Vision & Mission of Institute	
Vision:	To be a Leader in preparing professionally competent engineers
Mission:	We, at Annasaheb Dange College of Engineering and Technology, Ashta, are committed to achieve our vision by
•	Imparting effective outcome based education.
•	Preparing students through skill oriented courses to excel in their profession with ethical values.
•	Promoting research to benefit the society.
•	Strengthening relationship with all stakeholders.
Vision & Mission of Department	
Vision:	To be a leader in developing mechanical engineering graduates with knowledge, skills & ethics
Mission:	We, at the Department of Mechanical Engineering are committed to achieve our vision by,
•	M1- Imparting effective outcome based education.
•	M2- Preparing students to serve the society with professional skills and ethical values.
•	M3- Cultivating skills and attitude among students and faculties to promote research

Program Educational Objectives (PEOs)	
The graduates of the Department of Mechanical Engineering at ADCET, Ashta will be able to,	
PEO 1:	Provide solutions to the problems of mechanical and relevant engineering disciplines using the knowledge of fundamental science and skills developed during graduation studies.
PEO 2:	Demonstrate an understanding about selected specific areas of mechanical engineering in career development.
PEO 3:	Communicate and function effectively using professional ethics, social and environmental awareness.
PEO 4:	Engage in lifelong learning, for effective adaptation to technological changes.

Program Outcomes (POs)	
PO 1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	Environment and stainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	Project management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
Program Specific Outcomes (PSOs)	
PSO 1	An ability to find out, articulate the local industrial problems and solve with the use of mechanical engineering tools for realistic outcomes.
PSO 2	Apply the knowledge of mechanical engineering domains to design and analyze the products or processes.

HOD
Mechanical Engineering

Annasaheb Dange College of Engineering and Technology, Ashta

An Autonomous Institute

Curriculum Structure

S. Y. B. Tech.
MECHANICAL ENGINEERING

Academic Year 2018-19

SYME-01/55

Teaching and Evaluation Scheme
S.Y.B.Tech. Mechanical Engineering: III Semester

Course Code	Course	Teaching Scheme				Evaluation Scheme				
						Scheme	Theory (Marks)		Practical (Marks)	
		L	T	P	Credits		Max.	Min. for Passing	Max.	Min. for Passing
0MEBS201	Applied Mathematics-III	3	1	--	4	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEPC202	Engineering Thermodynamics	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEPC203	Fluid Mechanics	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEPC204	Manufacturing Processes and Machine Tools	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEPC205	Machine Drawing	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEES206	Computer Programming Using C++	2	--	--	2	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEMC207	Environmental Studies	2	--	--	--	ISE	50	GRADE	--	--
0MEPC251	Fluid Mechanics Laboratory	--	--	2	1	ISE	--		25	10
						ESE	--	POE	25	10
0MEPC252	Machine Drawing Laboratory	--	--	2	1	ISE	--		25	10
						ESE	--	POE	25	10
0MEES253	Computer Programming Using C++ Laboratory	--	--	2	1	ISE	--	--	25	10
0MEPC254	Workshop Practice -III	--	--	2	1	ISE	--	--	25	10
0MEHS255	General Proficiency	--	--	2	--	ISE	--	GRADE	--	--
	Total	**19**	**01**	**10**	**22**	**Total**	**650**		**150**	
	Total Contact Hours/Week: 30 hrs									

Course Category	HS	BS	ES	PC	PE	OE	PR
Credits	00	04	03	15	00	00	00
Cumulative Sum	03	20	32	15	00	00	00

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SYME-02/55

Teaching and Evaluation Scheme
S.Y.B.Tech. Mechanical Engineering: IV Semester

Course Code	Course	Teaching Scheme				Evaluation Scheme				
						Scheme	Theory (Marks)		Practical (Marks)	
		L	T	P	Credits		Max.	Min. for Passing	Max.	Min. for Passing
0MEES208	Applied Numerical Methods	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEPC209	Mechanics of Materials	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEPC210	Thermal Engineering	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEPC211	Hydraulic Machines	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEPC212	Kinematics of Machines	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEPC213	Materials Science and Metallurgy	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEES257	Numerical Methods using MATLAB Laboratory	--	--	2	1	ISE	--	--	25	10
0MEPC258	Hydraulic Machines Laboratory	--	--	2	1	ISE	--		25	10
						ESE	--	POE	25	10
0MEPC259	Kinematics of Machines Laboratory	--	--	2	1	ISE	--	--	25	10
0MEPC260	Materials Science and Metallurgy Laboratory	--	--	2	1	ISE	--	--	25	10
0MEPC261	Computer Aided Design Laboratory	--	--	2	1	ESE	--	POE	25	10
0MEPC262	Workshop Practice -IV	--	--	2	1	ISE	--	--	25	10
						ESE	--	POE	25	10
	Total	**18**	**--**	**12**	**24**	**Total**	**600**		**200**	
	Total Contact Hours/Week: 30 hrs									

Course Category	HS	BS	ES	PC	PE	OE	PR
Credits	00	00	04	20	00	00	00
Cumulative Sum	03	20	36	35	00	00	00

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SYME-03/35

Course Details:

Class	B. Tech, Sem.-III
Course Code and Course Title	**0MEBS201, Applied Mathematics-III**
Prerequisite/s	OBSBS 102, OBSBS 113
Teaching Scheme: Lecture/Tutorial	03/01
Credits	04
Evaluation Scheme: ISE I/ MSE/ ISE II/ ESE	10/30/10/50

Course Objectives:	
01	To improve mathematical skills for enhancing of logical thinking power of students.
02	To acquire knowledge with a sound foundation in mathematics and prepare them for graduate studies in Mechanical Engineering.
03	To aware about mathematics fundamental necessary to solve and analyze engineering problem.

Course Outcomes : Upon successful completion of the course, the student should be able to	
0MEBS201_1	Solve the problems on Fourier Series and Laplace Transform, **(K^3)**
0MEBS201_2	Make use of Linear Differential Equation to solve the Mechanical Engineering problems, **(K^3)**
0MEBS201_3	Make use of Partial Differential Equation to solve the Mechanical Engineering problems, **(K^3)**
0MEBS201_4	Solve the problems of vector calculus, **(K^3)**
0MEBS201_5	Construct the Fourier Series for any functions. **(K^3)**

Course Contents:		
Unit 1	**Vector Calculus** Introduction, Scalar and vector point functions - vector operator del, Del applied to scalar point functions - gradient, directional derivative, Del applied to vector point functions - Divergence and curl, Line integral, Green's theorem in the plane	**07 Hrs.**
Unit 2	**Linear Differential Equations** Definitions, Complete solution, Operator D, Rules for finding Complementary function, Inverse operator, Rules for finding the Particular integral, Cauchy's homogeneous linear differential equations	**07 Hrs.**
Unit 3	**Applications of Linear Differential Equations** Introduction, Oscillations of a spring - Free oscillations, Damped Oscillations, Forced oscillations without damping. The Whirling of Shafts.	**07 Hrs.**
Unit 4	**Laplace Transform** Introduction, Laplace transform of elementary functions. Properties of Laplace Transforms, Transforms of derivatives, Transforms of integrals, Multiplication by t^n, Division by t, Evaluation of integrals by Laplace Transforms. Inverse Laplace transforms - Method of Partial Fractions, convolution Theorem, Applications of Laplace transform to solve linear differential equations	**07 Hrs.**

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SYME-04/55

Unit 5	**Fourier Series** Introduction, Euler's Formulae, Conditions for a Fourier expansion, Functions having points of discontinuity, Change of interval, Expansion of odd or even periodic functions, Half range series	**07 Hrs.**
Unit 6	**Partial Differential Equations and its Application** Introduction –Formation of partial differential equations, linear equation of the first order (Lagrange's equation) , Method of separation of variables, Vibration of a stretched string, one dimensional wave equation (using separation of variables), One dimensional heat flow equation (using separation of variables).	**07 Hrs.**

Tutorials

Sr. No	Title of Tutorial
01	Vector Differential Calculus - gradient, directional derivative, Divergence and curl
02	Vector Differential Calculus - Line integral, Green's theorem in the plane
03	Linear Differential Equations – Solution of linear differential equation f(D) = X where a. $X = e^{ax}$, b. $X = \sin(ax+b)$ or $\cos(ax+b)$ c. $X = x^m$. d. $X = e^{ax}$V, whereV is a function of x .
04	Linear Differential Equations - – Solution of linear differential equation f(D) = X where a. When X is any other function of x. b. Cauchy's homogeneous linear differential equations.
05	Applications Linear Differential Equations - Oscillations of a spring a. Free oscillations b. Damped Oscillations
06	Applications Linear Differential Equations – a. Forced oscillations without damping. b. The Whirling of Shafts.
07	Fourier Series.
08	Laplace Transform
09	Inverse Laplace Transform
10	Partial Differential Equations
11	Applications of Partial Differential Equations

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Higher Engineering Mathematics	Dr. B. S. Grewal	Khanna Publication	40	2007
02	Higher Engineering Mathematics.	H. K. Das	S. Chand and company ltd.,	1	2011
03	Higher Engineering Mathematics.	B.V. Ramana	Tata McGraw Hill Education Pvt., ltd.	1	2007
04	A text book of Engineering Mathematics	N.P.Bali, Manish Goyal	Laxmi Publication New Delhi	7	2007

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Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Advanced Engineering Mathematics	Erwin Kreyszig	John Wiley & Sons,Inc.	9	2007
02	Advanced Engineering Mathematics.	Potter Merle C.	Oxford University Press,	3	2005
03	Engineering Mathematics Volume I and II	ITL Education	Cengage Learning India Private limited	1	2015
04	Advanced Engineering Mathematics.	ONeil Peter V	Cengage Learing India Pvt. Ltd.,	1	2012
05	Engineering Mathematics Vol- I.	Kandasamy P. Thilagavathy K. Gunavathy K.	S Chand & Company Ltd New Delhi	3	2000
06	Engineering Mathematics Vol- II.	Kandasamy P. Thilagavathy K. Gunavathy K.	S. Chand & Company Ltd, New Delhi	4	1999

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Course Details:

Class	B. Tech, Sem.-III
Course Code and Course Title	**0MEPC202, Engineering Thermodynamics**
Prerequisite/s	0BSES111
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I/ MSE/ ISE II/ ESE	10/30/10/50

Course Objectives:	
01	To understand fundamentals of thermodynamics and laws of thermodynamics
02	To understand basic theory of entropy and exergy.
03	To study the types of fuels and their properties.
04	To understand combustion process in thermodynamic systems and flue gas analysis

Course Outcomes (COs): Upon successful completion of this course, the students will be able to:	
0MEPC202_1	Explain basic laws of thermodynamics, **(K^2)**
0MEPC202_2	Define and describe fundamentals of entropy, **(K^2)**
0MEPC202_3	Explain the importance of heat and work and their correlation, **(K^2)**
0MEPC202_4	Apply the concepts of engineering thermodynamics to systems, **(K^3)**
0MEPC202_5	Analyze various properties of fuels related with combustions. **(K^3)**

Course Contents:		
Unit 1	**First Law of Thermodynamics** Dimensions and Units, Thermodynamic Systems, Properties of a System, State and Equilibrium, Processes and Cycles, Temperature and the Zeroth Law of Thermodynamics, Temperature Scales,Heat and Work Transfer, First law of Thermodynamics, First law applied to closed system, Limitations of First Law of Thermodynamics, Energy- a Property of system, Different forms of stored energy	**07 Hrs.**
Unit 2	**The Second Law of Thermodynamics** Qualitative difference between work and heat, cyclic heat engine, Kelvin–Planck Statement, Clausius Statement, Refrigerators and Heat Pumps, Equivalence of the Two Statements, Perpetual-Motion Machines, Reversible and Irreversible Processes, The Carnot Cycle, The Carnot theorem and its corollaries.	**07 Hrs.**
Unit 3	**Entropy** Clausius Theorem, Entropy-Property of system, T-s plot, Clausius Inequality, Entropy Principle, Applications of Entropy principle, The Tds Relations, Isentropic Efficiencies of Steady-Flow Devices, Entropy Balance, Entropy and Disorder	**07 Hrs.**
Unit 4	**Exergy** Available Energy, Available Energy referred to cycle, law of degradation of energy, maximum work in reversible process, Reversible work by open system, closed system and in steady flow process, Useful work, dead state, Exergy Balance.	**07 Hrs.**

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SYME-07/55

Unit 5	**Fuels** Introduction, Types of fuels, Properties of fuels, HCV and LCV, measurement of Calorific Value, Selection of fuel, Qualitative and Quantitative Analysis, Flue gas analysis	**06 Hrs.**
Unit 6	**Combustion** Basic Chemistry, Combustion Equations, Theoretical Air and Excess Air, Stoichiometric Air Fuel (A/F) Ratio, Air-Fuel Ratio from Analysis of Products, Conversion of Volumetric Analysis to Weight Analysis and Weight Analysis to Volumetric Analysis	**08 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Thermodynamics: An Engineering Approach	Yunus A. Cengel	McGraw Hill	8	2015
02	Engineering Thermodynamics	P. K. Nag	McGraw Hill	5	2013
03	Engineering Thermodynamics	R. K. Rajput	Laxmi Publications	3	2007
04	Engineering Thermodynamics	D.S. Kumar	S.K. Kataria and Sons	4	2012

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Fundamentals of Thermodynamics	Richard E. Sonntag, Claus Borgnakke	New Age International	7	2009
02	Applied Thermodynamics	Onkar Singh	New Age International	3	2009
03	Fundamentals of Thermodynamics	Borhnakke, Sonnatag	Wiley Publication	7	2009
04	Introduction to Thermal System Engineering	M.J. Moran, H.N. Shapiro, B.R. Munson, D.P Dewitt	Wiley Publication	10	2013
05	Fundamentals of Engineering Thermodynamics	Michael J. Moran, Howard N. Shapiro, Daisie D. Boettner, Margaret B. Bailey	John Wiley & Sons, Inc.	8	2014

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Dean Academic Office

SYME-08/55

Course Details:

Class	B. Tech, Sem.-III
Course Code and Course Title	**0MEPC203, Fluid Mechanics**
Prerequisite/s	0BSBS102,0BSES111,0BSBS113
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I/ MSE/ ISE II/ ESE	10/30/10/50

Course Objectives:	
01	To understand various properties and kinematic behavior of fluids.
02	To study the dynamic behavior of fluids.
03	To understand the concept of forces acting on submerged bodies and dimensional analysis.
04	To understand the concept of flow through pipe and boundary layers.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC203_1	Explain basic properties of fluid, fluid statics, kinematics and dynamics,(K^2)
0MEPC203_2	Identify various types of flow, flow pattern and their importance, (K^2)
0MEPC203_3	Explain concepts of flow through pipes, boundary layer theory, forces on immersed bodies and dimensionless parameters, (K^2)
0MEPC203_4	Explain basics of computational fluid dynamics and its applications, (K^2)
0MEPC203_5	Apply various equations in fluid mechanics such as Euler's, Bernoulli's, Momentum , Continuity etc, (K^3)
0MEPC203_6	Solve the problems related to properties of fluid, fluid kinematics, fluid dynamics, laminar flow, pipe flow, dimensional analysis, boundary layer theory, forces on immersed bodies. (K^3)

Course Contents:		
Unit 1	**Fluid Properties and Fluid Statics:** **A) Fluid Properties**: Definition of fluid, Fluid as a continuum, Properties of fluid, Viscosity, Types of fluid, Compressibility, Surface tension, Capillarity and vapor pressure. **B) Fluid Statics**: Pascal's law, Hydrostatic law of pressure, Total Pressure, Centre of Pressure, Buoyancy, Meta center, Condition of Equilibrium of floating and submerged bodies (No numerical Treatment)	**08 Hrs.**
Unit 2	**Fluid Kinematics:** Eulerian and Lagrangian approach of fluid flow, Types of flow, Streamline, Path line, Streak line, Stream tube, Continuity equation in Cartesian coordinates in three dimensional form. Velocity and Acceleration of fluid particles.	**06 Hrs.**
Unit 3	**Fluid Dynamics:** Equation of motion. Integration of Euler's equation as energy equation, Energy correction factor, Venturimeter, Orificemeter, Flow over triangular and rectangular notches, Steady flow through orifice. Momentum Equation, momentum correction factor. Applications of momentum equation.	**08 Hrs.**

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SYME-09/55

Unit 4	**Laminar Flow and Pipe Flow:** **A) Laminar Flow:** Laminar flow through circular pipes. Laminar flow through parallel plates, Introduction to Navier stocks equation **B) Pipe Flow:** Major and Minor Energy losses in pipes, Series and Parallel pipe, Siphon pipes, Branching pipes and equivalent pipes, Moody's Diagram.	08 Hrs.
Unit 5	**Boundary Layer Theory and Dimensional Analysis, Similitude** **A) Boundary Layer Theory:** laminar and turbulent boundary layer, Boundary layer thicknesses, its characteristics, Boundary layer separation, boundary layer control. **B) Dimensional Analysis, Similitude:** Dimensionally homogeneous equations, Buckingham's Pi-theorem, Calculation of dimensionless parameters. Similitude, complete similarity, Model Scales.	07 Hrs.
Unit 6	**Forces on Immersed Bodies:** Lift and Drag, Drag on a flat plate and on aerofoil. Types of drags, Development of lift, Magnus effect, stalling condition of aerofoil.	05 Hrs.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Fluid Mechanics and Hydraulic Machines	Dr.R.K.Bansal	Laxmi Publication	9	2010
02	Fluid Mechanics and Hydraulic Machines	R.K.Rajput	S. Chand Publication	9	2011
03	Fluid mechanics and hydraulic machines	P. N. Modi, S.M.Seth	Standard Book House	8	2011
04	Fluid Mechanics and Hydraulic Machines	S. Ramamrutham	Dhanpat Rai Publishing Company	8	2010
05	Fluid Mechanics	K.L.Kumar	S.Chand Publication	5	2010
06	Fluid Mechanics and Fluid Power engineering	Dr.D.S.Kumar	S.K.Kataria & sons	7	2008

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Fluid Mechanics	V.L.Streeter & E.B.wylie	Tata McGraw- Hill	2	1997
02	Introduction to fluid Mechanics	Edward J. Shaughnessy	Oxford uni. press	3	2008
03	Fluid Mechanics	Y.A.Cengel	McGraw-Hill,	2	2009
04	Fluid Mechanics	White	Tata McGraw-Hill, New Delhi	7	2014
05	Fundamentals of Fluid Mechanics	Munson Young	Wiley India Pvt.Ltd	6	2013

