GOVT. COLLEGE OF ENGINEERING

AURANGABAD

CURRICULUM

T. Y. B. Tech. (Mechanical Engineering)

Department of Mechanical Engineering

2018-2019

Structure for Third Year B. Tech. (Mechanical Engineering) (Full Time)

Choice Based Credit System

SEMESTER- V													
Sr. No.	**Code**	**Subject**	**Contact Period (Hrs.)**			**Credits**	**Continuous Evaluation in terms of Marks**						
							Theory				**TW**	**Practical /Viva Voce**	**Total**
			L	**T**	**P**		**C.T.I**	**C.T.II**	**TA**	**ESE**			
1.	ME 3001	Applied Mathematics	3	0	0	3	15	15	10	60	-	-	100
2.	ME 3002	Design of Machine Elements-I	2	1	0	3	15	15	10	60	-	-	100
3.	ME 3003	Engineering Metallurgy	2	0	0	2	10	10	05	25	-	-	50
4.	ME 3004	Fluid Mechanics and Hydraulics Machines	3	1	0	4	15	15	10	60	-	-	100
5.	#	**Professional Elective III**	3	0	0	3	15	15	10	60	-	-	100
6.	ME 3010	Lab -Design of Machines I	0	0	2	1	-	-	-	-	25	25	50
7.	ME 3011	Lab-Engineering Metallurgy	0	0	2	1	-	-	-	-	25	25	50
8.	ME 3012	Lab- Fluid Mechanics and Hydraulic Machines	0	0	2	1	-	-	-	-	25	25	50
9.	ME 3013	Lab –CAME II and Mini Project	0	0	2	1	-	-	-	-	25	25	50
10	HS 3001	Industrial Organization and management	3	0	0	3	15	15	10	60	-	-	100
11.	$	**Audit Course III**	0	0	2	0	0	0	0	0	0	0	0
		Total	**16**	**2**	**10**	**22**	**85**	**85**	**55**	**325**	**100**	**100**	**750**

SEMESTER- VI													
Sr. No.	**Code**	**Subject**	**Contact Period (Hrs.)**			**Credits**	**Continuous Evaluation in terms of Marks**						
							Theory				**TW**	**Practical /Viva Voce**	**Total**
			L	**T**	**P**		**C.T.I**	**C.T.II**	**TA**	**ESE**			
1.	ME 3014	Heat and Mass Transfer	2	1	0	3	15	15	10	60	-	-	100
2.	ME 3015	Metrology and Quality Control	3	0	0	3	15	15	10	60	-	-	100
3.	ME 3016	Industrial Engineering	2	0	0	2	10	10	5	25	-	-	50
4.	ME 3017	Mechanical Measurement	2	0	0	2	10	10	5	25	-	-	50
5.	#	**Professional Elective IV**	3	0	0	3	15	15	10	60	-	-	100
6.	ME 3023	Lab-Heat and Mass Transfer	0	0	2	1	-	-	-	-	25	25	50
7.	ME 3024	Lab-Metrology and Quality Control	0	0	2	1	-	-	-	-	25	25	50
8.	ME 3025	Lab-Mechanical Measurement	0	0	2	1	-	-	-	-	25	25	50
9.	ME 3026	Industrial Interaction	0	0	2	1	-	-	-	-	25	25	50
10.	*	**Open Elective II**	3	0	0	3	15	15	10	60	-	-	100
11.	HS 3005	Production Management	2	0	0	2	10	10	5	25	-	-	50
12.	$	**Audit Course IV**	0	0	2	0	0	0	0	0	0	0	0
		Total	**17**	**1**	**10**	**22**	**90**	**90**	**55**	**315**	**100**	**100**	**750**
		Grand Total	**33**	**3**	**20**	**44**	**175**	**175**	**110**	**640**	**200**	**200**	**1500**

L = Lecture, **T** = Tutorial, **P** = Practical, **TA** = Teacher Assessment, **ESE** = End Semester Examination

# Professional Elective III	**# Professional Elective IV**	*** Open Elective II**
ME 3005 Theory of Machines	3018Introduction to FEM	ME 3027 Quality Management Systems
ME 3006 Advanced Manufacturing Techniques	ME 3019 Mechanical Vibrations	
ME 3007 Machine Tool Design	ME 3020Advanced stress analysis	
ME 3008 Modern Control Theory	ME 3021 Design of Machine elements-II	
ME 3009 Power Plant Engineering	ME 3022Machine Tool Erection	

$ Audit Course III	**$ Audit Course IV**
AC 3001 Basics of Product Survey	AC 3002 Seminar

Structure for Third Year B. Tech. (Mechanical Engineering) (Part Time)
Choice Based Credit System

Sr. No	Code	Subject	Contact Period (Hrs.)			Credits	Continuous Evaluation in terms of Marks						
							Theory				TW	Practical /Viva Voce	Total
			L	T	P		Class Test I	Class test II	TA	ESE			
Semester I													
1.	ME 3001	Applied Mathematics	3	0	0	3	15	15	10	60	-	-	100
2.	ME 3002	Design of Machine Elements-I	2	1	0	3	15	15	10	60	-	-	100
3.	ME 3003	Engineering Metallurgy	2	0	0	2	10	10	05	25	-	-	50
4.	ME 3004	Fluid Mechanics and Hydraulics Machines	3	1	0	4	15	15	10	60	-	-	50
5.	ME 3010	Lab -Design of Machine-I	0	0	2	1	-	-	-	-	25	25	50
6.	ME 3011	Lab-Engineering Metallurgy	0	0	2	1	-	-	-	-	25	25	50
7.	ME 3012	Lab- Fluid Mechanics and Hydraulic Machines	0	0	2	1	-	-	-	-	25	25	50
8.	$	**Audit Course III**	0	0	2	0	0	0	0	0	0	0	0
		Total	**10**	**2**	**8**	**15**	**55**	**55**	**35**	**205**	**75**	**75**	**450**
Semester II													
Sr. No	**Code**	**Subject**	**Contact Period (Hrs.)**				**Continuous Evaluation in terms of Marks**						
							Theory						
			L	T	P	**Credits**	**Class Test I**	**Class test II**	**TA**	**ESE**	**TW**	**Practical /Viva Voce**	**Total**
1.	#	**Professional Elective III**	3	0	0	3	15	15	10	60	-	-	100
2.	ME 3014	Heat and Mass Transfer	2	1	0	3	15	15	10	60	-	-	100
3.	ME 3015	Metrology and Quality Control	3	0	0	3	15	15	10	60	-	-	100
4.	ME 3023	Lab-Heat and Mass Transfer	0	0	2	1	-	-	-	-	25	25	50
5.	ME 3024	Lab- Metrology and Quality Control	0	0	2	1	-	-	-	-	25	25	50
6.	ME 3013	Lab –CAME II And Mini Project	0	0	2	1	-	-	-	-	25	25	50
7.	HS 3005	Industrial Organization and management	3	0	0	3	15	15	10	60	-	-	100
		Total	**11**	**1**	**6**	**15**	**60**	**60**	**40**	**240**	**75**	**75**	**550**

Semester III

Sr. No	Code	Subject	Contact Period (Hrs.)			Credits	Continuous Evaluation in terms of Marks						
							Theory				TW	Practical /Viva Voce	Total
			L	T	P		Class Test I	Class test II	TA	ESE			
1.	ME 3016	Industrial Engineering	2	0	0	2	10	10	5	25	-	-	50
2.	ME 3017	Mechanical Measurement	2	0	0	2	10	10	5	25	-	-	50
3.	#	**Professional Elective IV**	3	0	0	3	15	15	10	60	-	-	100
4.	ME 3025	Lab- Mechanical Measurement	0	0	2	1	-	-	-	-	25	25	50
5.	ME 3026	Industrial Interaction	0	0	2	1	-	-	-	-	25	25	50
6.	*	**Open Elective II**	3	0	0	3	15	15	10	60	-	-	100
7.	HS 3001	Production Management	2	0	0	2	10	10	5	25	-	-	50
8.	$	**Audit Course IV**	0	0	2	0	0	0	0	0	0	0	0
		Total	**12**	**0**	**6**	**14**	**60**	**60**	**35**	**195**	**50**	**50**	**450**
		Grand Total	**33**	**3**	**20**	**44**	**175**	**175**	**110**	**640**	**200**	**200**	**1450**

L = Lecture, **T** = Tutorial, **P** = Practical, **TA** = Teacher Assessment, **ESE** = End Semester Examination

# Professional Elective III	# Professional Elective IV	* Open Elective II
ME 3005 Theory of Machines	3018Introduction to FEM	ME 3027 Quality Management Systems
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ME 3009 Power Plant Engineering	ME 3022Machine Tool Erection	

$ Audit Course III	$ Audit Course IV
AC 3001 Basics of Product Survey	AC 3002 Seminar

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ME 3001: APPLIED MATHEMATICS	
Teaching Scheme Lectures: 3 Hrs/Week Tutorial: -- Hr/Week Credits: 3	**Examination Scheme** Class Test 1 : 15 Marks Class Test 2 : 15 Marks Teacher's Assessment : 10 Marks End Semester Exam : 60 Marks

Pre-requisites::MA1001-Engineering Mathematics I, MA1002:Engineering Mathematics II, MA2001 Engineering Mathematics III**.**

Course Description:

This course is designed to introduce students to mathematical methods for analysis, modeling, prediction and problem solving. Topic covered are complex algebra, systems of linear equations, differentiation of algebraic and transcendental functions, introduction to integration, probability and curve fitting for linear and nonlinear data.

Course Objectives

1. To inculcate an ability to relate engineering problems to mathematical context
2. To provide a solid foundation in mathematical fundamentals required to solve engineering problem
3. To study complex variables and complex integrals
4. To study the basic principles of statistics and probability and complex integration
5. To study different numerical methods and curve fitting

Course outcomes: At the end of the course, the student will be able to:

CO1	Apply knowledge of complex variables and integral for real life and engineering problems.
CO2	Apply the knowledge of various numerical methods and interpolation.
CO3	Apply the concept of probability distribution to engineering problems.
CO4	Apply knowledge of curve fitting for engineering problems.
CO5	Identify, formulate and solve mathematical engineering problems.

Detailed Syllabus:

Unit 1	**Function of Complex variables:** Analytic functions, Cauchy-Riemann conditions, Harmonic functions, Conjugate functions and their applications. **Complex integral:** Integration of complex functions, simply and multiply connected regions, Cauchy's integral theorem, Cauchy's integral formula, Singularities, Zeroes, Residues and Residue theorem.
Unit 2	**Numerical solutions of algebraic and transcendental equations:** Bisection method, Regula-Falsi method, Newton-Raphson method, Direct iterative method, Graffe's root squaring method. **Solution of system of linear algebraic equation:** Matrix inversion method, Gauss-elimination Method, Jordan's method, Crout's method. Gauss-Seidel iterative method

Unit 3	**Interpolation:** Finite difference operator, Interpolation formula with equal and unequal intervals. Divided differences and central differences. **Numerical differentiation and integration:** Differentiation using forward, backward and divided difference, General quadrature formula, Trapezoidal rule, Simpson's 1/3rd rule, Simpson's 3/8th rule, Weddle's rule.
Unit 4	Basics of probability, Bayes theorem, Random variables, Probability and density functions, Binomial, Poisson and Normal distributions. **Probability Distributions:** Discrete and Continuous random variables, Probability mass and density function, Probability distribution for random variables, Expected value, Variance. **Probability Distributions:** Binomial, Poisson and Normal Distributions.
Unit 5	**Curve Fitting:** Least square curve fitting procedures for straight line, Nonlinear curve fitting, weighted least square approximation, Method of least square for continuous function.

Text Books

1. B. S. Grewal, "Engineering Mathematics", Khanna Publishers, 12/e, 2006.
2. Pipes & Pipes, "Mathematics for Engineers", ELBS Publication, 1998
3. S. S. Sastry, "Engineering Mathematics", Vol I, II Prentice Hall Publication, 3/e, 2004.

Reference Books:

1. Francis J. Scheid, "Schaum's Outline of Numerical Analysis", McGraw-Hill, New York, 1989.
2. Gupta P. P., Malik G.S., "Calculus of Finite Differences and Numerical Analysis", Krishna PrakashanMandir, Meerut, 21/e, 2006.
3. Murray R. Spiegel, Schaum's Outline of Complex Variables, McGraw-Hill, NewYork, 1968.

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1		2			3							2	
CO2	1		1			3								
CO3	2		3										2	
CO4	2		2			3							2	
CO5	1		1			3							2	

1 – High 2 – Medium 3 – Low

Teacher's Assessment: Teachers Assessment of 20 marks is based on one of the / or combination of few of following

1) Question & answer / Numerical solution
2) Power point presentation of case studies
3) Quiz

Assessment Pattern

Assessment Pattern Level No.	**Knowledge Level**	**Test 1**	**Test 2**	**Teachers Assessment/ Assignment**	**End Semester Examination**
K1	Remember	05	00	05	10
K2	Understand	05	00	05	10
K3	Apply	05	00	00	20
K4	Analyze	00	05	00	20
K5	Evaluate	00	05	00	00
K6	Create	00	05	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	K1	K2	K3	K4	K3
	CO1	CO2	CO3	CO4	CO5
Class Test (15 Marks)	05	05	05	00	00
Class Test (15 Marks)	00	00	05	05	05
Teachers Assessment (20 Marks)	05	05	00	00	00
ESE Assessment (60 Marks)	10	10	10	20	10

Special Instructions if any: Nil

ME 3002 : DESIGN OF MACHINE ELEMENTS-I	
Teaching Scheme **Lectures: 2 Hrs/Week** **Tutorial: 1 Hr/Week** **Credits: 3**	**Examination Scheme** **Class Test I : 15 Marks** **Class Test II : 15 Marks** **Teachers Assessment : 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: MA 2001 Mathematic III, ME 2002 Machine Drawing, ME 2012 Strength of Material

Course description:

After completing this course, students will have a broad and fundamental understanding of the concepts of mechanical component design. Students will have knowledge of different theories of failures and design process. Students will be able to apply fundamental knowledge design for joints, shafts, power screws etc. Students will be able to analyze safe design.

Course Objectives:

1. To understand procedure of machine design and develop an ability to apply it for simple component design by using design data hand book.
2.
3. To understand the different theories of failure and develop an ability to apply its knowledge for design of mechanical component and determine the resisting areas against failure.

4. To determine forces on transmission shaft and design of transmission shaft.

5. To determine the endurance strength and design of components subjected to fluctuating loads, welds and riveted joints.

Course Outcome:

After completing the course, students will able to:

CO1	Explain the basic concept of machine design.
CO2	Design of machine components.
CO3	Design of welds and riveted joints.

