GOVERNMENT COLLEGE OF ENGINEERING, JALGAON

Department of Mechanical Engineering

Scheme for Semester III B. Tech. (Mechanical Engineering with Multidisciplinary Minor) with effect from academic year 2023-24 (As per NEP 2020)

Course Code	Proposed Course Domain	Category	Teaching Scheme				Evaluation Scheme						
							Theory			Practical		Total	Credit
			L	T	P	Total	MSE	ISA	ESE	ICA	ESE		
ME201N	Strength of Materials	PCC	2	…	…	2	30	10	60	…	…	100	2
ME202N	Engg. Thermodynamics	PCC	3	…	…	3	30	10	60	…	…	100	3
ME203N	Fluid Mechanics and Fluid Power Engg	PCC	3	…	…	3	30	10	60	…	…	100	3
ME204N	Engg. Thermodynamics Lab	PCC	…	…	2	2	…	…	…	30	20	50	1
ME205N	Fluid Mechanics and Fluid Power Engg. Lab	PCC	…	…	2	2	…	…	…	30	20	50	1
ME206N	Community Engineering Project	CEP (ELC)	...	…	2	2	...	...	...	30	20	50	2
XXMYYYN	Multi Disciplinary Minor-I	MDM-I (MDC)	2	…	…	2	30	10	60	…	…	100	2
ME207N	Open Elective-I	OE-I	3	1	…	4	30	10	60	…	…	100	4
SH201N	Project and Financial Management	HSSM (EEMC)	2	…	…	2	30	10	60	…	…	100	2
SH203N	Environmental Science	VEC	2	…	…	2	30	20	…	…	…	50	2
Total			**17**	**1**	**6**	**24**	**210**	**80**	**360**	**90**	**60**	**800**	**22**

L : Lecture P: Practical MSE: Mid Semester Examination

ISA :Internal Sessional Assessment ESE: End Semester Examination ICA : Internal Continuous Assessment

Open Elective-I

X. Total Quality Management

Y. Reliability Engineering

ME201N STRENGTH OF MATERIALS

Teaching Scheme : 02 L + 00 T; Total: 02 hours/week **Credits** : 02
Evaluation Scheme : 10 ISA + 30 MSE + 60 ESE **Total Marks** : 100
ESE Duration : 3 Hrs.

COURSE DESCRIPTION: -

This course includes fundamentals of stress-strain and their relation, various forms of stresses, concept of Shear Force Diagram (SFD) and Bending Moment Diagram (BMD), simple bending & shear stresses in beam its stress distribution, basics for column & struts, principle stresses, strain energy.

DESIRABLEAWARENESS/SKILLS:

This course requires sound knowledge of mathematics, physics and engineering mechanics.

COURSE OUTCOMES: -

After completing the course, students will be able to

1) Apply concepts of stress and strain to solve the problems.
2) Compute Shear Force and Bending Moment for determinate beams.
3) Apply the knowledge of bending and shear concept to determine various stresses
4) Explain theory of column failure with different support conditions and develop numerical ability to solve numerical problems.
5) Apply knowledge of strain energy to solve numerical problems.

Relevance of Cos and Pos and strength of co-relation

CO	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	-	3	3	3	-	3	-	-	-	-	-	-	-	3
2	-	3	2	2	-	2	-	-	-	-	-	-	-	-
3	-	2	3	3	-	3	-	-	-	-	-	3	-	-
4	-	3	2	3	-	2	-	-	-	-	3	-	-	-

1- Weakly correlated **2-Moderately correlated** **3-Strongly correlated**

COURSE CONTENT:-

Unit 1: Simple Stresses and Strains (8Hrs)

Introduction to properties of engineering materials stresses and Strains:-definition–stress, strain, Hooke's law, elastic limit, Stress-strain diagram for ductile and brittle material.

stress system:- Uni-axial, Bi-axial and Tri-axial stresses, tensile & compressive stresses, shear stress, Principle of superposition, stresses and strains in composite bars. Bars of varying cross sections. Elastic constants: - modulus of elasticity, modulus of rigidity, bulk modulus, Poisson's ratio, relation between elastic constants, yield stress, ultimate stress, factor of safety, state of simple shear.

Unit 2: Shear Force and Bending Moment Diagrams for Beams (6Hrs)

Shear force and bending moment in determinate beams due to concentrated loads, uniformly distributed load (U.D.L.) uniformly varying load (U.V.L.) and couples, Relation between S.F. and B.M. Determination of position of point of contra flexure and maximum bending moment.

Unit 3: Bending Stresses in Beams (8Hrs)

Theory of simple bending, Assumptions, Flexural formula, Moment of resistance and Section modulus. Determination of bending stresses and bending stress distribution diagram for the beams with commonly used sections like rectangular, square, circular, symmetrical and unsymmetrical I, T- sections etc.

Shear Stresses in Beams: Shear stress in beams subjected to bending, Shear stress distribution formula, Maximum and average shear stress, Determination of shear stresses and shear stress distribution diagram for beams with commonly used sections like circular & symmetrical sections etc.

Unit4: Direct and Bending Stresses in Columns (8Hrs)

Direct and Bending stresses in column due to eccentric loading, Condition for no tension. **Columns and Struts: -** buckling load, types of end conditions for column, Euler's theory of column.

Principal Stresses and Strain Energy:-Principal planes and principal stresses, Maximum shear stress, principal planes, planes of maximum shear (2D cases only).

Strain Energy: - Strain energy, Proof resilience, Modulus of resilience, Strain energy in a uniform bar due to gradual load.

Text Books:

1. Strength of Materials, S.Ramamurtham & R.Narayanan, Dhanpat Rai Publishing Company (P) Limited.
2. Strength of Materials, I.B.Prasad, Khanna publication.
3. Strength of Material, R.K.Bansal, Laxmi Publication.
4. Strength of Material, B.C.Punmia, Vol.IStandard publisher and distributors.
5. Strength of Material, R.K.Rajput.Chand Publication.

Reference Book:

1. Mechanics of Materials, Gere.JamesM. &S.Timoshenko, IndianReprint, CBS Publisher & Distributor, New Delhi.
2. Mechanics of Structure, Dr. H. J. Shah and S. B. Junnarkar, Charter Publication House, ANAND.
3. Mechanics of Materials, by Beer, Johnston and De Wolf, Tata McGraw Hill Publication,New Delhi.
4. Strength of Materials, Ferdinand BeerandJr., E.Russell Johnston, Tata McGraw Hill, NewDelhi.

ME202N ENGINEERING THERMODYNAMICS

Teaching Scheme : 03 L + 00 T; Total: 03 hours/week **Credits** : 03
Evaluation Scheme : 10 ISA + 30 MSE + 60 ESE **Total Marks** : 100
ESE Duration : 3 Hrs.

Course Description

The course aims at imparting knowledge of basic Thermodynamics. course includes concept of system, surrounding and boundary, cycle, processes, Zeroth law, First law and its application, limitation of first law, statement of Second law, Carnot cycle, Clausius theorem, Ideal gas processes with their presentation on P- V & T-S plane, and properties of steam.

Desirable awareness / skills

Fundamental knowledge of Physics, Chemistry and Mathematics.

Course Outcomes

On the successful completion of this course; student shall be able to -

1. Apply basic laws of thermodynamics in analysis and design of thermodynamic cycles.
2. Elaborate different parameter of boiler performance and properties of steam.
3. Explain different types of condensers.
4. Analyze steam nozzle and diffusers.
5. Describe reciprocating and rotary compressors with performance calculations.

RELEVANCE OF COURSE OUTCOMES (COs) WITH POs AND PSOs (WITH STRENGTH OF CO-RELATION)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2								1			1	1	
2	2	1		1	1								1	1	
3	2	3	3										1	1	
4	1	1		1	1								1	1	
5	1	1		1									1	1	

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Course Content

Laws of Thermodynamics (8 Hrs)

Introduction of thermodynamics, Zeroth law of thermodynamics, macro and microscopic approach, state, process and thermodynamic cycles, First law of thermodynamics, Joules experiment, steady flow energy equation and its application to different devices. PMM I, concept of reversibility and irreversibility, thermal reservoir, heat engine & its efficiency, refrigerator and heat pump, coefficient of performance, statements of Second law, PMM-II, Carnot cycle, Carnot theorem, entropy – introduction, entropy as property.

Properties of Steam and Boilers Thermodynamics (8 Hrs)

Pure substance, phases of pure substances, sensible heat and latent heat of steam, use of steam table. Measurement of dryness fraction by using separating and throttling calorimeter, vapour processes sketch on p-v, t-s, h-s diagrams .classification and selection of boilers, modern boilers, boiler performance - equivalent evaporation, boiler efficiency, heat balance for a boiler, boiler draught.

Vapour Power Cycle and Steam Condenser (8 Hrs)

Steam power plant layout, Rankine cycle, analysis of Rankine cycle for work ratio, efficiency, power output, specific steam consumption, condenser, classification of condenser, necessity of condenser, condenser efficiency, vacuum efficiency, air leakage and its effect on condenser performance.

Steam Nozzle (8 Hrs)

Types of nozzles and diffusers, one dimensional steady isentropic flow through nozzles and diffusers, critical pressure ratio, maximum discharge, choked flow, effect of variation in back pressure on nozzle characteristics, effect of friction and nozzle efficiency.

Air compressors: **(8 Hrs)**

Reciprocating air compressor : introduction, use of compressed air, terminology used in compressor, classification of compressors ,construction and working of single stage compressor, thermodynamic analysis of reciprocating air compressor without clearance volume, isothermal efficiency, volumetric efficiency, actual indicator diagram. Rotary air compressor : introduction, classification of rotary compressors; construction, working and application of roots blower, construction, working and application of vane type compressor.

Text Books

1. Power Plant Engineering, P K Nag, 4th edition, Tata McGraw Hill, 2014.
2. Thermal Engineering, R. K. Rajput, 9th edition, Laxmi Publication New Delhi, 2013.
3. Engineering Thermodynamics, P. K. Nag, 5th edition, Tata McGraw Hill, 2013.

Reference Books

1. Fundamentals of classical thermodynamics, G J Van Wylen, Richard E Sonntag; 6 th edition, Wiley publication 2013.
2. Engineering thermodynamics, Y V C Rao, 4th edition, Universities Press 2008.
3. Engineering thermodynamics, J B Jones and R E Dugan, 2nd edition, PHI, publication 2009.
4. Basic Thermodynamics by Dr. Ganesan, 4th edition, Tata McGraw Hill,2018.

5. Thermodynamics: an Engineering Approach, Y. A. Cengel and M A Boles, 7th Edition Tata Mc Graw Hill, 2011.

6. Applied Thermodynamics for Engineering Technologists, T. D. Eastop and Mc Conkey, 5th edition, Pearson Education India, Reprint 2013.

7. Power Plant Technology, M. M. El-Wakil, 1st edition, Tata McGraw Hill, 2011.

8. Steam & Gas Turbines & Power Plant Engineering, R. Yadav, 7th edition, Central Publishing House, Allahabad, 2011.

9. Course in Thermal Engineering, C. P. Kothandaraman, Domkundwar, Domkundwar S, Dhanpat Rai & Company (P) Limited, reprint, 2016.

ME203N FLUID MECHANICS AND FLUID POWER ENGINEERING

Teaching Scheme : 03 L + 00 T; Total: 03 hours/week **Credits** : 03
Evaluation Scheme : 10 ISA + 30 MSE + 60 ESE **Total Marks** : 100
ESE Duration : 3 Hrs.

COURSE DESCRIPTION

The students learning this course will understand the basic concepts of hydrostatics, buoyancy and flotation, kinematics and dynamics of fluid motion.

DESIRABLE AWARENESS / SKILLS

Fundamental knowledge of mathematics and calculus.
Fundamental knowledge of physics and chemistry and thermodynamics.

