-13: 978-0876294635
2.	Richard Park	Value Engineering: A Plan for Invention, CRC press, 1st Edition, 1998, ISBN-13: 978-1574442359
3.	Del L. Younker	Value Engineering analysis and methodology, CRC press, 1st Edition, 2003, ISBN-13: 978-0824706968
4.	Miles, L.D	Techniques of Value Analysis and Engineering, McGraw Hill, 3rd Edition, 2015.

Biology for Engineers (S4CCA01)

Contact Hours/ Week	:	3(L)+0 (T)+0(P)	Credits:	3.0
Total Lecture Hours	:	40	CIE Marks:	50
Total Practical Hours	:	--	SEE Marks:	50

Course objectives:

- To familiarize the students with the basic biological concepts and their engineering applications.
- To enable the students with an understanding of bio-design principles to create novel devices and structures.
- To provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.
- To motivate the students to develop interdisciplinary vision of biological engineering.

Teaching-Learning Process (General Instructions)

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

- Explanation via real life problem, situation modelling, and deliberation of solutions, hands-on sessions, reflective and questioning /inquiry-based teaching.

- Instructions with interactions in classroom lectures (physical/hybrid).
- Use of ICT tools, including YouTube videos, related MOOCs, AR/VR/MR tools.
- Flipped classroom sessions (~10% of the classes).
- Industrial visits, Guests talks and competitions for learning beyond the syllabus.
- Students' participation through audio-video based content creation for the syllabus (as assignments).
- Use of gamification tools (in both physical/hybrid classes) for creative learning outcomes.
- Students' seminars (in solo or group) /oral presentations.

Unit-I

Introduction to Biology: The cell: the basic unit of life, Structure and functions of a cell. The Plant Cell and animal cell, Prokaryotic and Eukaryotic cell, Stem cells and their application. Biomolecules: Properties and functions of Carbohydrates, Nucleic acids, proteins, lipids. Importance of special biomolecules; Enzymes (Classification (with one example each), Properties and functions), vitamins and hormones.

8- Hours

Unit-II

Biomolecules and Their Applications (Qualitative): Carbohydrates (cellulose-based water filters, PHA and PLA as bioplastics), Nucleic acids (DNA Vaccine for Rabies and RNA vaccines for Covid19, Forensics – DNA fingerprinting), Proteins (Proteins as food – whey protein and meat analogs, Plant based proteins), lipids (biodiesel, cleaning agents/ detergents), Enzymes (glucose-oxidase in biosensors, lignolytic enzyme in bio-bleaching).

8- Hours

Unit-III

Human Organ Systems and Bio Designs (Qualitative): Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease). Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye). Heart as a pump system (architecture, electrical signalling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators). Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine). Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems).

8- Hours

Unit-IV

Nature-Bioinspired Materials and Mechanisms (Qualitative): Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swim suits), Kingfisher beak (Bullet train). Human Blood substitutes-hemoglobin-based oxygen carriers (HBOCs) and perflourocarbons (PFCs).

8- Hours

Unit-V

Trends In Bioengineering (Qualitative): Muscular and Skeletal Systems as scaffolds (architecture, mechanisms, bioengineering solutions for muscular dystrophy and osteoporosis), scaffolds and tissue engineering, Bioprinting techniques and materials, 3D printing of ear, bone and skin. 3D printed foods. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis. Self-healing Bioconcrete (based on bacillus spores, calcium lactate nutrients and biomineralization processes) and Bioremediation and Biomining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic).

8- Hours

Course Outcomes:

Upon completion of this course the student will be able to:

CO1	:	Elucidate the basic biological concepts via relevant industrial applications and case studies
CO2	:	Evaluate the principles of design and development, for exploring novel bioengineering projects.
CO3	:	Corroborate the concepts of bio mimetics for specific requirements.
CO4	:	Think critically towards exploring innovative biobased solutions for socially relevant problems.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2													3	
CO2	2	2	3												3	
CO3	2	2	3												3	
CO4	2	2													3	