Detailed Syllabus:

Unit 1	**Introduction – Design for Static Strength** Basic procedure for Machine design, Phases of Design, Design Considerations, Use of Standardization in design, Aesthetic, Ergonomic and Manufacturing considerations in design, Design for static strength, stress strain relationship for CI, MS, brass, rubber, Factor of safety, design considerations for cast and forged components, modes of failure, stresses due to bending, torsion, strain energy, eccentric loading, principal stresses, combined loading, Design of simple machine parts like as cotter joint and knuckle joint Introduction and use of software CAD and Hyperworks in design and drafting

Unit 2	**Theories of Failures and Design of Power Transmission Shafts** Theories of failures: Maximum Principal stress, Maximum Shear Stress, Distortion Energy, Max. Strain theory, Maximum total strain energy theory, Applications and problems based on above Transmission Shaft material, design of shaft on strength basis, design of shaft on torsional and rigidity basis, design of shaft for Lateral rigidity basis, Bending and torsional moments, ASME code for standard sizes of shaft, Effect of stress concentration, design of shaft against fluctuating loads
Unit 3	**Design against Fluctuating Loads** Stress concentration, stress concentration factors, reduction of stress concentration effect, fluctuating stress- fully reversed, repeated, fluctuating, Fatigue failures, mechanism of fatigue failure, Mean stress effect- master diagram for steel, ferrous and non ferrous metals, endurance limit, S-N curve, Moore's test, low cycle and high cycle fatigue, notch sensitivity, Effect of surface finish, size, reliability, temperature, surface treatment, residual stress, manufacturing process on fatigue life, design for fatigue - finite and infinite life, Soderberg's and Goodman diagrams, modified Goodman diagram, Gerber equation, ASME Elliptic criterion, combined stresses- Miner's rule.
Unit 4	**Design of Welded and Riveted Joints** Welded Joints, Types of welded joints, standard welding symbols, weld materials, design of welded joints, weld joint design for but weld, parallel fillet, transverse fillet, symmetrical section, Unsymmetrical sections, eccentric loads in plane of weld, bending moment, selection of joint by referring design data handbook Riveted Joints: Rivet materials, rivet heads, rivet terminology, types of riveted joints, Types of failures, strength equations, efficiency of riveted joints.
Unit 5	**Design of Power Screws and Fasteners** **Power screws:** Terminology of power screw, Force analysis for square, trapezoidal thread, self-locking of screw, efficiency of square thread, collar friction, stresses in screws, Design of screw jack, introduction to differential and compound screw, recirculating ball screw

Text and Reference Books

1. Shigley J. E. and Mischkey C. R., "Mechanical Engineering Design", TMH, New Delhi
2. Spotts M. F. and Shoup T. E., "Design of Machine Elements", Prentice Hall International
3. Hall A. S., Holowenko A. R. and Laughlin H. G., "Theory and Problems of Machine Design", Schaum's outline series, Tata McGraw Hill Publication. Co. Ltd, New Delhi
4. Bhandari V. B., "Design of Machine Elements", Tata McGraw Hill Publication. Co. Ltd, New Delhi
5. Black P. H. and O. E. Adam, "Machine Design", Tata McGraw Hill Publication. Co. Ltd, New Delhi
6. Burghardt M. D., "Introduction to engineering design and Problem Solving", McGraw Hill Publications
7. K. Lingaiah, "Machine Design Data book", Tata McGraw Hill Publication. Co. Ltd, New Delhi
8. Alfred Hall, Alfred Holowenko, Herman Laughlin, S. Somani, "Machine Design", Tata McGraw Hill Publication. Co. Ltd, New Delhi

Mapping of Course outcome with Program Outcomes:

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2											1	
CO2	1	2	3										2	
CO4		1	2	3									1	

1 – High 2 – Medium 3 - Low

Assessment table:

Course outcomes	CO1				CO2				CO3				CO4			
Assessment Tool	K1	K2	K3	K5	K1	K2	K3	K5	K1	K2	K3	K5	K1	K2	K3	K5
Class Test-I (15 Marks)	2	1	6	6	0	0	0	0	0	0	0	0	0	0	0	0
Class Test-II (15 Marks)	0	0	0	0	2	1	6	6	0	0	0	0	0	0	0	0
Teachers Assessment (10 Marks)	1	1	0	2	1	1	0	2	0	0	0	2	0	0	0	2
ESE Assessment (60 Marks)	4	0	10	10	4	0	10	10	2	0	0	10	2	0	0	10

Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of the following

1) **Question & answer / Numerical solution**
2) **Presentation of case studies of Mechanical component design**
3) **Design and assembly of a mechanical system**

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	Test1	Test2	Teachers Assessment/ Assignment	End Semester Examination
K1	**Remember**	**2**	**2**	**2**	**10**
K2	**Understand**	**1**	**1**	**2**	**0**
K3	**Apply**	**06**	**06**	**00**	**20**
K4	**Analyze**	**00**	**00**	**00**	**00**
K5	**Evaluate**	**06**	**06**	**06**	**30**
K6	**Create**	**00**	**00**	**00**	**00**
Total		**15**	**15**	**10**	**60**

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ME 3003: Engineering Metallurgy	
Teaching Scheme Lectures : 2 Hrs/ Week Credits : 2	**Examination Scheme** Class Test I : 10 Marks Class Test II : 10 Marks Teachers Assessment : 05 Marks End Semester Exam : 25 Marks

Prerequisites : ME 303 : Engineering Materials And Metallurgy

Course Description : After completing this course, students will have basic and fundamental knowledge in the field of Material Science. Students will get exposure to various Heat treatments and understanding the concept of Non ferrous Alloys and Bearing Materials.

Course Objectives

1) To enhance the basic knowledge in the field of Material Science

2) To get exposure to Iron Carbon Equilibrium Diagram and solidification of steels

3) To understand the basic concept of Time Temperature Transformation Diagram and properties/ Heat Treatment of High Speed Steels

4) To correlate and understand Cast Iron and Maurers Diagram

5) To able to explain the necessity of various Heat treatments

6) To understand the concept of Hardenability and End quench Test

7) To understand the concept of Non ferrous alloys, Bearing Materials and their essential properties

Course Outcome

After completing the course students will be able to

CO1	Explain the importance of materials properties and identify the material for specific applications.
CO2	Explain the changes in phases of material with respect to time and temperature.
CO3	Explain the role of carbon content in the material like steel and cast iron.
CO4	Explain the change in the properties of materials by various heat treatment processes.
CO5	Interpret the types of non-ferrous materials, their alloys and microstructure.

Detailed Syllabus:

Unit 1	**Properties of metals:** Toughness, impact strength, creep and fatigue resistance, Properties in selection of material, classification of metallurgy as Ferrous and Non Ferrous Metallurgy, Introduction to Iron and steel making process, Cast iron manufacture. Equilibrium Diagrams construction with reference of solidification of metals and alloys, cooling curve.

Unit 2	**Equilibrium Diagrams for systems** like isomorphous, eutectic, peritectic. Lever rule and its application with numerical. Iron Carbon diagram, study of different phases and compounds, critical temperatures and their significance during heating and cooling. Introduction to classification of ferrous materials. Constitution of alloys and phase diagram
Unit3	**Alloy steel:** Classification of Alloying elements on Fe-C, TTT diagrams,study of tool steels like HCHC, Free Cutting steels,spring steels, HSLA Steels, Maraging steels-Heat treatment, properties and uses, HSS- Heat treatment,subzero treatment. Stainless steels, Cast irons: Maurer diagram, classification of cast iron, effect of size and shape and distribution of graphite on the properties of Gray cast iron, mehanite, malleable cast iron, nodular cast iron.
Unit 4	**Necessity of H.T,** Transformations of steels during heating and cooling, non equilibrium cooling and transformation products of austenite, TTT diagrams, different hardening methods, quenching media, tempering of plain carbon steels and its effects. Other H.T like annealing, normalizing. Concept of hardenability, critical diameter, end quench test, surface/ case hardening- Principles of case hardening and without changing the composition,. Flame and induction hardening, solid, liquid and gas carburizing, nitriding, carbonitriding, Relative merits and demerits.
Unit 5	**Non Ferrous metals:** Engineering non ferrous metals and alloys, copper alloys, phase diagrams for CU-Zn and Cu-Sn, brass, bronze, alluminium alloy, Al-Si, Ai-Cu system, age hardening bearing materials and their essential properties, Important heat treatment on non ferrous alloys, mechanical properties and testing.

Text Books

1. V.Raghvan," Material Science and Engineering," PHI Publication
2. V.D Kodgire, " Metallurgy and Material Science," Everest Publication

Reference Books

1. S.Avner, " Physical Metallurgy," McGraw Hill Publication
2. Callister," Material science and Engineering," Wiley Publication
3. Dieter." Mechanical Metallurgy," McGraw Hill Publication
4. ASM Handbook Vol. 12 Material Characteristics
5. ASM Handbook Vol . 12 Properties and Selection

Mapping of Course Outcome With Program Outcome

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	1	3											1	
CO2			2										1	
CO3					1	2							2	
CO4				1									1	
CO5					2									

1- High 2- Medium 3- Low

Teachers Assessment: Teachers assessment of 10 marks is based on any one of the /or combination of few of the following

1) Assignment based on the above syllabus

2) Question & Answer/ Numerical Solution

Assessment Pattern

Assessment Pattern Level No	**Knowledge Level**	**Test**		**Teachers Assessment / Assignment**	**End Semester Examination**
		Test I	**Test II**		
K1	Remember	05	05	05	10
K2	Understand	05	05	00	10
K3	Apply	00	00	00	05
K4	Analyse	00	00	00	00
K5	Evaluate	00	00	00	00
Total Marks 50		10	10	05	25

Assessment Table

Assessment Tool	K1	K2	K3	K4	K5
	CO1	CO2	CO3	CO4	CO5
Class Test (20 Marks)	05	05	05	05	00
Teachers Assessment (05 Marks)	05	00	00	00	00
ESE Assessment (25 Marks)	10	10	05	00	00

Special Instructions if any: Nil

ME 3004: FLUID MECHANICS AND HYDRAULIC MACHINES	
Teaching Scheme	**Examination Scheme**
Lectures: 3Hrs/Week	**Class Test I : 15Marks**
Tutorial: 1Hr/Week	**Class Test II : 15 Marks**
Credits: 4	**Teachers Assessment : 10Marks**
	End Semester Exam : 60 Marks

Prerequisites: ME1001- Basics of Mechanical Engineering

Course description: In this course we are going to learn fluid properties and fluid statics buoyancy forces and different kinds of equilibrium of floating bodies also we are going to learn fluid kinematics and fluid dynamics, dimension analysis and flow through pipes and various types of pumps impeller and casings.

Objectives:

1. To study the different types of fluid properties and their determination
2. To study and analyze the behaviour of fluids under static, kinematic and dynamic states
3. To study and analyze the construction, working and performance of different impulseand reaction turbines
4. To study and analyze the construction, working and performance of centrifugal pumps and other hydraulic Machines

Course Outcome

After completing the course, students will able to:

CO1	Understand the various properties of fluids.
CO2	Apply the principles of fluid statics, kinematics and dynamics for various engineering applications.
CO3	Evaluate the performance of different impulse and reaction turbines.
CO4	Explain and analyze the concept of fluid flow through pipes.
CO5	Evaluate the performance of centrifugal pumps.

Detailed Syllabus:

Unit 1	**Fluid Properties & Fluid Statics** Definitions of fluid & fluid mechanics, properties of fluids like viscosity, surface tension, capillarity etc., types of fluids, illustrative examples, Definition of Fluid Statics, pressure in fluids at rest, Pascal's law, manometry, total pressure, center of pressure, hydrostatic forces on immersed plane and curved surfaces, buoyancy, metacenter and metacentric height, different kinds of equilibrium of floating bodies, illustrative examples
Unit 2	**Fluid Kinematics & Fluid Dynamics** Definitions of stream line, path line, streak line, stream tube, types of fluid flows, continuity equation in Cartesian and cylindrical co-ordinates, illustrative examples Euler's equation of motion, Bernoulli's equation from Euler's equation, energy correction factor, practical applications of Bernoulli's equation, momentum equation, momentum correction factor, engineering applications of momentum equation such as force on pipe bend and jet propulsion of ships, illustrative examples
Unit	**Dimensional Analysis & Flow through Pipes**

3	Dimensions of different fluid parameters, Buckingham's pie theorem, different dimensionless groups, physical meaning of dimensionless groups, types of similarities, laws of similitude, practical applications, illustrative examples, Loss of energy in pipes, major and minor losses, Hydraulic Gradient Line (HGL) and Total Energy Line (TEL), flow through series pipes, parallel pipes and branched pipes, equivalent pipe, power transmission through pipes, condition for maximum power transmission, efficiency for maximum power transmission, water hammer in pipes, illustrative examples
Unit 4	**Impulse Turbines & Reaction Turbines** Impact of jet, force of jet impinging on fixed and moving flat plate, fixed and moving curved plate, hinged plate, series of moving plates, illustrative examples Introduction to turbines, types of turbines, efficiencies of turbines, work done by an impulse turbine, power produced by an impulse turbine, Pelton turbine and its components, design of Pelton wheel, governing of Pelton wheel, illustrative examples Components of a reaction turbine, difference between impulse and reaction turbines, classifications of reaction turbines, efficiencies of reaction turbines, Francis Turbine, Kaplan Turbine, draft tube, types of draft tubes, efficiency of draft tube, unit power, unit speed, unit discharge, specific speed of a turbine, significance of specific speed, cavitation in turbines
Unit 5	**Centrifugal Pumps.** Introduction, types of pumps, types of impellers, types of casings, priming, various heads & efficiencies of centrifugal pump, minimum starting speed of a centrifugal pump, multistage centrifugal pump, performance of pumps, principles of similarity applied to centrifugal pump, specific speed, NPSH, cavitation in pumps, illustrative examples

Reference Books

1. Bansal R. K., "Fluid Mechanics and Hydraulic Machines", Laxmi Publications (P) Ltd. New Delhi 14
2. Modi and Seth, "Fluid Mechanics and Hydraulic Machines", Standard Book House, New Delhi
3. Jagdish Lal, "Hydraulic Machines", Metropolitan Book Company
4. Durgaiah Rama D., "Fluid Mechanics and Hydraulic Machines", New Age International, New Delhi
5. E. H. Shames, "Fluid Mechanics", McGraw Hill Publications
6. Streeter and Wylie, "Fluid Mechanics", McGraw Hill Publications
7. Rajput R. K., "Fluid Mechanics", S. Chand and Co., New Delhi

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1			3							1	
CO2	1	3	2		3	1							1	
CO3	1	3	2		3	1							2	
CO4	2	3	1			2							2	

1 – High 2 – Medium 3 – Low

Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1. Question & answer /Calculations of parameters
2. Assignment which contains all type of numerical
3. Quiz

4. Experimentation perform during practicals, calculations done by student

Assessment Pattern

Assessment Pattern Level No.	**Knowledge Level**	**Test -I**	**Test II**	**Teachers Assessment/ Assignment**	**End Semester Examination**
K1	Remember	03	03	02	10
K2	Understand	04	04	02	10
K3	Apply	03	03	02	20
K4	Analyze	05	05	02	20
K5	Evaluate	00	00	02	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	K1	K2	K3	K4
	C01	C02	C03	CO4
Class Test (15 Marks)	03	04	03	05
Class Test (15Marks)	03	04	03	05
Teachers Assessment (10 Marks)	02	03	02	03
ESE Assessment (60 Marks)	10	10	20	20

Special Instructions if any: Nil

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ME 3005:THEORY OF MACHINES	
Teaching Scheme Lectures: 3Hrs./Week Tutorial: -- Hr./Week Credits: 3	**Examination Scheme** Class Test 1 :15 Marks Class Test 2 :15 Marks Teacher's Assessment : 10 Marks End Semester Exam : 60 Marks

Pre-requisites: Mechanism of Machines -ME 2010, ME 2012-SOM

Course Description:

This course aims to equip the student with fundamental knowledge of dynamics of machines so that they can appreciate problems of dynamic force balance, transmissibility of forces. Students learn how to model simple mechanical systems as the problem of vibrating systems, governors, gyroscope, brakes and dynamometers and then analyze these systems. Once these analytical skills have been developed, the students can apply these skills to the practical problems.