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SYME-10/55

Course Details:

Class	B. Tech, Sem.-III
Course Code and Course Title	**0MEPC204, Manufacturing Processes and Machine Tools.**
Prerequisite/s	0BSES151, 0BSES111
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I/ MSE/ ISE II/ ESE	10/30/10/50

Course Objectives:	
01	To study and understand different manufacturing processes and their applications.
02	To acquire the knowledge of forming, plastic shaping and joining processes.
03	To understand different types of machine tools their components and accessories
04	To study and understand the conventional and nonconventional machining processes.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC204_1	Explain the basic casting process and the various operations involved in casting process, (K^2)
0MEPC204_2	Explain different types of forming and plastic shaping processes, (K^2)
0MEPC204_3	Explain types of joining processes and their applications, (K^2)
0MEPC204_4	Identify and explain the function of the basic components of machine tools and its accessories, (K^2)
0MEPC204_5	Explain working principle and applications of nonconventional machining processes, ($K^2 A^2$)
0MEPC204_6	Select manufacturing process and machine tools required to manufacture the component. (K^3)

Course Contents:		
Unit 1	**Introduction to manufacturing processes** Introduction and classification of manufacturing processes **Fundamentals of Casting** [1] Importance of casting, advantages, disadvantages and limitations of casting, introduction and types of patterns and core boxes, materials used and selection criteria for patterns, pattern allowances [2] Moulding and core processes: Types of sands used in moulding and core making, their properties. Sand moulding types such as Green sand Moulding, shell Moulding, CO2 Moulding, Investment casting. Equipments and tools used for moulding and core making. Components of gating system, functions and importance of runners and risers, solidification control devices: chills, ceramics. [3] Introduction to permanent mould casting processes such as Continuous casting, Gravity die casting, pressure die-casting, Centrifugal casting, Vacuum die casting, Squeeze casting, etc. Sand mould casting such as shell mould casting, green sand casting , dry sand casting, lost foam casting investment casing etc. various casting defects. [4] Introduction to 3D printing for mould making.	**10 Hrs.**

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SYME-1/55

Unit 2	**Forming Processes and Plastic Working** Various metal forming operations, hot and cold working of metals such as forging, rolling, extrusion, wire drawing, sheet metal working, spinning, swaging, thread rolling, metal forming defects etc. **Shaping of plastics**: Blow moulding, compression moulding, transfer moulding, injection moulding, extrusion, thermoforming, rotational moulding, foam moulding and calendaring etc.	08 Hrs.
Unit 3	**Joining Processes** Overview and classification of joining processes, Surface preparation and various joints, Arc Welding- SMAW, TIG, MIG, Resistance welding- Spot, Seam and Projection welding process, Soldering and Brazing, riveted and bolted joints.	06 Hrs.
Unit 4	**Machine Tools 1** [1] Lathe: Introduction, Working principle, types, specifications, principle parts, accessories, attachments, and various lathe operations. **[2] Grinding machines** :Introduction, types of grinding, classification of grinding machines, principle of grinding operations, grinding wheel, bonds and bonding processes, grit, grade and structures of wheel, wheel shapes and sizes, standard marking system for grinding wheel, mounting and balancing of grinding wheel and dressing of grinding wheel. **[3] Shaping and Planning machines**:-Crank shaper, hydraulic shaper, Table feed mechanism, various operations on shaper. Standard double housing planner, table drive and feed mechanism, various operations on planner.	10 Hrs.
Unit 5	**Machine Tools 2** [1] Drilling and Boring machines - Classifications, construction & working of Radial drilling machine, Various operations on drilling machines. Horizontal and vertical boring machine, boring tools and bars used, Jig boring machine. Drill bit. **[2] Milling machine** – classification of milling machines, construction and working of column and knee type milling machine, milling operations, study of standard accessories - dividing head, gear cutting on milling machine	05 Hrs.
Unit 6	**Nonconventional Machining Processes.** Need of nonconventional machining, Electro-chemical, electro-discharge, ultrasonic, LASER, electron beam, water jet machining etc., Introduction to Special machine tools.	03 Hrs.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Manufacturing Technology- Foundry, Forming and Welding	P. N. Rao	Tata Mc- Graw Hill Publication	2	2009
02	Principles of Foundry Technology	P. L. Jain	Tata Mc- Graw Hill	2	2006
03	Production Technology: Vol. 1: Manufacturing Processes	P. C. Sharma	S. Chand	1	2006
04	Production Technology: Vol. 2: Machine Tools	P.C.Sharma	S. Chand	2	2006
05	Workshop technology vol.1	S.K.Hajra	Media promoters	12	2012

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SYME-12/55

		Choudhary S.K.Bose	and publishers pvt ltd.		
06	Workshop technology vol.2 (Machine tools)	S.K.Hajra Choudhary S.K.Bose	Media promoters and publishers pvt ltd.	12	2012
07	Workshop Technology vol. II,	Raghuvanshi	Dhanpat Rai and Sons.	6	2015

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Materials and Processes in Manufacturing	E. Paul DeGarmo, J.T. Black.	PHI Publication	8	1997
02	Mechanical Metallurgy	George E. Dieter	Tata Mc Graw Hill Publication	3	2013
03	Machine Tools and Manufacturing Technology	Steve F. Krar, Mario Rapisarda.	Delmar publisher	2	2010
04	Workshop Technology", Vol.I 2001, Vol.II 2007 andVol.III 1995.	W.A.J.Chapman	CBS Publishing and Distributors, N. Delhi	5	2001

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Dean Academic Office

SYME-13/55

Course Details:

Class	B. Tech, Sem.-III
Course Code and Course Title	0MEPC205, Machine Drawing
Prerequisite/s	0BSES105, 0BSES155
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I/ MSE/ ISE II/ ESE	10/30/10/50

Examination duration for ESE- 4 Hrs

Course Objectives:	
01	To develop skill of free hand sketching and drafting
02	To develop drawing reading ability and imagination power in the students
03	To provide sound knowledge of detail and assembly procedure and to apply knowledge of different limits, fits and tolerances on assembly drawings
04	To study and understand interpenetration and auxiliary projection and its use

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC205_1	Draw mechanical engineering components and sketches of standard machine components using BIS conventions, (K^2)
0MEPC205_2	Assign limits, fits and tolerances on drawings, (K^2)
0MEPC205_3	Prepare detailed drawings from given assembly drawing and vice versa, (K^2A^1)
0MEPC205_4	Draw true shape of inclined surface using auxiliary projection, (K^3)
0MEPC205_5	Produce curves of intersections of the surfaces of solids. (K^3)

Course Contents:		
Unit 1	**Study and use of B.I.S.(Bureau of Indian Standards) Conventions** Significance and importance of BIS Conventions. Drawing sheet sizes and layout recommended by BIS. Conventions for Engineering Materials. Spur, helical and bevel gears. Worm and worm wheel. Rack and pinion. Gear assemblies. Type of helical coil, disc and leaf springs. Internal and external threads. Square head. Splined shaft, diamond knurling, BIS conventions for sectioning, type of sections. Exceptional cases in sections. BIS methods of linear and angular dimensioning. Symbolic representation of welds as per BIS.	**05 Hrs.**
Unit 2	**Sketching of machine components** Importance of sketching and entering proportionate dimensions on sketches. Sketches of nut, bolts, square and hexagonal nuts, flanged nuts, lock nut, dome nuts, capstan nut, wing nut, castle nut, split pin, square headed bolt, cup headed bolt, T-headed bolt, Rag foundation bolt, stud, washer. Various types of rivets. Various types of keys. Flat pulley, Knuckle joint, Rigid flanged coupling, Solid and bush bearing, Plummer block and applications of above machine components.	**09 Hrs.**
Unit 3	**Limits fits and tolerances** Significance of system of limits and fit. Definitions. Types. Tolerances of form and position, Surface finish symbols as per BIS. Selection and entering of all these symbols with reference to details and assembly drawing. Tolerancing an individual dimension of detail drawing..	**05 Hrs.**

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Unit 4	**Interpenetration of Solids** Interpenetration of prism with prism, prism with cylinder, prism with cone, (Prisms limited up to rectangular base), cylinder with cylinder.	**08 Hrs.**
Unit 5	**Auxiliary Projection** Projection on auxiliary vertical and horizontal plane, Auxiliary projection of simple machine components.	**07 Hrs.**
Unit 6	**Detail and Assembly Drawing** To prepare detail drawings from given assembly drawing. To prepare assembly drawing from given drawing of details. Maximum no. of parts to be limited to twelve only. Following parts may be considered for detail and assembly drawing: - Screw Jack, Pipe vice, Square Tool post, Non return valve light duty, Plummer block and similar detail and assembly problems may be taken. Entering limits, fits, tolerances and surface finish symbols on detail and assembly drawings.	**08 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Machine Drawing	R.K. Dhavan,	S. Chand and Company.	1	2007
02	Machine Drawing.	N. D. Bhatt	Charotor Publication House, Bombay.	50	2010
03	Production Drawing.	Narayana, Kannaiah and Venkata reddy,	New Age international	3	2008
04	Machine Drawing	Warren Luzadder	Prentice Hall of India	11	1999

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Machine Drawing	P.S. Gill	S.K. Kataria and Sons Delhi.	17	2008
02	Machine Drawing	K. L. Narayana	New Age International Publishers	3	1994
03	Engineering Drawing	Dhananjay Jolhe	McGraw hill	3	2008
04	Engineering Drawings And Graphics	K. Venugopal	New Age International Publishers	5	2004

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Course Details:

Class	B. Tech, Sem.-III
Course Code and Course Title	0MEES206, Computer Programming Using C++.
Prerequisite/s	0BSES112, 0BSES161
Teaching Scheme: Lecture/Tutorial	02/00
Credits	02
Evaluation Scheme: ISE I/ MSE/ ISE II/ ESE	10/30/10/50

Course Objectives:	
01	To provide knowledge on limitations of Procedural programming and Benefits of Object Oriented Programming
02	To introduce OOPs concepts like Class, Objects, Data hiding, Data Encapsulation and Data Abstraction.
03	To Introduce Inheritance, polymorphism and their implementation in C++
04	To introduce students about computer graphics and basic concepts of 2D and 3D transformations.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEES206_1	Explain object-oriented programming concept, (K^2)
0MEES206_2	Illustrate the concept of class and object in programs, (K^2)
0MEES206_3	Define the concepts of array, pointers, constructor and destructor, (K^2)
0MEES206_4	Explain concept of Inheritance for reusability, (K^2)
0MEES206_5	Define concept of overloading and polymorphism for solving the task in C++, (K^2)
0MEES206_6	Apply their knowledge and programming skills to solve various graphical and mechanical problems. (K^3A^2)

Course Contents:		
Unit 1	Introduction to Object Oriented Programming Introduction to object oriented structure, Basic concepts of object oriented language, Difference between structured and Object oriented language, Benefits and applications of Object oriented programming	**04 Hrs.**
Unit 2	Classes and Objects Introduction of class, Declaration of class, Defining object of class, Data members and member functions, Accessing members of class, Friend function.	04 Hrs.
Unit 3	Arrays and Pointers Introduction to arrays: One dimensional array, multidimensional array. Concept of pointer, Use of constructor and destructor.	**04 Hrs.**
Unit 4	Inheritance Introduction to Inheritance : Single inheritance, Multiple inheritance, multilevel inheritance. Types of Derivation: Public, Private and Protected, Virtual class.	**04 Hrs.**
Unit 5	Overloading and Polymorphism Concept of overloading: Operator overloading, function overloading, Pointer	**05 Hrs.**

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	to object, Virtual function, Pure virtual function	
Unit 6	Programming for graphics and Mechanical applications A: Introduction to computer graphics, DDA and Bresnhams algorithm, 2D transformation and 3D transformation. B: Programs for mechanical applications, numerical methods.	**07 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Object-Oriented Programming with C++	E. Balagurusamy	Tata McGraw Hill	5	2011
02	Let us C++	Yashwant Kanitkar	BPB Publication	2	2010
03	Computer Graphics	Hearn and Baker	Dorling Kindersley pvt. Ltd.	2	1997
04	Object-Oriented Programming in C++	Rajesh K. Shukla	Wiley India Pvt. Ltd.	1	2008

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Object oriented programming in C++	Robert Lafore	Pearson Education	4	2008
02	Programming with C++	D. Ravichandran	Tata McGraw Hill	2	2008
03	The C++ programming Language	Bjarne Stroustrup	Pearson Education	3	2008
04	The Complete Reference: C++	Herbert Schildt	Tata McGraw Hill	4	2008
05	Professional C++	Marc Gregoire	Wiley India Pvt. Ltd.	3	2015

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SYME-17/55

Course Details:

Class	B. Tech, Sem.- III
Course Code and Course Title	**0MEMC207, Environment Studies**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial	02/00
Credits	--
Evaluation Scheme: ISE/ ESE	50/00

Course Objectives:	
01	To discuss the importance of Environmental Elements.
02	To explain the characteristics of Environmental Pollutants and their impacts.
03	To promote practices for achieving better Environmental conditions.
04	To summarize the methods and laws relevant for Environmental Management.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEMC207_1	Explain importance of environmental studies with necessary of acts, (K^2)
0MEMC207_2	Explain importance of public awareness on environmental problems, (K^2)
0MEMC207_3	Write a technical report in team regarding course and impacts of environment related issues, (S^2)
0MEMC207_4	Discuss current concern of environment issues, (A^2)
0MEMC207_5	Describe the need of environment protection and ethics. (A^2)

Course Contents:		
Unit 1	**Nature of Environmental Studies** Definition, scope and importance. Multidisciplinary nature of environmental studies, Need for public awareness.	**2 Hrs.**
Unit 2	**Natural Resources and Associated Problems** a) Forest resources: Use and over-exploitation, deforestation, dams and their effects on forests and tribal people, b)Water resources: Use and over-utilization of surface and groundwater, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Usage and exploitation. Environmental effects of extracting and using mineral resources. d) Food resources: World food problem, changes caused by agriculture effect of modern agriculture, fertilizer-pesticide problems. e) Energy resources: Growing energy needs, renewable and non renewable energy resources, use of alternate energy sources. Solar energy, Biomass energy, Nuclear energy, f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources.	**4 Hrs.**
Unit 3	**Ecosystems** Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristics features, structure and function of the following ecosystem:- a)Forest ecosystem, b)Grassland ecosystem, c)Desert ecosystem, d)Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	**4 Hrs.**

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Unit 4	**Biodiversity and its conservation** Introduction- Definition: genetic, species and ecosystem diversity. Bio-geographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. India as a mega-diversity nation. Western Ghat as a biodiversity region. Hot-spots of biodiversity. Threats to biodiversity habitat loss, poaching of wildlife, man-wild life conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.	**5 Hrs.**
Unit 5	**Environmental Pollution** Definition: Causes, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution.	**4 Hrs.**
Unit 6	**Social Issues and the Environment** Disaster management: floods, earthquake, cyclone, tsunami and landslides Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issue and possible solutions. Global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation. Consumerism and waste products.	**3 Hrs.**
Unit 7	**Environmental Protection** From Unsustainable to Sustainable development Environmental Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Population Growth and Human Health, Human Rights	**6 Hrs.**

Hand written report	**Hand written report based on any one of the following:** Environmental assets River/Forest/Grassland/Hill/Mountain. A local polluted site Urban/Rural/Industrial/Agricultural. Study of common plants, insects, and birds. Study of simple ecosystems - ponds, river, hill slopes, etc.

Assessment Method:

1. Hand written report – 10 marks
2. ISE question paper format will be Multiple Choice Questions- 40 Marks

Unit No.	Topic Name	Weightage
1	Nature of Environmental Studies.	4 Marks
2	Natural Resources.	6 Marks
3	Ecosystems	6 Marks
4	Biodiversity and its conservation	6 Marks
5	Environmental Pollution	6 Marks
6	Social Issues and the Environment	6 Marks
7	Environmental Protection	6 Marks

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Important Notes:

1. ISE will be conducted in 14th week of semester.
2. Hand Written report will be submitted to course coordinator in 10th week of semester.
3. Students should get minimum 40% marks to get PP (PASS) grade.
4. Students getting less than 40% marks will be offered NP (NOT PASS) grade.
5. To get B. Tech. Degree PP grade in Environmental Studies is mandatory.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Environmental Studies	Dr. B. S. Chauhan	University Science Press, New Delhi	1	2008
2	Environmental Studies	Dr. P. D. Raut	S. U. Kolhapur	3	2011

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Principals of Environmental Science and Engineering	Raman Sivakumar	Cengage learning Singapore	2	2005
02	Elements of Environmental Science and Engineering	P. Meenakshi	Prentice Hall of India Private Limited, New Delhi	-	2006
03	Environmental Science – working with the Earth	G.Tyler Miller Jr	Thomson Brooks /Cole	11	2006

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SYME-20/55

Course Details:

Class	B. Tech, Sem.-III
Course Code and Course Title	**0MEPC251, Fluid Mechanics Laboratory**
Prerequisite/s	0BSBS102,0BSES111,0BSBS113
Teaching Scheme: Practical	02
Credits	01
Evaluation Scheme: ISE/ ESE (POE)	25/25

Course Objectives:	
01	To demonstrate various pressure measuring devices & concept of flow visualization, various losses and velocity distribution in pipe flow.
02	To demonstrate the Reynolds experiment & its significance.
03	To demonstrate practical applications of Bernoulli's theorem.
04	To explain importance of fluid mechanics with real life applications.

Course Outcomes (COs): Upon successful completion of this course student will be able to.	
0MEPC251_1	Identify various types of flow by using Reynolds Experiment, flow pattern, velocity profile, pressure measurement devices and their significance, (K^2)
0MEPC251_2	Apply the various equations to calculate the discharge through various flow measuring devices, equivalent pipe for parallel pipes, Coefficients of discharge and coefficient of friction values, (K^3)
0MEPC251_3	Communicate effectively, both orally and in writing journals, (S^2)
0MEPC251_4	Perform the experimental task individually and in team in fluid mechanics laboratory, and interpret the results, (S^2)
0MEPC251_5	Respond willingly to questions asked by faculty and asked to involve in experimental task of fluid mechanics laboratory. (A^2)

Course Contents:

The journal consisting of at least eight experiments among the following should be submitted.