COURSE OUTCOMES

On the successful completion of this course; student shall be able to -

1. Articulate the fundamental properties of fluid.
2. Understand the concept of hydrostatics, buoyancy and flotation for identification stability of bodies in submerged and floating conditions.
3. Distinguish various types of fluid flows and flow measuring devices.
4. Evaluate and major and minor losses associated with pipe flow in piping networks and apply the knowledge to minimize the losses in pipes.
5. Analyze the working of centrifugal and reciprocating pumps.

RELEVANCE OF COURSE OUTCOMES (COs) WITH POs AND PSOs (WITH STRENGTH OF CO-RELATION)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-
2	3	1	1	-	-	-	-	-	-	-	-	-	2	-	-
3	3	2	3	-	-	-	-	-	-	-	-	-	2	-	-
4	3	1	2	-	-	-	-	-	-	-	-	-	2	-	-

1-Weakly correlated **2 – Moderately correlated** **3 – Strongly correlated**

COURSE CONTENT

Fundamentals of Fluid Mechanics **(8Hrs)**

Fluid Properties Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, surface tension and capillarity, concept of continuum, rheological diagram.

Hydrostatics , Buoyancy and Flotation **(8Hrs)**

Pascal's law, hydrostatic law, total pressure and centre of pressure for vertical, horizontal inclined and curved surface, Manometers, buoyancy and flotation, concept of Metacentric height and equilibrium of floating and submerged bodies.

Fluid Kinematics & Fluid Dynamics **(8Hrs)**

Eulerian and Langragian approach of fluid flow, types of flow, Continuity equation Velocity and Acceleration of fluid particles, Stream function and velocity potential function. stream, path and streak

line , Equation of motion, Integration of Euler's equation as energy equation. Bernoulli's theorem, Application of Bernoulli's theorem such as venture-meter, orifice-meter, pitot tube, Derivation of momentum equation, Applications of momentum equation. (No numerical treatment on stream function and velocity potential function)

Flow through Pipes **(8Hrs)**

HGL,TEL , Energy losses through pipe-major and minor losses, Darcy-Weisbach equation, pipes in series, pipes in parallel and concept of equivalent pipe, Moody's diagram, Siphons, transmission of power through pipes. Water hammer phenomenon.

Centrifugal and Reciprocating Pump **(8Hrs)**

Introduction to main parts of centrifugal pump, working & construction of centrifugal pump, types of impellers, types of casings, priming. Work done on centrifugal pump, various heads and efficiencies of centrifugal pump, minimum starting speed of a centrifugal pump, multistage centrifugal pump, principles of similarity applied to centrifugal pump. Specific speed, NPSH, cavitations in pumps. Introduction to main parts of Reciprocating pump, construction & working of Reciprocating pump, classification of Reciprocating pump, slip of reciprocating pump, air vessels. (No numerical on Reciprocating pump)

Text books

1. Fluid Mechanics, Dr. R.K. Bansal- 9 th edition, Laxmi Publication (P) Ltd. New Delhi,2014.
2.Hydraulics and Fluid Mechanics, Modi P. N. and Seth S. M, 19th edition-Standard Book House, 2012.
3.Fluid Mechanics, Cengel and Cimbla, 3 rd edition, TATA McGraw-Hill,2019.
4.Fluid Mechanics, Frank M White, 7 th edition, TATA McGraw-Hill,2011.

Reference Books

1. Fluid Mechanics, Kundu, Cohen, Dowling-6 th edition- Elsevier India,2000.
2. Fluid Mechanics, Chaim Gutfinger, David Pnueli-1 st edition,Cambridge University press,1997.
3. Introduction to Fluid Mechanics, Edward Shaughnessy, Ira Katz James Schaffer-1st edition, OXFORD University Press,2003.
4. Fundamentals of Fluid Mechanics- Munson, Okiishi, Huebsch, Rothmayer 7th edition, John Wiley & Sons Inc, 2004.

ME204N ENGINEERING THERMODYNAMICS LAB

Teaching Scheme : 02 P; Total: 02 hours/week **Credits** : 01
Evaluation Scheme : 30 ICA + 20 ESE **Total Marks** : 50

COURSE DESCRIPTION

understanding of basic principles, working of different components of steam boiler and boiler mountings, boiler accessories, nozzles and diffusers, steam condensers, air compressors, apply knowledge of thermodynamics in various industries as required.

DESIRABLE AWARENESS / SKILLS

Concepts and theory of the course ME202N Engineering Thermodynamics

COURSE OUTCOMES

On successful completion of this course, students will be able to-

1. Describe various types of boilers with its mountings and accessories.
2. Explain construction and working of condensers.
3. Analyze the working of nozzles.

RELEVANCE OF COURSE OUTCOMES (COs) WITH POs AND PSOs (WITH STRENGTH OF CO-RELATION)

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	1		1	1								**1**	**1**	
2	2	1		1	1								**1**	**1**	
3	2	2	3		1								**1**	**1**	
4	1	2		1	1								**1**	**1**	
5	1	2			1								**1**	**1**	

1-Weakly correlated **2 – Moderately correlated** **3 – Strongly correlated**

COURSE CONTENT

Minimum six experiments and five assignments shall be performed to cover entire curriculum of course. The list given below is just a guideline.

1. Demonstration of Babcock and Wilcox boiler.(using model)
2. Demonstration of Cochran and Lancashire boiler.(using model)
3. Demonstration of boiler and boiler mountings. (Using virtual lab)
4. Demonstration of boiler accessories .(Using virtual lab)
5. Visit to thermal power plant.
6. Demonstration of steam condensers .(Using virtual lab)
7. Demonstration of boiler draught.(Using virtual lab)
8. Demonstration of nozzles.(Using virtual lab)

Evaluation Methodology:

ICA – Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format.

ESE – Oral will be based on content of syllabus and practical.

ME205N FLUID MECHANICS AND FLUID POWER ENGINEERING LAB

Teaching Scheme : 02 P; Total: 02 hours/week **Credits** : 01
Evaluation Scheme : 30 ICA + 20 ESE **Total Marks** : 50

COURSE DESCRIPTION

This course deal with the practical exposure to application of Bernoulli's equations, metacentric height, flow through pipes.

DESIRABLE AWARENESS / SKILLS

Concepts and theory of the course ME203N Fluid Mechanics and Fluid Power Engg

COURSE OUTCOMES

On the successful completion of this course; student shall be able to

1. Identify the dynamic viscosity of fluid.
2. Compare various types of Manometers and identify their practical applications.
3. Examine the coefficient of discharge of venturimeter and orifice meter.
4. Evaluate major and minor losses associated in flow through pipes.
5. Verify the Bernoulli's theorem.

RELEVANCE OF COURSE OUTCOMES (COs) WITH POs AND PSOs (WITH STRENGTH OF CO-RELATION)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	-	-	-	-	-	-	-	-	-	2	-	-
2	3	2	1	-	-	-	-	-	-	-	-	-	2	-	-
3	3	2	2	-	-	-	-	-	-	-	-	-	2	-	-
4	3	2	3	-	-	-	-	-	-	-	-	-	2	-	-

1-Weakly correlated **2 – Moderately correlated** **3 – Strongly correlated**

COURSE CONTENT

Minimum eight experiments shall be performed to cover entire curriculum of course ME203N.
The list of experiments provided below is just a guideline.

List of Experiments

1. Determination of viscosity of liquids and its variation with temperature.
2. Study of different manometers.
3. Determination of Metacentric height of a floating body.
4. Determination of coefficient of discharge for Orifice meter.
5. Determination of coefficient of discharge for venturimeter.
6. Determination of minor losses due to pipe fittings.
7. Determination of Major losses through pipes.
8. Experiment on Reynolds apparatus.
9. Verification of Bernoulli's theorem.
10. Experiment on Centrifugal Pump.

Evaluation Methodology:

- **ICA –** It shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using the prescribed internal continuous assessment format.

- **ESE –** It shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners, out of which one examiner shall be external examiner.

ME206N COMMUNITY ENGINEERING PROJECT

Teaching Scheme	**:** 02 P; Total: 02 hours/week	**Credits**	**:** 02
Evaluation Scheme	**:** 30 ICA + 20 ESE	**Total Marks**	**:** 50

COURSE DESCRIPTION

The Community Engineering Project is to provide an excellent opportunity to learner to see understand the conceptual aspects. It is introduced in curriculum to put into practice some of the techniques that have been taught to students in earlier years. It also provides the opportunity to students to demonstrate independence and originality, to plan and organize a large project over a long period. It ensures the satisfaction of the need to establish a direct link between the techniques they learnt and productivity. Thus it should reduce the gap between the world of work and the world of study.

DESIRABLEAWARENESS/SKILLS

Knowledge of concepts, principles and techniques studied in all earlier courses.

COURSE OUTCOMES

On successful completion of this course students shall

1. Able to apply the knowledge and skills previously gain to practice.
2. Take appropriate decision w.r.t various parameters related to production of a system or subsystem.
3. Demonstrate the leadership quality along with ability to work in a group.
4. Prove the ability to present the findings in a written report for oral presentation.

CONTENT:-

The Community Based Community Engineering Projectshall be carried out in-house i.e. in the department's laboratories/centers by a Group 2 – 4 students. In any case the group shall not consist of more than four students. The project outline on the selected topic should be submitted to the course coordinator for approval within one week from the commencement of the term. - it may involve fabrication, design or investigation of a technical problem that may take design, experimental or analytical character or combine element of these areas. The project work shall involve sufficient work so that students get acquainted with different aspects of fabrication, design or analysis. Each student is required to maintain separate log book for documenting various activities carried under it. Maximum three Community Engineering Project groups shall be assigned to one teaching staff.

- Before the end of semester, student shall deliver a presentation and submit the project report (paper bound copy) in following format: Size of report shall be of minimum 35 pages.
- Student should preferably refer minimum five reference books/magazines/standard research papers

Format of report

1. Introduction
2. Literature survey
3. Theory(Implementation,Methodology,Applications,Advantages,Disadvantages.etc)
4. Future scope
5. Conclusion

Assessment of Community Engineering Project

Name of the Project**:**
Name of the Guide:
Assessment Table:-

Sr. No.	Exam Seat No.	Name of Student	Project Selection & documentation	Design /Simulation/ optimization and result	Presentation	Total	Remark
1			10	20	20	50	

Evaluation Methodology:

- **ICA –** It shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using the prescribed internal continuous assessment format.

- **ESE –** It shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners, out of which one examiner shall be external examiner.

ME207N- Open Elective-II
X. TOTAL QUALITY MANAGEMENT

Teaching Scheme: 03 L + 01 T**; Total:** 04 hours/week **Credit : 04**
Evaluation Scheme: 30 MSE+ 10 ISA + 60 ESE **Total Marks: 100**
Duration of ESE: 03Hrs

COURSE DESCRIPTION

The course describes in depth knowledge to students about customer satisfaction techniques , tools for quality improvement and Quality system standards.

DESIRABLE AWARENESS / SKILLS

Fundamental knowledge of Manufacturing.
Fundamental knowledge of Management.

COURSE OUTCOMES

On the successful completion of this course; student shall be able to -

1. Enumerate the salient contributions of Quality Gurus like Deming, Juran and Crosby.
2. Identify general barriers in implementing TQM.
3. Employ concepts like customer focus, employee focus and their involvement, continuous process improvement and Supplier Management.
4. Exemplify students on the basic and new seven management tools, Quality concepts like Six sigma, Failure mode effect analysis.
5. Coordinate industrial applications of Quality function deployment, taguchi quality concepts and TPM.
6. Develop exposure to students on various quality systems like ISO and its standards.