Course Objectives

1. To determine the balancing of masses of rotating and reciprocating machine elements
2. To understand the principles of gyroscope and governors
3. To determine the forces and power calculations for brakes and dynamometer
4. To determine the static and dynamic forces for mechanical systems

To understand the principles of vibrations

Course outcomes: At the end of the course, the student will be able to:

CO1	Explain and apply the principles of balancing of rotary and reciprocating masses.
CO2	Apply the principles of governor and its stabilization on various transport vehicles.
CO3	Analyze the force and power generated in brakes and dynamometer.
CO4	Evaluate static and dynamic force and design dynamically equivalent systems.
CO5	Explain the principles of vibrations.

Detailed Syllabus:

Unit 1	**Balancing:** Static balancing, dynamic balancing, balancing of several masses in different planes, force balancing of linkages, balancing of reciprocating mass, balancing of locomotives, effect of partial balancing in locomotives, balancing of inline engines, balancing of V,W,V-8 and V-12 engines, balancing of radial engines.
Unit 2	**Governor:** Introduction to centrifugal & inertia types governor, classification, Watt, porter, prowell spring loaded governor, Sensitivity & stability, Force diagram (Numerical)
	Brake & Dynamometers: Introduction, brake materials, types of brakes, shoe brake, pivoted shoe brake, double block brake, simple and differential block brake

Unit 3	,band and block brake, braking force, braking torque calculations, internal expanding brake, normal pressure braking force, braking torque, braking of vehicle when brake is applied on real wheel, front wheel , four wheels ,Types of dynamometer, rope brake, epicyclic train ,belt transmission, torsion and eddy current dynamometer, fluid coupling and dynamometer, Numerical treatment.
Unit 4	**Static and Dynamic force analysis:** Static equilibrium, equilibrium of two and three force members, equilibrium of four forces and torque, force convention and free body diagrams. D'Alemberts principle, equivalent offset inertia force, dynamic analysis of four link mechanism and slider crank mechanism, Angular velocity and acceleration of connecting rod, engine force analysis.
Unit 5	**Vibration:** Introduction, Definitions, Types of vibration, Basic features of vibrating system, cause effects and terminology, degree of freedom, Free longitudinal vibration, displacement, velocity and acceleration, Inertia effect of the mass of spring, Damped vibration, logarithmic decrement, forced vibration, forced damped vibration, free torsional vibration (Single and Two rotor system).

Text Books

1. Rattan, "Theory of machine", Tata McGraw-Hill Publishing Co. Ltd, New Delhi
2. P. Ballaney, "Theory of machine", Khanna Publication, New Delhi
3. JagdishLal, "Theory of machine and Mechanisms", Metropolitan publication
4. Thomas Beven, "Theory of machine", C B S Publisher
5. K. G. Grover, "Mechanical vibration", New Chand publication, New Delhi

Reference Books

1. Shigley and Vicker, "Theory of machine", McGraw-Hill Publishing Co. Ltd, New Delhi
2. J. S. Rao& R. V. Dukkipati, Mechanism & Machine Theory, New Age Publication

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2				3							2	
CO2	1	2				3							1	
CO3	2	1	1			3							1	
CO4	3	3	2										2	
CO5	3	3	3			3								

1 – High 2 – Medium 3 – Low

Teacher's Assessment: Teachers Assessment of 20 marks is based on one of the / or combination of few of the following

1) Question & answer / Numerical solution
2) Presentation of case studies

3) Quiz

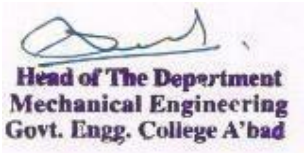
Assessment Pattern

Assessment Pattern Level No.	**Knowledge Level**	**Test-1**	**Test -2**	**Teachers Assessment/ Assignment**	**End Semester Examination**
K1	Remember	03	03	00	10
K2	Understand	05	05	05	10
K3	Apply	03	03	05	20
K4	Analyze	02	02	00	20
K5	Evaluate	03	03	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	K1	K2	K3	K4	K3
	CO1	CO2	CO3	CO4	CO5
Class Test-1 (15 Marks)	05	03	02	05	00
Class Test-2(15 Marks)	05	03	02	00	05
Teachers Assessment (10 Marks)	03	01	01	03	02
ESE Assessment (60 Marks)	10	10	10	20	10

Special Instructions if any: Nil



ME3006: Advanced Manufacturing Techniques	
Teaching Scheme Lectures: 3 hrs/week Credits: 3	**Examination Scheme** Class Test -1– 15 Marks Class Test-2 15 Marks Teachers Assessment – 10 Marks End Semester Exam - 60 Marks

Prerequisite:-ME 2003: Manufacturing Processes, ME 2013: Machine Tools

Course description: After completing this course, students will have a broad and fundamental understanding of Advanced Manufacturing Techniques. Topics range from an Advanced casting, Advanced micro machining, Laser beam machining, powder metallurgy and Advanced measuring techniques like CMM etc. Students will learn Advanced manufacturing technique knowledge and tools used in it, and career options available within this field.

Course objectives:

To acquire knowledge of various advanced casting processes, casting simulation and analysis Understand various micro-machining methods and devices

Understand the measurement system for micro-machining and understand it's inspection methods Understand different aspects of powder metallurgy and surface coating

Understand rapid prototyping and generative manufacturing processes

Course outcomes:

Students After completing the course, students will be able to:

CO1	Explain the different advanced manufacturing techniques.
CO2	Compare and select different types of micro-machining processes for various applications.
CO3	Compare and select different types of welding processes for various applications.
CO4	Explain and compare various powder metallurgy and surface coating methods.
CO5	Explain rapid prototyping and types of generative manufacturing processes.

Mapping of Course outcome with programme outcome

Course Out come	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**2**												2	
CO2		**2**											1	
CO3		**2**		**2**									1	
CO4	**2**												2	
CO5				**3**										

Detailed Syllabus

Unit 1	Advances in Casting Process: Sheet molding, casting, V-process, flask less molding, evaporative casting, plaster mould casting, design for plaster mould casting quality- accuracy, uniformity and other considerations in casting and molding. Recent developments in pattern and casting designing, Use of CAD/CAM in foundries, Casting simulation and analysis.
Unit 2	Micro Machining: Machining for Micro devices, Various methods of micromachining like Micro EDM, Micro ECM, Ultrasonic, Lithography, Beam machining processes: LBM, IBM, EBM. Micro Electro Manufacturing System (MEMS).

Unit 3	Advanced Welding Techniques Electron beam welding: LASER welding: Ultrasonic welding Under water welding ,TIG MIG Testing of welding: Destructive and non-destructive testing methods for welds
Unit 4	Powder metallurgy and surface coating: Powder Metallurgy: process, different methods of producing powders, different techniques to form the shape viz. pressing, extruding, sintering, and hot pressing, advantages, disadvantages, Surface Coating: principles, elements, process, advantages and surface preparation, physical vapour deposition, chemical vapour deposition, electroless coating.
Unit 5	Advanced metal forming processes: High velocity forming-principles, comparison of high velocity and conventional Forming processes. Explosive forming, Magnetic pulse forming, Electro hydraulic Forming, Micro forming, Microcline, micro extrusion, Micro bending Stretch forming, coining embossing, curling spinning, flow forming advantages, Limitations and application of the process.

Text and Reference Books

1. Benjamin W. Niebel, Allen B Draper, Richard A. Wysk, "Modern Manufacturing process engineering" by McGraw Hill International Editions.
2. Garry F. Benedict- Marcel Dekker Inc "Non Traditional Manufacturing Processes" by CRC Press New York.
3. H.M.T , "Production Technology Hand Book",TMH
4. Hayane and Rosanthal "Metal Casting"
5. Derban Michigan, "Non traditional manufacturing process" by E.J. Weller Society of Manufacturing Engineers.
6. B.H. Amsteal, Philip F. Ostwald & Myron L. Begeman "Manufacturing process", By John Wiley & Sons, Eighth edition.
7. ASM "Metals Hand Book", ASM Publications.
8. P.K. Mishra "Non conventional machining process" by, Narosa Publication.
9. M P Groover and Zimmer "Manufacturing processes"- PHI Pvt. Ltd. Publications
10. Amitabh Ghosh, "Genetic Manufacturing", Prentice Hall

Teacher's Assessment: Teachers Assessment of 20 marks is based on one of the / or combination offew of following

1) Presentation of case studies
2) Question & answer / Numerical solution
3) Study of Industry processes

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test1	Test-2	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	05	05	03	15
K2	Understand	05	05	02	20
K3	Apply	05	05	02	15
K4	Analyze	00	00	03	10
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	K1, K2	K1, K2	K3	K3, K4
	C01	C02	C03	CO4
Class Test-1 (15 Marks)	05	05	03	02
Class Test-2 (15 Marks)	05	05	02	03
Teachers Assessment (10 Marks)	04	03	02	01
ESE Assessment (60 Marks)	15	20	05	15

Special Instructions if any: Nil

ME 3007 : MACHINE TOOL DESIGN	
Teaching Scheme **Lectures: 3 Hrs/Week** **Total Credits : 03**	**Examination Scheme** **Class Test- I : 15 Marks** **Class Test- II :15 Marks** **Teachers Assessment : 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: ME1001 Basics of Mechanical Engineering, ME2013 Machine Tools

Course description: After completion of the course, students will have understanding of various machine tool drives and their components. They will have knowledge of how to design the gear boxes of machine tools, design of machine tool structures, guide ways, spindles etc. They will know the different control systems used in various machine tools. They also will acquire the knowledge of NC, CNC and DNC machines.

Course Objectives

1. To gain the knowledge of different drives and mechanisms used in machine tools
2. To gain the knowledge of design of gear boxes & feed boxes used in machine tools
3. To gain the knowledge of design of structures, guideways, spindles of machine tools
4. To gain the knowledge of various control systems used in machine tools

Course Outcome

After completing the course, students will be able to:

CO1	Design the various components of (structures, guide ways and spindles) of machine tools
CO2	Design gear box and feed box for machine tool.
CO3	Select control system for machine tool.

Detailed Syllabus:

Unit 1	**Machine Tool Drives & Mechanisms** Working & auxiliary motions, defining parameters, machine tool drives, hydraulic transmission & its elements, mechanical transmission & its elements, technico-economical prerequisites, general requirements of machine tool design processes.
Unit 2	**Regulation of Speed & Feed Rates** Definition, stepped regulation of speed, various laws of stepped regulation, design of speed box, selection of range ratio, structural diagrams, speed chart, design of feed box, machine tool drives using multiple speed motors, determination of number of teeth of gears, stepless regulation of speed & feed rates, hydraulic, electrical, mechanical stepless regulation
Unit 3	**Design of Machine Tool Structures** Functions of machine tool structures & requirements, materials, static & dynamic stiffness, profiles of machine tool structures, basic design procedure, design of beds, design of columns, design of housings, design of bases and tables, design of cross rails, arms, saddles, carriages, rams, model techniques

Unit 4	**Design of Guide ways, Power Screws & Spindles** Types of guide ways, functions, design of slide ways, design criteria, design of aerostatic slide ways, design of antifriction guide ways, protecting devices for slide ways, design of power screws, functions of spindle unit, materials of spindles, effect of machine tool compliance on machine accuracy, antifriction bearings, sliding bearings
Unit 5	**Control Systems in Machine Tools** Functions, requirements & classification, control systems for changing speeds & feeds, control systems for forming & auxiliary motions, automatic control systems, adaptive control systems, numerical control systems, distributed numerical control (DNC-1), computer numerical control, direct numerical control(DNC-2) systems, recent trends in machine tools

Text Books

1. Mehta N. K., "Machine Tool Design", Tata McGraw Hill
2. Pal D. K. and Basu S. K., "Design of Machine Tools", 4th Revised Edition, Oxford-IBH
3. Bhattacharya A., Sen G. C., "Principles of Machine Tools", New Central Book Agency, Calcutta

Reference Books

1. Acherkan N. S., "Machine Tool", Vol. I to Vol. II, MIR publications
2. Kundra T, Rao P.M., Tiwari N. K., "Numerical Control and Computer Aided Manufacturing", Tata McGraw Hill
3. Martin S. J., "NC Machine Tools", ELBS publication

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1			2			1						1	
CO2			2		3			2					2	

1 – High 2 – Medium 3 - Low

Teaching Strategies:

The teaching strategy planned through the lectures, and team based home works. Exercises assigned weekly to stimulate the students to actively use and revise the learned concepts, which also help the students to express their way of solving the problems fluently in written form. Most critical concepts and mistakes emphasized

Teacher's Assessment: Teacher's assessment of 10 marks based on the following.

1) Home assignments
2) Surprise tests with multiple choice questions

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test- I	Test- II	Teachers Assessment/ Assignment	End Semester Examination
K1	Understand	10	10	05	40
K2	Apply	05	05	05	20
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	K1	K2
Course outcomes	C01	C02
Class Test-I (15 Marks)	10	05
Class Test- II (15 Marks)	10	05
Teachers Assessment (10 Marks)	05	05
ESE Assessment (60 Marks)	40	20

Special Instructions if any: Nil.

ME 3008 MODERN CONTROL THEORY	
Teaching Scheme **Lectures: 3 Hrs/Week** **Credits: 3**	**Examination Scheme** **Class Test I : 15 Marks** **Class Test II : 15 Marks** **Teachers Assessment : 10 Marks** **End Semester Exam : 60 Marks**

Course description:
Instrumentation and Control technicians solve electrical, electronic, and computer problems using their minds and hands. These technicians install, upgrade, maintain, and repair automated equipment in industries that produce everything from appliances, medical equipment, ethanol and electric power. As an Instrumentation and Control student you learn calibration and control of industrial process equipment. You learn about process variables such as motor speed, temperature control, humidity control, pressure, level, and flow rate.

Course Objectives:

1. To provide sound knowledge about various techniques used for the measurement of industrial parameters.
2. To learn the principle of Pressure, Temperature, flow, level, density and viscosity measurements.
3. To explore the application of measuring instruments in various industries.
4. To have an adequate knowledge about pressure transducers.

Course Outcome:

After completing the course, students will be able to:

CO1	Explain basics principles of sensors, transducers and control system components.
CO2	Apply hydraulic and pneumatic system for the industrial and real life problems.
CO3	Explain working principles of thermocouples, pyrometry, RTD, Thermistors and Strain gauges.

Detailed Syllabus:

Unit 1	**BASIC CONTROL SYSTEM:** Basic industrial control system of Mechanical, Thermal, Hydraulic, Pneumatic and Electromechanical, Block diagrams and mathematical models.
Unit 2	**INDUSTRIAL AUTOMATION AND CONTROL:** Brief introduction about industrial processes and their automation, Elements of pneumatic, hydraulic and electrical control systems, Valves and Actuators, Stepper motors, PID controllers and their tuning, Implementation of digital controller, Control strategies for industrial processes, Programmable logic controller, Real-time issues on signal transmission and control, Communication systems for industrial automation, Data acquisition and Supervisory control, Control of discrete manufacturing processes, Intelligent systems for monitoring supervision and control.
Unit 3	**HYDRAULIC SYSTEM:** Characteristic of hydraulic components control valves, sources of hydraulic power, hydraulic meters, pistons and transmission, Elements of circuit

	design,Accumulation control circuit such as position control and speed control in both directions. Hydraulic Systems: Reciprocating Pump, pressure intensifier, cranes, ram,press, lift, coupling and hydraulic controls. Properties of hydraulic fluids, Filters regulator
Unit 4	**PNEUMATIC SYSTEMS:** Pneumatic power supply, Amplifiers with different controlling actions, Pneumatic valves and cylinders, theory of four way and pilot valves. **ELECTRICAL SYSTEMS:** Speed control of D.C. motors, Remote center positional serve mechanism (including effect of gearing between motor and load).
Unit 5	**INSTRUMENTATION DEVICES:** Transducers used in industrial applications and their static and dynamic characteristics, Resistance transducers, Potentiometers, RTD,Thermistors , Strain gauge: Hot wire anemometers and their industrial applications in pressure, temperature, torque, force and flow measurements, Inductive transducers: LVDT, Variable reluctance type, Synchronous and their associated Circuits.