1. Study of various pressure measuring devices.
2. Flow visualization by Heleshaw's apparatus.
3. Reynolds's experiment.
4. Verification of Bernoulli's theorem.
5. Calibration of Venturimeter.
6. Calibration of orifice-meter.
7. Orifice under steady flow condition to determine hydraulic coefficients.
8. Calibration of V notch.
9. Determination of velocity profile through circular pipes for laminar flow.
10. Determination of coefficient of friction for different pipes.
11. Determination of Minor losses in pipe fittings.
12. Demonstration of Equivalent Pipe for Pipes in Parallel.

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SYME-21/55

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Fluid Mechanics and Hydraulic Machines	Dr.R.K.Bansal	Laxmi Publication	9	2010
02	Fluid Mechanics and Hydraulic Machines	R.K.Rajput	S.Chand Publication	9	2011
03	Fluid mechanics and hydraulic machines	P. N. Modi, S.M.Seth	Standard Book House	8	2011
04	Fluid Mechanics and Hydraulic Machines	S. Ramamrutham	Dhanpat Rai Publishing Company	8	2010
05	Fluid Mechanics	K.L.Kumar	S.Chand Publication	5	2010
06	Fluid Mechanics and Fluid Power engineering	Dr.D.S.Kumar	S.K.Kataria& sons	7	2008

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Fluid Mechanics	V.L.Streeter & E.B.wylie	Tata McGraw- Hill	2	1997
02	Introduction to fluid Mechanics	Edward J. Shaughnessy	Oxford uni. press	3	2008
03	Fluid Mechanics	Y.A.Cengel	McGraw-Hill,	2	2009
04	Fluid Mechanics	White	Tata McGraw-Hill, New Delhi	7	2014
05	Fundamentals of Fluid Mechanics	Munson Young	Wiley India Pvt.Ltd	6	2013
06	Fluid Mechanics	Fox McDonald Pritchard	Wiley India Pvt.Ltd	8	2014

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S4ME-22/55

Course Details:

Class	B. Tech, Sem.-III
Course Code and Course Title	**0MEPC252, Machine Drawing Laboratory**
Prerequisite/s	0BSES105, 0BSES155
Teaching Scheme: Practical	02
Credits	01
Evaluation Scheme: ISE / ESE (POE)	25/25

Course Objectives:	
01	To provide sound knowledge of detail and assembly procedure.
02	To demonstrate AutoCAD software for drafting & 2D Drawings.
03	To demonstrate AutoCAD software for preparing assembly drawings.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC252_1	Produce sketches of detail and assembly drawing on drawing sheet, (K^2)
0MEPC252_2	Prepare the 2D drawings using AutoCAD, (K^2 S^2)
0MEPC252_3	Construct a basic three-dimensional drawing using AutoCAD, (K^2 S^2)
0MEPC252_4	Communicate effectively, both orally and in drawing sheets, (S^2)
0MEPC252_5	Follow professional and ethical principles during laboratory work. (A^2)

Course Contents:

The journal consisting of following sheets should be submitted.

Following drawings are to be completed using AutoCAD on A4 size papers.

1. Simple 2D figures
2. One detail and assembly drawing containing not more than ten parts
3. One 3D object

Following sheets are to be completed on A2 size drawing paper.

4. A sheet on drawing details and assembly from given drawing of details and entering limits fits and tolerances, surface finish symbols, geometrical tolerances etc.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Machine Drawing	R.K. Dhavan,	S. Chand and Company.	1	2007
02	Machine Drawing.	N. D. Bhatt	Charotor Publication House, Bombay.	50	2010
03	Production Drawing	Narayana, Kannaiah and Venkata reddy,	New Age International	3	2008
04	Machine Drawing	Warren Luzadder	Prentice Hall, India	11	1999

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5YmE-23/55

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Machine Drawing	P.S. Gill	S.K. Kataria and Sons Delhi.	17	2008
02	Auto cad 2014 for engineers and designers	Sham Tickoo	Dreamtech Publisher	1	2013
03	Advanced AutoCAD	Robert M. Thomas	Tech Publication.	3	1993
04	Exercise workbook for Advanced AutoCAD 2006	Cheryl R. Shrock	New Age International Publication.	1	2006

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SYME-24/55

Course Details:

Class	B. Tech, Sem.-III
Course Code and Course Title	**0MEES253 Computer Programming Using C++ Laboratory**
Prerequisite/s	0BSES112,0BSES161
Teaching Scheme: Practical	02
Credits	01
Evaluation Scheme: ISE / ESE	25/00

Course Objectives:	
01	To develop and enhance the programming skills amongst the students in general as well as application of it in the field of Mechanical Engineering.
02	To introduce an object-oriented programming language.
03	To introduce student about computer graphics and study basic concepts of 2D and 3D transformations.

Course Outcomes (COs) Upon successful completion of this course, the student will be able to:	
0MEES253_1	Explain the basic concept of object-oriented programming, (K^2)
0MEES253_2	Apply the concepts of class, object, array, pointers, inheritance, overloading, polymorphism and transformation in C++, (K^3)
0MEES253_3	Develop programming skills to solve problems using object-oriented concept in Turbo C, (S^3)
0MEES253_4	Communicate effectively, both orally and in writing journals and complete assigned tasks in team, (S^2)
0MEES253_5	Follow given instructions during practical performance, (A^2)
0MEES253_6	Engage in independent and life-long learning in the programming domain. (A^2)

Course Contents:

The journal consisting of following experiments should be submitted.

1. Simple programs on C++, Creation of source files, Compile and Linking
2. Programs on operator and loops: for loop, switch, if else, while, do while, nested loops
3. Programs on implementation of class, object and structure.
4. Programs on pointers with arrays and functions.
5. Programs containing constructors and destructors.
6. Programs on single inheritance and multiple inheritance
7. Programs on function overloading and operator overloading.
8. Programs on implementation of polymorphism, abstract class, virtual and pure virtual function
9. Simple programs to draw line, circle, triangle etc.
10. Programs on 2D, 3D transformation like scaling, translation, rotation
11. Programs on solving mechanical problems

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Text Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Object-Oriented Programming with C++	E. Balagurusamy	Tata McGraw Hill	5	2011
02	Let us C++	Yashwant Kanitkar	BPB Publication	2	2010
03	Computer Graphics	Hearn and Baker	Dorling Kindersley pvt. Ltd.	2	1997
04	Object-Oriented Programming in C++	Rajesh K. Shukla	Wiley India Pvt. Ltd.	1	2008

Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Object oriented programming in C++	Robert Lafore	Pearson Education	4	2008
02	Programming with C++	D. Ravichandran	Tata McGraw Hill	2	2008
03	The C++ programming Language	Bjarne Stroustrup	Pearson Education	3	2008
04	The Complete Reference: C++	Herbert Schildt	Tata McGraw Hill	4	2008
05	Professional C++	Marc Gregoire	Wiley India Pvt. Ltd.	3	2015

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SYME-26/55

Course Details:

Class	B. Tech, Sem.-III
Course Code and Course Title	**0MEPC254, Workshop Practice -III**
Prerequisite/s	0BSES105, 0BSES151, 0BSES155
Teaching Scheme: Practical	02
Credits	01
Evaluation Scheme: ISE / ESE	25/00

Course Objectives:	
01	To prepare pattern for casting.
02	To demonstrate TIG/MIG welding.
03	To conduct sand testing, size analysis, moisture percentage, permeability test.
04	To demonstrate different manufacturing processes and machine tools during industrial visit.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC254_1	Explain the basics of manufacturing processes and machine tools, (K^2A^2)
0MEPC254_2	Prepare a pattern for casting, (K^2S^2)
0MEPC254_3	Explain joining operation by application of TIG/MIG welding, (K^2S^2)
0MEPC254_4	Perform various sand tests to check the properties of sand, (K^2)
0MEPC254_5	Work individually or in team to perform the experimental task effectively, (S^2)
0MEPC254_6	Follow professional and ethical principles during laboratory work.(A^2)

Course Contents:

The journal consisting of following experiments should be submitted.

1. Preparation of Pattern for solid casting with allowances
2. Demonstration of TIG/MIG welding process
3. Grain Size analysis.
4. Moisture percentage testing of given green sand.
5. Permeability Test of a given green sand.
6. Preparation and testing of standard Specimen for Green Compressive strength.
7. Clay content testing of given green sand.
8. Preparation of green sand mold and Mould Hardness testing of given green sand.
9. Industrial visit.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Manufacturing Technology- Foundry, Forming and Welding	P. N. Rao	Tata Mc- Graw Hill Publication	2	2009
02	Principles of Foundry Technology	P. L. Jain	Tata Mc- Graw Hill	2	2006
03	Production Technology: Vol. 1:	P. C. Sharma	S. Chand	1	2006

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	Manufacturing Processes				
04	Production Technology: Vol. 2: Machine Tools	P.C.Sharma	S. Chand	2	2006
05	Workshop technology vol.1	S.K.Hajra Choudhary S.K.Bose	Media promoters and publishers pvt ltd.	12	2012
06	Workshop technology vol.2 (Machine tools)	S.K.Hajra Choudhary S.K.Bose	Media promoters and publishers pvt ltd.	12	2012
07	Workshop Technology vol. II,	Raghuvanshi	Dhanpat Rai and Sons.	6	2015

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Materials and Processes in Manufacturing	E. Paul DeGarmo, J.T. Black.	PHI Publication	8	1997
02	Mechanical Metallurgy	George E. Dieter	Tata Mc Graw Hill Publication	3	2013
03	Machine Tools and Manufacturing Technology	Steve F. Krar, Mario Rapisarda.	Delmar publisher	2	2010
04	Workshop Technology", Vol.I 2001, Vol.II 2007 andVol.III 1995.	W.A.J. Chapman	CBS Publishing and Distributors, N. Delhi	5	2001

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SYME-28/55

Course Details:

Class	B. Tech, Sem.-III
Course Code and Course Title	**0MEHS255, General Proficiency**
Prerequisite/s	0BSHS106, 0BSHS156
Teaching Scheme: Practical	02
Credits	00
Evaluation Scheme: ISE / ESE	--/--

Course Objectives:	
01	To enhance students' grammatical competence and enable them to utilize it while communicating.
02	To improve students' competence in oral communication.
03	To review students' competence of written communication and enrich it by assigning them various exercises.
04	To enrich students' vocabulary for better professional communication.
05	To enhance students' team spirit and enable them to work in a team.

Course Outcomes : Upon successful completion of this course, the student will be able to	
0MEHS255_1	Communicate effectively and accurately by using grammatically sound language, (S^3)
0MEHS255_2	Be acquainted of etiquettes of formal communicative event and perform better in events like Group Discussion, Interview etc, (A^2S^3)
0MEHS255_3	Review ones' competence and produce more meaningful and logically interwoven extracts necessary for professional correspondence like email, technical paragraph etc, (A^3S^3)
0MEHS255_4	Identify importance of vocabulary and update it to become confident speaker, (S^3)
0MEHS255_5	Mould accordingly and able to work in various teams and will contribute positively to strengthen team work. (A^2S^3)

Course Contents:

1. **Speech Production:-** A trigger (image/video/audio/script) is used to initiate the discussion.
2. **Grammar Activity:-** Exercise related to compound and complex sentences.
3. **Group Discussion:-** Current topic or technical topic for discussion.
4. **Debate:-** A trigger (image/video/audio/script) is used to initiate the discussion.
5. **Reading Exercise:-** Reading of text or News Paper effectively & understand sensory perceptions & emotions involved.
6. **Writing & Presenting Narrative:-** Develop insight into expression & identify different errors.
7. **Email writing:-** Triggers/ Key words will be provided.
8. **Attitude Building:-** Developing positive attitude exercises.
9. **Mock Interview:-** Helpful to develop interview skills of students.
10. **Team Building:-** Team games to nurture team values.
11. **Role Play:-** Develop insight into expression & identify different errors.
12. **Vocabulary Building Games:-** To enhance the vocabulary.

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Text Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	English for Engineers and Technologists: A Skills Approach	Rod Ellis	Orient Blackswan	Illustrated	2003
02	The Effective Business Email Writing Formula in 7 Easy Steps	Alain Greaves	Create Space Independent Publishing Platform	--	2011
03	Group Discussion: A Practical Guide to Participation and Leadership	Julia T. Wood, Gerald M. Phillips	Waveland Press	4	2007
04	Business Communication	Urmila Rai & S.M. Rai	Himalaya Publishing House	3	2012
05	Effective Technical Communication	Ashraf Rizvi	Tata McGraw-Hill	5	2014

Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Technical Writing & Professional Communication for non-native speakers of English	Thomas N.Huckin & Leslie A.Olsen	Tata McGraw-Hill	1	2004
02	Better English pronunciation.	J. D. O'Connor,	Universal Book Stall	1	1997
03	High-school English Grammar and Composition	Wren and Martin	S. Chand and Co., New Delhi	1	2011
04	Spoken English for You -II	Pillai G.R.	Emrald Publishers	2	
05	The Ace of Soft Skills	Gopalswami Ramesh, Mahadevan Ramesh.	Pearson Publication, Delhi.	2	2011

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Course Details:

Class	B. Tech, Sem-IV
Course Code and Course Title	0MEES208, Applied Numerical Methods
Prerequisite/s	0MEES201, 0BSBS102, 0BSBS113
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Objectives:	
01	To review and implement fundamentals of errors, root-finding, elementary numerical linear algebra, solving systems of linear equations, curve fitting, and numerical solution to differential equations.
02	To solve real time engineering problems by applying numerical methods.
03	Perform an error analysis for various numerical methods

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEES208_1	Use different methods to find roots of equations and check its convergence. (K^3)
0MEES208_2	Solve the various simultaneous linear algebraic equations and analyze them. (K^3)
0MEES208_3	Apply the least square and interpolation methods to obtain the best fitting curves for engineering problems. (K^3)
0MEES208_4	Apply various differentiation and integration processes to solve the current engineering problems. (K^3)
0MEES208_5	Distinguish and apply various methods to solve ordinary & partial differential equations. (K^3)

Course Contents:		
Unit 1	**Errors:** Introduction, Types of errors, Rules for estimate errors **Roots of equation:** Bracketing Methods - Bisection Methods, False Position Method Open Methods - Newton Raphson, Multiple Roots, System of non-linear Equations, Roots of polynomials -Muller's Method	**07 Hrs.**
Unit 2	**Linear Algebraic equation:** Gauss Elimination Method, Gauss-Jordan Method, Matrix Inversion - LU Decomposition, Iterative Method - Gauss Jacobi method and Gauss Seidel method,	**06 Hrs.**
Unit 3	**Curve Fitting:** Least Square Regression - Linear Regression, Polynomial Regression, Curves reducible to linear regression ; Interpolation - Lagrange's interpolating polynomial.	**07 Hrs.**
Unit 4	**Numerical Differential & Integration:** Newton's Cote's quadrature formula Trapezoidal rule, Simpson's rules, Integration of equations - Gauss quadrature. Numerical Differentiation. - Differentiation formulae, Newton's divided difference, Forward difference, Central difference, Backward difference	**08 Hrs.**
Unit 5	**Ordinary Differential Equation:** Taylor's Series method, Picard method, Runge-Kutta methods, Euler's method, Finite Difference Method, Power Method.	**08 Hrs.**

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Unit 6	**Partial Differential Equation:** Classification of partial differential equations, Elliptical Equations, Solution to Laplace Equation, Parabolic Equations, Crank Nicolson Formula,	06 Hrs.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Numerical Methods For Engineers	Santosh K Gupta	New Age International Publisher	Third	2015
02	Numerical Methods	R. K Jain	New Age International Publisher	Second	2008
03	Applied Numerical Methods	S. S . Patil	Electrotech Publication	First	2015
04	A First Course in Numerical Methods	Uri M. Ascher, Chen Greif	SIAM (Society For Industrial And Applied Mathematics)	First	2012

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Numerical Methods	Dr. B.S. Grewal	Khanna Publications New Delhi	Eleventh	2011
02	Numerical Methods	G.kandaswami	S.Chand publication	Eighth	2011
03	Numerical Methods	E. Balguruswamy	Tata McGrawHill, NewDelhi	Third	1999
05	Numerical Analysis Using MATLAB	Steven T. Karris	Orchard Publications	Third	2007

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Course Details:

Class	B. Tech, Sem.-IV
Course Code and Course Title	0MEPC209, Mechanics of Materials
Prerequisite/s	0BSES110
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I/ MSE/ ISE II/ ESE	10/30/10/50

Course Objectives:	
01	Explain various stress and strain determination methods and basic knowledge of principal stresses and strains.
02	Develop ability to draw shear force and bending moment diagram of the beam.
03	Explain methods for determining deflection of beams, columns and find strain energy stored in the body.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC209_1	Explain different types of stresses, strains and elastic constants. (K^2)
0MEPC209_2	Identify and apply a particular theoretical method of stress and strain determination for mechanical elements under various loads. (K^3)
0MEPC209_3	Apply different methods to determine the deflection of beams. (K^3)
0MEPC209_4	Apply different theories to determine the loads on the columns. (K^3)
0MEPC209_5	Determine strain energy absorbed in the body due to external load, torsion and bending. (K^3)
0MEPC209_6	Analyse the beam by drawing shear force and bending moment diagram. (K^4A^2)

Course Contents		
Unit 1	**Stresses and Strain** Elasticity, Stress, Strain, Hooke's Law, Poisson's ratio, Modulus of Elasticity, Modulus of rigidity, Stress-strain diagram for ductile and brittle material, Factor of safety, Normal and shear stresses, Stresses in bars of varying sections and composite, Thermal Stresses, Complementary shear stress, Stresses induced in thin cylinder shells and thin spherical vessels subjected to internal fluid pressure, Bulk modulus, Shear modulus, Inter-relationship between elastic constants.	**08 Hrs.**
Unit 2	**Principal Stresses and Strains (2D)** Normal and shear stresses on any oblique planes, concept of Principal planes, Derivation of expression for Principal stresses and maximum shear stress, Positions of principal planes and planes of maximum shear, Graphical solutions using Mohr's circle of stresses, Theories of elastic failure. Introduction to 3D stresses	**06 Hrs.**
Unit 3	**I) Shear Force and Bending Moment:** Definition of shear force and bending moment, relation between SF, BM and intensity of loading, numerical on statically determinate beams (simply supported, cantilever, overhanging) subjected to point load, UDL, UVL, Couple.	**08 Hrs.**