RELEVANCE OF COS /POS AND STRENGTH OF CO-RELATION:

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	1			1		3					1		1		1
CO 2		2												2	
CO 3			2		1										1
CO 4						1			1				1		
CO 5	1			3										1	
CO 6	1			2					1				1		

1-Weakly correlated 2–Moderately correlated 3–Strongly correlated

Introduction **(8Hrs)**

Need for quality , Evolution of quality, Definitions of quality, Dimensions of product and service quality, Basic concepts of TQM, TQM Framework, Contributions of Deming, Juran and Crosby, Barriers to TQM Quality statements, Customer focus, Customer orientation , Customer satisfaction, Customer complaints, Customer retention, Costs of quality.

TQM Principles **(8Hrs)**

Leadership ,Strategic quality planning, Quality Councils , Employee involvement , Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal ,Continuous process improvement , PDCA cycle, 5S, Kaizen ,Supplier partnership - Partnering, Supplier selection, Supplier Rating.

TQM Tools and Techniques I **(8Hrs)**

The seven traditional tools of quality , New management tools, Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT ,Bench marking -Reason to bench mark, Bench marking process , FMEA : Stages, Types.

TQM Tools and Techniques II **(8Hrs)**

Control Charts , Process Capability , Quality Function Development (QFD) - Taguchi quality loss function ,TPM : Concepts, improvement needs , Performance measures.

Quality Systems **(8Hrs)**

Need for ISO 9000-ISO 9001-2008, Quality System, Elements, Documentation , Quality Auditing , QS9000-ISO14000, Concepts, Requirements and Benefits, TQM Implementation in manufacturing and service sectors.

TEXTBOOKS:

Dale H.Besterfiled, Total quality Management, Pearson Education Asia, Third Edition, Indian Reprint 2006.

REFERENCEBOOKS:

1. James R. Evans and William M. Lindsay , The Management and Control of Quality ,8th Edition, First Indian Edition, Cengage Learning, 2012.
2. Suganthi. L and Anand Samuel, Total Quality Management , Prentice Hall (India) Pvt. Ltd., 2006.
3. Janakiraman Band Gopal.R.K., Total Quality Management–Text and Case ,Prentice Hall (India) Pvt. Ltd., 2006.

ME207N- Open Elective-II
Y RELIABILITY ENGINEERING

Teaching Scheme : 03 L + 01 T; Total: 04 hours/week **Credits** : 04
Evaluation Scheme : 10 ISA + 30 MSE + 60 ESE **Total Marks** : 100
ESE Duration : 3 Hrs.

COURSE DESCRIPTION

Focuses on system level reliability modeling approaches. Engineering system reliability modeling and prediction; reliability of programmable devices and human reliability; reliability and risk management of engineering systems.

DESIRABLE AWARENESS / SKILLS

Knowledge of basic industrial engineering and their concepts

COURSE OUTCOMES

Students who pass the course will:

1. Acquire the basics of reliability engineering.
2. Comprehend the basic concepts and methods in maintenance management.
3. Understand the qualitative approaches in reliability engineering and gain the aptitude to apply These approaches.
4. Understand the quantitative approaches in reliability engineering and gain the aptitude to Apply these approaches

RELEVANCE OF COURSE OUTCOMES (COs) WITH POs AND PSOs (WITH STRENGTH OF CO-RELATION)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	1		2								1	1	
2	2	3	2		1								1	1	
3	1	3	1		3								1	2	
4	2	2	1		2								1	2	

1-Weakly correlated **2 – Moderately correlated** **3 – Strongly correlated**

COURSE CONTENT

Chapter 1 **(8Hrs)**

Reliability Engineering: Reliability function, failure rate, Mean time between failures (MTBF), Mean time to failure (MTTF), mortality curve, useful life availability, maintainability, system effectiveness. Introduction to probability distributions. Time to failure distributions: Exponential, normal, Gamma, Weibull; ranking of data, probability plotting techniques, Hazard plotting Concept of Bathtub Hazard Rate curve, Reliability evaluation of two-state device networks-series, parallel, k-out-of-m systems; Standby redundant systems, Reliability evaluation of three-state device networks-series and parallel.

Chapter 2 **(12Hrs)**

Reliability Determination and Prediction: Reliability Determination Methods: Network reduction technique, Path tracing technique, Decomposition technique, Delta-Star method.
Advanced Reliability Evaluation Concepts: Supplementary variables technique, Interference theory, Human reliability, Common cause failures, Fault trees, Failure mode and effect analysis.

Chapter 3 **(8Hrs)**

Reliability Prediction Models: Series and parallel systems - RBD approach - Standby systems - m/n configuration - Application of Baye's theorem - cut and tie set method - Markov analysis - FTA – Limitations

Chapter 4 **(12Hrs)**

Reliability testing: Time acceleration factor, influence of acceleration factor in test planning, application to acceleration test, high temperature operating life acceleration model, temperature humidity bias acceleration model, temperature cycle acceleration model, vibration accelerator model, failure free accelerated test planning. Accelerated reliability growth.
Risk Assessment: Definition and measurement of risk - risk analysis techniques - risk reduction resources - industrial safety and risk assessment

Text Books

1. Introduction to Reliability Engineering, 3rd Edition , James Brenman , Wiley-Blackwell
2. Introduction to Reliability Engineering, E. E. Lewis , Wiley

Reference Books

1. B. Bhadury and S.K. Basu, "Terotechnology: Reliability Engineering and Maintenance Management", Asian Books, New Delhi 2002.

2. A. K. Gupta, "Terotechnology & Reliability Engineering", McMillan Co.

3. A. K. S. Jardine, "Maintenance, Replacement & Reliability", HMSO, London.

4. C.Singh and C.S. Dhillon, "Engineering Relaibility-New Techniques and Applications", John Wiley and Sons, Tata McGraw Hill Publishing Company Limited, New Delhi.

5. L.S.Srinath, "Concepts in Reliability Engineering" Affiliated East West Press.

6. K.C. Kapoor and L.R. Lubersome, "Reliability in Engineering Design" ,Willey

7. C. Singh and C.S. Dhillon, "Engineering Reliability New Techniques and Applications" John Wiley and Sons.

SH201N: PROJECT AND FINANCE MANAGEMENT

Teaching Scheme: L: 02 T: 00 P: 00 **Credit:** 02
Evaluation Scheme:10 ISA+30 MSE +60ESE **Total marks:**100
MSE Duration: 1.5 Hrs. **ESE Duration:** 3.0 Hrs.

COURSE DESCRIPTION:

The course is intended to provide basic understanding of project and financial management to engineering students with the basic and fundamental concept of project and finance. This course introduces the student to selection, appraisal, organization and planning of the project management as well as project scheduling and resource management. Students will study fundamental concept, budget and budgetary control as well as leverage analysis and Working capital management.

COURSE OBJECTIVES:

The course is designed to achieve comprehensive learning outcomes across several key areas. Firstly, it introduces participants to the fundamental principles of project management, emphasizing techniques for project selection and appraisal to ensure alignment with organizational goals. Secondly, it covers project organization and planning strategies, including project scheduling and resource management techniques essential for efficient project execution. Additionally, the course delves into financial management principles, providing insights into leverage analysis and effective working capital management strategies to optimize financial resources within project environments. By integrating these topics, the course aims to equip participants with the knowledge and skills necessary to successfully manage projects while maintaining financial sustainability and achieving strategic objectives.

COURSE OUTCOMES:

On the successful completion of this course student will be able to

1. Apply the basic concept of project management
2. Demonstrate the ability to prepare projects and risk management
3. selection, appraisal, organization and planning of the project
4. assess the budget and budgetary control
5. analyze and evaluate the leverage and working capital management

Course Outcomes (COs) and Program Outcomes (POs) mapping with strength of co-relation

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	-	-	-	-	-	2	-	-	2	3	3	3			3
2	-	-	-	-	-	2	-	-	2	3	3	3			3
3	-	-	-	-	-	2	-	-	2	3	3	3			3
4	-	-	-	-	-	2	-	-	3	3	3	3			3
5						2	-	-	2	3	3	3			3

l- Weakly correlated 2-Moderately correlated 3-Strongly correlated

Contents:

Introduction to Project Management: What is a project? Evolution of project management, Importance of project management, Where is project management appropriate? Project Management Today—An Integrative Approach, Characteristics of projects, Characteristics of project management, Projects in contemporary organizations, Project lifecycle, Job conflict, Labour conflict, Material conflict.

Project Selection and Appraisal: Brain storming and concept evolution, The Strategic Management Process: An Overview, The Need for an Effective Project Portfolio Management System, A Portfolio Management System, Applying a Selection Model, Managing the Portfolio System, Types of appraisals, SWOT analysis, Cash flow analysis, Payback period, and Net present value.

Project Organization and Planning: Project manager, Cross-functional team, Dedicated project organization, Influence project organization, Matrix organization, Advantages and disadvantages of project organizations, Selection of project organization, Work Breakdown Structure (WBS), Integration of project organization and WBS, WBS and responsibility matrix, Risk Management Process, Contingency Planning

Project Scheduling and Resource Management: Gant chart, Milestone chart, Network techniques: PERT and CPM, AON and AOA representation, Three time estimates, Using probability distributions for time computation, Probability of project completion, Time scale version of network, Early start and late start schedules, Resource allocation, Resource loading and leveling, Constrained resource scheduling, Multi-project scheduling and resource allocation, Crashing a project.

Introduction to Financial Management: Finance and other discipline, nature and scope of financial management, Functions of financial management; Objectives of the firm, Sources of finance, long term sources, short term sources; Introduction and analysis of financial statement; Introduction& definition of **budget** and budgetary control, objectives, essential requirements, advantages and disadvantages, types of budgets- cash and flexible.

Leverage Analysis and Working Capital Management: Concepts, Operating leverage, Financial leverage, Combined leverage, Working capital management: Operating cycle, Determinants of working capital, Types of working capital, Importance of working capital, Components of working capital, measuring working capital requirements

Text books:

1. Project Planning and Management with CPM and PERT, Kundan Singh & Dr. M.L. Kansal, HP Hamilton Limited, 2021.
2. Project Management Planning and Control Techniques, Rory Burke, 4th Edition, Wiley India Pvt. Ltd, 2010.
3. Project Management, Planning and Control, Albert Lester, 5th edition, Butterworth-Heinemann, 2007
4. Fundamentals of Financial Management,D.ChandraBose,2nd edition,PHI,2010

5. Project Management: The Managerial Process, Erik Larson , Cliffor Gray, 6th edition,McGraw Hill Education, 2017
6. Project Management, Megha Jain, Sultan Chand&Sons,2020

Reference Book:

1. Projects: Planning, Analysis, Selection, Financing, Implementation,and Review, Prasanna Chandra., 10th edition, McGraw Hill Education, 2022
2. Project Management–The Complete Process(with Case Studies from Renewable Energy Sector), Vishwanath Murthy, Sultan Chand & Sons 2018
3. Project Management, Harvey Maylor, 5th edition, Pearson, 2021
4. Financial Accounting for Management, Paresh Shah, 3rd edition, Oxford University Press, 2019.
5. Financial Management Text, Problems and Cases, Khan& Jain, 8th edition, Tata McGraw Hill, 2018
6. Financial Management, Dr. P. C. Tulsian, 5th edition, S.Chand and company, 2017.
7. Financial Management, Ravi Kishore, 8th edition,Taxmann PublicationsPvt. Ltd, 2020

Evaluation Methodology:

MSE: The Mid-Semester Examination will cover 50% of the syllabus.

ESE: The End-Semester Examination will cover 75% of the remaining syllabus (excluding the MSE syllabus) and 25% of the MSE syllabus.

ISA: The Internal Sessional Assessment (ISA) will be based on any one or a combination of the following components:

1. Declared Test
2. Surprise Test
3. MCQ Test
4. Performance in Tutorials
5. Assignments/Tutorials/Punctuality/Attendance

Additionally, the Course Coordinator may select other components and will announce the method of evaluation at the beginning of the course.