Text and Reference Books

1. "S.K. SINGH" , "Industrial Instrumentation And Control" Tata McGraw Hill, Second edition ,2007.
2. "Williams C. Dunn", "Fundamental Industrial Instrumentation and process control" Tata McGraw Hill, Second edition ,2009.
3. Distefano J.J. & Williams I.J. "Control Systems", McGraw Hill, Third edition, 2017
4. Gopal M. "Modern Control System Theory", Second edition, New Age International Publishers,2005.
5. Ogata, "Modern Control Engineering", PHI, Eastern Economy Edition,

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1		3									2	
CO2		1	2	3								1	
CO3	1	2	3										
CO4			2									2	

1 – High 2 – Medium 3 – Low

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ME 3009: POWER PLANT ENGINEERING	
Teaching Scheme Lectures: 3 Hrs/Week Credits: 3	**Examination Scheme** Class Test 1 : 15 Marks Class Test-2 :15 Marks Teachers Assessment : 10 Marks End Semester Exam : 60 Marks

Prerequisites: ME 1001 Basics of Mechanical Engineering, ME 2011 Applied Thermodynamics

Course description: After completion of the course, students will have understanding of different types of power plants, their construction and working. They will have knowledge of impact of various power plants on our environment. They will have the knowledge of different methods for the storage of energies obtained from the power plants. They will also have the knowledge of power generation economics and will be able to do the cost analysis of power plants.

Course Objectives

1. Define terms and factors associated with power plant economics.
2. Calculate present worth, depreciation cost of different types of power plants.
3. List types, principles of operations, components and applications of steam turbine power plants, steam generators.
4. Describe basic working principles of gas turbine and diesel engine power plants.
5. Define the performance characteristics and components of such power plants.
6. List the principal components and types of nuclear reactors.
7. Understand the basics of pollution from power plants, thermal pollution, air pollution, and its environmental effects.
8. Understand the various devices for energy storage.

Course Outcome

After completing the course, students will be able to:

CO1	Analyze the economics of power generation.
CO2	Explain the working power generation systems (e.g. thermal power, hydraulic power, nuclear power).
CO3	Explain impact of power plant on environment and their remedies.
CO4	Explain and compare various energy storage devices.

Detailed Syllabus:

Unit 1	**Economics of Power Generation:** Type of loads, demand factor, load factor, diversity factor, utilization factor, plant capacity factor, and plant use factor. Load curves, load duration curves. (Numerical) Location of power plant, Layout of power plant building. Cost analysis: capital cost, operational cost, initial cost, interest, depreciation cost. Selection of type of power generation, selection of power plant equipments, economics in plant selection, factors affecting economics of generation and distribution of power. Performance and operating characteristics of power plants, economic load sharing.

Unit 2	**Steam power plants:** Classification, layout of a modern steam power plant, essential requirements of steam power station design, selection of site for steam power station, capacity of steam power plants, choice of steam conditions. Coal handling systems, fluidized bed combustion, CFBC, ash handling, dust collection, disposal and applications of fly ash, chimney draught. Classification of steam turbines, energy losses in steam turbines, governing and control. Super Critical Ultra Mega Power Plant
Unit 3	**Power Plants:** Nuclear: Atomic structure, Nuclear reaction, Nuclear stability and energy of binding, radioactive decay and half-life, heat transfer and fluid flow in nuclear reactors, types of reactors, metals for nuclear energy, advantages of nuclear power plants, site selection, safety measures, India's nuclear power program; Hydro-electric: classification, advantages and disadvantages, selection of site, hydrologic cycle, essential elements of hydroelectric power plant,comparison of hydro power station with thermal power station. Diesel Engine Power Plant: application, advantages and disadvantages, typed of Diesel plants,Heavy Fuel Oil Engines based power plant, essential components of Diesel engine power plants. Gas Turbines Power Plant: applications, advantages and disadvantages, site selection, layout, classification, components of gas turbines plant, gas turbine fuels, Gas Turbine materials.
Unit 4	**Environmental Impact of Power Plant Operation:** Pollution from thermal power plants, Thermal pollution: sources, side effects, measurement, control. Air pollution: sources, effects on health, effects on material, gaseous emission and its control, particulate emission and its control, greenhouse effect, acid rain, acid snow, photochemical smog, dry acidic deposition, flue gas desulfurization system. Pollution from nuclear power plants: nuclear power and environment, storage and disposal of radioactive waste. Introduction to pollution control norms (refer to CPCB and SPCB websites)
Unit 5	**Energy Storage:** Pumped Hydro, Compressed Air Energy Storage (CAES), Flywheel Energy storage, Electrochemical Energy Storage, Magnetic Energy Storage, Thermal Energy Storage, Chemical Energy Storage, Hydrogen Energy.

Text Books

1. P K Nag, “Power Plant Engineering”, Tata McGraw Hill
2. R K Rajput, “Power Plant Engineering”, Laxmi Publications (P) Ltd.
3. Arora and Domkundwar,”A Course in Power Plant Engineering”, DhanpatRai& Co., Delhi

Reference Books

1. M. M. El Wakil, “Power plant technology”, Tata McGraw Hill
2. S M Khopkar, “Environmental Pollution: Monitoring and Control”, New Age International Publishers,
3. Dr B BParulekar, “Energy Technology”, Khanna Publishers, Delhi
4. A K Raja, “Power Plant Engineering”, New Age International Publishers, Delhi

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1						1						1	
CO2			3		2								2	
CO3			2	2	2		2						2	
CO4	1			2									1	

1 – High 2 – Medium 3 - Low

Teacher’s Assessment: Teachers Assessment of 20 marks is based on one of the / or combination of few of following

1) Technical quizzes
3) Industrial case studies
4) Question & answer / Numerical solutions

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test 1	Test-2	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	03	03	03	12
K2	Understand	05	05	04	18
K3	Apply	04	04	01	12
K4	Analyze	03	03	02	18
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	K1	K2	K3	K4
	C01	C02	C03	CO4
Class Test-1 (15 Marks)	03	05	05	02
Class Test-2 (15 Marks)	03	05	05	02
Teachers Assessment (10 Marks)	02	04	02	02
ESE Assessment (60 Marks)	12	18	12	18

Special Instructions if any: Nil

ME 3010 : LAB-DESIGN OF MACHINE ELEMENTS-I	
Teaching Scheme **Practical : 2 Hrs/Week** **Credits: 1**	**Examination Scheme** **Term Work : 25 Marks** **Practical examination : 25 Marks**

Course Objective:

To understand and apply practical application of mechanical design

Course Outcome:

As an outcome of completing the Laboratory course, students will able to:

CO1	Understand and apply the knowledge of machine design process for practical/real loading conditions
CO2	Apply knowledge of machine design for different mechanical component like joints and brackets for practical/real loading conditions
CO3	Understand and apply the knowledge of design for different types of simple components and analyze its failure for practical/real loading conditions
CO4	Apply the knowledge of design for various joints, transmission shaft, welds and riveted joints, power screws etcand analyze its failure.

Term Work

Students shall complete the following practicals.

Sr.No	Details
1	Design of Joint with systematic procedure of design for given loads. Drawing the assembly details and the failure areas of each component of design solution. Selection of all components Material, Strengths, standard dimensions, by using Design Data Hand Book and ISO standards (Use A1 sheet).
2	Drafting assembly and details of above joint by using CAD software and checking safe stresses on software.
3	Design of Shafts subjected to direct and combined loading for practical/real loading conditions problem. Analyze design by mathematical treatment.
4	Design of standard welded or riveted joint for practical/real loading conditions problem, Analysis of design solution by mathematical treatment.
5	Design of power screw, Drawing the assembly details and the failure areas of each component for practical/real loading conditions and checking safe stresses by mathematical treatment.

Mapping of Course outcome with Program Outcomes														
Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2											3	
CO2	1	2		3									2	
CO3	1	2	3			3			3				3	
CO4	1	2	3			3			3				2	

1 – High 2 – Medium 3 – Low

Assessment Pattern:

Assessment Pattern Level No.	**Skill Level**	**Term Work**	**Practical Examination & viva voce**
S1	Imitation	05	05
S2	Manipulation	05	05
S3	Precision	05	05
S4	Articulation	05	05
S5	Naturalization	05	05
Total		25	25

Preparation (S1)	05	05
Conduct of Experiment (S2)	05	05
Observation and Analysis of Results (S3)	05	05
Record (S2)	05	05
Presentation/ Viva-Voce (S3)	05	05
Total	**25**	**25**

Assessment Table:

Assessment Tool	S1	S2	S3	S3
	C01	C02	C03	CO4
Term Work (25 Marks)	10	05	05	05
Practical Examination & Viva Voce (25 Marks)	10	05	05	05

Head of The Department
Mechanical Engineering
Govt. Engg. College A'bad

ME 3011: Lab Engineering Metallurgy	
Teaching Scheme Practical: 2 Hrs/Week Credit : 1	**Examination Scheme** Term Work : 25 Marks Practical Examination And Viva – Voce : 25 Marks

Course Outcome

As an outcome of completing the Laboratory course, students will able to:

CO1	Understand different crystal systems and various calculation included in the study of crystal system.
CO2	Use of metallurgical microscope to observe the microstructures.
CO3	Understand the significance of observation of microstructure of plain carbon steels / Alloy steels.
CO4	Interpret and observe microstructure of Cast Iron/ Non Ferrous Alloys.
CO5	Study the change in mechanical properties due to heat treatment.
CO6	Study of change in structure due to surface/ case hardening of steels.

List of Experiments

Sr. No.	Details
1.	Observation of the different Crystal Systems
2.	Operation of Metallurgical Microscope
3.	Observation of Microstructure of the Plain Carbon Steels
4.	Observation of Microstructure of Alloy Steels
5.	Observation of Microstructure of Cast Iron
6.	Observation of Microstructure of the Non Ferrous alloys
7.	Study of changes in the mechanical properties due to heat treatment
8.	Study of the change in the structure due to surface/ case hardening of steels

Mapping of Course Outcome with Program Outcomes

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1						2							1	
CO2				2		1								
CO3				2									1	
CO4				2									2	
CO5						2							1	
C06						2								

1-High 2- Medium 3- Low

Assessment Pattern

Assessment Pattern Level No.	Skill Level	Term work	Practical Examination & Viva Voce
S1	Imitation	05	05
S2	Manipulation	10	10
S3	Precision	10	10
S4	Articulation	00	00
S5	Naturalization	00	00
Total		25	25

Preparation (S1)	05	05
Conduct of Experiment (S2)	05	05
Observation and Analysis of Results (S3)	05	05
Record (S2)	05	05
Presentation/ Viva Voce (S3)	05	05
Total	25	25

Assessment Table

Assessment Tool	S1	S2	S3	S3
	CO1	C02	CO3/CO4	C05/CO6
Term Work (25 Marks)	05	10	05	05
Practical Examination & Viva Voce(25 Marks)	05	10	05	05

Head of The Department
Mechanical Engineering
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ME 3012: LAB-FLUID MECHANICS AND HYDRAULIC MACHINES	
Teaching Scheme	**Examination Scheme**
Practical: 2 Hrs/Week	**Term Work : 25 Marks**
Credit: 1	**Practical Examination & Viva Voce :25 Marks**

Course Outcome

As an outcome of completing the Laboratory course, students will able to:

CO1	Ability enhancement in practical determination of fluid viscosities and to decide the flow patterns
CO2	Ability enhancement in applying Bernoulli's theorem & momentum principle to various flow patterns
CO3	Ability enhancement in applying theoretical knowledge to find the performance of different turbines and pumps

List of Experiments in fluid mechanics

Sr. No.	Details
1	Experiment on Red wood viscometer
2	Experiment on Reynolds's apparatus
3	Experiment on Bernoulli's theorem
4	Experiment on flow measurement by orifice &venturimeter
5	Experiment on verification of momentum principle
6	Experiment on determination of force due to impact of jet
7	Experiment on determination of metacentric height of a floating body
8	Experiment on flow through pipes

List of experiments in fluid machines

Sr. No.	Details
1	Trial on Pelton wheel
2	Trial on Francis turbine
3	Trial on Kaplan turbine
4	Trial on centrifugal pump
5	Trial on gear pump
6	Trial on torque converter
7	Trial on reciprocating pump
8	Visit to hydroelectric power station

Term work

The term work will consist of submitting a file for all the experiments with neatly written records of the study and diagrams.

The term work will be assessed by the course coordinator

Practical Examination

The Practical Examination will comprise of performing the experiment and viva voce on the syllabus

The practical will be assessed by two examiners, one will be the course coordinator and other will be examiner appointed by BOS

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2			1	3	3					1	
CO2	2	2	1			2							2	
CO3	2	3	1		3	2	3						1	

1 – High 2 – Medium 3 – Low

Assessment Pattern

Assessment Pattern Level No.	**Skill Level**	**Term Work**	**Practical Examination & viva voce**
S1	Imitation	05	05
S2	Manipulation	10	10
S3	Precision	10	10
S4	Articulation	00	00
S5	Naturalization	00	00
Total		25	25

Preparation (S1)	05	05
Conduct of Experiment (S2)	05	05
Observation and Analysis of Results (S3)	05	05
Record (S2)	05	05
Presentation/ Viva-Voce (S3)	05	05
Total	**25**	**25**

Assessment Table

Assessment Tool	S1	S2	S3
	C01	C02	CO3
Term Work (25 Marks)	10	10	05

Practical Examination & Viva Voce (25 Marks)	05	10	10

ME 3013: Lab Computer Application In Mechanical Engineering-II and Mini Project	
Teaching Scheme Practical: 2 Hrs/Week Credit: 1	**Examination Scheme** Term Work : 25 Marks Practical Examination & Viva Voce :25 Marks

Course Outcome: Able to-

CO1	Identify different modelling and analysis of Mechanical Products.
CO2	Recognize the mechanical parts and choose to form 3D modelling.
CO3	Solve linear problem by making 3D model.
CO4	Create and analyse 3D model of product.

Sr. No.	Details
1	3D Modelling and analysis/ Generative Structural Analysis of mechanical components like bend Rod, I section beam, Rectangular beam etc on any of the available 3D modelling software/Computer-Aided Engineering (CAE) simulation software platform. 1) FEA concepts, 2) Meshing (pre-processing) 3) Analysis case setup (post processing) 4) Results and evaluation
2	The Mini Project based on above modelling, simulation and analysis. The student shall apply this knowledge to evaluate a product and assess different specification of product by modelling and simulation. The student creativity shall be encourage in deciding Mini Projects.

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	3										1	
CO2	2	1	3										2	
CO3	3	2	1										1	
CO4	2	2	1					2						

1 – High 2 – Medium 3 - Low

Assessment Pattern

Assessment Pattern Level No.	**Skill Level**	**Term Work**	**Practical Examination & viva voce**
S1	Imitation	05	05
S2	Manipulation	10	10
S3	Precision	10	10
S4	Articulation	00	00
S5	Naturalization	00	00
Total		25	25

Preparation (S1)	05	05
Conduct of Experiment (S2)	05	05
Observation and Analysis of Results (S3)	05	05
Record (S2)	05	05
Presentation/ Viva-Voce (S3)	05	05
Total	**25**	**25**

HS3001: INDUSTRIAL ORGANIZATION AND MANAGEMENT	
Teaching Scheme Lectures: 3 hrs/week Credits : 3	**Examination Scheme** Class Test 1 – 15 marks Class Test 2 – 15 marks Teacher's Assessment – 10 Marks End Sem Exam -60 Marks

Course Objectives

1. Students are able to understand the evolution of management thought
2. Students will be able to understand the premises of administrative behaviour and decision making required for proper motivation of employees .
3. Capable to understand the different functions and structure of management
4. Capable to understand various concepts and practices in personnel administration
5. Able to understand and compare the management in developed and developing countries and the effect of environment on management.