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	II) Torsion: Theory of torsion, assumptions, derivation of torsion equation, Polar modulus, stresses in solid and hollow circular shaft, power transmitted by shaft, Shear stress distribution on axi-symmetric cross sections of beam.	
Unit 4	**Stresses in Beams** **I) Bending stresses:** Symmetric pure bending of beams, flexure formula, moment of resistance of cross-sections, simple built-up section, design of various solid and hollow sections. **II) Shear stresses:** Distribution of shear stresses in beams of various commonly used sections.	**07 Hrs.**
Unit 5	**Deflection of Beams** Concept of slope and deflection, Strain curvature and moment curvature relation, Methods for determining deflections, Solution of beam deflection problem by Double integration method. (Simply supported, cantilever subjected to point load, UDL).	**06 Hrs.**
Unit 6	**I) Columns:** Concept of critical load and buckling, Derivation of Euler's formula for buckling load with various end conditions, limitations of Euler's formula, Rankine buckling load, Safe load on column. **ii) Strain Energy:** Strain energy due to different types of loading, Pure bending (Simply Supported Beam & Cantilever.), Shear stresses (Direct Shear & Pure Torsion).	**07 Hrs.**

Text Books

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Mechanics of Materials	Ferdinand P Beer E.R. Johnston	McGraw Hill Book Company	5th	2009
02	Elements of Strength of Materials	Timoshenko and Young.	East-West Press. Pvt. Limited,	5th	1968
03	Strength of Materials	Ramamurthum	Dhanpat Rai and Sons, New Delhi	17th	2011
04	Strength of Materials	Bansal	Laxmi Publication	4th	2007
05	Strength of Materials	Khurmi Gupta	S. Chand Publication.	1st	Reprint 2011

Reference Books

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Advanced Strength of Materials	Denhartong J P	Dover Publication Inc Mineola.	--	2002
02	Mechanical Analysis and Design	H. BURR and John Cheatam	PHI, New Delhi.	2nd	1997
03	Machine Design	Robert Norton	Prentice Hall	2nd	2003
04	Strength of materials	B.K.Sarkar	McGraw Hill Pub.	--	2003

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Course Details:

Class	B. Tech, Sem.-IV
Course Code and Course Title	**0MEPC210, Thermal Engineering**
Prerequisite/s	0BSES111, 0MEPC202
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I/ MSE/ ISE II/ ESE	10/30/10/50

Course Objectives:	
01	To discuss concepts of steam generation and its properties.
02	To calculate performance of steam power cycle and gas power cycle and its components.
03	To apply the knowledge of vapour and gas cycle in power engineering applications.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC210_1	Explain the phenomenon of steam generation and properties of steam.(K^2)
0MEPC210_2	Illustrate the application of laws of thermodynamics in steam power generation systems.(K^2)
0MEPC210_3	Demonstrate various performance parameters and their estimations in respect to steam turbines. (K^2)
0MEPC210_4	Discuss various applications of compressors, and calculate performance parameters. (K^3)
0MEPC210_5	Demonstrate the working and performance of gas turbine. (K^2)
0MEPC210_6	Compute performance of gas power cycles. (K^3)

Course Contents:		
Unit 1	**Properties of Pure Substance** Definition of pure substance, Phase change of pure substances, p-T, p-v-T Surface and triple point of water, Formation and Properties of steam, Quality of steam, Steam calorimeters , h-s chart or Mollier chart, Use of steam table and Mollier chart, Difference between real gases and ideal gases, Ideal gas equation	**07 Hrs.**
Unit 2	**Vapour Power Cycles** Introduction to Steam generators, Carnot cycle using steam, Limitations of Carnot cycle, Rankine cycle, Effect of steam supply pressure and temperature, Condenser pressure on the performance, Reheat and regenerative steam power cycles	**06 Hrs.**
Unit 3	**Steam Turbines** Classification of steam turbines, difference between impulse turbine and reaction turbine, Velocity triangles for Impulse turbines and Reaction turbines, turbine efficiencies, reheating steam, bleeding, Pressure and Velocity compounding, Blade erosion prevention- surface treatment, Maintenance of steam turbines.	**07 Hrs.**
Unit 4	**Gas Power Cycles** Air standard efficiency, Otto cycle, Diesel cycle, Dual combustion cycle, Comparison, Atkinson cycle, Ericson cycle, Brayton cycle, Comparison between cycles	**07 Hrs.**

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Unit 5	**Air Compressor** Classification, Reciprocating compressors, Single Acting, Double Acting Compressors, Clearance Volume, Volumetric Efficiency, FAD, Multi-staging, Optimum Compression Ratio, Rotary compressors, Roots Blower, Vane Compressor, Screw Compressor, Axial Flow Compressors, Centrifugal Compressors, Velocity diagrams, Pre Whirl, Slip Factor, Surging, Choking, Stalling, Performance Characteristics Comparison	09 Hrs.
Unit 6	**Gas Turbines and Jet Propulsion** Classification, Merits, Constant pressure combustion, Constant volume combustion, Applications and uses, Fuels, Jet propulsion, Gas turbine Blade cooling	06 Hrs.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Engineering Thermodynamics	P. K. Nag	Mc Graw Hill	Fifth	2013
02	Thermal Engineering	R. K. Rajput	Laxmi Publications	Eighteen	2012
03	Steam & Gas Turbines	R. Yadav	CPH Allahabad.	Sixth	2010
04	Applied Thermodynamics	Onkar Singh	New Age International	Third	2009

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Thermal Engineering	Ballaney P.L.,	Khanna Publishers, New Delhi.	Twenty Fourth	2012
02	Engineering Thermodynamics	M Achutan	PHI Learning Pvt.Ltd	Second	2011
03	Thermal Engineering	D.S. Kumar	S.K. Kataria and Sons	Fourth	2012
04	Heat Engines Vol 1,2 and 3	Patel Karamchandani	Acharya Publications	Sixteenth	1997

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Course Details:

Class	B. Tech, Sem.-IV
Course Code and Course Title	**0MEPC211 Hydraulic Machines**
Prerequisite/s	0BSES111, 0MEPC203
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Objectives:	
01	Describe the construction and working principles of hydraulic turbines, pumps and hydraulic devices.
02	Understand model testing of turbines and pumps.
03	Explain the performance characteristics of turbines and pumps.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC211_1	Explain the construction and working of water turbines, centrifugal pump, Reciprocating pump ,Hydraulic Devices ,Other types of pumps, (K^2)
0MEPC211_2	Describe the various applications of Hydraulic machines, (K^2)
0MEPC211_3	Compute various design parameters of water turbines, centrifugal pump and Reciprocating pump by using the velocity diagrams, (K^3)
0MEPC211_4	Solve step by step problems based on Hydraulic machines, (K^3)
0MEPC211_5	Apply model testing concept to analyze the performance of Hydraulic machines. (K^3)

Course Contents:		
Unit 1	**Impulse Water Turbines:** Euler's equation for work done in Rotodynamic Machines classification of water turbines, Pelton wheel, its construction and working, velocity triangles , Pelton wheel design(bucket dimensions, number of buckets, jet diameter, wheel diameter, jet ratio, speed ratio, number of jets) calculation of efficiency, power, discharge etc. Governing of Pelton wheel.	**07 Hrs.**
Unit 2	**Reaction Water Turbines:** Principle of operation, construction and working of Francis and Kaplan Turbine, effect of modification of velocity triangles on runner shape, draft tube, cavitation calculation of various efficiencies, power, discharge, blade angles, runner dimensions etc. Draft tube-types, Governing of Francis and Kaplan turbine, performance characteristics of turbines	**07 Hrs.**
Unit 3	**Centrifugal Pumps:** Working principles, Construction, types, various heads, multistage pumps, velocity triangles, minimum starting speed, cavitation, MPSH and NPSH. Methods of priming, calculations of efficiencies, discharge, blade angles, head, power required, impeller dimensions etc., performance characteristics of pumps, Family Curve	**07 Hrs.**
Unit 4	**Similarity Principles** : Model testing, unit quantities, specific speed of turbine, specific speed of	**05 Hrs.**

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	pumps, prediction of performance at other operating conditions, scale effect.	
Unit 5	**Reciprocating Pump:** Principle of operation, construction and working of reciprocating pump, Discharge through reciprocating pump, work done by reciprocating pump, discharge, work done and power required to drive a double acting pump, slip of reciprocating pump, classification of reciprocating pump, variation of velocity and acceleration in the suction and delivery pipes due to acceleration of the piston, effect of variation of velocity on friction in the suction and delivery pipes, Indicator Diagram, effect of acceleration in suction and delivery on indicator diagram, Maximum speed of reciprocating pump, Air vessels.	**08 Hrs.**
Unit 6	**Hydraulic Devices** Intensifier, Accumulator, Hydraulic jacks, Numericals on Hydraulic press, Hydraulic Crane, Hydraulic ram. Hydraulic coupling, Hydraulic Torque convertor **Other Types of Pump** Gear pump, Jet pump, Submersible pump, Air lift pump, (Descriptive treatment only)	**08 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Fluid Mechanics and Hydraulic Machines	Dr.R.K. Bansal	Laxmi Publication	9	2010
02	Fluid Mechanics and Hydraulic Machines	R.K.Rajput	S. Chand Publication	9	2011
03	Fluid Mechanics and Hydraulics	Suresh Ukarande	Ane Books Pvt.Ltd	1	2014
04	Hydraulics ,Fluid Mechanics and Hydraulic Machines	R.S.Khurmi	S. Chand	1	2003
05	Hydraulics Fluid Mechanics and Hydraulic Machines	S.Ramamrutham	Dhanpat Rai Publishing Company	8	2010

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Fluid mechanics and hydraulic machines	Modi and Seth	Standard Book House	8	2011
02	Fluid mechanics and fluid power engineering	Dr. D. S. Kumar	S.K.Kataria& sons	1	2001
03	Fluid mechanics including hydraulic machines	Dr. A. K. Jain	Khanna publishers	1	2009
04	Fluid mechanics and hydraulic machines	S. C. Gupta	Pearson	6	2011

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Course Details:

Class	B. Tech, Sem.-IV
Course Code and Course Title	**0MEPC212, Kinematics of Machines**
Prerequisite/s	0BSES111
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I / MSE/ ISE II/ESE	10/30/10/50

Examination Duration for ESE – 4 Hr

Course Objectives:	
01	To represent kinematic behavior of different machine elements and mechanisms.
02	To select various power transmitting devices and energy storage devices.
03	To explain types of cam with followers and select according to their applications.
04	To analyze effect of friction in mechanisms and machines.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC212_1	Demonstrate different types of mechanisms with their applications. (K^2)
0MEPC212_2	Summarise the friction for various applications, (K^2)
0MEPC212_3	Select different power transmitting elements according to application. (K^3)
0MEPC212_4	Analyze kinematic theories of mechanism. (K^4)
0MEPC212_5	Differentiate between types of gears and to analyze the characteristics of meshing gears, (K^4)
0MEPC212_6	Design cam with follower for different practical applications. (K^5)

Course Contents:		
Unit 1	**Fundamentals of Mechanisms** Link, Kinematic pair, Kinematic chain, Mechanism, Inversions, Types of constrained motions, Grubbler's criterion, Grashof's criterion for mobility, Kutzbach criteria, Four bar chain and its inversions, Slider crank chain and its inversions, Double slider crank chain and its inversions, Steering Mechanism, Hooke's joint.	**05 Hrs.**
Unit 2	**Mechanical Power Transmitting and Storing Devices** **Belt Drive-** Calculation of power transmitted, Belt tension ratio, Actual tension in a running belt, Centrifugal and initial tension in belt, Slip and creep of belt. V Belts. Selection of Belts. [Numerical Treatment on flat belt only] **Flywheel-** Turning moment diagrams, Fluctuation of energy, Coefficient of fluctuation of speed, Rimmed flywheel [Only Theoretical treatment for Flywheel	**06 Hrs.**
Unit 3	**Gears** Classification of gears and gear trains, **Spur Gears** - terminology, fundamental law of toothed gearing, involutes and cycloidal profile, conjugate action, contact ratio, minimum number of teeth, interference and under cutting. **Helical Gears-** Nomenclatures, center distance, **Spiral Gears-** Center distance, efficiency.	**07 Hrs.**
Unit 4	**Cams and Followers** Classification of cams, Classification of followers, Terminologies of cam and	**07 Hrs.**

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	follower, Motions of Follower a) Uniform velocity b) Simple harmonic motion c) Uniform acceleration and retardation d) Cycloidal motions, Displacement diagram of follower, Velocity and acceleration diagram of Follower, Construction of cam profile	
Unit 5	**Velocity and Acceleration Analysis in Mechanism** **Graphical analysis-** velocity and acceleration for different mechanisms using relative velocity and acceleration method, Corioli's component of acceleration (Simple Problems), Klein's construction for slider crank mechanism, Instantaneous centre method (Up to 6 IC), Kennedy's theorem. **Analytical analysis-** Approximate analytical method for velocity and acceleration of piston	**10 Hrs.**
Unit 6	**Friction** Introduction of friction, Friction in pivot bearings, Inclined plane theory, Friction circle	**05 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Theory of Machines	Ratan S.S	Tata McGraw Hill New Delhi.	3rd	13th reprint 2012
02	Theory of Machines	P.L.Ballany	Khanna Publication, New Delhi	25th	2012
03	Theory of Machines	V.P. Singh	Dhanpat Rai and Sons	3rd	2012
04	Theory of machines	Dr. R.K.Bansal	Laxmi Publication	4th	2011

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Theory of Machines	Thomas Bevan	CBS Publishers, New Delhi.	3rd	reprint 2005
02	Theory of Machines and Mechanism	Shigley	Oxford International	3rd	2009
03	Theory of mechanism and machines	Sadhu Singh	Pearson	1st	2012
04	Theory of machines and Mechanism	Jagdish Lal	Metropolitin Book Company	1st	2011
05	Mechanism and Machines	Gosh And Mallik	East West Press	3rd	1998
06	Theory of Machine	Sarkar	Tata Mc Graw Hill	1st	2002

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Course Details:

Class	B. Tech, Sem.-IV
Course Code and Course Title	**0MEPC213, Materials Science and Metallurgy**
Prerequisite/s	0BSBS101, 0BSBS108
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Objectives:	
01	To acquaint students the linking of composition-structure-property relationship in metals and alloys.
02	To explain the importance of different destructive and non-destructive material testing methods.
03	To identify the significant heat treatment process and apply for given component.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC204_1	Discuss properties of metals, defects and its possible causes, (K^2)
0MEPC204_2	Differentiate various ferrous and non-ferrous metals along with their microstructure, (K^2)
0MEPC204_3	Describe various destructive and non-destructive testing, (K^2)
0MEPC204_4	Apply principles of heat treatment, (K^3)
0MEPC204_5	Discuss the principle of mechanical testing to evaluate the mechanical properties, (K^2)
0MEPC204_6	Explain powder metallurgy methods and their applications, (K^2)

Course Contents:		
Unit 1	**Metals and Alloy Systems**: Introduction to Metallic and Non-metallic materials and its classification (metals/alloys, polymers and composites) a) Metals, Metallic bonds, Crystal structure (SC, BCC, FCC, HCP), Imperfections in crystals, Dislocations in crystals. b) Alloy formation by crystallization, Nucleation and growth, Cooling curves, Dendritic structure and coring. c) Solid solutions and intermediate phases d) Phases and Gibbs phase rule e) Construction of equilibrium diagrams from cooling curves, Isomorphous system (Solid Solution), Eutectic, Partial solubility Peritectic and Intermetallic Compounds Lever arm principles, Long and short-range freezing.	**08 Hrs.**
Unit 2	**Study of Phase Diagrams**: (With respect to typical compositions, Properties and Applications for the following alloys.) a) Fe- Fe3C equilibrium diagram - Ferrous alloys (Plain carbon steels, cast iron) b) Alloy steels- Free cutting steels, HSLA high carbon low alloy steels,	**11 Hrs.**

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	maraging steels. creep resisting steels, Stainless steels- different types. Tool steels- types, c) Selection of materials and Specifications based on -IS, BS, SAE, AISI, d) Copper based alloys brasses Cu- Zn, Bronzes Cu- Sn, , Cu- Be, Cu-Ni. e) Aluminum based alloys Al- Cu(Duralumin) - Al-Si (Modification), f) Pb- Sn(Solders and fusible alloys) g) Sn-Sb alloys (Babbits) h) Ti (Ti-6Al-4V) i) Miscellaneous alloys such as super alloys, Heating element alloys. Study of low expansion and controlled expansion alloys	
Unit 3	**Principles of Mechanical Testing:** a) Destructive Testing methods:Tensile, Compressive, Impact, Fatigue, Creep, Hardness (Rockwell, Brinell and Vickers) c) Non- Destructive Testing: Dye Penetrant, Magnetic, Ultrasonic, Radiography, Eddy Current testing.	**04 Hrs.**
Unit 4	**Principles of Heat Treatment:** a) Transformation of Pearlite into austenite upon heating, b) Transformation of austenite into Pearlite, Bainite and Martensite on cooling. c) TTT –Diagram and CCT - Diagrams - significance, Effect of alloying elements on TTT diagram and its significance. d) Heat treatment furnaces and equipments, controlled atmosphere.	**05 Hrs.**
Unit 5	**Heat Treatment Processes:** a) Heat Treatment of Steels: Annealing – Types-Full, Partial and Sub critical annealing (Various types) and purposes; Normalizing- Purposes; Hardening (Hardening types), Purposes, Austempering and Martempering, Mechanism of quenching and Quenching media, Hardenability- Concept and methods of determination of hardenability- Grossmans critical diameter method and Jominy end quench test; Tempering Types, Structural transformations during tempering, purposes subzero treatment; Surface hardening - Flame and Induction; Chemical heat treatments for case hardening - Carburizing, Nitriding, Cyaniding, Carbonitriding b) Heat treatment of Nonferrous Alloys: Annealing- Stress relief, Recrystallization and Process annealing; Precipitation hardening - Basic requirements, Stages, Common alloys. c) Heat treatment defects and remedies.	**09 Hrs.**
Unit 6	**Powder Metallurgy:** a) Advantages, Limitations and Applications of Powder Metallurgy b) Powder manufacturing types- Mechanical, Physical, Chemical and Electro-Chemical c) Mixing/ Blending- (Double cone and Y- Cone mixers) d) Compaction- types- Conventional, Isostatic, HERF, Powder rolling and extrusion e) Sintering- Types liquid stage and solid stage sintering f) Finishing operations: Sizing, Machining, Infiltration and Impregnation. g) Powder metallurgy defects and remedies.	**05 Hrs.**

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Text Books					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Material Science and Metallurgy,	V.D. Kodgire,	Everest Publishers Pune	2008	1991
2	Heat Treatments Principles and Practices	T.V. Rajan / C.P. Sharma	Prentice Hall of India Pvt Ltd,,	2009	1995
3	Physical Metallurgy	S.H. Avner,	TMH publication	2010	1988
4	Heat Treatments Principles and Practices	T.V. Rajan / C.P. Sharma	Prentice Hall of India Pvt Ltd	2010	1994

Reference Books					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Engineering Metallurgy I and II	Higgins R. A., Hodder	Higgins publication	2005	1987
2	Powder Metallurgy	A.K. Sinha		2008	1999

Other Books/E-material				
Sr. No	Title	Author	Edition	Year of Edition
1	Materials and Processes in Manufacturing	Campbell,Harry .	1859-	1904
2	Principles of metallurgy	Fulton, Charles	-----	1910
3	Physical Metallurgy	Calister	--	--
4	Metallurgy and heat treatment of tool steel	Wilson R	---	1975

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Course Details

Class	B. Tech, Sem.-IV
Course Code and Course Title	0MEPC257, Numerical Methods **using MATLAB Laboratory**
Prerequisite/s	0BSBS102, 0BSBS113, 0MEES201
Teaching Scheme : Practical	02
Credits	01
Evaluation Scheme: ISE/ESE	25/00

Course Objectives:	
01	To introduce the software Matrix Laboratory (MATLAB) as a programming tool.
02	To demonstrate use of MATLAB for scientific computations of engineering problems.
03	To analyze and compare numerical solution with MATLAB solution.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC257_1	Demonstrate the basics of MATLAB programming, (K^4)
0MEPC257_2	Interpret the results of engineering problems through mathematical and programming and find out the errors,(K^2)
0MEPC257_3	Use MATLAB to solve computational problems through programming, (S^2)
0MEPC257_4	Communicate effectively about laboratory work in writing journals/technical reports, (S^2)
0MEPC257_5	Behave with highest ethical standards with concern to life- long learning, and awareness of contemporary issues. (A^3)

Course Content

The journal consisting of following experiments should be submitted.