SH203N: ENVIRONMENTAL SCIENCE

Teaching Scheme: L: 02 T: 00 P: 00 **Credits:** 02
Evaluation Scheme: 20 ISA+30 MSE **Total marks:**50
MSE Duration: 1.5 Hrs.

COURSE DESCRIPTION:

This course provides basic scientific knowledge and understanding of how our word works from an environmental perspective. Topics covered include energy resources, basic principles of ecosystem function; biodiversity and its conservation; human population growth; water, air and noise pollution; climate change and green chemistry.

DESIRABLE AWARENESS/SKILLS:

Basic knowledge of environment and importance of its protection

COURSE OBJECTIVES:

The course in Environmental Science is designed to achieve a comprehensive understanding of key environmental issues and principles. It begins by exploring the nature of the environment, including its components and interactions. The course then focuses on natural resources, highlighting their significance, sustainable management, and conservation strategies. Additionally, it delves into the structure and function of ecosystems, emphasizing their resilience and importance in maintaining ecological balance. Furthermore, the course addresses biodiversity and its conservation, emphasizing the preservation of species and habitats. It also covers environmental pollution and the principles of green chemistry, aiming to mitigate pollution and promote sustainable practices. Moreover, it examines social issues related to the environment, such as environmental justice, sustainable development, and the impacts of human activities on natural systems.Overall, the course aims to equip students with the knowledge, critical thinking skills, and practical insights necessary to understand and address contemporary environmental challenges effectively. Through a multidisciplinary approach, students will develop a holistic understanding of environmental science and its implications for sustainable development and human well-being.

COURSE OUTCOMES:

On the successful completion of this course, student shall be able to–

1. Demonstrate the primarily environmental problems.
2. Remember the concept of ecology, their structure and types, different components and their functions.
3. Understand abiotic and biotic factors and their relation to each other.
4. Apply various types of ecosystem, function, components of ecosystem and their stability.
5. Analyze the social issues and apply environmental acts.

RELEVANCE OF PROGRAM OUTCOMES (POS) AND STRENGTH OF CORELATION:

CO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
1	-	-	-	-	-	2	2	-	-	-	-	-
2	-	-	-	-	-	2	2	-	-	-	-	-
3	-	-	-	-	-	2	2	-	-	-	-	-
4	-	-	-	-	-	2	2	-	-	-	-	-
5	-	-	-	-	-	2	2	-	-	-	-	-

1- Weakly Correlated; 2 – Moderately Correlated; 3 - Strongly Correlated

COURSE CONTENT:

Nature of Environment: Definition, scope and importance, multidisciplinary nature, need of public awareness.

Natural Resources:

Renewable and non-renewable resources: Natural resources and associated problems.

Forest resources: Use and over-exploitation, deforestation, case studies, timber extraction, mining, demand and their effects on forest and tribal people

Water resources: use and overutilization of surface and groundwater, floods, drought, conflicts over water, dams-benefits and problems

Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources

Food resources: world food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity

Energy resources: growing energy needs, renewable and non-renewable energy resources Land resources: land as a resource, land degradation, man induced landslides, soil erosion and desertification. Roll of individual in conservation of natural resources.

Ecosystem- Concept, structure and function of ecosystem, producers, consumers and decomposers, energy flow in ecosystem, ecological succession, food chain, food web and ecological pyramid, types of ecosystem-forest, grassland, desert and aquatic.

Biodiversity and Its Conservation- Introduction, definition, genetic, species and ecosystem diversity, biogeographical classification of India, India as mega diversity nation, hot spots of biodiversity, threats to biodiversity, habitat loss, poaching of wildlife, man wildlife conflicts, endangered and endemic species of India, conservation of biodiversity-In-situ and ex-situ conservation of biodiversity.

Environmental Pollution and Green Chemistry- Definition, causes, effects and control measures of –air pollution, water pollution, soil pollution, noise pollution, thermal pollution, nuclear hazards, role of individual in prevention of pollution, concept of green chemistry, principles of green chemistry.

Social Issues and the Environment-Water conservation, rain water harvesting, watershed management, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents, environmental protection act, air (prevention and control of pollution) act, water (prevention and control of pollution) act, wildlife protection act, forest conservation act.

Text books-

1. A Textbook of Environmental Studies for Undergraduate Courses, Erach Bharucha,4th edition, University Press, 2004.
2. A Textbook of Environmental Chemistry, O.D.TyagiandMMehta, 4th edition, Anmol publication, 2016.
3. A Text book of environmental studies for undergraduate courses, Dr.D.K. Asthana, Dr. Meera Asthana, 2nd edition, S. Chand publication, 2012.

References-

1. Green Chemistry Environmental Friendly Alternatives, Rashmi sanghi, M.M. Shrivastawa, 3rd edition, Narosa publication, New Delhi, 2008.
2. Green Chemistry-Theory and Practice, Paul T Anastas and John C. Warner,1st Edition,Oxford University Press, 2000 V.K.
3. Environmental ChemistryA.K.De,3rdEdition,NewAgeInternationalPublishersLtd, New Delhi, 2010.
4. New Trends in Green Chemistry, V.K. Ahluwalia, M.Kidwai,1stEdition, Springer publisher, 2004.
5. Environmental Studies,BennyJoseph,3rdEdition,TataMcGraw-Hill publication, 2017.

Evaluation Methodology:

MSE: The Mid-Semester Examination will cover 50% of the syllabus.

ESE: The End-Semester Examination will cover 75% of the remaining syllabus (excluding the MSE syllabus) and 25% of the MSE syllabus.

ISA: The Internal Sessional Assessment (ISA) will be based on any one or a combination of the following components:

1. Declared Test
2. Surprise Test
3. MCQ Test
4. Performance in Tutorials
5. Assignments/Tutorials/Punctuality/Attendance

Additionally, the Course Coordinator may select other components and will announce the method of evaluation at the beginning of the course.

GOVERNMENT COLLEGE OF ENGINEERING, JALGAON

Department of Mechanical Engineering

Scheme for Semester IV B. Tech. (Mechanical Engineering with Multidisciplinary Minor) with effect from academic year 2023-24 (As per NEP 2020)

Course Code	Proposed Course Domain	Category	Teaching Scheme				Evaluation Scheme						
							Theory			Practical		Total	Credit
			L	T	P	Total	MSE	ISA	ESE	ICA	ESE		
ME251N	Machine Drawing and Computer Graphics	PCC	2	…	…	2	30	10	60	…	…	100	2
ME252N	Kinematics of Machine	PCC	2	…	…	2	30	10	60	…	…	100	2
ME253N	Material Science and Engineering Metallurgy	PCC	2	…	…	2	30	10	60	…	…	100	2
ME254N	Machine Drawing and Computer Graphics Lab	PCC	…	…	4	4	…	…	…	30	20	50	2
ME255N	Kinematics of Machines Lab	PCC	…	…	2	2	…	…	…	30	20	50	1
ME256N	Material Science and Engineering Metallurgy Lab	PCC	…	…	2	2	…	…	…	30	20	50	1
XXMYYYN	Multi Disciplinary Minor-II	MDM-II (MDC)	2	…	…	2	30	10	60	…	…	100	2
ME257N	Open Elective-II	OE-II	2	…	…	2	30	10	60	…	…	100	2
ME258N	Mechanical Engineering Workshop	VSEC	…	…	4	4	…	…	…	50	…	50	2
SH205N	मराठी लेखनकौशल्य)Writing Skills)*	AEC (HSSM)	2	…	…	2	30	20	…	**...**	**...**	50	2
SH202N	Entrepreneur Development	HSSM (EEMC)	2	…	…	2	30	10	60	…	…	100	2
SH204N	Universal human Values -II	VEC (HSSM)	2	…	…	2	30	70	…	…	…	100	2
Total			**16**	**0**	**12**	**28**	**240**	**150**	**360**	**140**	**60**	**950**	**22**

* Students are permitted to earn credits of this course for any other Modern Indian Language (other than English) through MOOC courses, as per credit transfer policy of the institute.

L : Lecture P: Practical MSE: Mid Semester Examination

ISA :Internal Sessional Assessment ESE: End Semester Examination ICA : Internal Continuous Assessment

Open Elective-II

X. Introduction to Robotics

Y. Hybrid Vehicles

Exit Option for UG Diploma in Engg/Tech.: 8 credits in Skill based Vocational Courses/Internship/apprentiship/MiniProject offered during summer vacation after Second Year (As per exit policy approved by Board of Studies (Mechanical Engineering) in its meeting held on 06 July, 2023).

Note: Students having CGPA more than 8.0, can register for additional 18 credits departmental honours courses from semester-V to earn the credits which will lead to honours degree in mechanical engineering/tech program with MDM

ME 251N - MACHINE DRAWING AND COMPUTER GRAPHICS

Teaching Scheme : 02 L + 00 T; Total: 02 hours/week **Credits** : 02
Evaluation Scheme : 10 ISA + 30 MSE + 60 ESE **Total Marks** : 100
ESE Duration : 3 Hrs.

COURSE DESCRIPTION:

This course provides the elementary level knowledge of Machine Drawing and computer CAD software. Course includes introduction to machine drawing, dimensioning, elements of production drawing, and types of fits, surface roughness, and conventional representation of machine components, riveted joints and welded joints. The course also introduces students to study sequences of preparing the assembly drawing and bill of materials and introductory about common commands used for prepare and part, assembly drafting and plotting module based drawings.

DESIRABLE AWARENESS/SKILLS:

Fundamental knowledge of Engineering Graphics, measurements, Basic of Computer software.

COURSE OUTCOMES:

Ability to,

1. take decision about suitable relevance standard parts to be use in application.
2. draft and assigning basic tolerances and GDT on individual component.
3. imagine, recognise the function and draft the assembly and details of mechanical applications.
4. aware various kinds of commands of 3D software for convert 2 D sketch to 3 D model for Individual parts as well as assembly along with other relevant allied features in mechanical applications.

RELEVANCE OF COS /POS AND STRENGTH OF CO-RELATION:

CO/PO	PO 1	PO 2	Po 3	Po 4	Po 5	Po 6	Po 7	Po 8	Po 9	Po 10	Po 11	Po 12
Co 1	2	3	1	-	-	-	-	-	-	-	-	-
Co 2	1	1	-		-	-	-	-	-	-	-	-
Co 3	1	-	2	1	-	-	-	-	-	-	-	-
Co 4	-	-	2	2	3	-	-	-	-	-	-	-
Co 5	1	-	-	2	-	-	-	-	-	-	-	-

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

COURSE CONTENT

Introduction to Machine Drawing

Conventional (Machining) lay symbols of various machining processes, conventional representation of materials and machining symbols, Surface Textures, Roughness values and Roughness Grades, Machining symbols, Standard Conventional Representation on part drawings.

Limits, Fits and Tolerances:

Limit and tolerances:- Conventional Tolerancing, definitions, concerning tolerancing and limit system, unilateral and bi-lateral limits, symbols for tolerances (Descriptive theory questions on these topics are not part of ESE but diagram based questions are part of the theory ESE), terminology for dimensional tolerances, selection of tolerances, representation of dimensional tolerances on drawing, deviations and fits, IT grades, fundamental tolerances and deviation and only its basic calculation for representation on drawings (No numerical), Fits:-Introduction to fits and its classification, of fits and its representation, Hole - base and shaft -basis system of tolerance, grades of holes & relevant appropriate manufacturing processes Geometric Dimensioning Tolerances: Introduction, types, , GDT forms and position, rules for indicating tolerances, symbols of geometrical tolerancing, nomenclature used in GDT, standards followed in industry (Standard and prevalent representation of various forms, position and profiles).

(Exercises shall be based on represent symbolically dimensioning tolerance and geometrical dimensioning tolerance on various mechanical components. No any analytical and descriptive theoretical questions part will be covered in questions of ESE of above).