Suggested Learning Resources:
Books

1. Biology for Engineers, Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao N Publishing, Bengaluru, 2023.
2. Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
3. Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
4. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
5. Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
6. Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
7. Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
8. Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.
9. Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N Geetha A C Udayashankar Lambert Academic Publishing, 2019.
10. 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
11. Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016

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

1. Group Discussion of Case studies.
2. Model Making and seminar/poster presentations.
3. Design of novel device/equipment like Cellulose-based water filters, Filtration system

Advance Technical Training – Python Lab (S4CCA03)

(Ability Enhancement Course)

Contact Hours/ Week	:	0(L)+0 (T)+2(P)	Credits:	1.0
Total Lecture Hours	:	0	CIE Marks:	50
Total Practical Hours	:	26	SEE Marks:	50

1.Introduction to Programming

☐ History, Features, Setting up Path
☐ IDLE/IDE, Data types, Variables

1- Hour

2.Working with IO & Operators

- ☐ Declaration, Input - Output, Operators
- ☐ Arithmetic Operator
- ☐ Relational Operators
- ☐ Assignment Operators
- ☐ Logical Operators
- ☐ Membership Operators
- ☐ Identity Operators
- ☐ Bitwise Operators
- ☐ Multi- line Statements
- ☐ Comment Line

1.5- Hours

3. Decision Making

- ☐ Need of Decision Making, Syntax
- ☐ If
- ☐ If-else
- ☐ Nested if
- ☐ If-else if

1- Hour

4. Iterations

- ☐ For, While, Nested loop, Break, continue
- ☐ Number Based Problems
- ☐ Number Crunching Problems

5.5- Hours

5. Patterns

- ☐ Pattern Programming

1.5- Hours

6. Function

- ☐ Syntax of Function
- ☐ With Argument With return type
- ☐ With Argument without return type
- ☐ Without Argument with return type
- ☐ Without Argument without return type
- ☐ Predefined, User defined, Anonymous Functions
- ☐ Scope of variables

1- Hour

7. String

- ☐ Creating a String
- ☐ Memory Allocation
- ☐ Built Functions in String

1- Hour

8. List

☐ Creating List
☐ Accessing Elements in List
☐ Negative Accessing Elements in List
☐ Slicing in List
☐ Built Functions in List

1- Hour

9. Arrays

- Arrays - 1D,2D

1.5- Hours

10. Tuple

- Creating Tuples
- Immutable
- Accessing values in Tuple
- Slicing in Tuple
- Built Functions in List

1- Hour

11. Dictionary

- Creating a Dictionary with Integer Key, Mixed Key, dict(), Pair element, nested Dictionary
- Adding Element to Dictionary
- Accessing Element in Dictionary
- Built Functions in Dictionary

1- Hour

12. File Handling

- Open & Close File
- Read & Write operations

1- Hour

13. OOPS

- Classes & Objects
- Inheritance
- Encapsulation
- Polymorphism
- Method Overloading
- Method Over Riding
- Data Abstraction
- Methods

6- Hours

14. Exceptional Handling
• Try Block • Except • Finally
1.5- Hours
15. Hashing and Hash Table
1.5- Hours
16. Arrays & Data Structures
• List using Array – Operations • List using Linked List – Introduction • List using Linked List – Operations • List using Array versus List using Linked List
6- Hours
17. Stack
• Stack Operations • Stack Applications
3- Hours

Course Outcomes:

Upon completion of this course the student will be able to:

CO1	:	Design and develop solutions for particular programming problems using the fundamental concepts of Python Programming.
CO2	:	Implement different data structures like Arrays, Dictionary, Queues, Lists and Tuples.
CO3	:	Implement File operation like Open, close reading & writing the file
CO4	:	Understand the Object Oriented Concepts like Classes, Objects, Inheritance and Polymorphism

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3										3			
CO2	3	3											3			
CO3	3	3											3			
CO4	3	3											3			

CIE(Continuous Internal Evaluation): 50 Marks

☐ Students are evaluated every week for 35 marks.

☐ Evaluation includes Problem Analysis, Program Writing and Executir Programs in the Lab (10 + 15 + 10).

☐ Two tests are conducted for 15 marks each.