1. Introduction to fundamentals of MATLAB
2. MATLAB program on Roots of equation by bracketing method.
3. MATLAB program on Roots of equation by open method.
4. MATLAB program on Linear algebraic equation
5. MATLAB program on Curve Fitting
6. MATLAB program on interpolation
7. MATLAB program on Numerical differentiation.
8. MATLAB program on Numerical integration.
9. MATLAB program on Ordinary differentiation equation
10. MATLAB program on Partial differentiation equation

Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Applied Numerical Methods with MATLAB	Steven C. Chapra	Tata McGrawHill, NewDelhi	3	2012

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2	Introduction to Numerical Methods and MATLAB programming for Engineers.	Todd Young and Martin J. Mohlenkamp	Elsevier Science	4	2012
3	Introductory Methods of Numerical Analysis 5th Edition	S. S. Sastry	PHI Learning	5	2012
4	Numerical Methods	R. K Jain	New Age International Publisher	2	2008

Reference Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Numerical Analysis Using MATLAB	Steven T. Karris	Orchard Publications	3	2007
2	Numerical Methods in Engineering with MATLAB	Jaan Kiusalaas	Cambridge university press	1	2017
3	An Introduction to Programming and Numerical Methods in MATLAB	James P Denier S R Otto Denier Otto	Springer London	1	2016
4	MATLAB Numerical Methods with Chemical Engineering Applications	Al-Malah Kamal I. M	McGraw-Hill Professional Publishing.	1	2013

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SYME-45/55

Course Details:

Class	B. Tech, Sem.-IV
Course Code and Course Title	**0MEPC258, Hydraulic Machines Lab**
Prerequisite/s	0BSES111, 0MEPC203,0MEPC251
Teaching Scheme: Practical	02
Credits	01
Evaluation Scheme: ISE / ESE (POE)	25/25

Course Objectives:	
01	Demonstrate the various parts and working of turbines, pumps, hydraulic devices.
02	Understand the performance characteristic curves of hydraulic machines.
03	Understand the various parts and working principle of turbocharger used in automobiles.

Course Outcomes (COs): Upon successful completion of this course student will be able to:	
0MEPC211_1	Describe construction, working principle, importance, application and their selection of Hydraulic Machines, through Laboratory, industrial visit or hydro power plant visit (K^2)
0MEPC211_2	Draw and Interpret the performance characteristics of various turbines and pumps. (K^4)
0MEPC211_3	Follow written or verbal instructions to carry out experimental task in Hydraulic Machines. (S^1)
0MEPC211_4	Perform the experimental task individually in Hydraulic Machines, communicate effectively and interpret the results. (S^2)
0MEPC211_5	Respond willingly to question asked by faculty and involve in experimental task of Hydraulic Machines. (A^2)

Course Contents:

The journal consisting of following experiments should be submitted.

1. Trial on Pelton Wheel Turbine for plotting main characteristics.
2. Trial on Francis turbine for plotting main characteristics.
3. Trial on Francis turbine for plotting operating characteristics.
4. Trial on Kaplan turbine for plotting main characteristics.
5. Trial on Kaplan turbine for plotting operating characteristics.
6. Trial on centrifugal pump for plotting operating characteristics.
7. Trial on reciprocating pump for plotting operating characteristics.
8. Demonstration of hydraulic ram
9. Demonstration of Hydraulic jack.
10. Demonstration of Gear pump, submersible pump.
11. Demonstration of turbocharger used in automobiles
12. Industrial or hydro power plant visit

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Fluid Mechanics and Hydraulic Machines	Dr.R.K. Bansal	Laxmi Publication	9	2010

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02	Fluid Mechanics and Hydraulic Machines	R.K.Rajput	S. Chand Publication	9	2011
03	Fluid Mechanics and Hydraulics	Suresh Ukarande	Ane Books Pvt.Ltd	1	2014
04	Hydraulics ,Fluid Mechanics and Hydraulic Machines	R.S.Khurmi	S. Chand	1	2003
05	Hydraulics Fluid Mechanics and Hydraulic Machines	S.Ramamrutham	Dhanpat Rai Publishing Company	8	2010

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Fluid mechanics and hydraulic machines	Modi and Seth	Standard Book House	8	2011
02	Fluid mechanics and fluid power engineering	Dr. D. S. Kumar	S.K.Kataria& sons	1	2001
03	Fluid mechanics including hydraulic machines	Dr. A. K. Jain	Khanna publishers	1	2009
04	Fluid mechanics, Hydraulics and hydraulic machines	Dr. K. R. Arora	Standard Publishers	1	2012
05	Fluid mechanics and hydraulic machines	S. C. Gupta	Pearson	6	2011

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SYME-47/55

Course Details:

Class	B. Tech, Sem.-IV
Course Code and Course Title	**0MEPC259, Kinematics of Machines Lab**
Prerequisite/s	0BSES111, 0BSES160
Teaching Scheme: Practical	02
Credits	01
Evaluation Scheme: ISE/ ESE	25/00

Course Objectives:	
1	To analyze kinematics in mechanism and machines.
2	To verify concepts, laws and terminologies of gears, cam and followers, belt drive etc.
3	To impart the skills and ethics during practical sessions.

Course Outcomes:	
Upon successful completion of this lab, the student will be able to,	
0MEPC260_1	Explain the appropriate application of mechanisms, power transmission devices, friction and mechanical energy storage devices.
0MEPC260_2	Simulate the process of experimentation to calculate various parameters effectively. (K^3)
0MEPC260_3	Analyze the mechanism and machines effectively using graphical method, (K^5)
0MEPC260_4	Record all calculations related with these experiment and generate a Technical report (S^2)
0MEPC260_5	Respond ethically on fundamentals of mechanisms as well as cams while presentation (A^2)

Course Contents:

The journal consisting of at least eight experiments among the following should be submitted.

1. Study of basic mechanisms and its inversions. (Demonstration of models, Actual mechanisms, etc.)
2. Verification of ratio of angular velocities of shafts connected by Hooks joint.
3. Velocity problems by relative velocity method. (Minimum 4 problems).
4. Velocity problems by Kliens construction and Instantaneous center method. (Minimum 4 problems)
5. Acceleration problems by relative acceleration method. (Minimum 4 problems).
   a) Generation of involutes tooth profile.
   b) Verification of the Law of Gearing.
6. Problems on cam profile. (Minimum 4 problems)
7. Experimental analysis of various types of cam and follower to draw displacement diagrams.
8. Experiment on belt drive

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Theory of Machines	Ratan S.S	Tata McGraw Hill New Delhi.	3rd	13th reprint 2012
02	Theory of Machines	P.L.Ballany	Khanna Publication, New Delhi	25th	2012

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03	Theory of Machines	V.P. Singh	Dhanpat Rai and Sons	3rd	2012
04	Theory of machines	Dr. R.K.Bansal	Laxmi Publication	4th	2011

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Theory of Machines	Thomas Bevan	CBS Publishers, New Delhi.	3rd	reprint 2005
02	Theory of Machines and Mechanism	Shigley	Oxford International	3rd	2009
03	Theory of mechanism and machines	Sadhu Singh	Pearson	1st	2012
04	Theory of machines and Mechanism	Jagdish Lal	Metropolitin Book Company	1st	2011
05	Mechanism and Machines	Gosh And Mallik	East West Press	3rd	1998
06	Theory of Machine	Sarkar	Tata Mc Graw Hill	1st	2002

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SYME-49/55

Course Details:

Class	B. Tech, Sem.-IV
Course Code and Course Title	**0MEPC260, Materials Science and Metallurgy Laboratory**
Prerequisite/s	0BSBS101, 0BSBS108
Teaching Scheme: Practical	02
Credits	01
Evaluation Scheme: ISE / ESE	25/00

Course Objectives:	
01	To acquaint students the linking of composition-structure-property relationship in metals and alloys.
02	To explain the importance of different destructive and non-destructive material testing methods.
03	To compute the phases in microstructure and estimate the mechanical properties of the metals and their alloys.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC252_1	Evaluate different mechanical properties of materials using various destructive testing techniques with their significance. (K^3)
0MEPC252_2	Estimate percentage phases present in microstructure of ferrous and non-ferrous alloys with their effect on mechanical properties. (K^3)
0MEPC252_3	Recognize and handle the tools and materials from written or verbal instruction. (S^1)
0MEPC252_4	Competently repeat the experiment performance individually and interpret the results. (S^2)
0MEPC252_5	Express awareness of the concepts and their applications with satisfactory demonstration as a response. (A^3)

Course Contents:

The journal consisting of following experiments should be submitted.

1. Spark tree analysis of different types of material.
2. Hardness testing (Brinell and Rockwell)
3. Impact testing (Izod and Charpy)
4. To locate the position of a crack employing ultrasonic test.
5. Surface damage analysis using dye-penetration test
6. To study the microstructure of different types of steel
7. To study the microstructure of different types of Cast Iron
8. To study the microstructure of different types of Non Ferrous Alloys
9. Hardenability testing by Jominy end quench test
10. Tensile test for measurement of mechanical properties.
11. Industrial Visit

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Text Books					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Material Science and Metallurgy,	V.D. Kodgire,	Everest Publishers Pune	2008	1991
2	Heat Treatments Principles and Practices	T.V. Rajan / C.P. Sharma	Prentice Hall of India Pvt Ltd,, New Delhi.	2009	1995
3	Physical Metallurgy	S.H. Avner,	TMH publication	2010	1988
4	Heat Treatments Principles and Practices	T.V. Rajan / C.P. Sharma	Prentice Hall of India Pvt Ltd,, New Delhi.	2010	1994

Reference Books					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Engineering Metallurgy I and II	Higgins R. A., Hodder	Higgins publication	2005	1987
2	Powder Metallurgy	A.K. Sinha	Dhanpat Rai Publications	2008	1999

Other Books/E-material				
Sr. No	Title	Author	Edition	Year of Edition
1	Materials and Processes in Manufacturing	Campbell, Harry .	1859-	1904
2	Principles of metallurgy	Fulton, Charles	-----	1910
3	Physical Metallurgy	Calister	--	--
4	Metallurgy and heat treatment of tool steel	Wilson R	---	1975

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SYME-51/55

Course Details:

Class	B. Tech, Sem.- IV
Course Code and Course Title	**0MEPC261, Computer Aided Design Lab**
Prerequisite/s	0MEPC205, 0MEPC252
Teaching Scheme: Practical	02
Credits	01
Evaluation Scheme: ISE / ESE (POE)	00/25

Course Objectives:	
01	To explain Computer Aided Design, its advantages and scope,
02	To develop skills in different modules of the CAD software for solid modeling,
03	To discuss procedure of DMU Kinematics.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC261_1	Prepare solid, assembly, surface model with suitable constraints and 2D drafting using CATIA software. (K^3 S^2)
0MEPC261_2	Demonstrate kinematics of simple assembly using CATIA software. (K^3 S^2)
0MEPC261_3	Communicate effectively, both orally and in writing journals. (S^2)
0MEPC261_4	Practice professional and ethical behavior to carry forward in their life. (A^3)
0MEPC261_5	Recognize the need of modeling software and utilize it for their project work. (A^3)

Course Contents:		
Unit 1	**Introduction to CAD/CAM/CAE** Introduction to CAD, CAM, CAE, modeling, simulation, analysis and optimization. Different CAD software, file format IGES, STEP, applications. Introduction to Graphical User Interface (GUI) of CATIA, different modules in CATIA, introduction to 2-D sketcher, different commands in 2-D sketcher: profile/operations/constraints.	**02 Hrs.**
Unit 2	**Solid Modeling** Parametric solid modeling – fundamentals, transform the parametric 2-D sketch into a 3D solid, introduction to different commands in 3-D solid modeling, feature operations.	**08 Hrs.**
Unit 3	**Assembly Modeling** Introduction to Assembly modeling, defining relationship between various parts of machine, top down approach, bottom up approach, creation of constraints, generation of exploded view.	**06 Hrs.**
Unit 4	**2–D Drafting** Introduction to Drafting, Production drawing – Generation of 2-D sketches from solid model and assembly model, Geometric Dimensioning and Tolerance, straightness, perpendicularity, flatness, angularity, roundness, concentricity, cylindricity, run out, profile, true position, parallelism, orientation.	**02 Hrs.**
Unit 5	**Surface Modeling** Introduction to surface modeling, difference between part modeling and	**08 Hrs.**

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	surface modeling, various commands in surface modeling, creation of different surfaces.	
Unit 6	**DMU Kinematics** Introduction to DMU Kinematics, defining constraints, simulating motion of different parts of the assembly, velocity and acceleration of assembly parts.	02 Hrs.

Course Contents:

The journal consisting of following experiments should be submitted

1. Introduction to CAD/CAM/CAE
2. Solid Modeling with drafting - 4 Exercises
3. Assembly with minimum 5 components - 2 Exercises
4. Surface Modeling - 2 Exercises
5. DMU Kinematics - 1 Exercises

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	CAD/CAM	Ibrahim Zeid, R. Sivasubramanian	Tata McGraw Hill Pvt. Ltd.	1st	2008
2	CAD/CAM (Principles & Applications)	P.N.Rao	Tata McGraw Hill Pvt. Ltd.	5th	2012
3	CAD/CAM	Kuldeep Sareen, Chandandeep Grewal	S.Chand	1st	2009
4	CATIA V6R16/17	ShyamTickoo Deepak Maini.	DreamTech Press.	-	2009

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	CAD/CAM	M.P.Grover, E.W.Zimmer.	Prentice Hall of India Pvt. Ltd.	1st	2007
2	CAD/CAM/CIM	Radhakrishnan, Subramanyam,	New Age Int. Publishers.	3rd	2004, 2008
3	Computer Aided Mechanical Design & Analysis	V. Ramamurti	Tata McGraw Hill Pvt. Ltd.	4th	2000
4	Computer Aided Design	C.S.Krishnamoorthy,S .Rajeev, A.Rajaraman	Narosa Publishing House	2nd	2005
5	CAD/CAM/CAE	N.K. Chougule	Scitech	1st	2009
6	Computer Aided Design	S.S.Khandare	Charotar Publishing House	3rd	2011
7	CAD/CAM – Concepts and applications	Chennakesava R. Alavala	Prentice Hall of India Pvt. Ltd.	2nd	2009
8	Machine Drawing	N. D. Bhatt and V.M. Panchal	Charotar Publications	2nd	2009

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Course Details:

Class	B. Tech, Sem.-IV
Course Code and Course Title	**0MEPC262, Workshop Practice -IV**
Prerequisite/s	0BSES151, 0MEPC255,
Teaching Scheme: Practical	02
Credits	01
Evaluation Scheme: ISE / (ESE)POE	25/25

Course Objectives:	
01	To understand and perform the various machining operations.
02	To design the sequence of various processes required to manufacture the components.
03	To develop ability for manufacturing given job by smithy/ forging.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC262_1	Select the suitable machining operations and prepare process sheet to manufacture a component and implement the same. (3^{rd} cognitive level)
0MEPC262_2	Choose and set appropriate gear combination to manufacture threads. (3^{rd} cognitive level)
0MEPC262_3	Gain hands-on experience in manufacturing of a component by smithy/ forging operations as per given drawing. (3^{rd} cognitive level)
0MEPC262_4	Explain working of surface grinding, shaper/planer machines. (2^{nd} cognitive level)
0MEPC262_5	Work effectively in teams to accomplish the assigned responsibilities in an integral manner (2^{nd} cognitive level),
0MEPC262_6	Behave with highest ethical standards with concern to global, environmental, economic issues (2^{nd} cognitive level).