Course Outcomes

1. Explain and apply principles of scientific management.
2. Explain and apply theories of motivation.
3. Explain various methods of recruitment and trainings.
4. Explain organizational structure and principles.

Detailed Syllabus

Unit –1: Theories of Management Scientific Management (Taylor and the Scientific Management Movement), Classical Theory (Fayol, Urwick, Gulick and others) Bureaucratic Theory (Weber and his critics). Ideas of Mary Parker Follett and C.I. Barnard; Human Relations School (Elton Mayo and others). Behavioral Approach, Systems approach.
Unit-2: Administrative Behaviour,Decision making with special reference to H. Simon, communication and control, leadership theories. Theories of motivation (Maslow and Herzberg)
Unit-3: Organisation Hierarchy, Principles of organization- Unity of command, Span of control, Authority and Responsibility, Co-ordination, Centralization and Decentralization, Delegation, Supervision, Types of organizations, structures
Unit–4: Personnel Administration, Position classification, Recruitment, Training, Promotion, Pay and Service conditions, Administrative Ethics
Unit-5: Administrative Systems Comparative management features of USA, Great Britain, France and Japan (Riggs concept)

Text Books

1.OrganisationalBehaviour, Stephen P. Robbin ,pearson education
2. O. P. Khanna, "Industrial Organization and Management, Khanna Publications

3. D. Ravindra Prasad and V. S. Prasad, Admistrative Thinkers, Sterling Publishers, New Delhi
4.Public administration and Public affairs, Nicholas Henry, Routledge

Reference Books

1.Management of Organizational Behaviour2nd Edition by Paul Hersey, Kenneth H. Blanchard, Prentice-Hall

2.D. Gvishiyani, Organisation and Management, Progress Publishers, Moscow

Teacher's Assessment:
Teachers Assessment of 10 marks is based on one of the / or combination of few of following
1) Student's Presentation on related topics
2) Industrial Interaction
3) Case study

Mapping of Course out come with programme outcome

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			3							2			2	
CO2				2			2		2				2	
CO3		2				3		3					2	
CO4					3					1			2	
C05		3											2	

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	05	02	10
K2	Understand	10	02	10
K3	Apply	10	02	20
K4	Analyze	05	02	20
K5	Evaluate	00	02	00
K6	Create	00	00	00
Total Marks 100		30	10	60

Assessment table

Assessment Tool	K1	K2	K3	K4	K5
COs	CO1	CO2	CO3	CO4	CO5
Class Test (15+15 Marks)	06	07	05	06	06
Teachers Assessment (10 Marks)	02	03	01	02	02
ESE Assessment	12	05	10	15	18

(60 Marks)					

AC3001: Basics of Product Survey	
Teaching Scheme Practical: 2 hrs/week	**Examination Scheme** Audit Course

Course Objectives

1. To cultivate symbiotic relationship between industry and institute
2. To provide experience in valuation of engineering products
3. Interaction with Industry

Course Outcomes

1. Awareness about the various valuation methods
2. Insight of what is a proper value engineering product
3. Knowing the process involved in the designing of a value product

Term Work:

Student has to undertake a detailed survey of following engineering products

(1) Successful/failed products in the market and accessing the reasons for it

(2) Projections for a future vale product with proper data support.

The students will conduct industrial and market visits for surveying various engineering products. They will be preparing a detailed report with drawings, technical and fundamental analysis etc of the products surveyed with proper justification.

Reference Books

1. Philips kottler Marketing Management

Mapping of Course out come with programme outcome

Course Outcome	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1			3			3							1	
CO2			2		2	2							2	
CO3		2	2			3							1	

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ME 3014: HEAT AND MASS TRANSFER	
Teaching Scheme **Lectures: 2Hrs/Week** **Tutorial: 1 hr/week** **Total Credits : 03**	**Examination Scheme** **Class Test-I : 15 Marks** **Class Test-II : 15 Marks** **Teachers Assessment: 10Marks** **End Semester Exam : 60 Marks**

Prerequisites: ME1001-Basics of Mechanical Engineering

Course description: After completion of the course, students will have understanding of Steady state heat conduction, Unsteady state heat conduction, Fins, Various types of Fins Convection Radiation and Heat Exchanger and mass transfer.

Course Objectives:

1. Understand the different laws and mechanisms of different modes of heat transfer like conduction, convection and radiation.
2. Understand to analyse the steady state and unsteady state conduction mode of heat transfer.
3. Understand the need, application and performance evaluation of various types of fins.
4. Understand the construction, working and performance of different heat exchangers.

Course Outcome

After completing the course, students will be able to:

CO1	Explain the modes and principles of heat and mass transfer.
CO2	Compute temperature distribution in steady state and unsteady state heat conduction
CO3	Analyze heat transfer through extended surfaces
CO4	Interpret and analyze forced and free convection heat transfer
CO5	Design heat exchangers using LMTD and NTU methods

Detailed Syllabus:

Unit 1	**Steady State Heat Conduction** Modes of heat transfer, basic laws governing modes of heat transfer, general three dimensional heat conduction equation in Cartesian and cylindrical co-ordinates, simplification to steady state, unidirectional heat transfer equation and temperature distribution equation, with and without internal heat generation for simple case like slabs, cylinders & spheres; electrical analogy, contact resistance, composite system, critical thickness of insulation, illustrative examples
Unit 2	**Unsteady State Heat Conduction & Fins** Lumped heat capacity system, Biot number, unsteady state heat transfer for lumped

	capacity system, time constant of thermocouples, illustrative examples. Definition, need, types of extended surfaces, temperature distribution equations and heat transfer equations for pin fins and rectangular circumferential fins with various end conditions, fin efficiency, fin effectiveness, thermometric error using fin theory, illustrative examples Two dimensional heat conduction with numerical method for solution.
Unit 3	**Convection** Thermal boundary layer, heat transfer in flow through pipe, entry length, heat transfer in high speed flow, free and forced convection over vertical / horizontal plate, pipe/cylinder and sphere using empirical relations only, cup temperature; pool boiling, Nusselt theory of condensation, film-wise/drop-wise condensation, heat transfer through pipe at constant temperature & constant heat flow, illustrative examples
Unit 4	**Radiation** Mechanism of radiation, thermal radiation, definitions like black body, white body, grey body, reflectivity, absorptive, transmitivity, emissivity, emissive power, monochromatic emissive power, solid angle, intensity of radiation, radioity, irradiation Lambert's cosine law, Kirchhoff's law, Plank's distribution law, Wien's displacement law, radiation shape factor for geometrical arrangements, electrical analogy, radiative heat transfer between two large grey surfaces placed at distance with different temperature, heat transfer between concentric cylinders, spheres with different temperature, use of radiation shields, errors in thermo couple reading in radiative heat transfer, illustrative examples
Unit 5	**Heat Exchangers and Mass transfer** Introduction, classification, parallel flow and counter flow heat exchangers, applications, fouling and fouling factors, overall heat transfer coefficient, LMTD method, NTU effectiveness method of design, pressure drop, optimizations, design by LMTD method for condensers, illustrative examples, Compact heat exchanger: plat-fin type heat exchanger. Introduction to mass transfer, Fick's law, dimensionless numbers: Sherwood, Schmidt, Peclet, Rayleigh

Text Books

1. Sukhatme S. P., "A text book of Heat Transfer", Universities Press (Pvt Ltd), Hyderabad
2. Holman J. P., "Heat transfer", McGraw Hill Publishing, New York
3. Sucec James, "Heat transfer", JAICO publication house, New Delhi

Reference Books

1. Sachdeva R. C., "Fundamentals of Engineering Heat and Mass Transfer", New Age Science Limited, Delhi
2. Frank Kreith, "Principles of Heat transfer", Cengage Learning, New York
3. Kothandraman, "Heat and Mass transfer Data Book" New Age International Publication, Delhi
4. Thirumaleshwar M., "Fundamentals of Heat and Mass Transfer", Pearson Education., New Delhi

Mapping of Course Outcomes with program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2											1	
CO2	2		1										1	
CO3		3	2										2	
CO4			1										1	
CO5	1			2										

1–High 2–Medium 3-Low

ME 3015: METROLOGY AND QUALITY CONTROL	
Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs./Week	Class Test-1 :15 Marks
Tutorial: -- Hr./Week	Class Test-2 :15 Marks
Credits: 3	Teacher's Assessment:10 Marks
	End Semester Exam : 60 Marks

Pre-requisites: ME1001:Basics Of Mechanical Engineering, BS1001: Engineering Physics,

Course Description:

The course is aimed at giving the fundamentals of quality assurance methods for manufacturing processes and dimensional measuring systems. In particular, the course focuses on: introduction to quality management systems, measurement management systems, requirements for measurement processes and measuring equipment, geometrical products specifications & verification, dimensional & geometrical metrology, coordinate metrology, surface metrology.

Course Objectives:

1. To determine measuring instruments capabilities
2. To introduce measuring instruments used for linear and angular measurement
3. To introduce concept of limits and fits for engineering applications
4. To study Various comparative measurements
5. To study Control chart techniques in quality control
6. To study Purpose and use of sampling and its benefits

Course outcomes: At the end of the course, the student will be able to:

CO1	Define and explain principles and methods of measurements.
CO2	Define and explain limits, fits and gauges.
CO3	Explain and compare the different comparators
CO4	Explain principles of quality control and quality systems.
CO5	Prepare and evaluate control charts for various application.

Detailed Syllabus:

Unit 1	Definition and concept of metrology and standardizations, International system of units, Methods of measurements, Standards of measurements: standards of linear measurement, Line standard including linear standard meter, End standard, wavelength standard, Classification of standards of traceability, **Linear measurements**: Surface palate, angle plate, V-block, Bench centers, Combination set, radius gauges, Feeler gauges, Angle gauges, Pitch screw gauge,

	Principle of venires, venire height gauge, venire depth gauge, Micrometers, Types of micrometers, Slip gauges, wringing of slip gauges, care in use of slip gauges
Unit 2	**Limits and Fits:** **Limits**: Tolerances, different ways of expressing accumulation, relationship between tolerances and cost, maximum and minimum metal conditions, Indian standard (IS 919-1963) **Fits:** Terminology for limits and fits, types of fits, hole basis system, shaft basis system, selection of fits, types of assemblies like trial and error, interchangeable assembly, **Gauges**: Plain gauges, ring gauges, snap gauges, adjustable gap gauges, control and profile gauges, material for gauges, Gauge design: Taylor's principle, gauge maker's tolerance, wear allowances, numerical on gauge design
Unit 3	**Comparators:** Introduction, types of comparators, construction and working of different types of comparators like mechanical, optical, electric, pneumatic, Angular measurements: Venire bevel protector, universal bevel protector, sine bar, angle gauges, optical instrument like auto collimator, angle dekkor Measurement of surface finish: Definition, terminology, methods of measuring surface finish, Analysis of surface traces, assessment of surface roughness as per Indian standards, Metrology of screw threads: Screw threads terminology, error in threads and their effects, measurements of various elements of threads
Unit 4	**Quality Control:** Quality: Definitions, meaning of quality of product & services, Quality characteristics, Quality of design, Quality of conformance, Quality of performance, Concept of reliability, Cost, Quantity assurance, Cost of rework & repair, Quality & Inspection, Inspection stages. ISO 9000 Series & other standards: Concept, ISO 9000 series quality standards, QS14000, Standards in general, Its evaluation & Implications, necessity of ISO certification, other Quality systems
Unit 5	**Statistical Quality Control** – Meaning and importance of SQC, Variable and attribute Measurement. control charts – inherent and assignable sources of variation, control charts for variables – X & R charts, 25 control charts for attributes p, np, C charts, process capability of machine, determination of statistical limits, different possibilities, Rejection area, Statistically capable and incapable processes, Cp, Cpk. **Acceptance Sampling** – Concept, Comparison with 100% inspection, Different types of sampling plans, with merits and demerits, OC curve, It's importance and significance, Producers risk, Consumer's risk, AQL, AOQL, IQL, LTPD

Text Books

1. Jain R. K., "Engineering Metrology", Khanna Publishers, Delhi
2. Gupta I. C., A Text book of Engineering Metrology, DhanpatRai and Sons.

Reference Books

1. ASTE, Handbook of Industrial Metrology, PHI Publications.
2. Grant and Leavenworth," Statistical Quality Control", McGraw Hill publication
3. Quality Control, NITTTR Madras, Tata McGraw Hill Publishing Ltd.
4. Hume K J, "Engineering Metrology", Macdonald & Company Limited, London

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	1				2	2							1	
CO2					2	2	3						2	
CO3					2	2							1	
CO4	1		2										2	
CO5	1		2	2	2	3								

1 – High 2 – Medium 3 – Low

Teacher's Assessment: Teachers Assessment of 20 marks is based on one of the / or combination of few of following

1) Question & answer / Numerical solution
2) Presentation of case studies
3) Study of Industrial processes and its presentation
4) Quiz

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test-1	Test-2	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	03	03	03	10
K2	Understand	05	05	02	10
K3	Apply	02	02	03	20
K4	Analyze	05	05	02	20
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	K1	K2	K3	K4	K3	K2
	CO1	CO2	CO3	CO4	CO5	CO6
Class Test (15 Marks)	03	02	03	03	02	02
Class Test (15 marks)	03	02	03	03	02	02
Teachers Assessment (10 Marks)	02	01	01	04	01	01
ESE Assessment (60 Marks)	10	05	10	20	10	05

Special Instructions if any: Nil

ME3016: INDUSTRIAL ENGINEERING	
Teaching Scheme Lectures: 2hrs/week Credits : 2	**Examination Scheme** Class Test 1 – 10 marks Class Test 2 – 10 marks Teacher's Assessment- 5marks End Sem Exam- 25Marks

Course Objectives

1) To study the basics and details of Production, planning and control
2) To understand the use of work study, method study and Time study analysis related to production
3) To enable students to do the material and purchase management and inventory control
4) To study about the Plant location and lay outs
5) To enable to use the Demand forecasting and Production information system

Course Outcomes

1. Explain principles of PPC.
2. Apply methods of motion and time study for industrial problems.
3. Explain and apply principles of material management and inventory control.
4. Analyze the plant location and design the plant layout.
5. Select and apply forecasting method for particular application.

1) To provide an introductory course in Production.
2) To present the student with an overall view of the decision-making process as it relates to the major areas of Production.
3) To present the principles of operations economies (how to employ labor materials, machines, and capital) in a balance to match the changing relative values of the basic components.
4) The course will provide students with knowledge that can be applied in an industry for production planning and scheduling,
5) To be able to forecast and plan production activities effectively.