Representation of standard components

Screw fasteners:-about thread, forms of threads, hands of thread, fine and coarse thread nomenclature all types screw, nut, washer & bolts, conventional representation of Nut, bolt and washer assembly, locking devices, Rivets and riveted joints, various types of keys, different kinds of couplings with empherical relation for purpose of drawing, shaft bearings:- Journal, solid, bush, pedestal and angular bearings ; thrust bearing:- Pivot, foot step bearings, symbolic presentation of all types of gear (no any question shall be covered on tooth profile to be draw), Welding symbols. Pipe Joints: - Expansion joints, stuffing box and glands, piping layouts, conventional Representation of pipe fittings, valves, joints, etc.

(Dimension parameters shall be considered as per empherical calculation. This is necessitate and the initial part of the drawing the sketch of bolt, rivet joint, keys and couplings only and shall be answerable in brief in ESE exam without theory).

Preparation of Detailed drawing from given Assembly drawing & vice-versa:

Reading and imagination of individual parts, understand the importance, reorganization (function) and its orientation, relation in sub- assembly and assembly. Preparation of part list and sequencing. Preparing bill of materials, assembling from given details of parts and detailing the components from given assembly. Making *Assembling and details of following:-*

1. Engine parts: Stuffing box, cross head, Connecting Rod End, crank,; 2. *Machine Tool parts & Accessories:* Single Tool Post, Square Tool Post, Clapper Block, Shaper Tool Head, Lathe Tail Stock, 4. *Jigs and fixtures*: Drill Jig, Indexing Drill jig; Milling Machine Tail Stock, Machine Vice, Swivel Machine Vice,; *Valves & Boiler Mounting:* Gate Valve, Non Return Valve, Blow off Cock, Feed Check Valve, Lever Safety Valve, Miscellaneous Parts: Plummer Block, Swivel Bearing, C – clamp, , Pipe Vice.

Text Books:

1. Machine drawing, N. D. Bhatt, 38th edition, 2003 Charotar Publisher,
2. Machine Drawing, N. Sidheshwar, Shastry, Kannaiah, 4thedition, Tata Mc Graw Hill, 1996 and 2005.

Reference Books:

1. Machine Drawing, Narayana, K.L.Reddy, 2nd Edition, New AGE International Publishers, 2004
2. Machine Drawing, P.J.Shah, 3rd Edition, Shah Publishers, 1997
3. Machine Drawing, R. K. Dhawan, Revised Edition, S. Chand Publication, 2011
4. Machine Drawing, R.K.Dhawan, 4th edition, S. Chand& Co., 2006, Delhi.
5. Machine Drawing, Basudeb Bhattacharya, Second Edition, Oxford Higher Education Publication, Noida U.P., 2012

6.Machine drawing – P.S Gill, seventh edition, S. K. Kataria publication, NewDelhi, 2012 onwards

ME252N KINEMATICS OF MACHINE

Teaching Scheme : 02 L + 00 T; Total: 02 hours/week **Credits** : 02
Evaluation Scheme : 10 ISA + 30 MSE + 60 ESE **Total Marks** : 100
ESE Duration : 3 Hrs.

COURSE DESCRIPTION

The students learning this course will understand the basic concepts of Planar Mechanism, Kinematic Analysis and Synthesis of a Planar Mechanism, Static Force Analysis of a Mechanism.

DESIRABLE AWARENESS / SKILLS

Fundamental knowledge of mathematics and calculus, Engineering Mechanics.

COURSE OUTCOMES

On the successful completion of this course; Students shall be able to -

1. Identify the various mechanisms for industrial applications.
2. Apply the procedure of graphical and analytical methods for Kinematic Analysis of Mechanism in industry.
3. Develop various linkage-mechanisms for different applications.
4. Apply the procedure of static force analysis for Industrial Applications.

RELEVANCE OF COURSE OUTCOMES (COs) WITH POs AND PSOs (WITH STRENGTH OF CO-RELATION)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	1	-	1	-	-	-	-	-	-	1	-	-
2	3	2	1	1	1	1	-	-	-	-	-	-	-	-	-
3	3	2	1	1	1	1	-	-	-	-	-	-	-	-	-
4	3	2	1	1	1	1	-	-	-	-	-	-	1	-	1

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

COURSE CONTENT

Planar Mechanism (7 Hrs)

Basic Kinematics- Machine, Structure, Mechanism, Kinematic link & its types , Kinematic pairs and its classification, kinematic chain & its types, Mobility of Mechanism , Degree of freedom, Inversion of Mechanism- Four bar chain, Single slider crank chain, Double slider crank chain, Equivalent Mechanism, Transmission angle, Mechanical advantage.

Kinematic Analysis of Planar Mechanisms (7 Hrs)

Velocity- Acceleration Analysis by Relative method involving Corioli's acceleration (Graphical approach), Introduction to instantaneous center method. Kennedy's theorem.

Kinematic Synthesis of a Mechanism (7 Hrs)

Introduction- Synthesis, Task of Kinematic Synthesis. Concept of function generation, Path generation, and Motion generation problem, Number Synthesis, Freudenstein's equation, stages of kinematic synthesis and errors, Chebyshev spacing of precision points, graphical and analytical approaches for synthesis of a planar mechanism for three precision points only.

Static Force Analysis **(7 Hrs)**

Constraints and applied forces, Static Equilibrium, Equilibrium of two and three-force Members, Members with two forces and Torque, Equilibrium of Four- Force Members, Force convection, Free Body Diagrams, Superposition (Graphical approach for Static force analysis)

Text Books

1. Theory of Machines, S.S.Rattan, Tata McGraw Hill, New Delhi,2000
2. Theory of Mechanisms & machines, Ballaney 21st edition, Khanna Publication, 1998.
3. Theory of Machines by Dr. R.K. Bansal 5th edition, Laxmi Publications (P) Ltd., 2002.
4. Theory of Machines by Sadhu Singh 3rd edition, Pearson Publication, 1995.

Reference books

1. Theory of Machines and Mechanisms, Shigley, J.E. and Uicker, J.J. 4th edition Mc Graw Hill International Book co., 2001.
2. Mechanisms and Machines theory, Rao J.S and Dukkipati R.V. 2 nd edition, Wiley Eastern Ltd, New Delhi, 2002.
3. Theory of Mechanisms' & machines, Amitabh Ghosh, 3rd edition, East West Press, New Delhi, 2002.
4. Advanced Mechanism –Analysis and Synthesis Vol-I ,II , Sandor and Erdman ,Prentice hall.
5. Theory of Mechanisms' & machines, Jagdish Lal, 1st edition, Metropolitan Book Co., Hyderabad, 1997.

ME253N MATERIAL SCIENCE AND ENGINEERING METALLURGY

Teaching Scheme : 02 L + 00 T; Total: 02 hours/week **Credits** : 02
Evaluation Scheme : 10 ISA + 30 MSE + 60 ESE **Total Marks** : 100
ESE Duration : 3 Hrs.

COURSE DESCRIPTION

This course provides the introduction of fundamentals of material science and metallurgy to undergraduate students. The objective of the course is to understand the basic principles of material science and metallurgy. It includes mechanical testing to determine mechanical properties. It also includes various heat treatments, introduction of furnaces and various engineering materials and their applications.

DESIRABLE AWARENESS/SKILLS (PRE REQUISITES):

Fundamental knowledge of Engineering Chemistry and Physics

COURSE OUTCOMES:

On the successful completion of this course, student will be able to –

1. Describe the crystal structure.
2. Apply procedures for different testing methods to determine mechanical and other properties.
3. Classify ferrous materials and their applications.
4. Select suitable heat-treatment process to achieve desired properties of metals / alloys and establish structure property co relationship.
5. Articulate phase diagrams and their applications.

RELEVANCE OF COS /POS AND STRENGTH OF CO-RELATION:

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	--	--	--	--	--	--	2	--	1	3	2	1
2	3	2	2	--	--	--	--	--	--	2	--	2	2	2	1
3	3	1	1	--	--	--	--	--	--	3	--	2	2	1	1
4	3	2	2	--	--	--	--	--	--	3	--	2	2	1	1
5	2	1	1	--	--	--	--	--	--	2	--	1	2	1	1

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

COURSE CONTENTS:

Structure of materials, plastic deformation and metallography: (6 Hrs)

Crystal structures, atomic packing factor and coordination number, crystal defects and their effects on plastic deformation i.e. description of point, line and surface defects. Slip and twinning & its mechanism, strain hardening.

Metallic specimen preparation for microscopic examinations, etching & its mechanism. Spark testing of steels, flow line observation of forged parts. Relationship between structures-property-processing-performance.

Mechanical Testing, non-destructive Testing and evaluation of properties: (7 Hrs)

Tensile test, Engineering and true stress-strain curves, evaluation of properties, types of engineering stress-strain curve, compression test, hardness testing's- Brinell hardness test, Poldi hardness test, Rockwell hardness test , Vickers hardness test. durometers, micro hardness. Erichson's cupping test, impact test- Charpy and Izod impact test, fatigue and creep test. Non-destructive testing of metals: dye penetrant test, magnetic particle test. ultrasonic testing, radiography and eddy current testing.

Phase Diagram, ferrous metals and alloys: (9 Hrs)

Alloys and solid solutions, types and their formations, Gibb's phase rule, lever rule for phase mixtures and their application in system. Steels: Iron, allotropy, cooling curves and volume changes of iron. Iron-Iron carbide equilibrium diagram, critical temperatures, various phases, reactions, solubility of carbon in iron, microstructure of slowly cooled steels, Non - equilibrium cooling of steels. Classification and application of steels, effect of alloying elements, specification of some commonly used steels for engineering applications, classification of alloying elements, examples of alloy steels – limitation of plain carbon steels, stainless steels-classification, heat treatment of stainless steels, tool steels-classification, cold work and hot work tool steels, high speed tool steels , heat treatment of high speed tool steel, special purpose tool steels,

Cast Iron (C.I.): its classification, Effects of various parameters on structure and properties of C.I. like carbon equivalent, cooling rate during eutectic reaction and alloying additions, properties, compositions, applications and specifications of cast iron.

Heat Treatments: (8Hrs)

Principle of heat treatment of steel, transformation products of austenite, isothermal transformation diagram, procedure of plotting its diagram, continuous cooling transformations, heat treatment for steels such as core heat treatment – annealing and its types, normalizing, hardening, tempering. Jominy test for hardenability. Quench media, austempering and martempering, surface heat treatment of steels-flame hardening, induction hardening, laser and electron hardening, carburising, cyaniding, nitriding, sursulf, tufftride.

Text Book:

1. Material Science and Metallurgy for Engineers, by V.D.Kodgire, 37th edition, Everest Publishing House. Pune, 2015.

2. Material Science and Metallurgy, by U. C. Jindal, 1st edition, Pearson Publication, 2012.

Reference Books:

1. Materials and processes in manufacturing, Degarmo's, by J.T. Black, Ronald A Kosher, 10th edition, Willey student edition,2010.

2. Introduction to Engineering Materials, by B. K. Agrawal, Tata McGraw Hill, New Delhi,1989.

3. An Introduction to Physical Metallurgy, by S.H. Avner, 2nd edition,Tata McGraw Hill, New Delhi,1997.
4. Fundamentals of modern manufacturing materials, processes and systems, by Mikell P. Groover, 4th edition, Wiley student edition, New Delh.2010.

ME254N - MACHINE DRAWING AND COMPUTER GRAPHICS LAB

Teaching Scheme: 04PR**, Total**: 04 hours/week **Credit :** 02

Evaluation Scheme: 30 ICA+20 ESE **Total marks :** 50

COURSE DESCRIPTION:

This course introduces the student to CAD tool of engineering science. The student will learn to the use of computer systems to assist in the creation, modification, analysis, or optimization of a design & manufacturing using CAD packages like CATIA, Creo-Parametric, and AutoCAD or any other 2 d to 3 d cad softwares. Students will learn about of these CAD packages and also learn how they are useful for them to develop visualization skills

Desirable awareness/skills:

Fundamental knowledge of Engineering Graphics, measurements, Basic of Computer software.