Course Contents:

The journal consisting of following experiments should be submitted

1. One job based on smithy/ forging.
2. Description on thread manufacturing processes and gear train calculations.
3. One job of plain turning, taper tuning, external threading and knurling operation with its process sheet.
4. Demonstration of surface grinding machine.
5. Demonstration of shaper/planer (mechanisms and stroke).
6. Industrial visit.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Manufacturing Technology- Foundry, Forming and Welding	P. N. Rao	Tata Mc- Graw Hill Publication	2	2009
02	Principles of Foundry Technology	P. L. Jain	Tata Mc- Graw Hill	2	2006
03	Production Technology: Vol. 1:	P. C. Sharma	S. Chand	1	2006

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	Manufacturing Processes				
04	Production Technology: Vol. 2: Machine Tools	P.C.Sharma	S. Chand	2	2006
05	Workshop technology vol.1	S.K.Hajra Choudhary S.K.Bose	Media promoters and publishers pvt ltd.	12	2012
06	Workshop technology vol.2 (Machine tools)	S.K.Hajra Choudhary S.K.Bose	Media promoters and publishers pvt ltd.	12	2012
07	Workshop Technology vol. II,	Raghuvanshi	Dhanpat Rai and Sons.	--	---

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Materials and Processes in Manufacturing	E. Paul DeGarmo, J.T. Black.	PHI Publication	8	1997
02	Mechanical Metallurgy	George E. Dieter	Tata Mc Graw Hill Publication	3	2013
03	Machine Tools and Manufacturing Technology	Steve F. Krar, Mario Rapisarda.	Delmar publisher	2	2010
04	Workshop Technology", Vol.I 2001, Vol.II 2007 andVol.III 1995.	W.A.J.Chapman	CBS Publishing and Distributors, N. Delhi	---	---
05	ASTM Volumes on Welding, casting, forming and material selection.	----	----	---	---
06	ASM Handbook," Volume- 15, 1988, Casting.	----	----	---	---

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Annasaheb Dange College of Engineering and Technology, Ashta

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Curriculum Structure

T.Y.B. Tech.
MECHANICAL ENGINEERING

SEMESTER V- VI

Academic Year: 2019-20

Department of Mechanical Engineering

ANNASAHEB DANGE COLLEGE OF ENGINEERING AND TECHNOLOGY, ASHTA

(An Autonomous Institute)

Department of Mechanical Engineering

Teaching and Evaluation Scheme
T.Y.B. Tech: Semester-V

Course Code	Course	Teaching Scheme				Evaluation Scheme				
						Scheme	Theory (Marks)		Practical (Marks)	
		L.	T	P	Credits		Max.	Min. for Passing	Max.	Min. for Passing
0MEPC301	Design of Machine Elements-I	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEPC302	Heat and Mass Transfer	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEPC303	Dynamics of Machines	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEPC304	Control Engineering	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEPC305	Manufacturing Engineering	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEPE30*	Professional Elective-I	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEPR309	Research Methodology-I	1	--	--	1	MSE	20	20	--	--
						ESE	30		--	--
0MEPC351	Heat and Mass Transfer Laboratory	--	--	2	1	ISE	--	--	25	10
						ESE	--	POE	25	10
0MEPC352	Dynamics of Machines Laboratory	--	--	2	1	ISE	--		25	10
						ESE	--	OE	25	10
0MEPC353	Manufacturing Engineering Laboratory	--	--	2	1	ISE	--	--	25	10
0MEPC354	Computer Aided Manufacturing Laboratory	--	--	2	1	ISE	--	--	25	10
						ESE	--	POE	25	10
0MEPC355	Workshop Practice -V	--	--	2	1	ISE	--	--	25	10
0MEPR356	Mini Project-I	--	--	1	1	ISE	--	--	50	20
Total		**19**	--	**11**	**25**	**Total**	**650**		**250**	

Total Contact Hours/Week: 30 hrs

Course Category	HS	BS	ES	PC	PE	OE	PR
Credits	00	00	00	20	03	00	02
Cumulative Sum	03	20	36	55	03	00	02

0MEPE30* Professional Elective-I

0MEPE306- Advanced Mechanics of Solids	**0MEPE307-** Advanced Foundry Technology	**0MEPE308-** Fluid Dynamics

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Department of Mechanical Engineering

Teaching and Evaluation Scheme
T.Y. B. Tech: Semester-VI

Course Code	Course	Teaching Scheme				Evaluation Scheme				
						Scheme	Theory		Practical	
		L	T	P	Credits		Max.	Min. for	Max.	Min. for
0MEPC310	Design of Machine Elements-II	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEPC311	Mechatronics	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEPC312	Industrial Hydraulics and Pneumatics	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEPC313	Metrology and Quality Control	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEPE31*	Professional Elective-II	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEPR317	Research Methodology-II	1	--	--	1	MSE	20	20	--	--
						ESE	30		--	--
0MEPC357	Mechanical Measurement	--	--	2	1	ISE	--		25	10
						ESE	--	POE	25	10
0MEPC358	Design of Machine Elements-II Laboratory	--	--	2	1	ISE	--	--	25	10
0MEPC359	Mechatronics Laboratory	--	--	2	1	ISE	--	--	25	10
						ESE	--	POE	25	10
0MEPC360	Industrial Hydraulics and Pneumatics Laboratory	--	--	2	1	ISE	--	--	25	10
0MEPE36#	Professional Elective-II Laboratory	--	--	2	1	ISE	--	--	25	10
0MEPC364	Workshop Practice -VI	--	--	2	1	ISE	--	--	25	10
0MEPR365	Mini Project-II	--	--	2	1	ESE	--	--	25	10
0MEPR366	Vocational Training	--	--	--	2	ESE	--	--	25	10
Total		**16**	**00**	**14**	**25**	**Total**	**550**		**250**	

Total Contact Hours/Week: 30 hrs

Course Category	HS	BS	ES	PC	PE	OE	PR
Credits	00	00	00	17	04	00	04
Cumulative Sum	03	20	36	72	07	00	06

0MEPE31* Professional Elective-II

0MEPE314 -FEA	**0MEPE315** -Advanced Manufacturing Technology	**0MEPE316** -CFD

0MEPE36# Professional Elective-II Laboratory

0MEPE361 - FEA	**0MEPE362** - Advanced Manufacturing Technology	**0MEPE363** - CFD

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ANNASAHEB DANGE COLLEGE OF ENGINEERING ASHTA 416 301

Course Details:

Class	T. Y. B. Tech. Semester-V
Course Code and Course Title	**0MEPC301, Design of Machine Elements I**
Prerequisite/s	0MEPC205, 0MEPC209
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I/ MSE/ ISE II/ ESE	10/30/10/50

Course Objectives: The course aims:	
01	To explain the various theories of failures and basic design principles,
02	To describe, derive and use design methodology for designing various components of machine.
03	To design the machine elements under static and dynamic loading conditions.
04	To develop an ability to use manufacturer's catalogues and design data book.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC301_1	**Explain** the fundamentals of machine element like joints, levers, power screws, & springs. **(K^2)**
0MEPC301_2	**Describe** the significance of material selection for various machine elements. **(K^2)**
0MEPC301_3	**Apply** the basic concepts to design machine element for applications on strength basis using design data book. **(K^3)**
0MEPC301_4	**Solve** problems by applying acquired knowledge of machine elements to compute design dimensions under static conditions. **(K^3)**
0MEPC301_5	**Solve** problems on mechanical components subjected to fluctuating/ reversed loading conditions. **(K^3)**

Mapping of Course Outcomes to Program Outcomes:

Course Outcomes	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
0MEPC301_1	2													
0MEPC301_2	2													
0MEPC301_3	3													
0MEPC301_4	3	1												
0MEPC301_5	3	2	1											
Avg.	2.6	1.5	1											
0MEPC301	3	2	1											

ASHTA 416 301

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Course Contents:		
Unit 1	**Fundamentals of Machine Design** Concept of Machine design, basic procedure of design of machine elements, requirements of machine elements, Types of loads, Factor of safety- its selection & significance, Theories of elastic failure & their applications, Design considerations for cast and forged components, Selection of various engineering materials, I.S. coding for ferrous materials, Factors governing the selection of engineering materials.	06 Hrs.
Unit 2	**Design against static load:** Static Load, Modes of failure, Eccentric axial loading, Design of machine parts subjected to combined, direct and bending stress. Design of machine elements under static loading- Knuckle joint, Turn buckle and Levers.	07 Hrs.
Unit 3	**Design of bolted and welded joints** **a) Bolted joints -** subjected to following conditions- 1) Joints in shear 2) joints subjected to load perpendicular to the axis of bolt. **b) Welded joints -** 1) Strength of transverse and parallel fillet welds 2) Eccentric load in the plane of weld 3) Welded joint subjected to bending moment.	08 Hrs.
Unit 4	**Design of Power Screw** Forms of threads, Terminology of threads, Torque requirement (lifting and lowering load) Self locking and overhauling properties, Efficiency of square threaded, Self locking screw, Collar friction torque, Design of power screw & nuts, Introduction to Recirculating ball Screw.	07 Hrs.
Unit 5	**Design for fluctuating loads** Stress concentration - causes & remedies, fluctuating stresses, S-N diagram under fatigue load, Endurance limit, Notch sensitivity, Endurance strength-modifying factors, Design for finite and infinite life under reversed stresses, Cumulative damage in fatigue failure, Soderberg and Goodman diagrams, Modified Goodman diagram, Fatigue design for components under combined stresses such as shafts, springs, thin pressure vessels, Beams subjected to point loads etc.	08 Hrs.
Unit 6	**Design of Springs** Types of springs and their applications, Selection of material, Types of failures, terminology of helical spring, styles of end, Design of helical compression spring subjected to static loading. Terminology of leaf spring, design of leaf spring, nipping of leaf spring	06 Hrs.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Design of Machine Elements	V.B. Bhandari	Tata Mc- Graw Hill Publication	Third	2012

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Text Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
02	Design of Machine Element	J.F. Shigley	McGraw Hill Publication.	Eighth	2010
03	Machine Design	R. K. Jain	Khanna Publication	Seventh	2004
04	Machine Design	Pandya Shah	Charotar Publication	Seventh	2009
05	Mechanical Engineering Design	Shigley and C. R. Miscke	Tata Mc- Graw Hill	Eighth	2010
06	Design of Machine Elements	M. F. Spotts	Pearsons Edu. Inc.	Eighth	2004
07	Design of Machine Elements	P. Kannaiah	Scitech Publication.	Second	2008

Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Machine Design an Integrated Approach	R.L Norton	Pearson Education Publication	Second	2007
02	Fundamentals of Machine Component Design	J Marshek	Willey Eastern Ltd.	Third	2011
03	Mechanical Analysis & Design	H. Burr & Cheatam	Prentice Hall Publication.	Second	1997
04	Machine Design	Hall, Holowenko, Laughlin	Tata McGraw Hill Publication.	First	2008
05	Standard Handbook of Machine Design	J. Shigley, C. Mischke,	McGraw Hill Publication.	Third	2004
06	Design data book	PSG	PSG	--	--
07	Design data book	V.B. Bhandari	Tata Mc- Graw Hill Publication	First	2014

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ANNASAHEB DANGE COLLEGE OF ENGINEERING AND TECHNOLOGY, ASHTA

(An Autonomous Institute)

Department of Mechanical Engineering

Course Details:

Class	T.Y B. Tech, Semester-V
Course Code and Course Title	**0MEPC302, Heat and Mass Transfer**
Prerequisite/s	0MEPC202, 0MEPC203, 0MEPC210
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I/MSE/ISE II/ESE	10/30/10/50

Course Objectives: The course aims:	
01	To develop ability among the students to distinguish and solve steady and unsteady heat transfer problems by conduction.
02	To offer students with the knowledge of various laws of thermal radiation and its role in heat transfer.
03	To impart basic knowledge of forced and natural convection correlations using dimensionless numbers.
04	To explain the principles of heat transfer to analyze heat exchangers.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC302_1	**Explain** the mechanism and basic concept of heat transfer,(K^2)
0MEPC302_2	**Describe** different forms of heat equations in conduction, convection and radiation heat transfer, (K^2)
0MEPC302_3	**Solve** the problems on conduction, convection and radiation heat transfer, (K^3)
0MEPC302_4	**Apply** empirical correlations for both forced and natural convection to determine convection heat transfer coefficient ,(K^3)
0MEPC302_5	**Analyze** the performance of shell and tube type heat exchanger.(K^4,A^2)

Mapping of Course Outcomes to Program Outcomes:

Course Outcomes	Programme Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
0MEPC302_1	3													
0MEPC302_2	2	2												
0MEPC302_3	3	2												
0MEPC302_4	3	2												
0MEPC302_5	3	2	1			1								
Avg.	2.8	2	1			1								
0MEPC302	3	2	1			1								

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Course Contents:		
Unit 1	**INTRODUCTION TO HEAT TRANSFER:** **Basic Concepts:** Modes/laws of heat transfer, Combined modes of heat transfer, Thermal conductivity and its variation with temperature. Derivation of Generalized differential equation of Heat Conduction in Cartesian co-ordinates, its reduction to Fourier, Laplace and Poisson's equations. Generalized Heat conduction equation in cylindrical and spherical coordinates (no derivations). Introduction to mass transfer, Modes of mass transfer **One-dimensional steady state heat conduction without heat generation:** Temperature boundary conditions, heat flux boundary condition, convection boundary condition and radiation boundary condition. Reduction of Generalized differential equation of Heat Conduction to one dimension (1D), Heat conduction through plane wall, cylinder, sphere; electrical analogy; concept of thermal resistance and conductance, composite slab, composite cylinder and composite sphere, critical radius of insulation for cylinder and sphere.	08 Hrs.
Unit 2	**HEAT CONDUCTION WITH HEAT GENERATION AND UNSTEADY STATE HEAT CONDUCTION** **One-dimensional steady state heat conduction with heat generation:** One dimensional steady state heat conduction with uniform heat generation for plane wall cylinder, and sphere. **One-dimensional unsteady State Heat Conduction** Lumped Heat capacity Analysis, Biot and Fourier number and their significance, (Numerical based on Lumped Heat capacity Analysis).	07 Hrs.
Unit 3	**HEAT TRANSFER THROUGH EXTENDED SURFACES** Types and applications of fins, Heat transfer from rectangular and pin fins (with different boundary conditions). Fin effectiveness and efficiency, Error estimation in temperature measurement in thermo well	06 Hrs.
Unit 4	**HEAT TRANSFER THROUGH CONVECTION** **Fundamentals of convection:** Mechanism of natural and forced convection. Concept of Hydrodynamic and thermal boundary layer, local and average convective coefficient for laminar and turbulent flow for flat plate and pipe **Natural or Free Convection:** Dimensional analysis, Physical significance of dimensionless numbers, correlations for natural convection over vertical plate cylinder sphere and flow patterns **Forced Convection:** Dimensional analysis, Physical significance of dimensionless numbers, Reynolds analogy for laminar flow, correlations for forced convection over flat plate and closed conduits.	07 Hrs.

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Unit 5	**HEAT TRANSFER THROUGH RADIATION** Nature of thermal radiation, absorptivity, reflectivity, transmissivity, emissive power and emmissivity, spectural and total concept, black body, gray body and white body.Kirchoff's law, Wein's law and Planck's law, and deduction of Stefan Boltzmann law. Lambert cosine rule, Intensity of radiation. Energy exchange by radiation between two black surfaces with non-absorbing medium in between and in absence of reradiating surfaces. Shape factor and its characteristics. Energy exchange by radiation between two gray surfaces without absorbing medium, concept of radiosity and irradiation. Radiation network method, network for two surfaces, radiation shields.	**07 Hrs.**
Unit 6	**HEAT EXCHANGERS AND PHASE CHANGE PHENOMENON** **Heat Exchangers:** Classification and types of Heat exchangers, Fouling factor, and Overall heat transfer coefficient, Heat Exchanger Analysis using LMTD and NTU methods for parallel and counter flow, shell and tube type HEX, Design consideration of Heat exchangers and introduction to design standards like TEMA. Introduction to Compact HEX. **Boiling and Condensation:** Types of boiling, pool boiling and Forced convection boiling, Nusselt's theory of condensation for vertical plate, Film wise and drop wise condensation.	**07 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Heat and Mass Transfer	R K Rajput	S. Chand & Company Ltd., New Delhi	Third	2007
02	Fundamentals of Heat and Mass Transfer	R.C. Sachdeva	New Age International	First	2000
03	Heat and Mass Transfer	Dr. D.S. Kumar	S. K. Kataria & Sons, Delhi	Third	2013
04	Heat and Mass Transfer	P. K. Nag	Tata Mc- Graw Hill Publication	Third	2011

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Heat and Mass Transfer	J P Holman S Bhattacharya	Tata MacGraw Hill, New Delhi	Tenth	2011
02	Heat and Mass Transfer	Yunus. A Cengel	Tata MacGraw Hill, New Delhi	Fourth	2011
03	Heat and Mass Transfer	S C Arora S Domkunwar	Dhanpatrai and Sons, Delhi	Seventh	2012
04	Fundamentals of Heat	Frank P. Incropera,	John Wiley & Sons	Fourth	1996

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Course Details:

Class	T. Y. B. Tech. Semester-V
Course Code and Course Title	**0MEPC303, Dynamics of Machines**
Prerequisite/s	0MEPC212
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I/MSE/ISE II/ESE	10/30/10/50

Course Objectives: The course aims:	
01	To understand the concept of motion transmission using various methods.
02	To study basic theory related to vibrations.
03	To understand gyroscopic effect in aero plane, Naval ship, Four and Two-wheeler.
04	To study different types of governor and its applications

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC303_1	**Solve** problems of gear train according to its application, (K^3)
0MEPC303_2	**Select** and apply different governing mechanisms for prime mover. (K^3)
0MEPC303_3	**Illustrate** the effects of gyroscopic couple in aero-plane, ship, two wheelers and four wheelers, (K^3)
0MEPC303_4	**Apply** balancing concept while designing machine components, (K^3)
0MEPC303_5	**Select** vibration measuring device for condition monitoring. (K^3)
0MEPC303_6	**Analyze** machines/mechanical system under free vibration and damped vibration. (K^4)

Mapping of Course Outcomes to Program Outcomes:

Course Outcomes	Program Outcomes													
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
0MEPC303_1	3													
0MEPC303_2	3	2												
0MEPC303_3	3	2												
0MEPC303_4	3	2												
0MEPC303_5	3	1												
0MEPC303_6	3	2	1											
Avg.	3	1.8	1											
0MEPC303	**3**	**2**	**1**											

Course Contents:		
Unit 1	**Gear train** Types of Gear trains- Simple, Compound, Reverted, Epicyclic gear train, Tabular method for finding the speeds of elements in epicyclic gear train, Differential gear box.	**07 Hrs.**