Detailed Syllabus

Unit - 1: Production Planning & Control (PPC) Introduction, need, objectives, phases, functions of PPC, aggregate planning, master production schedule, capacity planning, measurement of capacity, process of capacity planning, routing, techniques of routing, scheduling, objectives of scheduling, scheduling methodology, loading, production control, objectives of production control, techniques of production control.
Unit - 2: Work Study Introduction, advantages of work study, method study, objectives of method study, scope of method study, steps involved in method study, charts used in method

study, motion study, principles of motion study, recording techniques of motion and study, work measurement, objectives of work measurement, techniques of work measurement, time study, computation of standard time, introduction to MOST
Unit - 3: Materials Management Introduction and meaning, objectives of materials management, importance of materials management, purchasing, purchasing procedure, reasons for keeping inventory, inventory control, benefits of inventory control, standardization, simplification, value analysis
Unit - 4: Plant Location: Introduction, importance of plant location, dynamic nature of plant location, factors responsible for plant location, location analysis Layout Planning: Introduction and meaning, objectives of layout, principles of plant layout, advantages of good layout, types of layout, techniques of plant layout, features of good layout, factors relevant for the choice of layout, revising and improving plant layout
Unit - 5: Demand Forecasting: Introduction, objectives of demand forecasting, importance of demand forecasting, steps in forecasting, techniques of forecasting, other methods of forecasting Production Information System: Introduction, fundamentals of production information system, production planning system, production control system, materials management information systems Reliability: Introduction, Concepts and applications in Engineering

Text Books

1. K C Jain, L N Agrawal, "Production, Planning and Control", Khanna publishers, Delhi.
2. S. N. Chary, "Production and Operations Management", Tata Mc-Graw Hill Publishing Company Limited, New Delhi
3. Dr. B. S. Goel, "Production Operations Management", PragatiPrakashan,Meerut, India

Reference Books

1. S. Anil Kumar, "Production and Operations Management", New Age International Publishers.
2. "Introduction to Work Study", ILO, Geneva
3. Everett E. Adam, Jr, Ronald J. Ebert, "Production and Operations Management", Prentice Hall of India, Private Limited, New Delhi

Teacher's Assessment:

Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1) Student's Presentation on related topics

2) Industrial Interaction

3) Case study

Mapping of Course out come with programme outcome

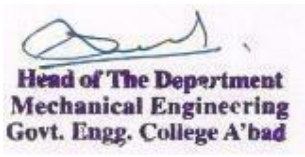
Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1				3									2	
CO2					2		2		2				1	
CO3		2				3							2	
CO4					3								2	
C05		3											2	

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	05	01	5
K2	Understand	05	01	10
K3	Apply	05	01	5
K4	Analyze	05	01	5
K5	Evaluate	00	01	00
K6	Create	00	00	00
Total Marks 100		20	5	25

Assessment table

Assessment Tool	K1	K2	K3	K4	K5
COs	CO1	CO2	CO3	CO4	CO5
Class Test (10+10 Marks)	04	04	04	04	04
Teachers Assessment (5 Marks)	01	01	01	01	01
ESE Assessment (25 Marks)	05	05	05	05	05



ME 3017 : Mechanical Measurement	
Teaching Scheme **Lectures: 2Hrs/Week** **Total Credits : 02**	**Examination Scheme** **Class Test-I : 10 Marks** **Class Test-II : 10 Marks** **Teachers Assessment: : 05Marks** **End Semester Exam : 25 Marks**

Course description:

After completing this course, students will have a broad and fundamental understanding of different measuring devices. Topics range from an overview of basic measuring instruments and systems with their characteristics, different displacement, vacuum, strain, pressure, angular velocity, acceleration and temperature measurement techniques in details.

Course Outcomes

CO1	Explain the characteristics of measurement system.
CO2	Make use of various displacement and strain measuring devices.
CO3	Make use of angular speed, acceleration, temperature and pressure measuring devices.

Detailed syllabus:

Unit-I	Significance of Mechanical Measurements, Classification of measuring instruments, generalized measurement system, types of inputs: Desired, interfering and modifying inputs. **Static characteristics:** Static calibration, Linearity, Static Sensitivity, Accuracy, Static error, Precision, Reproducibility, Threshold, Resolution, Hysteresis, Drift, Span & Range etc. **Error in measurement:** Types of errors, Effect of component errors on combination and distribution of combination errors on components, Probable errors.
Unit-II	**Displacement measurement:** Transducers for displacement measurement, Potentiometers, LVDT, Capacitance type, Digital transducers (optical encoder), Nozzle flapper transducer. **Strain measurement:** Theory of Strain Gauges, Gauge factor, Temperature compensation, Bridge circuit, Orientation of Strain Gauges for Force and Torque measurement, Strain Gauge based Load Cells and Torque Sensors
Unit-III	**Measurement of angular velocity:** Tachometers, Tacho-generators, digital tachometers and stroboscopic methods. **Pressure measurement:** Pressure standards, Elastic pressure transducers viz. Bourdon Tubes, Diaphragm, Bellows and piezoelectric pressure sensors. High−pressure measurements, Bridgman gauges Calibration of pressure sensors. **Vacuum measurement:** Vacuum gauges viz. McLeod gauge, Ionization and Thermal Conductivity gauges.
Unit-IV	**Acceleration Measurement:** Theory of accelerometers and vibro-meters, Practical Accelerometers, strain gauge based and piezoelectric accelerometers.
Unit-V	**Temperature measurement:** Resistance thermometers, Thermistors and Thermocouples, Pyrometers

Text and Reference Books

1. Sawhney A K, “Mechanical Measurements and Instruments”, DhanpatRai& Sons. New Delhi.
2. Rangan C. S, Sarma G. R.,” Instrumentation Devices and Systems”, Tata McGraw Hill, Delhi
3. Kumar D S,” Mechanical Measurements and Control” Metropolitan publication, Delhi
4. J. P. Holman, Experimental Methods for Engineers, McGraw Hills Int. Edition.
5. E. O. Doebelin, “Engineering Experimentation: planning, Execution, Reporting”, McGraw Hills Int. Edition.
6. Richard, Figliola,” Theory and Design for Mechanical Measurements”, 3rd Edition, Wiley Publication.
7. E. O. Doebelin, Measurement Systems: Applications and Design”, 5th ed., McGraw Hill.
8. Thomas Beckwith, N. Lewis Buck, Roy Marangoni, “Mechanical Engineering Measurement”, Narosa Publishing House, Bombay.

Mapping of Course outcome with Program Outcomes (Mechanical Engineering)

Course Outcome	PO1	PO 2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	1	2	3										1	
CO2	2	1	3	2	3		3						2	
CO3	3	1	2	3			3						1	
CO4	2	1	2	1									2	

Head of The Department
Mechanical Engineering
Govt. Engg. College A'bad

ME 3018: INTRODUCTION TO FEM	
Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/Week	Class Test I : 15 Marks
Credits: 3	Class Test II : 15 Marks
	Teachers Assessment : 10 Marks
	End Semester Exam : 60 Marks

Prerequisites: MA1001Engineering Mathematics,MA1002Engineering Mathematics-II,MA2001Engineering Mathematics -III

Course description: This course consists of basic understanding of finite element method. Basic finite element formulation techniques are covered in this course. This course is useful to solve solid and structural mechanics problem, heat transfer problem and fluid mechanics problem using FEM.

Course Objectives:

1. Understand how and why finite element techniques work.
2. Learn how the finite element method is implemented.
3. Develop finite element formulations of engineering problems from a variety of application areas including structural mechanics, heat transfer and fluid mechanics.
4. Understand how to use finite element analysis in design.

Course Outcome

After completing the course, students will able to:

CO1	Explain the general steps of finite element methods
CO2	Explain the various FEM techniques
CO3	Formulate and develop FEM model for common engineering problems
CO4	Apply FEM methods to solve basic problems in heat transfer, solid mechanics and fluid mechanics.

Detailed Syllabus:

Unit1	**Introduction:** Basic concept, Historical background, engineering applications, general description, comparison with other methods, Need for weighted – integral forms, relevant mathematical concepts and formulae, displacement transformation matrix, stiffness matrix, weak formulation of boundary value problems, variational methods, Rayleigh –Ritz method and weighted residual approach
Unit2	**Finite Element Techniques:** Model boundary value problem, finite element discretization, element shapes, sizes, and node locations, interpolation functions, shape functions, derivation of element equations, connectivity, boundary conditions, principal of potential energy, FEM solution, convergence criteria
Unit3	**Applications to solid and structural mechanics problems:** External and internal equilibrium equations, one-dimensional stress-strain relations, plane stress and strain problems, strain displacement relations, boundary conditions compatibility equations
Unit4	**Application to heat transfer problem:** Variation approach, Galerkin approach, one-dimensional steady state problems for conduction, convection and radiation
Unit5	**Application to fluid mechanics problems:** In viscid incompressible flow, potential-function and stream-function formulation, incompressible viscous flow, solution of incompressible fluid film lubrication

Text and Reference Books

1. Reddy J.N., "An Introduction to Finite Element Method", (2005), TMH, New Delhi
2. Seshu P., "Finite Element Analysis", (2006), PHI, New Delhi
3. T R Chandrupatla, A D Belegundu, "Finite Elements in Engineering", PHI learning Pvt Ltd.

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2			1							2	
CO2	3	2	3		1								2	
CO3	3	2	3										2	
CO4			3			2	1	1					2	

1 – High 2 – Medium 3 - Low

Teacher's Assessment: Teachers Assessment of 20 marks is based on one of the / or combination of few of following

1) Question & answer
2) Numerical solution
3) Attendance
4) Quiz

Assessment Pattern

Assessment Pattern Level No.	**Knowledge Level**	**Test I**	**Test II**	**Teachers Assessment/ Assignment**	**End Semester Examination**
K1	Remember	04	04	02	10
K2	Understand	04	04	03	10
K3	Apply	04	04	03	20
K4	Analyze	03	03	02	20
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	K1	K2	K3	K4
	C02	C01	C03	CO4
Class Test I (15 Marks)	04	04	04	03
Class Test II (15 Marks)	04	04	04	03
Teachers Assessment (10 Marks)	02	03	03	02
ESE Assessment (60 Marks)	10	10	20	20

Special Instructions if any: Nil

ME 3019: Mechanical Vibration	
Teaching Scheme **Lectures: 3Hrs/Week** **Total Credits : 03**	**Examination Scheme** **Class Test-I : 15 Marks** **Class Test-II : 15 Marks** **Teachers Assessment: 10Marks** **End Semester Exam : 60 Marks**

Course description:

This is a comprehensive course on Mechanical Vibrations And Noise Control to serve the requirements of undergraduate students in Mechanical Engineering. The course deals with the basic concepts of vibrations. Undamped, damped and forced vibrations have been analysed. Whirling of shafts, two-degree, multi-degree and torsional vibrations and approximate methods have been explained. Advanced topics like non-linear vibrations, transient, and random vibrations have been covered in this course. Methods for vibration control, noise control and their measurements have been given.

Course Objective:

To understand the basic concepts and behavior of vibrations in machines,
To understand the determination of frequencies and other parameters in single degree and two degree vibration systems
To understand to determine the critical speeds of rotating shafts
To understand how to apply the different measures for controlling the machine vibrations and noise

Course Outcomes:

After completing the course, students will be able to:

CO1	Explain various types of vibration and its effects.
CO2	Measure and analyse free and forced vibration in various mechanical systems.
CO3	Apply the control techniques for mechanical vibrations and noise.

Detailed syllabus:

Unit-I	**Single Degree of Freedom Systems-Free Vibrations:** Introduction to vibration, definitions and basic concepts, degree of freedom, types of vibrations, S.H.M., Fourier analysis. Undamped free vibrations, spring mass system, equivalent stiffness of spring combinations, longitudinal vibrations, transverse vibrations, torsional vibrations; illustrative examples; Damped free vibrations, types of damping, free vibrations with viscous damping, logarithmic decrement, dry friction or coulomb damping, illustrative examples.
Unit-II	**Single Degree of Freedom Systems-Forced Vibrations** Forced vibrations with constant harmonic excitation, magnification factor, vibrations with rotating & reciprocating unbalance, vibrations due to excitation of the support, vibrations with coulomb damping, illustrative examples.
Unit-III	**Two Degree of Freedom Systems**

	Introduction, principle modes of vibration, spring mass coupled systems, double pendulum, torsional systems; combined rectilinear & angular modes, systems with damping, illustrative examples. Critical speed of a light shaft having a single disc without and with damping, illustrative examples
Unit-IV	**Vibration Control** Vibration isolation and transmissibility, force transmissibility, motion transmissibility, vibration absorbers, measurement of vibration, vibration measuring instruments, real time frequency processing, vibration control, vibration control for noise reduction, vibration dampers and vibration isolators, illustrative examples.
Unit-V	**Noise Control** Sound, human response to sound, the Decibel scale, octave band analysis, noise, effects of noise, standards and limits, sources of noise, noise measuring instruments, noise control, industrial noise control strategies, noise control at source, noise control along path, noise control at receiver, acoustic barriers, illustrative examples.

Text and Reference Books

Text Books:

1. G. K. Grover," Mechanical Vibrations", Nemchand Publication, New Delhi
2. A.G. Ambekar, "Mechanical Vibrations and Noise Engineering, PHI, New Delhi
3. J. D. Irwin & E. R. Graf, Industrial Noise and Vibration Control, PHI, New Delhi

Reference Books:

1. Den Hartog, "Mechanical Vibrations", Dover Publication, New York
2. Hand Book of Noise and Vibration Control, Trade and Technical Press Ltd., England
3. L. L. Faulkhar, "Industrial Noise Control", Industrial Press Inc., New York .

Mapping of Course outcome with Program Outcomes (Mechanical Engineering)

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	PO 8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1		2				1							1	
CO2	2		1			1							1	
CO3		1	2	3									2	

1 – High 2 – Medium 3 – Low

Assessment table:

Course outcomes	CO1				CO2				CO3			
Assessment Tool	K1	K2	K3	K5	K1	K2	K3	K5	K1	K2	K3	K5
Class Test-I (15 Marks)	2	1	6	6	0	0	0	0	0	0	0	0
Class Test-II (15 Marks)	0	0	0	0	2	1	6	6	0	0	0	0
Teachers Assessment (10 Marks)	1	1	0	2	1	1	0	2	0	0	0	2
ESE Assessment (60 Marks)	4	0	10	10	4	0	10	10	2	0	0	10

Teaching Strategies:

The teaching strategy planned through the lectures, and team based home works. Exercises assigned weekly to stimulate the students to actively use and revise the learned concepts, which also help the students to express their way of solving the problems fluently in written form. Most critical concepts and mistakes emphasized

Teacher's Assessment: Teacher's assessment of 10 marks based on the following.

3) Home assignments
4) Surprise tests with multiple choice questions

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	Test1	Test2	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	2	2	2	10
K2	Understand	1	1	2	0
K3	Apply	06	06	00	20
K4	Analyze	00	00	00	00
K5	Evaluate	06	06	06	30
K6	Create	00	00	00	00
Total		15	15	10	60

ME 3020 : ADVANCED STRESS ANALYSIS	
Teaching Scheme **Lectures: 3Hrs/Week** **Credits: 3**	**Examination Scheme** **Class Test I : 15 Marks** **Class Test II : 15 Marks** **Teachers Assessment : 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites:ME 3002 Design of Machine Elements, ME 2012 Strength of Material

Course description:

Studies of stresses and strains in two-dimensional problems. Failure theories and yield criteria. Stress function approach to two-dimensional problems. Bending of non-homogeneous symmetric beams. Torsion of bars with prismatic bar.

Course Objectives:

1. To understand concepts of plain stress, strain, strain energy, two dimensional and octahedral stress conditions and applying it for numerical analysis.
2. Enhancing torsion concepts for circular and non-circular cross sections and applying it to various experimental and numerical analysis.
3. To understand concepts of shear centre and contact stresses in various geometric conditions and using it for numerical analysis.

Course Outcome:

After completing the course, students will able to:

CO1	Explain the concepts of principal stress and principal strains.
CO2	Solve basic problems in two-dimensional elasticity using Airy's stress function.
CO3	Solve problems based on critical conditions of loading in two dimensional state.