☐ Marks distribution (50 Marks) = Average of weekly assessments (35 Marks) + Average of two tests (15 Marks)

SEE(Semester End Examination): 50 Marks

☐ There are 20 programs in the list divided into two parts A & B, students have to pick
one program each from the Part A & Part B

☐ Both the parts carry equal weightage.

☐ The evaluation includes Program Write-up + Analysis + Program Execution + Viva (10
+ 10 + 20 + 10 = 50 Marks)

☐ Change of the experiment is allowed only once in the first half an

Universal Human Values (SHS02)

Contact Hours/ Week	:	1(L)+0 (T)+0(P)	Credits:	1.0
Total Lecture Hours	:	15	CIE Marks:	50
Total Practical Hours	:	--	SEE Marks:	50

Pre-requisites: Universal Human Values (conducted during induction programme)

Course objectives:

- Understanding of self-exploration about themselves (human beings), family, society and nature/existence.
- Appreciating the harmony in the human being, family, society and nature/existence
- Strengthening holistic perception of co-existence and mutual fulfilment among the four orders of nature.

Unit-I

Understanding Harmony in the Human Being - Harmony in self: Understanding human being as a co-existence of the sentient 'I' and the material 'Body'; Understanding the needs of Self ('I') and 'Body' - happiness and physical facility; Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer); Understanding the characteristics and activities of 'I' and harmony in 'I'.

3- Hours

Unit-II
Understanding Harmony in self and body: Understanding the harmony of 'I' with the Body: Sanyam and Health, correct appraisal of Physical needs, meaning of Prosperity in detail, Include discussions to differentiate between i) Prosperity and accumulation. ii) Ensuring health vs dealing with disease.
3- Hours
Unit-III
Understanding Harmony in the Family - Harmony in Human-Human Relationship: Understanding values in human - human relationship, meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness, Trust and Respect as the foundational values of relationship; Understanding the meaning of Trust, Difference between intention and competence; Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship.
3- Hours
Unit-IV
Understanding Harmony in Society and Nature: Understanding the harmony in the society (society being an extension of family)- Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals. Understanding the harmony in the Nature; Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature.
3- Hours
Unit-V
Understanding Harmony in all levels of Existence: Understanding Existence as Co-existence of mutually interacting units in all-pervasive space; Holistic perception of harmony at all levels of existence. Include discussions on-human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.
3- Hours

Course Outcomes:		
Upon completion of this course the student will be able to:		
CO1	:	Become more aware of themselves, and their surroundings (family, society, nature)
CO2	:	Become more responsible in life, and value human relationships and human society
CO3	:	Have better critical ability in handling problems and in finding sustainable solutions

CO – PO Mapping:															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1						2		3						3		
CO2						2		3						3		
CO3						2		3						3		

Text Books

Sl No.	Author/s	Title, Publisher, Edition, Year, ISBN
1.	Gaur, R.R. & Sangal R	Foundation Course in Human Values and Professional Ethics; Presenting a universal approach to value education through self-exploration, Excel Books, Bangalore, 2016, ISBN: 978-8-174-46781-2

Reference Books

Sl No.	Author/s	Title, Publisher, Edition, Year, ISBN
1.	Tripathi A N	Human Values, New Age International Publisher, 2003, ISBN: 81-224-1426-5

Evaluation Pattern:

Two Tests of 25 marks each and 45 minutes duration
SEE for 50 marks and examination duration is 90 minutes

Description	*Schedule*	*Duration (min)*	*Conducted for*	*Reduced to*
Test-1	7th Week	45	25 marks	25 marks
Test-2	14th Week	45	25 marks	25 marks
CIE			50 marks	50 marks
SEE		90	50 marks	50 marks
Total			**100 marks**	**100 marks**

Question Paper Pattern

CIE: *CIE pattern may be hybrid type with MCQs and descriptive questions.*

- *10 Marks MCQs*
- *3 descriptive questions of 5 marks each*
- *All the questions are compulsory*

SEE: *SEE pattern may also be hybrid type with MCQs and descriptive questions.*

- *20 Marks MCQs*
- *1 descriptive question of 10 marks from each of the units (total 3 questions)*

or

2 questions of 5 marks from each of the units (total 6 questions)

- *All the questions are compulsory*