Course Objectives:

Students required

1. to understand the intersection curves for joining the surfaces
2. to apply fundamental tolerances appropriately for various Mechanical Engg. applications.
3. to know various types of standard parts with its specifications and their practical application
4. to use effectively for generating the part with allied requirement by using 3 d softwares.
5. to use commands for assembling all parts appropriately.
6. to plotting individual component and assembly in drafting mode and printing.

COURSE OUTCOMES:

Able to,

1. take decision about suitable relevance standard parts to be use in application.
2. draft and assigning basic tolerances and GDT on individual component.
3. imagine, recognise the function and draft the assembly and details of mechanical applications.
4. use effectively various kind of commands of 3D software for convert 2 D sketch to 3 D model for individual parts along with other relevant allied features in mechanical application.

RELEVANCE OF COS /POS AND STRENGTH OF CO-RELATION:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	3	1	-	-	-	-	-	-	-	-	-
CO 2	1	1	-		-	-	-	-	-	-	-	-
CO 3	1	-	2	2	-	-	-	-	-	-	-	-
CO 4	-	-	3	2	3	-	-	-	-	-	-	-
CO 5	2	-	-	3	-	-	-	-	-	-	-	-

CONTENT :-

Introduction to 3-D CAD Drafting Software/Package (CAD –parametric type) [Choosing and learn all basic from any one suitable drafting CAD software]

Introduction to CAD software, Advantages of CAD packages, applications of CAD, the theory of CAD software consisting of basic operation of drafting packages, use of various commands for drawing, part modeling,

assembling, drafting, transferring model files for analyze and produces in any kind of analytical and manufacturing software respectively, printing/plotting the drawings

Internal continuous assessment (ICA) shall be on performances of sheets drawn and based on syllabus of course ME 251 N.

All ***Seven*** sheets are mandatory. Each sheet shall be based and drawn as per below;

Group A :-

Draw the following sheets given in Group-A shall be hand sketched and drawn over the full imperial size of drawing sheets

(All following sheets are mandatory).

1. A drawing sheet on introduction of machine drawing and limit fits & tolerances conventional representation & symbols.
2. A drawing sheet on symbol and conventional Presentation of standard components,
3. A drawing sheet on details of any one of machine component's assembly.

   Note: - This sheet consist of bill of material, Boolean, tolerance chart, Miscellaneous Symbols as per the requirements.
4. A drawing sheet on Assembly of any one of details component of Mechanical system.

   Note: - This sheet consist of all limit, fits, tolerances and GD & T with Machining Symbols, Boolean & bill of materials.

Group B :-

Plot and print the following sheets given in Group-B by using CAD software on A3- or A-4 size paper. Draw any **three** sheets among following. *Choose wisely any one (three dimensional) modeling CAD software which will be available for following all*

1. any one part of machine shall be create in part modelling mode and plotted on A- 3 or A-4 sheet by using various commands of chosen 3D cad software.
2. draw the three views of earlier modelled parts in part mode by draft mode and plot it on A- 3 or A-4 sheet by using various commands of 3D cad software.
3. create and showing the threads of the bolts and insides of holes (any 03 component shall be created in prescribed above manner in part mode and drafted as per the principle of orthographic projection by using draft mode) and plot it on A- 3 or A-4 sheet by using various commands of 3D cad software.
4. Create any one kind of coupling in assembly mode and plot it on A- 3 or A-4 sheet by using various commands of 3D cad software.
5. Generate the details drawing of any one given assembly of mechanical system and plot it on A-3 or A-4 sheet by using various commands of 3D cad software.
6. Generate the Assembly drawing of any one given details of mechanical system and plot it on A-3 or A-4 sheet by using various commands of 3D cad software.

Guide lines for ICA:

Internal Continuous Assessment should support for regular performance of practical/sheets and its regular assessment with proper understanding principles of practical/ sheets completed.

Guide lines for ESE:

Oral will be base on the content of theory syllabus and practices / sheets / assignments

ESE oral Examination:

Note:- *ESE Oral examination shall be conducted to check the knowledge of theoretical as well as practical parts covered under ME251N and ME254N*

Text books:

1. A text book of Engineering Graphics with an Introduction to Computer Aided Drafting (Vol. I) by Phakatkar. H. G , 1st edition, Nirali Prakashan, Pune 1997.
2. A text book of Machine Drawing and Computer Graphics by Farazdak Haideri, Nirali Prakashan, Pune, 1998.
3. A text book of Engineering Graphics using AutoCAD by T Jeyapoovan, 3rd edition, Vikas Publication House Pvt. Ltd, Noida 2008.
4. A text book of Engineering Drawing and Graphics + AutoCAD by K. Venugopal, 4th edition, New Age International publishers, New Delhi 2005.

Reference Books:

1. N. D. Bhatt and V.M. Panchal, Machine Drawing, Charoter Publications
2. Mastering CAD/CAM by Zeid Ibrahim, Special Indian edition, Tata McGraw Hill New Delhi 2007.

ME255N KINEMATICS OF MACHINES LAB

Teaching Scheme	**:** 02 P; Total: 02 hours/week	**Credits**	**:** 01
Evaluation Scheme	**:** 30 ICA + 20 ESE	**Total Marks**	**:** 50

COURSE DESCRIPTION

The students learning this course will understand the basic concepts of Planar Mechanism, Kinematic Analysis and Synthesis of a Planar Mechanism, Static Force Analysis of a Mechanism.

DESIRABLE AWARENESS / SKILLS

Concepts of theory course ME252N Kinematics of Machine

COURSE OUTCOMES

On the successful completion of this course; student shall be able to

1. Identify the various mechanisms for industrial applications.
2. Apply the procedure of graphical and analytical methods for Kinematic Analysis of Mechanism in industry.
3. Develop various linkage-mechanisms for different applications.
4. Apply the procedure of static force analysis for Industrial Applications.

RELEVANCE OF COURSE OUTCOMES (COs) WITH POs AND PSOs (WITH STRENGTH OF CO-RELATION)

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	1	1	1	-	-	-	-	-	-	-	-	-	**1**
2	3	2	1	1	1	1	-	-	-	-	-	-	-	-	**1**
3	2	2	1	1	1	-	-	-	-	-	-	-	**1**	-	**2**
4	2	2	1	1	1	-	-	-	-	-	-	-	**1**	-	**1**

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

COURSE CONTENT

Minimum **Eight** experiments shall be performed to cover entire curriculum of course ME252N. The list is given below-

List is Experiments:

1. Demonstration of various types of kinematics links, pairs, chains & mechanisms.
2. Demonstration of kinematic inversion of four bar mechanism, single-slider crank mechanism and double slider –crank mechanism.
3. Velocity determination by Instantaneous Centre Method (Three problems)
4. Kinematic analysis using Graphical Approach (Three problems)
5. Kinematic synthesis using graphical methods/analytical approach. (Three problems)
6. Static force analysis of a Planer mechanism. (Three problems)
7. Demonstration of various parts of single plate & multiple plates clutches.
8. Demonstration of various parts of Cone & Centrifugal clutches
9. To determine mass moment of inertia of compound pendulum.
10. To determine mass moment of Inertia by Bifilar/ Trifillar suspension method.
11. To Study various types of belt drives & pulleys.

Evaluation Methodology:

- **ICA –** It shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using the prescribed internal continuous assessment format.

- **ESE –** It shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners, out of which one examiner shall be external examiner.

ME 256N MATERIAL SCIENCE AND ENGINEERING METALLURGY LAB

Teaching Scheme : 02 P; Total: 02 hours/week **Credits** : 01
Evaluation Scheme : 30 ICA + 20 ESE **Total Marks** : 50

COURSE DESCRIPTION

This course provides the fundamentals of materials testing and metallographic study to undergraduate students. It includes destructive and non destructive testing to evaluate mechanical properties and characterize the materials. It also includes macro and micro examination and their correlation with materials properties.

DESIRABLE AWARENESS/SKILLS (PRE REQUISITES):

Fundamental knowledge of engineering chemistry and physics.

COURSE OUTCOMES:

On successful completion of this course student shall be able to:-

1. Perform destructive and non destructive testing of different materials.
2. Interpret microstructure of ferrous, nonferrous metals and alloys.
3. Correlation of microstructure, heat treatment with properties and subsequent applications.
4. Articulate phase diagrams and their commercial applications.

RELEVANCE OF COS /POS AND STRENGTH OF CO-RELATION:

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	2	--	2	--	--	--	2	2	--	2	3	2	1
2	3	2	1	--	2	--	--	--	2	2	--	2	2	2	1
3	2	2	2	--	2	--	--	--	2	2	--	2	2	1	1
4	2	2	1	--	1	--	--	--	1	2	--	2	2	1	1

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

COURSE CONTENT:

Minimum eight experiments and two assignments shall be performed to cover entire curriculum of course ME253 N. The list given below is just a guideline.

List of Experiments – (Any Eight shall be performed from following)

1. Detection of defect by Non-destructive tests such as dye penetrant test, magnetic particle testing, ultrasonic testing, eddy current test. (Any two)
2. Jominy test for hardenability.
3. Determine hardness value of mild steel by using Poldi hardness test.
4. Specimen preparation for microstructure and use of metallurgical microscope.

5. Observing, study and drawing the microstructure of mild steel, medium carbon, eutectoid steel, hypereutectoid steel.
6. Observing, study and drawing microstructure of annealed, normalized and hardened medium carbon steel specimens.
7. Study and drawing microstructure of white, malleable, gray and spheriodal cast iron and any one non-ferrous metal.
8. Spark testing of steels, flow line observation of forged parts.
9. Study the Iron carbon diagram and its reactions.
10. Study the TTT diagrams and formation of different phases.
11. Study of the lever rule for phase mixtures.
12. Study of any one hardness test.

Guidelines for ICA:

Internal Continuous Assessment shall support for regular performance of practical's and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal and sheet) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format**.**

Guidelines for ESE:

Oral will be based on content of syllabus and practical.

ME257N. Open Elective II
X. INTRODUCTION TO ROBOTICS

Teaching Scheme: 02 L + 00 T**; Total:** 02 hours/week **Credit :** 2
Evaluation Scheme: 30 MSE+ 10 ISA + 60 ESE **Total Marks:** 100
Duration of ESE: 03Hrs

COURSE DESCRIPTION

This course is an introduction to the field of robotics. It covers the fundamentals of kinematics, dynamics, trajectory planning, control of robot manipulators, and sensing. The course deals with homogeneous transformations, forward and inverse kinematics of robotic manipulators, differential kinematic equations, the manipulator Jacobian, and force relations. It also presents the fundamental principles on proximity, tactile, and force sensing. Students are expected to have a background in linear algebra, calculus, and basic physics.

COURSE OUTCOME:

On the successful completion of this course; student shall be able to

1.understand fundamental knowledge about the robot
2.know about robot motion analysis
3.describe drives and control system used in robots
4.understand end effectors, sensors and vision system
5.learn about robot programming methods and languages

RELEVANCE OF COS / POS AND STRENGTH OF CO- RELATION:

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		3		2			1					1	1		
CO 2	1		2		2									2	
CO 3						1		1			1				
CO 4		3		1									1		
CO 5	2								1						

1-Weakly correlated 2–Moderately correlated 3–Stronglycorrelated

Course contents:

Introduction To Robotics **(8Hrs)**

History of Robot, Definition and classification of robots, evolution of robotics, Current trends and future scope in robotics, Basic Concepts and Terminology-: Links and joints, Degrees of freedom, Need, Laws, Robot Anatomy, specifications. Robot wrist mechanism, Precision and accuracy of robot, Robot configurations-cartesian, cylinder, polar and articulate.