Detailed Syllabus:

Unit 1	**Theory of Elasticity:** Plane stresses and plane strain: plane stress, plane strain, stressand strain at a point, differential equations of equilibrium, boundary conditions, compatibility equations, Airy's stress function. Two-dimensional problems in rectangular coordinates: Solutions by polynomials, end effects, Saint Venant's principal.
Unit 2	**Applications of Energy Methods:** First and second theorems, Castigliano's theorems, applications foe analysis oftwo dimensional loaded members to determine deflections and reactions at supports and numerical.
Unit 3	**Theory of Torsion:** Torsion of prismatic bars , Thin walledhollow and rectangular cross sections, Saint Venant's theory and numerical .
Unit 4	**Experimental Stress Analysis:** Stress analysis by–mechanical, optical and electrical strain gauges, strain rosette, whole field methods, Moire fringe method, brittle coatings for strain indication.
Unit 5	**Shear Center and Symmetrical Bending:** Shear center for beams of different cross sections, bending and deflections of beams subjected to symmetrical bending.

Text and Reference Books

1.Timoshenko and Young, "Theory of Elasticity", TMH Publications.
2.Seely and Smith, "Advanced Mechanics of Materials", John Wiley, New York
3.Den Hartog J. P., "Advanced Strength of Materials", McGraw Hill Publications.
4.Nash W., "Strength of Materials", Schaum's outline series, McGraw Hill.

Mapping of Course outcome with Program Outcomes:

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2											1	
CO2	1	2	3										2	
CO3		1	2	3									3	

1 – High 2 – Medium 3 - Low

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	Class Test -I	Class Test -I	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	05	05	05	10
K2	Understand	07	07	05	10
K4	Analyze	03	03	05	20
K5	Evaluate	00	00	00	00
Total Marks 100		15	15	10	60

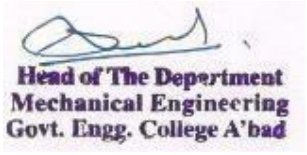
Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of the following

1) Question & answer / Numerical solution
2) Presentation of case studies.

Assessment table:

Assessment Tool	K1	K2	K3	K4
	CO1	CO2	CO3	CO4
Class Test (15 Marks)	05	07	03	00
Class Test (15 Marks)	05	07	03	00
Teachers Assessment (10 Marks)	02	03	02	00
ESE Assessment (60 Marks)	12	18	12	18

Special Instructions if any: Nil



ME 3021: DESIGN OF MACHINE ELEMENTS-II	
Teaching Scheme **Lectures: 3 Hrs/Week** **Credits: 3**	**Examination Scheme** **Class Test I : 15 Marks** **Class Test II : 15Marks** **Teachers Assessment : 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: ME2012: Strength of Materials; ME3002: Design of Machine Elements

Course description: This course builds on the foundation laid by courses of Strength of Materials and Design of Machine Elements at the undergraduate level. It takes the design of machine element aspects further and introduces PG student to optimum design of mechanical elements by considering adequate design and other aspects. It also looks into design principles for machine elements such as mechanical springs, cams, flat plates etc.

1. To understand use of different types springs and determine safe design of spring under given conditions by using design data hand book.
2. To understand the standard nomenclature, forces, failures, application, design procedure of Spur and Helical gears (As per AGMA) and to determine standard geometry under given loading condition by using design data hand book and AGMA procedure.
3. To understand the standard nomenclature, forces, failures, application, design procedure of Spur and Helical gears (As per AGMA) and to determine standard geometry under given loading condition by using design data hand book and AGMA procedure..
4 To understand the standard nomenclature, forces, failures, application, design procedure of Spur and Helical gears (As per AGMA) and to determine standard geometry under given loading condition by using design data hand book and AGMA procedure.

Course Outcome

After completing the course, students will able to:

CO1	Design of springs and gears.
CO2	Design of brakes, clutches and bearings
CO3	Explain design optimization methods

Detailed Syllabus:

Unit 1	**Springs** Functions of springs, types of springs, spring rate, closed coil helical springs, design equations, Wahl's correction factor, deflection of springs, design against static load, design against fluctuating load, effect of end turns, surging, optimum design of springs, fatigue loading, helical torsion spring, leaf spring, nipping of leaf spring, design equations
Unit 2	**Design of Spur and Helical Gears** **Spur gear**: nomenclature, force analysis, types of failures, beam and wear strength equations, effective load, dynamic effect, Buckingham's equation, AGMA approach,

	Spott's equation, different approaches used in design. **Helical Gear**: terminology of helical gears, formative number of teeth, force analysis, beam strength, effective load on gear tooth, wear strength, Design of simple and compound gear trains.
Unit 3	**Design of Bevel and Worm Gears** **Bevel gears**: terminology, bevel factor, relations of different angles, beam strength, wear strength, effective load, design equations **Worm gears:** geometry, terminology, force analysis, friction in worm gears, design for beam strength, wear consideration, and heat dissipation, empirical relations (only AGMA approach)
Unit 4	**Design of Clutches and Brakes** **Clutches:** friction clutches, uniform intensity of pressure and uniform rate of wear in conical and flat pivot, materials and design equations for single, multi-plate cone and centrifugal clutch **Brakes:** types, short shoe brakes, frictional torque, long shoe brakes, internal and external shoe brakes, frictional torque and force analysis, simple, differential and additive types of bond brakes, heat dissipation, material for lining
Unit 5	**Design of sliding and rolling contact bearings and Design optimization** **Sliding contact bearings:** viscosity, petroff's law, hydrostatic lubrication, hydrostatic step bearing, hydrodynamic theory, Reynolds's equation, Summerfield number, hydrodynamic bearing performance, Raimondi and Boyd's method **Rolling contact bearings**: Types of rolling contact bearings, Hertz contact stresses, static load carrying capacity, striebeck equation, dynamic load carrying capacity, equivalent bearing load, load life relationship, load factor, selection of bearing, roller bearings, lubrication and mounting of bearings. Design optimization, Different Methods of Optimization. Johnson's Method for size, shape, weight for simple parts. of Optimization. Johnson's Method for size, shape, weight for simple parts.

Text and Reference Books

1. Shigley J. E. and Mischkey C. R., "Mechanical Engineering Design", TMH, New Delhi
2. Spotts M. F. and Shoup T. E., "Design of Machine Elements", Prentice Hall International
3. Hall A. S., Holowenko A. R. and Laughlin H. G., "Theory and Problems of Machine Design", Schaum's outline series, Tata McGraw Hill Publication. Co. Ltd, New Delhi
4. Bhandari V. B., "Design of Machine Elements", Tata McGraw Hill Publication. Co. Ltd, New Delhi Reference Books
1. Black P. H. and O. E. Adam, "Machine Design", Tata McGraw Hill Publication. Co. Ltd, New Delhi

2. Burghardt M. D., “Introduction to engineering design and Problem Solving”, McGraw Hill Publications
3. K. Lingaiah, “Machine Design Data book”, Tata McGraw Hill Publication. Co. Ltd, New Delhi
4. Alfred Hall, Alfred Holowenko, Herman Laughlin, Somani, “MACHINE DESIGN”, Tata McGraw Hill Publication. Co. Ltd, New Delhi

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2				1		2	1			1	
CO2	1	1	2										1	
CO3	2	3	1										2	
CO4		2	3				1	2	2	1				

1 – High 2 – Medium 3 – Low

Teacher’s Assessment: Teachers Assessment of 20 marks is based on one of the / or combination of few of following

1) Question & answer / Numerical solution
2) Presentation of case studies of Application of experimental stress analysis
3) Test consisting of multiple choice questions

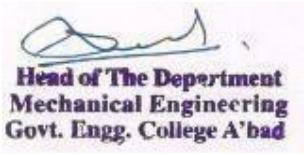
Assessment Pattern

Assessment Pattern Level No.	**Knowledge Level**	**Test I**	**Test II**	**Teachers Assessment / Assignment**	**End Semester Examination**
K1	Remember	02	02	01	20
K2	Understand	02	03	02	20
K3	Apply	03	04	02	10
K4	Analyze	03	04	05	10
K5	Evaluate	05	02	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	K1	K2	K3	K4
	CO1	CO2	CO3	CO4
Class Test (15 Marks)	03	03	05	04
Class Test (15 Marks)	05	04	03	03
Teachers Assessment (10 Marks)	02	02	03	03
ESE Assessment (60 Marks)	15	15	15	15

Special Instructions if any: Nil



ME 3022: MACHINE TOOL ERECTION	
Teaching Scheme Lectures: 3Hrs./Week Tutorial: -- Hr./Week Credits: 3	**Examination Scheme** Class Test 1 :15 Marks Class Test 2 :15 Marks Teacher's Assessment : 10 Marks End Semester Exam : 60 Marks

Pre-requisites: ME 2002-Machine Drawing, ME 2010-Mechanism of Machines

Course Description: This course is meant for the candidates who aspire to become professional machine tool maintenance engineer or maintenance consultant.

Course Objectives

1. To understand the basics of foundation of machines
2. To understand the principles of levelling and alignment
3. To understand the application of cutting fluids and coolants and lubrications
4. To understand the common maintenance of mechanical system and components

Course outcomes: At the end of the course, the student will be able to:

CO1	Explain the different types of foundation systems
CO2	Apply the principles of leveling and alignment
CO3	Analyze the properties of cutting fluids and coolants
CO4	Explain and apply the knowledge of lubrication
CO5	Explain the principles of braking system, transmission system and bearing mounting and dismounting

Detailed Syllabus:

Unit 1	**MACHINE FOUNDATION** Purpose & methods employed for installation &erection of precision & heavy duty machines.Location & excavation for foundation. Different types of foundations – foundation bolts, structural,reinforced, wooden, isolated foundations. Maintenance and Repairs of Various types of drilling machines.
Unit 2	**Leveling** Definition and importance of leveling. Types of levels- Spirit level, Water level, Dumpy level, Method of leveling. Preparation of packing and shim. **Alignment:** Definition and importance of alignment, Types of misalignment, Planes of misalignment, Shaft vs.coupling alignment, Actions to be taken before alignment, Concept of axial float, Concept of Indicator sag, Dial Test Indicator, Methods of alignment - Rim and Face readings on Stationary Machine, Rim and Face reading on

	machine to be seamed.Geometrical Alignment of Machine.
Unit 3	**Cutting Fluids and Coolants**: Essential parts of a basic cooling system used in the cutting of metals. Various types of coolants, its properties and uses , cooling system type-soluble oils- soaps, Suds paraffin, soda water etc. Effect of cutting fluids in metal cutting. Difference between coolant and lubricants.
Unit 4	**Lubrication:** Lubrication and Its Importance, lubricating systems Concept of lubrication Types and properties of Oil and Grease. Methods of oil lubrication- Once through and centralized lubrication system. Methods of grease lubrication system-grease guns, centralized lubrication system. Warning & protective devices used in centralized lubrication system (Pressure switch, temperature gauge, level indicator and relief valve.)
Unit 5	**Mechanical Components and systems:** **Brakes & Braking Systems**: Types & Functions. Inspection of brakes for safe& effective working. **Transmission System: Belt**: Problems related to belts(Creep and slip)Belt maintenance. **Gear**s: operation and maintenance of gear systems **Bearing Mounting and Dismounting:** Mounting of bearings, measurement and adjustment of clearances in bearings and storage of bearings.Related hazards, risk and precautions

Text Books

1. John Piotrowski, ”Shaft alignment handbook”, CRC Press.
2. M. K. Ghosh, B. C. Majumdar, MihirSarangi, “Theory of Lubrication” McGraw Hill Publication.
3. Robert OParmley, “Mechanical Components Handbook”, McGraw Hill Publication.
4. Neil Sclater, Nicholas P. Chironis, “Mechanisms and Mechanical Devices Sourcebook”, McGraw Hill Publications.
5. Dr. Kirpal Singh, “Automobile Engineering Volume 1 & 2”, McGraw Hill Publications.

Reference Books

1. Terrell Croft, “Machinery Foundations and Erection”, McGraw Hill Publications.

Mapping of Course outcome with Program Outcomes

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	1	2				3							1	
CO2	1	2				3							1	
CO3	2	1	1			3							2	
CO4	3	3	2											
CO5	3	3	3			3								

1 – High 2 – Medium 3 – Low

Teacher's Assessment: Teachers Assessment of 20 marks is based on one of the / or combination of few of the following

1) Question & answer / Numerical solution
2) Presentation of case studies
3) Quiz

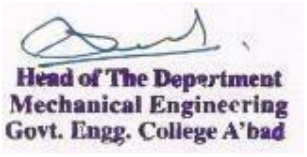
Assessment Pattern

Assessment Pattern Level No.	**Knowledge Level**	**Test 1**	**Test 2**	**Teachers Assessment/ Assignment**	**End Semester Examination**
K1	Remember	05	00	00	10
K2	Understand	05	00	05	10
K3	Apply	05	00	05	20
K4	Analyze	00	05	00	20
K5	Evaluate	00	05	00	00
K6	Create	00	05	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	K1	K2	K3	K4	K3
	CO1	CO2	CO3	CO4	CO5
Class Test (15 Marks)	05	05	05	00	00
Class Test (15 Marks)	00	00	05	05	05
Teachers Assessment (10 Marks)	03	01	01	03	02
ESE Assessment (60 Marks)	10	10	10	20	10

Special Instructions if any: Nil.



ME 3023 : LAB-HEAT AND MASS TRANSFER	
Teaching Scheme Practical: 2 Hrs/Week Credits: 1	**Examination Scheme** Term Work :25 Marks Practical Examination & Viva Voce: : 25 Marks

Course Outcome

As an outcome of completing the Laboratory course, students will able to:

CO1	understand the basic laws of heat transfer, the fundamentals of convective heat transfer process.
CO2	analyze problems involving steady state heat conduction in simple geometries, performance of pin fin under different tip conditions, Steffen Boltzmann constant, emissivity of test surface, critical heat flux.
CO3	develop solutions for transient heat conduction in simple geometries, heat exchanger performance by using the method of log mean temperature difference.
CO4	calculate radiation heat transfer between black body surfaces, radiation heat exchange between gray body surfaces.

Minimum Eight experiments shall be performed to cover entire curriculum of course ME3023. List of Experiments

Sr. No.	Details
1	Determination of thermal conductivity of Metal rod
2	Determination of thermal conductivity of Insulating powder
3	Determination of thermal conductivity of composite wall
4	Determination of heat transfer coefficient in Natural convection
5	Determination of heat transfer coefficient in forced convection
6	Determination of fin efficiency in Natural and Forced convection
7	Determination of Emissivity of a test surface
8	Determination of Stefan Boltzmann constant
9	Determination of critical heat flux of given Nichrome wire
10	Determination of LMTD and Effectiveness of heat exchanger in parallel and counter flow arrangement
11	Determination of heat transfer from a heat pipe
12	Calibration of thermocouple

Term work

The term work will consist of submitting a file for all the experiments with neatly written records of the study and diagrams.

The term work will be assessed by the course coordinator

Practical Examination

The Practical Examination will comprise of performing the experiment and viva voce on the syllabus

The practical will be assessed by two examiners, one will be the course coordinator and other will be examiner appointed by BOS

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1		3										1	
CO2		2				3							1	
CO3	1			2		3							2	
CO4			3											

1 – High 2 – Medium 3 - Low

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Mechanical Engineering
Govt. Engg. College A'bad

ME 3024: Lab-METROLOGY AND QUALITY CONTROL	
Teaching Scheme	**Examination Scheme**
Practical: 2 Hrs/Week	Term Work : 25 Marks
Credit: 1	Practical Examination & Viva Voce :25 Marks

Course Objectives

Students will be able to:

1. Define accuracy, precision, calibration, sensitivity, repeatability and such relevant terms in metrology
2. Select appropriate instrument/s for specific measurement.
3. Analyze and interpret the data obtained from the different measurements processes and present it in the graphical form, statistical form.
4. Construct and draw the control charts.
5. Understand ISO certification procedure and quality system.