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Unit 2	**Governors** Comparison between governors and flywheel. Types-centrifugal governors, inertia governors. Force analysis - gravity loaded governors-Porter, Spring loaded governors-Hartnell, Performance characteristics of governors-stability, isochronism, hunting, governor effort and governor power, coefficient of insensitiveness. Applications of governors.	**06 Hrs.**
Unit 3	**Gyroscope** Introduction Gyroscopic couple and its effect on spinning bodies. Gyroscopic effect on naval ships during steering, pitching and rolling. Ship stabilization with gyroscopic effect. Two-wheeler and four-wheeler on curved path– effect of gyroscopic and centrifugal couples, maximum permissible speeds on curve path.	**08 Hrs.**
Unit 4	**Balancing** Static and Dynamic balancing of rotary and reciprocating masses. Primary and Secondary forces and couples. Direct and Reverse cranks. Balancing of Single cylinder, Multi cylinder-Inline and V-Engines for four-wheeler.	**09Hrs.**
Unit 5	**Fundamentals of Vibrations** Basic concepts and definitions, vibration measuring parameters - Displacement, Velocity and acceleration, Free and forced vibrations, Equivalent Springs. Types of damping.	**05 Hrs.**
Unit 6	**Single degree of freedom systems** Free vibrations with and without damping (Rectilinear, Torsional & Transverse), degree of damping. Logarithmic decrement, equivalent viscous damping, Coulomb damping.	**07Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Theory of Machines,	Ratan S.S	Tata McGraw Hill New Delhi.	Third	2012
02	Theory of Machines	V. P. Singh	Dhanpat Rai and Sons	Third	2012
03	Mechanical Vibrations	V. P. Singh	Dhanpat Rai and Sons Publication	Third	2004
04	Mechanical Vibrations	G. K. Grover	Nemchand Publication	Third	2010

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Theory of Machines	Thomas Bevan	CBS Publishers, New Delhi.	Third	2005

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Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
02	Theory of Machines and Mechanism	Shigley	Oxford International	Third	2009
03	Mechanical Vibrations	S. S. Rao	Pearson Education Publication	Third	2012
04	Theory of Machines	P. L. Ballany	Khanna Publication, New Delhi	Twenty fifth	2012

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Course Details:

Class	T. Y. B. Tech. Semester-V
Course Code and Course Title	**0MEPC304, Control Engineering**
Prerequisite/s	0MEES201
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I/ MSE/ ISE II/ ESE	10/30/10/50

Course Objectives: The course aims:	
01	To classify the control system and mathematically represent the system.
02	To apply the technique of linearization and block diagram algebra.
03	To find transient response specifications for first and second order system
04	To find the stability of the control system.
05	To find frequency response of the system.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC304_1	**Explain** the type of control system, their applications, limitations & concepts of feedback. **(K^2)**
0MEPC304_2	**Compute** the analogies of the given physical system by using grounded chair representation. **(K^3)**
0MEPC304_3	**Use** technique of linearization and block diagram algebra. **(K^3)**
0MEPC304_4	**Calculate** transient response using Laplace transform and time specifications. **(K^3)**
0MEPC304_5	**Identify** the stability of control systems using Root-Locus Technique and Routh's Stability Criteria. **(K^4)**
0MEPC304_6	**Analyze** control systems using frequency response technique (Bode plot). **(K^4A^2)**

Mapping of Course Outcomes to Program Outcomes:

Course Outcomes	Program Outcomes													
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
0MEPC304_1	2													
0MEPC304_2	3	2												
0MEPC304_3	3	2												
0MEPC304_4	3	2												
0MEPC304_5	3	2												
0MEPC304_6	3	2				1								
Avg.	2.8	2				1								
0MEPC304	**2**	**2**				**1**								

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Course Contents:		
Unit 1	**Introduction to Automatic Control** Introduction to Automatic Control: Generalized Control System Types, Open Loop and Closed Loop, Linear and Non-Linear, Time Variant and Time invariant Systems with examples, advantages of Automatic Control Systems, Laplace Transforms.	**03 Hrs.**
Unit 2	**Mathematical Model of Control System** Mechanical Translational Systems, Mechanical Rotational Systems, Grounded Chair Representation, Electrical Elements, Analogous Systems, Force –Voltage Analog, Force – Current Analog.	**07 Hrs.**
Unit 3	**Linearization and Block Diagram Reduction** Linearization of non linear functions, Block Diagram Algebra, Rules for Reduction of Block Diagram.	**08 Hrs.**
Unit 4	**Transient Response** General form of Transfer Function, Response of systems (First and Second Order) to Various Inputs (Impulse, Step, Ramp), Damping Ratio and Natural Frequency, Transient Response Specification.	**08 Hrs.**
Unit 5	**Stability and Root Locus Technique** Concept of Poles and Zeros, Distinct, Repeated and Complex Zeros, Effect of Poles and Zeros on the System Stability, Routh's Stability Criteria, Significance of Root Locus, Construction of Root Loci, General Procedure.	**08 Hrs.**
Unit 6	**Frequency Response Analysis** Frequency Response (Bode plot): Log Magnitude Plots and Phase angle Plots, Gain Margin, Phase Margin, and Stability analysis. Introduction to system compensation: Types of Compensators, Lead, Lag, Lead-Lag Compensators (No numerical).	**08 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Control System Engineering	R Anandnatarajan, P. Ramesh Babu	SciTech Publi	Third	2012
02	Control Systems	A. Anand Kumar	Prentice Hall Publi	Fourth	2010
03	Automatic Control Engineering	D. Roy and Choudhari	Orient Longman Publi	Sixth	2012
04	Control Systems Engineering	I.J. Nagrath, Madan Gopal	New Age International Publishers Ltd.- New Delhi	Fifth	2007

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Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Automatic Control Engineering	F.H. Raven	Tata McGraw Hill Publi.	Fifth	1995
02	Modern Control Systems	K Ogata	Prentice Hall Publi	Third	2010
03	Automatic Control Systems	B.C. Kuo	Willey India Ltd.	Seventh	2011
04	MatLab for Control Engineers	Katsuhiko Ogata	Pearson	Fourth	2007

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Course Details:

Class	T. Y. B. Tech. Semester-V
Course Code and Course Title	**0MEPC305, Manufacturing Engineering**
Prerequisite/s	0MEPC204, 0MEPC205, 0MEPC254, 0MEPC262
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I/ MSE/ ISE II/ ESE	10/30/10/50

Course Objectives: The course aims:	
01	To study the metal cutting technology, cutting tools, various machining affecting parameters.
02	To design of the jigs and fixtures by using various elements of it.
03	To study various types of presses and press working operations.
04	To compute various economic aspects of tooling.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC305_1	**Explain** the basics of metal cutting mechanism and cutting tools. **(K^2)**
0MEPC305_2	**Explain** the fundamentals of press tools operations and study of cutting forces. **(K^2)**
0MEPC305_3	**Determine** the effect of cutting parameters on machining. **(K^3)**
0MEPC305_4	**Compute** the parameters related with economics of tooling. **(K^3)**
0MEPC305_5	**Design** and draw assembly of jig and fixture for a given component. **(K^3)**

Mapping of Course Outcomes to Program Outcomes:

Course Outcomes	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
0MEPC305_1	2													
0MEPC305_2	2													
0MEPC305_3	3	2												
0MEPC305_4	3	2												
0MEPC305_5	3	2	1											
Avg.	2.6	2	1											
0MEPC305	3	2	1											

Course Contents:		
Unit 1	**Cutting tools:** Fundamentals of metal cutting processes, Concept of speed, Feed and depth of cut. Tool geometry, angles and types of single point cutting tools, Milling and drilling tool geometry. Cutting tool materials and their properties.	**06 Hrs.**

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Unit 2	**Theory of metal cutting:** Mechanics of metal cutting-Chip formation, orthogonal and oblique cutting, Types of chips, cutting ratio, shear plane and shear angle, velocity relationships, force calculations, Merchant circle (numerical). Types of wear and failure, optimum cutting speed, tool life, factors affecting tool life, computation of tool life (numerical). Machinability and factors affecting it.	**07 Hrs.**
Unit 3	**Drilling Jigs** Applications, basic elements, principles and types of locating, clamping and indexing elements, Type of Drilling jigs, Design consideration of Jigs, Design and drawing of drilling Jig.	**08 Hrs.**
Unit 4	**Machining Fixtures:** Applications, basic elements, principles and types of locating, clamping and indexing elements, auxiliary elements like tenon, setting block etc. Type of Milling fixtures-Design consideration of fixtures with respect to different operations, Design and drawing of milling fixtures.	**08 Hrs.**
Unit 5	**Press Tools:** Press Operations, press-type, press components, metal cutting in a press work, types of dies, clearance, strip layout, stripper, cutting forces.	**06 Hrs.**
Unit 6	**Economic aspect of tooling:-** Elements of costs, cost estimation and method of estimating, Calculations of machining times, Estimation of total unit time, Depreciation, Tool Replacement, Break even analysis.	**07 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Text Book of Production Engg.	P.C. Sharma	S. Chand Publication	Eleventh	2008
02	Machine Tool Engg.	G.R. Nagpal	Khanna Publication	Eighth	2013
03	Principles of Modern manufacturing	M. P. Groover	Wiley	Fifth	2013
04	Manufacturing Technology Vol 2	P. N. Rao	McGraw-Hill Publishing Ltd	Seventh	2015

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Tool Design	Donaldson	THM Publication	Forth	2012
02	Manufacturing Engineering and Technology	S. Kalpakjian, S. Schmid	Pearson	Seventh	2013
03	Production Technology-	HMT	Tata McGraw-Hill Publishing Ltd	First	Reprint 2001
04	Metal Cutting- Theory and Practice	A. Bhattacharya	New central book agency pvt. Ltd.	First	Reprint 2008

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Reference Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
05	Metal cutting theory & Tool design	Mr. Arshinnov	MIR Publication	First	2010
06	Jigs and Fixtures	P. H. Joshi	Tata McGraw-Hill.	Third	2013

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Course Details:

Class	T.Y. B. Tech, Semester-V
Course Code and Course Title	**0MEPE306, Advanced Mechanics of Solids**
Prerequisite/s	0MEPC209
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I/MSE/ISE II/ESE	10/30/10/50

Course Objectives: The course aims:	
01	To describe the fundamentals of stress and strain analysis- A differential approach.
02	To develop the frame work of Stress-Strain Relations.
03	To extend the differential approach for torsion and axisymmetric problems.
04	To distinction between different energy methods and its applications.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPE306_1	**Conceptual analysis** of stress and strain. (K^2)
0MEPE306_2	**Solve** numerical on stress and strain analysis. (K^3)
0MEPE306_3	**Analyze** torsion induced in shafts, elliptical bars and rectangular bars. (K^3)
0MEPE306_4	**Apply** the different energy methods. (K^3)
0MEPE306_5	**Analyze** thick-walled cylinder subjected to internal and external pressures. (K^4)

Mapping of Course Outcomes to Program Outcomes:

Course Outcomes	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
0MEPE306_1	2													
0MEPE306_2	2													
0MEPE306_3	3	2												
0MEPE306_4	3	2												
0MEPE306_5	3	2	1											
Avg.	2.6	2	1											
0MEPC306	**3**	**2**	**1**											

Course Contents:		
Unit 1	**Analysis of Stress:** Introduction, types of forces, state of stress at a point, normal and shear stress components, stress components on an arbitrary plane, hydrostatic stress, equations of equilibrium and equality of cross shears, principal stresses, stress invariants, principal planes, octahedral stresses, state of pure shear, decomposition into hydrostatic and pure shear states.	**08 Hrs.**

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Unit 2	**Analysis of Strain:** Introduction, deformations, deformation in the neighborhood of a point, change in length of a linear element, linear strains, state of strain at a point, principal axes of strain and principal strains, compatibility conditions, strain deviator and its invariants, plane stress and plane strain.	**08Hrs.**
Unit 3	**Stress-Strain Relations for Linearly Elastic Solids:** Introduction, generalized statement of Hooke's law, stress-strain relations for isotropic material, relation between the elastic constants, displacement equations of equilibrium.	**06 Hrs.**
Unit 4	**Torsions:** Introduction, torsions of general prismatic bars-solid sections, torsion of circular and elliptical bars, torsion of rectangular bars, membrane analogy, centers of twist and flexural center.	**06 Hrs.**
Unit 5	**Axisymmetric problems:** Introduction, thick-walled cylinder subjected to internal and external pressures, stresses in composite tubes-shrink fits, rotating disks of uniform thickness, rotating shafts and cylinders.	**06 Hrs.**
Unit 6	**Energy Methods and theories of failure:** **A-**Introduction, generalized forces and displacements, expressions for strain energy, superposition of elastic energies, theorem of virtual work. **B-** Introduction, maximum principal stress theory, maximum shearing stress theory, maximum elastic strain theory, octahedral shear stress theory, maximum elastic energy theory, distortion energy theory, significance of the theories of failure, factor of safety in design.	**08 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Advanced Mechanics of Soilds	L. S. Srinath	Tata Mc- Graw Hill Publication	Third	2009
02	Theory of Elasticity	Goodier Jn, S. P. Timoshenko	Tata Mc- Graw Hill	Third	2012

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Solid Mechanics	S. M. A. Kazimi	Tata Mc- Graw Hill Publication	First	2011
02	Advanced Mechanics of Soilds	O. T. Bruhns	Springer	First	2003
03	Theory of Elasticity	Sadhu Singh	Khanna Publisher	First	1988

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Course Details:

Class	T. Y. B. Tech. Semester-V
Course Code and Course Title	**0MEPE307 Advanced Foundry Technology.**
Prerequisite/s	OMEPC204, OMEPC213
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I/ MSE/ ISE II/ ESE	10/30/10/50

Course Objectives: The course aims:	
02	To Explain the concepts related to casting solidification for getting homogeneous and sound casting.
03	To impart knowledge related to design of gating and feeding system.
04	To provide knowledge of melting practices and various equipment used in modern foundries.
05	To Acquaint the concepts of quality control in foundries.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPE307_1	**Explain** the foundry processes / equipment.(K^2)
0MEPE307_2	**Describe** the concepts of solidification in castings.
0MEPE307_3	**Describe** the feeding and gating system, gating ratio, cooling rate. (K^2)
0MEPE307_4	**Explain** the melting practices and equipment. (K^2)
0MEPE307_5	**Describe** the advanced moulding, core making, melting, pouring, shake out and fettling equipment used in foundries. (K^2)
0MEPE307_6	**Discuss** the quality control specifications of foundry sand, sand additives, furnace charging material. (K^2)

Mapping of Course Outcomes to Program Outcomes:

Course Outcomes	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
0MEPE307_1	3													
0MEPE307_2	3													
0MEPE307_3	3													
0MEPE307_4	3													
0MEPE307_5	3													
0MEPE307_6	3													
Avg.	3													
0MEPE307	3													

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Course Contents:		
Unit 1	**Introduction:** Brief History, Foundry, Comparison of casting technology with other metal processing technologies, merits and limitations, Comparison of casting manufacturing in India with that in other countries, 3-D printing for pattern making.	**05 Hrs.**
Unit 2	**Solidification of Casting:** Crystallization and development of cast structure, Shrinkage of metals, Nucleation, Growth, Dendritic growth, Independent nucleation, Eutectic freezing, Peritectic reactions, The structure of castings, Concept of progressive and directional solidification, Chvorinov's equation, heat flow analysis, Composite casting of polymers.	**08 Hrs.**
Unit 3	**Gating system:** Characteristics, gating technique, casting temperature and pouring speed, use of chills, padding and insulators, feeding and gating system design.	**07 Hrs.**
Unit 4	**Melting of Ferrous Alloys:** Melting Practices: Developments in melting practices with reference to energy saving, Furnaces- types and selection criteria, Melting technologies for steels, special steels, grey C.I., S.G. iron.	**07 Hrs.**
Unit 5	**Modernization And Mechanization Of Foundry:** Need for modernization and mechanization, molding and core making, melting, pouring, shake out equipment and fettling, material handling equipment for sand mould and cores, molten metal and castings, reclamation of sands ,Pollution control.	**08 Hrs.**
Unit 6	**Quality Control in Foundries:** Quality specifications in respect of raw materials used in foundry sand, sand additives, furnace charging material, alloys; Q.C. checklists maintained for raw materials, Q.C. checklists for mould – core properties; Heat wise pouring reports, details of melting log sheets, test bars, calibration records of testing equipments (U.T.M., Sand testing equipments)	**07 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Principles of Metal Casting	Heine Loper & Rosenthal	Tata McGraw Hill	Fifth	2005
02	Foundry Technology	P.Beelay	Tata McGraw Hill	Second	2001
03	Manufacturing Technology	RK Rajput	Laxmi Publications	Third	2007
04	Foundry Technology	O. P Khanna	Dhanpat Rai Publications	Seventeenth	2011

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Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Principle of Foundry Technology	P. L. Jain	Tata McGraw Hill, India	First	2001
02	Workshop Technology vol 1 & vol 2	Hajara Choudhari	MPP	Second	2000
03	Foundry Technology	K.P. Sinha & D.B. Goel	Standard Publishers Distributors, India	First	2002
04	Principles of Metal Casting	Mahi Sahoo and Sam Sahu	McGraw-Hill Education	Third	2014

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Course Details:

Class	T.Y. B. Tech, Semester-V
Course Code and Course Title	**0MEPE308, Fluid Dynamics**
Prerequisite/s	0MEPC203
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I/ MSE/ ISE II/ ESE	10/30/10/50

Course Objectives: The course aims:	
01	To enable students to solve and analyze fluid related problems.
02	To train students to demonstrate fluid dynamics theories.
03	To develop skills to analyze the fluid systems with mathematical modeling for applications of fluid dynamics in research or design.
04	To develop a professional approach for lifelong learning in the fluid dynamics to include the awareness of social and environment issues associated with engineering practices.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPE308_1	**Understand** the basic principles of fluid mechanism to solve real life engineering problems. **(K^2)**
0MEPE308_2	**Apply** the governing differential equations to solve the fluid flow problem for different fluid model. **(K^2)**
0MEPE308_3	**Describe** the various properties of inviscid incompressible flow of fluid. **(K^2)**
0MEPE308 _4	**Evaluate** fluid systems for performance of compressible flow. **(K^3)**
0MEPE308 _5	**Analyze** the fluid systems for performance of viscous incompressible flow at different conditions. **(K^3 A^2)**
0MEPE308_6	**Analyze** the dimensionless parameter of fluid mechanics for different fluid flow model. **(K^3)**

Mapping of Course Outcomes to Program Outcomes:

Course Outcomes	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
0MEPE308_1	3													
0MEPE308_2	3													
0MEPE308_3	2													
0MEPE308 _4	2													
0MEPE308 _5	2	1				1								
0MEPE308_6	3	1												
Avg.	2.5	1				1								
0MEPC308	**3**	**1**				**1**								