Sensors and End Effectors **(8Hrs)**

Introduction to Sensors: Need of sensors in a robotic system, selection of sensors, Sensors in robot – Touch Sensors-Tactile sensor – Proximity and range sensors. Force sensor-Light sensors, Pressure sensors, Sensor calibration, End Effectors, Types of end effectors, Gripper selection, mechanical grippers, vacuum, magnetic, adhesive grippers, hydraulic gripper, tools as end effectors, Workspaces and Reachability

Actuator and Drives **(8Hrs)**

Actuators, Types of Actuators-: Electric motors, DC motors, Servo Motor, construction and working principle, Application, BLDC servo motors, Stepper Motor, construction and working principle, applications, Hydraulic actuators, Pneumatic actuators, Mechanical Drive Systems -: Electric drive, Hydraulic drive, Pneumatic drive, Advantages and Applications.

Robot Vision and AI **(8Hrs)**

Introduction to Machine Vision ,functions of vision system, Basics of image processing, industrial application of vision controlled robotic system, advantage and application of machine vision. Artificial Intelligence and industry 4.O, Industrial applications of robots, Medical, Household, Entertainment, Space, Underwater, defence, Disaster management. Applications, Micro and Nanorobots, Future Applications.

Text Books

1. Industrial Robotics,M. P. Groover, McGraw Hill Publication Co. Ltd.
2. Fu.K.S, Gonzalez.R.C&Lee.C.S.G, "Robotics control, sensing, vision and intelligence", Tata-McGraw Hill Pub. Co., 2008
3. Introduction to Robotics Mechanics and Control, John J. Craig, Pearson Education inc.,

Reference Books

1. Mikell P. Groover, Mitchell Weiss, Roger N Nagel, Nicholas G Odrey, "Industrial Robotics Technology, Programming and Applications", Tata –McGraw Hill Pub. Co., 2008
2. Robotic Engineering an Integrated Approach, Richard D. Klafter, Thomas A. Chmielewski and Michael Negin, Prentice Hall India, 2002.
3. Klafter.R.D, Chmielewski.T.A, and Noggin's., "Robot Engineering: An Integrated Approach"', Prentice Hall of India Pvt. Ltd., 1994
4. Introduction to Robotics: Analysis System and Application, Niku, Pearson Education

ME257N. Open Elective II
Y- HYBRID VEHICLES

Teaching Scheme : 02 L + 00 T; Total: 02 hours/week **Credits** : 02
Evaluation Scheme : 10 ISA + 30 MSE + 60 ESE **Total Marks** : 100
ESE Duration : 3 Hrs.

COURSE DESCRIPTION

To understand the fundamental concepts, principles, analysis and design of hybrid and electric vehicles. To know the various aspects of hybrid and electric drive train such as their configuration, types of electric machines that can be used energy storage devices, etc.

DESIRABLE AWARENESS / SKILLS

Knowledge of basic hybrid and electrical engineering and their concepts

COURSE OUTCOMES

On the successful completion of this course; student shall be able to -

- Understand the models to describe hybrid vehicles and their performance.
- Understand the different possible ways of energy storage.
- Understand the different strategies related to energy storage systems.

RELEVANCE OF COURSE OUTCOMES (COs) WITH POs AND PSOs (WITH STRENGTH OF CO-RELATION)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2								1			1	1	
2	2	1		1	1								1	1	
3	2	3	3										1	1	
4	1	1		1	1								1	1	
5	1	1		1									1	1	

1-Weakly correlated **2 – Moderately correlated** **3 – Strongly correlated**

COURSE CONTENT

UNIT-I **(8Hrs)**

Introduction Conventional Vehicles: Basics of vehicle components, it's construction and performance, vehicle power sources , transmission. Introduction To Electric Vehicles.

UNIT - II **(8Hrs)**

Introduction To Hybrid Vehicles: History of hybrid (Conventional and electric) vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

Hybrid Drive-Trains: Basic concept of hybrid traction, Basic architecture of hybrid drive train and analysis series drive train, introduction to various hybrid drivetrain topologies, power flow control in hybrid drive-train topologies, fuel efficiency.

UNIT–III **(8Hrs)**

Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its

analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting sub systems

UNIT–IV **(8Hrs)**

Energy Management Strategies: Battery management system, Battery charging system , Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

Text Books

1. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2011.

2. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, 2015

Reference Books

1. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2004.

2. T. Denton, "Electric and Hybrid Vehicles", Routledge, 2016

ME258N MECHANICAL ENGINEERING WORKSHOP

Teaching Scheme : 04P, Total: 04 hours/week **Credits:** 02

Evaluation Scheme : 50 ICA, Total Marks: 50 **Total Marks:** 50

COURSE OUTCOMES:

On successful completion of this course, students will be able to-

1. Design the patterns and moulds for various mechanical engineering applications.
2. Explain metal removing process for particular application.
3. Compare different metal forming process for particular application.
4. Use proper joining processes for particular application.

RELEVANCE OF COS AND POS AND STRENGTH OF CO-RELATION

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

1-Weakly correlated 2–Moderately correlated 3–Strongly correlated

COURSE CONTENT

Internal continuous assessment consist of following the performance of practical's,

1. Turning Shop: Study of different operations to be carried on the lathe machine, taper turning methods(calculations),singlepointcuttingtooloperations,externalthreading,facing,finishingcuts

2. Job: Preparing a job on lathe machine performing the above operations

3. Pattern Making Shop: Study of pattern materials, types of pattern sand cores, allowances, pattern making tools and allowances parting line of multi piece patterns etc.
Job: Preparing at least one pattern in wood, involving details like, allowances, core prints.

4. Foundry Shop: Sand molding, types of sands, preparing sand for molding, equipment, sand moulds (cope, drag, check etc.).

5. Welding Shop:
Different welding machines and equipments, types of welding and welded joints, used in fabrication, preparation for weld joints, joint finishing, safety precautions, different tools, types of electrodes, angle cutters, portable grinder, drills etc.

Job: Preparing a job individually or in a group of student so any useful item of daily use using welding operations.

Guidelines for ICA:

Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (Journal and Jobs) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10).

SH205N: मराठी लेखन कौशल्य (Marathi Writing Skills)

एकूण तासिका : ०२ तास प्रति आठवडे **शैक्षणिक जमा गुणसंख्या (Credits) :०२**
मध्य सत्र परीक्षा : ३० गुण; अंतर्गत मुल्यांकन : २० गुण **एकूण: ५० गुण**
मध्यसत्र परीक्षा कालावधी:१.५तास

उद्दिष्टे:

- प्रभावी लेखनकौशल्य विकसित करणे.
- व्यावसायिक व शैक्षणिक उद्देशांसाठी विविध लेखनतंत्रांची समज व उपयोग करणे.
- मराठी साहित्याची महत्ता व तांत्रिक शिक्षणातील त्याचे महत्त्व समजून घेणे.
- स्पष्ट आणि संक्षिप्त लेखनशैली विकसितकरणे.
- तांत्रिक व व्यावसायिक संवाद कौशल्य विकसित करणे.
- विविध प्रकारच्या तांत्रिक दस्तऐवजीकरणासाठी मानके आणि प्रारूप शिकविणे.

घटक विश्लेषण:

मराठी भाषाआणि लेखनाचीओळख **(०२ तास)**

तांत्रिक शिक्षणात मराठीचे महत्त्व,मराठी व्याकरण (वाक्यरचना) संक्षिप्त परिचय,मूलभूत वाक्यरचनाआणि वापर.

लेखन कौशल्य विकास **(०४ तास)**

लेखनाचे प्रकार: वर्णनात्मक, कथात्मक, विवरणात्मक, आणि पटवून देणारे लेखन,प्रभावी लेखनतंत्रे,स्पष्टआणि संक्षिप्त लेखनशैली विकसित करणे.

व्यावसायिकआणितांत्रिकलेखन **(०४ तास)**

अधिकृतपत्रे, ईमेल्स आणि अहवालांचे लेखन,तांत्रिक दस्तऐवज आणि मार्गदर्शक तयार करणे,प्रकल्प प्रस्तावआणि संक्षिप्त सारांशलेखन.

सृजनशील लेखन **(०२ तास)**

कथालेखन आणि निबंधलेखन, कविता आणि तिचे प्रकार,माध्यमांसाठी लेखन: लेख, ब्लॉग्स, आणि स्तंभलेखन.

प्रस्तुतीकरण, संवाद आणि सारांशलेखन कौशल्य: **(०६ तास)**

मराठीत प्रस्तुतीकरण तयार करणे,सार्वजनिक बोलणे आणि मौखिक संवाद कौशल्य,मराठीत सेमिनारआणि गटचर्चाआयोजित करणे.वाचनाच्या प्रमुखअंगांचे संक्षेपीकरण,पाठ्यपुस्तकांचे संक्षेपीकरण आणि सारांश.

पत्रलेखनाचे नियम, तत्त्व,प्रकार: **(०४ तास)**

पत्रलेखनात अनुसरण करण्याचे सर्वोत्तम नियम,अभिप्राय व्यक्तकरण्याचे तंत्र. पत्रलेखनाचे बाबीचे मूलसिद्धांत,पत्रलेखनाचे प्रकार: अनौपचारिक, औपचारिक, व्यावसायिक. व्यक्तिगतपत्र (आधिकारिक, अआधिकारिक),व्यावसायिकपत्र (निवेदन, विवादपत्र, मागणीपत्र, तक्रारपत्र),

अनौपचारिक पत्र (आभारपत्र, निमंत्रणपत्र)

निबंध लेखनाचे मूलसिद्धांत, प्रकार, उपयोगी तंत्रे:(०४ तास)

निबंध लेखन बाबीचे मूलसिद्धांत आणि नियम, सामाजिक, राजकीय, वैज्ञानिक, सांस्कृतिक, कल्याणकारी विषयांवर निबंधलेखन,निबंधाच्या लेखनात संप्रेषण करण्याचे तंत्र.

अभ्यासक्रमाचे परिणाम:

1. तांत्रिक संकल्पनांचे स्पष्ट आणि प्रभावी लेखन क्षमता विकसित करणे.
2. व्यावसायिक संदर्भात सुसंवाद आणि प्रभावी प्रस्तुती करणाची क्षमता विकसित करणे.
3. विविध प्रकारच्या तांत्रिक दस्तऐवज स्वतंत्रपणे तयार करणे.
4. सर्जनशील विचारांच्या माध्यमातून आकर्षक आणि मनोरंजक साहित्य निर्मिती करणे.
5. मराठीत प्रभावी सार्वजनिक बोलणेआणि प्रस्तुतीकरण कौशल्य विकसित करणे.

RELEVANCE OF COURSE OUTCOMES [COS] WITH POS AND PSOS [WITH STRENGTH OF CO-RELATION]:

CO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
1	-	-	-	-	-	2	2	1	2	-	-	3
2	-	-	-	-	-	2	2	1	2	-	-	3
3	-	-	-	-	-	2	2	1	2	-	-	3
4	-	-	-	-	-	2	2	1	2	-	-	3
5	-	-	-	-	-	2	2	1	2	-	-	3

1-Weakly correlated 2 –Moderately correlated 3–Strongly correlated

संदर्भपुस्तके:

1. "सारांश आणि संक्षेपणकला" – मीना देशपांडे
2. "मराठी सारांशलेखन कौशल्य" – विजय देशमुख
3. "सर्जनशील लेखनाचे मार्ग" – शिवाजीसावंत
4. "लेखनप्रेरणाआणि तंत्र" – अनुपमानिरंजन
5. "व्यावसायिक आणि तांत्रिकलेखनाची कला" – कृष्णास्वामी
6. उत्कृष्ट मराठी निबंध" - संकलन, लोकवाङ्मयगृह
7. "मराठी निबंधलेखन कौशल्य" - प्रो. सुधाकर पाटील
8. "मराठी विचारमंच" – विश्वास प्रकाशन

वर्गातील कमीत कमी उपस्थिती ७५% असणे अनिवार्य असेल अन्यथा गुणांकन केले जाणार नाही.