Course Outcome

As an outcome of completing the Laboratory course, students will able to:

CO1	Proper alignment of the instrument with work piece
CO2	Handle measuring instruments
CO3	Care and maintenance of instruments
CO4	Measure the angle, surface finish using the instruments
CO5	Calibration and traceability of the instruments
CO6	Graphical representation of data

List of Experiments

Sr. No.	Details
1	Demonstration and experimentation on measuring instruments for linear measurements
2	Demonstration and experimentation on sine bar, sine Centre
3	Demonstration and experimentation on different types of comparators
4	Demonstration and experimentation on auto-collimator/angle dekkor
5	Demonstration and experimentation on surface finish measuring instruments
6	Demonstration and experimentation on screw thread measuring instruments
7	Inspection of production job by statistical process control
8	Study control charts for statistical quality control

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1												1	
CO2	2	3											3	
CO3	3												1	
CO4	1	3			3	1							2	
CO5	1		2			2							1	
CO6	3	3			3	2								

1 – High 2 – Medium 3 – Low

Assessment Pattern

Assessment Pattern Level No.	**Skill Level**	**Term Work**	**Practical Examination & viva voce**
S1	Imitation	05	05
S2	Manipulation	10	10
S3	Precision	10	10
S4	Articulation	00	00
55	Naturalization	00	00
Total		25	25

Preparation (S1)	05	05
Conduct of Experiment (S2)	05	05
Observation and Analysis of Results (S3)	05	05
Record (S2)	05	05
Presentation/ Viva-Voce (S3)	05	05
Total	**25**	**25**

Assessment Table

Assessment Tool	S1	S2	S2	S3	S2	S3
	C01	C02	C03	CO4	C05	C06
Term Work (25 Marks)	05	03	03	05	04	05
Practical Examination & Viva Voce (25 Marks)	05	03	03	05	04	05

ME 3025: LAB- MECHANICAL MEASUREMENT	
Teaching Scheme Practicals : 2 Hrs/Week Credits : 1	**Examination Scheme** Term Work : 25 Marks Practical examination : 25 Marks

Course Objective

To understand and apply knowledge of transducers and measuring equipments for practical/real situations

Course Outcome

As an outcome of completing the Laboratory course, students will able to:

CO1	Apply knowledge of principles of various sensors and transducers for measuring system.
CO2	Apply knowledge of displacement, strain measuring instrument for practical /real life situation and setting the instruments for zero error adjustment, Calculation of least count of instrument
CO3	Apply knowledge of Angular velocity, pressure, vaccum measuring instrument for practical /real life situation and analyse its characteristics, setting the instruments for zero error adjustment, Calculation of least count of instrument (for group of 15 students)
CO4	Apply knowledge of Temperature, acceleration measuring instrument for practical /real life situation (for group of 15 students)

Term Work

Students shall perform the following practical(Any Five)

Sr.No	Details
1	Study and demonstration of generalized measurement system with a typical instrument
2	Measurement of force using any one force measuring instrument, setting the instruments for zero error adjustment, Calculation of least count of instrument
3	Measurement of strain using strain gauge and calculation of gauge factor (for group of 15 students)
4	Measurement of pressure using any one pressure measuring instrument and setting the instruments for zero error adjustment
5	Measurement of temperature using RTD/Thermocouple/pyrometer and analyzing its characteristics.
6	Measurement of speed using any one speed measuring instrument and analyzing of its constant
7	Measurement of torque using any one torque measuring instrument analyzing of its constant
8	Measurement of displacement using LVDT and analyzing its characteristics.

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	3										1	
CO2	1	2	3										2	
CO3	1	2	3			3			3				1	
CO4	1	2	3			3			3				3	

Assessment Table

Assessment Tool	S1	S2	S3	S3
	C01	C02	C03	CO4
Term Work (25 Marks)	05	05	10	05
Practical Examination & Viva Voce (25 Marks)	05	05	10	05

Assessment Pattern

Assessment Pattern LevelNo.	**Skill Level**	**Term Wor k**	**Practical Examination & vivavoce**
S1	Imitation	05	05
S2	Manipulation	05	05
S3	Precision	05	05
S4	Articulation	05	05
55	Naturalization	05	05
Total		25	25

Preparation (S1)	05	05
Conduct of Experiment (S2)	05	05
Observation and Analysis of Results (S3)	05	05
Record (S2)	05	05
Presentation/ Viva-Voce (S3)	05	05
Total	**25**	**25**

ME 3026: LAB- INDUSTRIAL INTERACTION	
Teaching Scheme Practical: 2 hrs/week Credit 1	**Examination Scheme** Term work: 25 marks Practical/Oral: 25 marks

Course Objectives

1. To cultivate symbiotic relationship between college and industry as well as college and other research institutes.
2. To provide ample opportunities for industry exposure to students through industrial visits, summer internship and industry projects.
3. Interact with the engineers in industry and get acquainted with the latest technologies and use theoretical knowledge for solving 'real life' problems encountered in industry

Course Outcomes

Student will able to

CO1	Aware about the job functions in the industry technique
CO2	Develop attitudes to adapt to industrial environment
CO3	Enhance proper practical and relevant knowledge and skills
CO4	Develop capabilities to become self-employed

MappingofCourseoutcomewithprogrammeoutcome

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1				2	2	1						1	
CO2						3	1						2	
CO3			1			2	1	1					2	
CO4						2	1		1	1			2	

1 – High 2 – Medium 3 - Low

Term Work

Student has undergo industrial training of minimum three weeks and submit a report of industrial training of at least 30 pages containing Organization goal, history, structure, layout, departmental details, PPC, material management, R&D etc The students will be engage in Industry in consultation with his guide. The guide will monitor the training with weekly review. Guide will instruct and advise the student from time to time. The student has to engage in Training immediately after the end semester exam of semester 4.

Practical Examination

The Practical Examination will comprise of performing the experiment and viva voce on the syllabus the practical will be assessed by two examiners, one will be the course coordinator and other will be examiner appointed by BOS

AssessmentTable

Assessment Tool	S1	S2	S3	S3
	C01	C02	C03	CO4
Term Work(25Marks)	06	04	10	05
Practical Examination & Viva Voce(25Marks)	06	04	10	05

Assessment Pattern

Assessment Pattern LevelNo.	**Skill Level**	**Term Wor k**	**Practical Examination & vivavoce**
S1	Imitation	06	09
S2	Manipulation	04	06
S3	Precision	05	05
S4	Articulation	10	05
55	Naturalization	00	05
Total		25	25

ME 3027: QUALITY MANAGEMENT SYSTEMS	
Teaching Scheme Lectures:3hrs/week Credits :3	**Examination Scheme** Class Test 1 – 15 Marks Class Test 2 -15 Marks Teacher's Assessment – 10 Marks End Sem Exam- 60 Marks

Objectives:

To,

1. Understand the laws, principles and phenomena in the field of quality management

2. Be able to apply quality philosophies and tools.

3. Create and evaluate process management systems

4. To understand and analyse the customer supplier dynamics

5. To understand the contemporary trends in logistics

Outcomes:

1. Explain the principles and various philosophies of quality management.

2. Apply Just in time technique.

3. Apply various techniques of SQC and TQM.

4. Explain quality standards and supply chain management.

Detailed Syllabus:

Unit 1 Quality Management: Introduction to Quality management, principal of Quality management, Philosophies of various Quality Gurus, Quality planning, leadership theories, Theories of motivation (Maslow and Herzberg), Fred W. Riggs model of comparative management
Unit 2 Element of Just In Time manufacturing, Advantages, limitations, plant arrangement for flexible plan, planning, control, kanban, just in time logistics, Implementation issues in JIT manufacturing, Inventory management for JIT , Decision making in JIT, leadership theories.

Theories of motivation

Unit 3

Quality circle, Human dimension in TQM, Quality Management Tools like Brainstorming, Histogram, check sheet, pareto diagram, Ishiwaka Diagram, control chart, scatter diagram, Affinity diagram, Tree diagram, Five S theory. Quality certification, ISO 9000, TPM- Definition and distinctive feature of TPM, Four developmental Stages of TPM Relationship between TPM, Terotechnology and logistics, Maximization equipment effectiveness organization for TPM implementation, communication and control

Unit 4

Customers and suppliers -- Define internal and external customers, identify their expectations, and determine their satisfaction levels; define internal and external suppliers and key elements of relations with them, Customer satisfaction and loyalty, Basic customer service principles, Multiple and diverse customer management

Unit 5

Quality principles for products and processes -- Identify basic quality principles related to products (such as features, fitness-for-use, freedom from defects, etc.) and processes (such as monitoring, measuring, continuous improvement, etc.). • Quality standards, requirements, and specifications Supply Chain Management ,Supplier Selection ,• Supplier communications, Supplier Performance , Supplier Improvement, Supplier Certification, Partnerships, and Alliances , Supplier Logistics

Reference Books

1. D. C. Montgomery, Introduction to Statistical Quality Control, John Wiley & Sons,
2. Mitra A., Fundamentals of Quality Control and Improvement, PHI
3. J Evans and W Linsay, The Management and Control of Quality, Thomson.
4. Besterfield, D H et al., Total Quality Management, Pearson Education.
5. D. C.Montgomery, Design and Analysis of Experiments, John Wiley & Sons
6. D. C. Montgomery and G C Runger, Applied Statistics and Probability for Engineers, John Wiley & Sons

Teacher's Assessment:

Teachers Assessment of 10 marks is based on one of the / or combination of few of following

Student's Presentation on related topics

Mapping of Course out come with programme outcome

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1				3									1	
CO2	3				2		2		2				2	
CO3		2				3							1	
CO4					3								3	
C05		3												

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test 1	Test 2	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	05	05	05	10
K2	Understand	03	03	02	10
K3	Apply	02	02	05	20
K4	Analyze	02	02	03	20
K5	Evaluate	03	03	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	K1	K2	K3	K4	K5
COs	CO1	CO1/CO5	CO3	CO4/CO2	CO5
Class Test (30 Marks)	05	07	05	08	05
Teachers Assessment (10 Marks)	02	01	03	02	02
ESE Assessment (60 Marks)	12	05	10	15	18

HS 3005: Production Management	
Teaching Scheme Lectures: 2hrs/week Credits: 2	**Examination Scheme** Class Test 1 – 10marks Class Test 2 – 10 marks Teacher's Assessment – 05 marks End Sem Exam – 25marks

Course Objectives

1. Students are able to understand the concepts of system and personnel productivity.
2. Students are able to understand various tools of operation management
3. Understand the various strategies and their characteristics.
4. Able to understand the concept of supply chain management
5. Able to understand concepts of forecasting and planning.

Course Outcomes

1. Explain principles of production and operation management.
2. Analyze the operations effectiveness.
3. Apply various management strategies.
4. Define and explain the various supply chain management
5. Apply various forecasting techniques.

Detailed Syllabus

Unit 1- Production Management: Integrated Production Management, System Productivity, Capital Productivity, Labour Productivity, Personnel Productivity, Training
Unit 2- Operations Management: Introduction, Operations Management and Strategy, Tools for Implementation of Operations, Industry Best Practices
Unit 3- Operations Strategy: Operations Strategy, Competitive Capabilities and Core Competencies, Operations Strategy as a Competitive Weapon, Linkage Between Corporate, Business, and Operations Strategy, Developing Operations Strategy, Elements or Components of Operations Strategy, Competitive Priorities, Manufacturing Strategies, Service Strategies, Global Strategies and Role of Operations Strategy, Case-lets
Unit 4-Supply Chain Management : Introduction, Domain Applications, SCM– The Breakthrough Article, Supply Chain Management, Views on Supply Chain, Bullwhip Effect in SCM, Collaborative Supply Chain, Inventory Management in Supply Chain, Financial Supply Chain – A New Revolution within the SCM Fold
Unit 5- Forecasting: Introduction, The Strategic Importance of Forecasting, Benefits, Cost implications and Decision making using forecasting, Classification of Forecasting Process, Methods of Forecasting, Forecasting and Product Life Cycle, Selection of the Forecasting Method, Qualitative Methods of Forecasting, Quantitative Methods, Associative Models of Forecasting, Accuracy of Forecasting

Text Books:

(1) Production and operation managements, S.N.Chary, Tata McGrawhill
(2) Principles of Managments, Charles WL Hill, Tata McGrawhill
(3) Quantitative Techniques, P.C.Tulsian, Pearson
(4) The Management of Business Logistics. By John Coyle, Edward Bardi and John Langley published by Thomson, 2003.

Reference Books:

(1) Operations Management, Jay Heizer, Pearson
(2) Introduction to management science, Bernard W.Taylor, Pearson
(3) Supply chain design and management: Strategic and tactical perspectives. By Manish Govil and Jean-Marie Proth. edition published by Academic Press, 2002

Teacher's Assessment:

Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1) Student's Presentation on related topics

2) Industrial Interaction

3) Case study

Mapping of Course out come with programme outcome

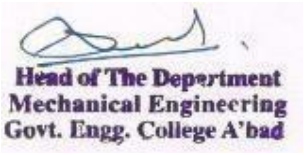
Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1			3										1	
CO2		2		2	2		2		2				2	
CO3		2				2		3					1	
CO4					3								2	
C05		3												

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	05	01	05
K2	Understand	05	02	10
K3	Apply	05	01	05
K4	Analyze	05	01	05
K5	Evaluate	00	00	00
K6	Create	00	00	00
Total Marks 100		20	5	25

Assessment table

Assessment Tool	K1	K2	K3	K4	K5
COs	CO1	CO2	CO3	CO4	CO5
Class Test (10+10 Marks)	04	04	04	04	04
Teachers Assessment (5 Marks)	01	01	01	01	01
ESE Assessment (25 Marks)	05	05	05	05	05



AC 3002: Seminar	
Teaching Scheme Practical: 2Hrs/week	**Examination Scheme**

Course description: After completing this course, students will develop the life-long learning habit of archiving, assessing, and sharing their learning by creating a portfolio to honor, understand, and connect their learning from self to global society for the betterment of both. The seminar will cover topics of current interest or provide in-depth coverage of selected topics.

Course Objectives:

To survey selected topics addressing issues of science in society today To familiarize with scientific literature
To collect information on each topic
To assimilate, synthesize and integrate information
To organize the information on each topic into an analysis structured in this manner To discuss the information and present work in prescribed formats

Course Outcome

After completing the course, students will be able to:

CO1	Identify and compare technical and practical issues related to the area of program specialization.
CO2	Outline annotated bibliography of research demonstrating scholarly skills.
CO3	Prepare a well organized report employing elements of technical writing and critical thinking.
CO4	Demonstrate the ability to describe, interpret and analyze technical issues and develop competence in presenting.

Detailed description:

Seminar should be based on literature survey on any current topic, with audiovisual aids, graphs, charts and models as assigned to them on individual basis. It will be submitted as a report in hard bound. The candidate will have to deliver a seminar presentation in front of the examiners, one of them will be guide and other will be the examiner appointed by BoS. The performance of the student will be evaluated by both examiners jointly based on the content of the seminar, delivery of seminar and answers to the queries of the examiners.

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1		2		3			2	1	1			1	
CO2			3				2	2					3	
CO3	1			2		2							3	
CO4			1	1				1					3	