मध्य सत्र परीक्षेचा अभ्यासक्रम हा एकुण अभ्यासक्रमाच्या ५० टक्के असेल.

तांत्रिक संकल्पनांची स्पष्ट आणि प्रभावी लेखन क्षमता	व्यावसायिक संदर्भात सुसंवादआणि प्रभावी प्रस्तुती करणाची क्षमता	विविध प्रकारच्या तांत्रिक दस्तऐवज स्वतंत्रपणे तयार करण्याची क्षमता.	सर्जनशील विचारांच्या माध्यमातूनआकर्षकआणि मनोरंजक साहित्य निर्मिती करण्याची क्षमता	मराठीत प्रभावी सार्वजनिक बोलणेआणि प्रस्तुतीकरण कौशल्य विकसित करण्याची क्षमता
०४	**०४**	**०४**	**०४**	**०४**

SH202N: ENTREPRENEUR DEVELOPMENT

Teaching Scheme:02 L **Credit:**02
Evaluation Scheme:10 ISA +30 MSE +60ESE **Totalmarks:**100
MSE Duration: 1.5 Hrs **ESE Duration:** 3.0 Hrs.

COURSE DESCRIPTION

Entrepreneurship Development is a dynamic course designed to equip students with the knowledge, skills, and mindset essential for success in entrepreneurial endeavors. The course focuses on awareness of entrepreneurs and its different aspects. This course will cover details about design thinking, Entrepreneurial Behavior and Innovation Function, small-scale enterprises, family business and rural entrepreneurship as well as recent trends. It gives anoverviewof entrepreneurship.

COURSE OBJECTIVES

The course "Entrepreneurship Development" aims to achieve comprehensive learning outcomes across various critical areas of entrepreneurial studies. Firstly, it explores the concept of entrepreneurship and the role of entrepreneurs in driving innovation and economic development. Secondly, it delves into entrepreneurial behavior, emphasizing traits such as creativity, risk-taking, and opportunity recognition essential for entrepreneurial success. The course also introduces design thinking methodologies and Entrepreneurship Development Programs (EDP), focusing on practical project implementation and management skills. Furthermore, it addresses the dynamics of small business enterprises, including the causes and management of business sickness, to prepare entrepreneurs for operational challenges. Lastly, it examines the unique aspects of family businesses and rural entrepreneurship, providing insights into their challenges and opportunities. By covering these diverse topics, the course aims to equip participants with the knowledge, skills, and mindset necessary to initiate, sustain, and grow successful entrepreneurial ventures in various contexts.

COURSE OUTCOMES

On successful completion of this course the students will be able to

1. Apply the concept and knowledge of entrepreneurship
2. Utilize the concept of entrepreneurial behavior as well as innovation
3. Prepare project report to start own enterprise
4. Develop the ability to start small scale business
5. Run and enhance their own family business, develop rural entrepreneurship and Utilize recent trends in entrepreneurship

COURSE OUTCOMES (COS) AND PROGRAM OUTCOMES (POS) MAPPING WITH STRENGTH OF CO- RELATION

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	-	-	-	-	-	3	2	2	2	2	2	3			3
2	-	-	-	-	-	3	2	2	2	2	2	3			3
3	-	-	-	-	-	3	2	2	2	2	2	3			3
4	-	-	-	-	-	3	2	2	2	2	2	3			3

5	-	-	-	-	-	3	2	2	2	2	2	3			3

1-Weaklycorrelated 2-Moderatelycorrelated 3 -Stronglycorrelated

CONTENTS:

Entrepreneur and Entrepreneurship:

Entrepreneur, entrepreneur and enterprise, entrepreneurs and managers, traits of a true entrepreneur, characteristics of a successful entrepreneur, classification and functions of an entrepreneur, problems faced by entrepreneurs, Concepts of entrepreneurship, importance, myths, barriers, stages in the entrepreneurial process, socio-economic origins of entrepreneurship, environmental factors affecting entrepreneurship, entrepreneurship in economic growth:-definition, relationship between entrepreneur and entrepreneurship, Nature and characteristics of entrepreneurship, role of entrepreneurship in economic growth, Concepts- Sociopreneur, Edupreneur, Ecopreneur, Netpreneur, Intrapreneur (Only concept and Characteristics)

Entrepreneurial Behavior and Innovation Function: Innovation and Entrepreneur, Schumpeter's and Ducker's theories, Entrepreneurial Behavior and Psychological Theories:Maslow's need hierarchy theory, McClelland's Need Achievement Theory, Knight's Risk Taking theory, Social Responsibility, **Innovation Function**: Concept, Characteristics, Sources, Types, Levels, and Evolution of innovation management, Effective innovation management, Performance evaluation.

Design Thinking, EDP and Projects:

Design Thinking – Basics, Principles, Process, Personality Profile of Design Thinker,Design Thinking Cultures, Ten Tools for Design Thinking, Creating Ideal conditions fordesign thinking.

EDP - Concept, Phases, Importance, Objectives,Success of EDP, Shortcomings of EDP, Project - Identification, Classification,internal and external constraints,project objectives

Small Business Enterprise and sickness in small business enterprises:

Business idea- Sources, selection, concepts and Business opportunities in various sectors, Identifying thebusiness opportunity,Steps for startingof business, Definitions of SSI, Formalities for setting up of a small business enterprise, Environment pollution related clearances, Project report guidelines, Procedures and formalities for registration, Problems for small-scale industries. Definition of sickness and status of sickness of SSI in India, Criteria to identify sickness/incipient sickness, Causes for sickness/incipient sickness in SSI, Symptoms of sickness, Cures for SSI sickness, Institutions supporting small business enterprises: introduction, Central level institutions, State level institutions, Other agencies, Industry associations.

Family Business and Rural Entrepreneurship:

Family business - Importance, Types, Succession, Management development plan and precautions Meaning and Needs of Rural Entrepreneurs, Rural Industrialization in Retrospect, Problems of Rural Entrepreneurship and Step to Develop Rural

Entrepreneurship, Advantages and Major Challenges to Develop Rural Entrepreneurship, Recommendations to Boost up Rural Entrepreneurship, Recent Trends- Start up, Stand up, Skill India, Make in India, Incubation Centre-Concept and Importance.

TEXT BOOKS:

1. Entrepreneurship Development Small Business Enterprises, Poornima M Charantimath, Pearson, 1st edition Reprint, 2005.
2. Entrepreneurial Development, C.B.Gupta, Srinivasan N.P., Sultan Chand and Sons Publications, 5thedition, 2008.
3. DynamicsofEntrepreneurshipDevelopmentandManagement,VasantDesai, Himalaya, 1st edition, 2009.
4. EntrepreneurshipDevelopment,Dr.S.Senthil,Suchitrapublications
5. Entrepreneurship Development–Lall & Sahai: Excel Books
6. Entrepreneurial Development by Dr. S.S Khanka, S Chand & Company, 2011edition

REFERENCE BOOKS:

1. Entrepreneurship, Robert D.Hisrich, Michal P. Peters, Tata McGraw-Hill,7th Edition, Jan 1, 2007.
2. Patterns of Entrepreneurship, Jack M. Kaplan, Willey Publications, 4th edition, 2013.
3. Entrepreneurship Development and Project Management, Neeta Baporikar, Himalaya, 2nd edition, 2011.
4. Entrepreneurship Development, Cynthia L.Greene,CengageLearning,4th edition, 2008.

EVALUATION METHODOLOGY:

MSE: The Mid-Semester Examination will cover 50% of the syllabus.
ESE: The End-Semester Examination will cover 75% of the remaining syllabus (excluding the MSE syllabus) and 25% of the MSE syllabus.

ISA: The Internal Sessional Assessment (ISA) will be based on any one or a combination of the following components:

1. Declared Test
2. Surprise Test
3. MCQ Test
4. Performance in Tutorials
5. Assignments/Tutorials/Punctuality/Attendance

Additionally, the Course Coordinator may select other components and will announce the method of evaluation at the beginning of the course.

SH204N: UNIVERSAL HUMAN VALUES- II

Teaching Scheme: **02 L per week** **Credits: 02**
Evaluation Scheme: 30 MSE + 70 ISA **Total Marks:** 100
MSE Duration: 1.5 Hours **ESE Duration:** 3:00 Hrs.

COURSE DESCRIPTION:

The course is intended to provide universally adaptable, systematic and rational study of the human being vis-à-vis the rest of existence. It is free from any dogma or value prescriptions. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with and within the student himself/herself finally.

DESIRABLE AWARENESS/SKILLS:

Fundamental knowledge of universal human values and ethics.

COURSE OUTCOMES:

On the successful completion of this course students shall be able to

1. Create awareness on Engineering Ethics and Human Values.
2. Understand social responsibility of an engineer.
3. Appreciate ethical dilemma while discharging duties in professional life.
4. Develop Faculty-student or mentor-mentee programs throughout their time with the institution

RELEVANCE OF COURSE OUTCOMES [COS] WITH POS AND PSOS [WITH STRENGTH OF CO-RELATION]:

CO	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
1						3	2					
2						3	2					
3						3	2					
4						3	2					

1-Weakly correlated 2 –Moderately correlated 3–Strongly correlated

COURSE CONTENT

Exploring aspirations and concerns (basic human aspirations): (05 Hrs.)

Value Education, Definition, Concept and Need for Value Education, The Content and Process of Value Education, Basic Guidelines for Value Education, Self exploration as a means of Value Education, Happiness and Prosperity as parts of Value Education.

Harmony in the Human Being (05 Hrs.)

Human Being is more than just the Body, Harmony of the Self ('I') with the Body, Understanding Myself as Co-existence of the Self and the Body

Understanding Needs of the Self and the needs of the Body, Understanding the activities in the Self and the activities in the Body.

Harmony in the Family and Society and Harmony in the Nature (05 Hrs.)
Family as a basic unit of Human Interaction and Values in Relationships, The Basics for Respect and today's Crisis: Affection, Guidance, Reverence, Glory, Gratitude and Love, Comprehensive Human Goal: The Five Dimensions of Human Endeavour, Harmony in Nature: The Four Orders in Nature, The Holistic Perception of Harmony in Existence**.**

Social Ethics (05 Hrs.)
The Basics for Ethical Human Conduct, Defects in Ethical Human Conduct, Holistic Alternative and Universal Order, Universal Human Order and Ethical Conduct, Human Rights violation and Social Disparities

Professional Ethics (5 Hrs.)
Value based Life and Profession, Professional Ethics and Right Understanding, Competence in Professional Ethics, Issues in Professional Ethics -The Current Scenario, Vision for Holistic Technologies, Production System and Management Models

TEXT BOOKS:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010A.N Tripathy, New Age International Publishers, 2003.
2. A.N Tripathy, New Age International Publishers, 2003.
3. Bajpai. B. L.New Royal Book Co, Lucknow, Reprinted, 2004
4. Bertrand Russell Human Society in Ethics & Politics

REFERENCE BOOKS:

1. Corliss Lamont, Philosophy of Humanism
2. Gaur. R.R., Sangal. R, Bagaria. G.PA Foundation Course in Value Education,
3. I.C. Sharma Ethical Philosophy of India Nagin & co Julundhar
4. Mortimer. J. Adler, – Whatman has made of man
5. William Lilly Introduction to Ethic Allied Publisher

EVALUATION METHODOLOGY:

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ISA: The Internal Sessional Assessment (ISA) will be based on any one or a combination of the following components:

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