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Course Contents:		
Unit 1	**Basics of Fluid Dynamics** The physical properties of fluids, Difference between solid and fluids. Aspects of thermodynamics, Elementary Kinetic theory. Introduction to tensors.	07 Hrs.
Unit 2	**Governing Equations of Fluid Motion** Langragian and Eulerian description, Reynolds transport theorem, Integral and differential forms of governing equations: mass, momentum and energy conservation equations, Navier-Stokes equations, Euler's equation, Bernoulli's Equation	08 Hrs.
Unit 3	**Inviscid Incompressible Flows** Circulation, Line vortex, Basic plane potential flows: Uniform stream; Source and Sink; Vortex flow, Doublet, Superposition of basic plane potential flows, Flow past a circular cylinder, Robins and Magnus effect; Kutta-Joukowski lift theorem; Concept of lift and drag	06 Hrs.
Unit 4	**Compressible Flows** Speed of sound and Mach number, Basic equations for one dimensional flows, Isentropic relations, Normal-shock wave, Oblique shock wave, Prandtl-Meyer expansion waves, Fundamentals of hypersonic flows, Mach number independence, Compressible viscous flows, Compressible boundary layers	07 Hrs.
Unit 5	**Viscous Incompressible Flows** Couette flows, Poiseuille flows, Creeping flows, Concepts of boundary layer and flow separation	08 Hrs.
Unit 6	**Dimensional Analysis** Introduction to dimensional parameters, Buckingham pi theorem, Non-dimensional parameter in fluid mechanics, Modelling and similitude, Flow similarity, Models and prototype, Distorted model	06 Hrs.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Computational fluid dynamics	Gautam Biswas	Narosa Publishing House, New Delhi	Third	2013
02	Fundamentals of incompressible fluid flow	Babu V	Anne Books Pvt Ltd. New Delhi, India	First	2010
03	Introduction to fluid dynamics	Batchelor G. K.	Cambridge University Press. New Delhi, India	Second	1999
04	Fluid Dynamics	Raisinghania M.D.	S Chand & Company, New Delhi	Fifth	2003

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Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Introduction to Fluid Mechanics	Fox W. Robert, McDonald T. Alan	John Wiley & Sons	Fourth	1995
02	Viscous Fluid Flow	Frank M. White	McGraw-Hill Series of Mechanical Engineering	Third	2006
03	Modern Compressible Flow with Historical Perspective	John D. Anderson Jr	McGraw-Hill	Second	1990
04	Fluid Mechanics	Frank M. White	Tata McGraw-Hill, Singapore	Sixth	2008

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Course Details

Class	B. Tech, Semester- V
Course Code and Course Title	**0MEPR309, Research Methodology-I**
Prerequisite/s	--
Teaching Scheme: Lecture/Tutorial	01/00
Credits	01
Evaluation Scheme: MSE/ESE	20/30

Course Objectives: The course aims:	
01	To introduce the basics of research activities;
02	To explain the process to identify and formulate design problems;
03	To study various methods of data collection;
04	To develop an ability to select appropriate sample for research activities.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPR309_1	**Understand** basic concepts of research and its necessity. (K^2)
0MEPR309_2	**Compare** between research and research methodology. (K^2)
0MEPR309_3	**Explain** the procedure for defining and designing a research problem. (K^2)
0MEPR309_4	**Express** the need of sampling design, its types and characteristics of a good sample design. (K^2)
0MEPR309_5	**Select** appropriate data collection method for a given research work. (K^3)

Mapping of Course Outcomes to Program Outcomes:

Course Outcomes	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
0MEPR309_1	2													
0MEPR309_2	2													
0MEPR309_3	2													
0MEPR309_4	3													
0MEPR309_5	3	1												
Avg.	2.4	1												
0MEPR309	2	1												

Course Contents		
Unit 1	**Basics of Research** Definition and meaning of research, research objectives, motivation in research, types of research, research approaches, significance of research, research methods verses methodology, research and scientific methods, research process, criteria of good research, problems encountered by researches in India,	**06 Hrs.**

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Unit 2	**Designing a Research Problem** What is a research problem? Literature survey and review, Selecting the problem for research, necessity of defining the problem, technique involved in defining a problem. Meaning and need of research design, features of good research design.	**04 Hrs.**
Unit 3	**Methods of Data Collection and sampling design** Collection of primary data, observation methods, interview method, collection of data through questionnaires and schedules, collection of secondary data, selection of appropriate method for data collection, case study method **Sampling design** Need of a sample design, steps in sampling design, criteria of selecting a sampling procedure, characteristics of a good sample design, different types of sample designs,	**04 Hrs.**

Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Research Methodology	C. R. Kothari	New Age international	First	2004
02	Research Methodology: concepts and cases	Deepak Chopra and Neena Sondhi	Vikas Publishing House, New Delhi	First	1998
03	Research Methodology: An introduction for science and engineering students	Stuart Melville and Wayne Goddard	Tata McGraw Hill	First	2000
04	The Essential Guide to Doing Research	Zina O'Leary	SAGE	Fourth	2004

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Research Methodology – a step by step guide for beginners	Kumar R.	SAGE	Third	2012
02	Research Methodology	G. Ramamurthy	Dream Tech Press	First	2009

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Course Details:

Class	T.Y B. Tech, Semester-V
Course Code and Course Title	**0MEPC351, Heat and Mass Transfer Laboratory**
Prerequisite/s	0MEPC202, 0MEPC203, 0MEPC210
Teaching Scheme: Practical/Tutorial	02/00
Credits	01
Evaluation Scheme: ISE/ ESE (POE)	25/25

Course Objectives: The course aims:	
01	To introduce various modes of heat transfer.
02	To demonstrate temperature variation across the field, to calculate various heat transfer parameters
03	To develop a professional approach to lifelong learning in analysis of heat transfer systems.
04	To determine heat flow rate in various heat transfer modes.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC351_1	**Carry** out experiment and calculate various heat transfer parameters, **(K^3)**
0MEPC351_2	**Interpret** the experimental results of heat transfer properties. **(K^3)**
0MEPC351_3	**Communicate** effectively, both orally and in writing journals, **(S^2)**
0MEPC351_4	**Function** effectively as an individual, and as a team member for performing laboratory work,**(S^3)**
0MEPC351_5	**Follow** professional and ethical principles during laboratory work, **(A^2)**

Mapping of Course Outcomes to Program Outcomes:

Course Outcomes	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
0MEPC351_1	3													
0MEPC351_2	3	2												
0MEPC351_3										2				
0MEPC351_4									2					
0MEPC351_5								2						
Avg.	3	2						2	2	2				
0MEPC351	3	2						2	2	2				

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Course Contents:

The term work consists of following experiments.

1. To determine Thermal Conductivity of Insulating powder.
2. To determine the thermal conductivity of Composite wall.
3. To find Thermal Conductivity of metal bar.
4. To find the heat transfer coefficient in Natural Convection.
5. To determine the heat transfer coefficient in Forced Convection
6. To determine the Stefan –Boltzmann constant in radiation heat transfer
7. To measure the Emissivity of non-black surface
8. To study Pool Boiling and find out critical heat flux
9. To determine the heat transfer coefficient of Drop and film wise condensation process
10. Trial on Heat exchanger – parallel and counter flow
11. Computer programs to determine thermal conductivity.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Heat and Mass Transfer	R K Rajput	S. Chand & Company Ltd., New Delhi	Third	2007
02	Fundamentals of Heat and Mass Transfer	R.C. Sachdeva	New Age International Publishers	First	2000
03	Heat and Mass Transfer	Dr. D.S. Kumar	S.K.Kataria&Sons,Delhi	Second	2013
04	Heat and Mass Transfer	P. K. Nag	Tata Mc- Graw Hill Publication	Third	2011

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Heat and Mass Transfer	J P Holman S Bhattacharya	Tata MacGraw Hill, New Delhi	Tenth	2011
02	Heat and Mass Transfer	Yunus. A Cengel	Tata MacGraw Hill, New Delhi	Fourth	2011
03	A course in Heat and Mass Transfer	S C Arora S Domkunwar A Domkunwar	Dhanpatrai and Sons, Delhi	Seventh	2012
04	Fundamentals of Heat & Mass Transfer	Frank P. Incropera, David P. Dewitt	John Wiley & Sons	Fourth	1996

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Course Details:

Class	T. Y. B. Tech. Semester-V
Course Code and Course Title	**0MEPC352, Dynamics of Machines Laboratory**
Prerequisite/s	0MEPC212, 0MEPC259
Teaching Scheme: Practical/Tutorial	02/00
Credits	01
Evaluation Scheme: ISE / ESE (OE)	25/25

Course Objectives: The course aims:	
01	To understand methods for calculation of M.I.
02	To solve problems on gear trains & balancing of reciprocating masses.
03	To perform experiments on gear train, gyroscope, balancing of rotary masses & longitudinal vibrations.
04	To understand the practical application of various principles of dynamics of machines.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC352_1	**Calculate** M.I of bifilar, Trifilar & Compound pendulum (K^3)
0MEPC352_2	**Perform** the experiments on Gyroscope, Epicyclic gear train, Governor, balancing of rotary masses & Longitudinal vibrations of helical springs. (K^3)
0MEPC352_3	**Solve** the problems on Gear trains & Balancing of reciprocating masses(K^3)
0MEPC352_4	**Analyze** logarithmic decrement in free damped vibrations. (K^4)
0MEPC352_5	**Follow** professional & ethical principles during laboratory work (A^3)
0MEPC352_6	**Record** all calculations related with these experiments & generate technical report. (S^2)

Mapping of Course Outcomes to Program Outcomes:

Course Outcomes	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
0MEPC352_1	3	2												
0MEPC352_2	2	1		1										
0MEPC352_3	3	2												
0MEPC352_4	2	2												
0MEPC352_5								1						
0MEPC352_6										1				
Avg.	2.5	1.75		1				1		1				
0MEPC352	2	2		1				1		1				

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Course Contents:

The term work consists of following experiments.

1. Determination of M.I. by compound pendulum.
2. Determination of M.I. by Bifilar suspension, Trifilar suspension.
3. Problems on Gear Train (5 Problems).
4. Experiment on determination of torques in Epicyclic gear train.
5. Governor characteristics for Porter and/or Hartnell governor
6. Experiment on Gyroscope.
7. Balancing of rotary masses (Static and Dynamic).
8. Problems on balancing of reciprocating masses (4 Problems).
9. Experiment on Longitudinal vibrations of helical springs.
10. Determination of logarithmic decrement (Free Damped Vibrations).
11. Determination of Natural frequency using impact hammer test

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Theory of Machines,	S. S. Ratan	Tata McGraw Hill New Delhi.	Third	13th reprint 2012
02	Theory of Machines	P. L. Ballany	Khanna Publication, New Delhi	Twenty fifth	2012
03	Theory of Machines	V. P. Singh	Dhanpat Rai and Sons	Third	2012
04	Theory of Machines I and II	Phakatkar	Nirali Publication. Pune	Fourth	2005

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Theory of Machines	Thomas Bevan	CBS Publishers, New Delhi.	Third	reprint 2005
02	Theory of Machines and Mechanism	Shigley	Oxford International	Third	2009
03	Theory of Machines and Mechanism	G. S. Rao and R. V. Dukipatti	New Age Int. Publications Ltd. Delhi.	Second	1992
04	Theory of Machines	Shah and Jadhawani	Dhanpat Rai & Sons	Second	2000

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Course Details:

Class	T. Y. B. Tech. Semester-V
Course Code and Course Title	**0MEPC353, Manufacturing Engineering Laboratory**
Prerequisite/s	0MEPC204, 0MEPC205, 0MEPC254, 0MEPC262
Teaching Scheme: Practical/Tutorial	02/00
Credits	01
Evaluation Scheme: ISE/ESE	25/00

Course Objectives: The course aims:	
01	To introduce the broaching and gear manufacturing processes.
02	To design the jigs for mass production.
03	To design the fixtures for mass production.
04	To study and solve the numerical on economic aspect of tooling.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC353_1	**Explain** broaching and various gear manufacturing processes. (K^2)
0MEPC353_2	**Solve** the numerical on economic aspect of tooling. (K^3)
0MEPC353_3	**Design and draw** assembly of drilling jig and milling fixture for a given component. (K^3A^2)
0MEPC353_4	**Explain** the work effectively both orally and in writing. (S^2)
0MEPC353_5	**Function** effectively as an individual, and as a team member for producing technical reports and drawings. (S^3)
0MEPC353_6	**Follow** professional and ethical principles during lab and industrial visit (A^2)

Mapping of Course Outcomes to Program Outcomes:

Course Outcomes	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
0MEPC353_1	2													
0MEPC353_2	3	2												
0MEPC353_3	3	2	1			1								
0MEPC353_4										2				
0MEPC353_5									2					
0MEPC353_6								2						
Avg.	2.7	2	1			1		2	2	2				
0MEPC353	3	2	1			1		2	2	2				

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Course Contents:

The term work consists of following assignments.

1. Demonstration of broaching machine. (Theoretical only)
2. Demonstration of gear manufacturing process. (Theoretical only)
3. Design and drawing of any one drilling jig on A3 sized drawing sheet.
4. Design and drawing of any one milling fixture on A3 sized drawing sheet.
5. Exercises on economic aspect of tooling.
6. Industrial visit.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Text Book of Production Engg.	P. C. Sharma	S. Chand Publication	Eleventh	2008
02	Machine Tool Engg.	G. R. Nagpal	Khanna Publication	Eighth	2013
03	Principles of Modern manufacturing	M. P. Groover	Wiley	Fifth	2013
04	Manufacturing Technology Vol 2	P. N. Rao	McGraw-Hill Publishing Ltd	Seventh	2015

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Tool Design	Donaldson	THM Publication	Forth	2012
02	Manufacturing Engineering and Technology	Serope Kalpakjian, Steven Schmid	Pearson	Seventh	2013
03	Production Technology-	HMT	Tata McGraw-Hill Publishing Ltd	First	Reprint 2001
04	Metal Cutting- Theory and Practice	A. Bhattacharya	New central book agency pvt. Ltd.	First	Reprint 2008
05	Metal cutting theory & Tool design	Mr. Arshinnov	MIR Publication	First	2010
06	Jigs and Fixtures	P. H. Joshi	Tata McGraw-Hill Publishing Ltd.	Third	2013

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Course Details:

Class	T.Y. B. Tech, Semester- V
Course Code and Course Title	**0MEPC354, Computer Aided Manufacturing Laboratory**
Prerequisite/s	0MEPC261,0MEPC204
Teaching Scheme: Practical/Tutorial	02/00
Credits	01
Evaluation Scheme: ISE / ESE (POE)	25/25

Course Objectives: The course aims:	
01	To explain CAM and its scope in manufacturing.
02	To explain G and M codes and its application on CNC machine.
03	To demonstrate tool path generation using suitable simulation software.
04	To demonstrate the casting process using suitable simulation software.

Course Outcomes (COs) Upon successful completion of this course, the student will be able to:	
0MEPC354_1	**Explain** CAM, NC/CNC machine, G and M codes **(K^2)**
0MEPC354_2	**Develop** part program for machining on CNC machine using G and M codes. **(K^3)**
0MEPC354_3	**Simulate** metal cutting process and casting process. **(S^2)**
0MEPC354_4	**Communicate** the importance of CAM and its simulation tools both orally and in written. **(S^2)**
0MEPC354_5	**Practice** professional and ethical behavior. **(A^2)**
0MEES354_6	**Engage** in independent and life-long learning in the programming domain. **(A^2)**

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
0MEPC354_1	2													
0MEPC354_2	2													
0MEPC354_3					2									
0MEPC354_4					2									
0MEPC354_5								1						
0MEPC354_6												1		
Avg.	2				2			1				1		
0MEPC354	2				2			1				1		

Course Contents:

The term work consists of following experiments/assignments.

1. Assignment on introduction to CAM, CAPP, VMC, HMC, NC/CNC machine.

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2. Assignment on fundamentals of part programming.
3. Develop part program for CNC machining operations using modal codes.
4. Develop part program for CNC machining operations using non-modal codes.
5. Tool path generation by using suitable machining simulation software.
6. Assignment on casting process, defects and challenges in casting process, casting yield.
7. Develop mold cavity and core design for given casting using simulation software.
8. Create the gating layout (sprue, runners, feeders and gates) for given casting using simulation software.
9. Verify the gating design by mold filling simulation and optimize the design for given casting using simulation software.
10. Estimate the casting yield, cost of casting process and generation of report.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	CAD/CAM	Ibrahim Zeid, R. Sivasubramanian	Tata McGraw Hill Pvt. Ltd.	First	2008
2	CAD/CAM (Principles & Applications)	P. N. Rao	Tata McGraw Hill Pvt. Ltd.	Fifth	2012
3	CAD/CAM	Kuldeep Sareen, Chandandeep Grewal	S. Chand	First	2009
04	Computer Aided Manufacturing	P. N. Rao, N. K. Tewari, T. K. Kundra	Tata McGraw Hill Publishing Company Ltd.,	Third	2009

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	CAD/CAM	M.P.Grover, E.W.Zimmer.	Prentice Hall of India Pvt. Ltd.	First	2007
02	CAD/CAM/CIM	Radhakrishnan, Subramanyam,	New Age Int. Publishers.	Third	2004, 2008
03	Computer Aided Mechanical Design & Analysis	V. Ramamurti	Tata McGraw Hill Pvt. Ltd.	Fourth	2000
04	CAD/CAM/CAE	N.K. Chougule	Sci-tech	First	2009
05	CAD/CAM – Concepts and applications	Chennakesava R. Alavala	Prentice Hall of India Pvt. Ltd.	Second	2009
06	Metal Casting:Computer-aided Design and Analysis	Ravi, B	PHI, New Delhi	Second	2010

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Course Details:

Class	B Tech, Semester-V
Course Code and Course Title	**0MEPC355, Workshop Practice -V**
Prerequisite/s	0BSES105, 0BSES155, 0MEPC255, 0MEPC262
Teaching Scheme: Practical/Tutorial	02/00
Credits	01
Evaluation Scheme: ISE / ESE	25/00

Course Objectives: The course aims:	
01	To prepare the process sheet for manufacturing of given component.
02	To perform different operations like turning, facing, taper turning, parting, drilling, threading etc. using different machines.
03	To present different gear manufacturing processes.
04	To demonstrate different operations and settings on milling machine to manufacture spur gear.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC355_1	Explain spur gear manufacturing on milling machine. (K^2)
0MEPC355_2	Select suitable machining operations and prepare the process sheet required to manufacture the components (K^4)
0MEPC355_3	Perform series of manufacturing operations independently by controlling key dimensions on a component using principles of metrology and assembly (S^3)
0MEPC355_4	Smoothly coordinates a series of operations precisely with speed and timing (S^4)
0MEPC355_5	Follow professional and ethical principles during lab and industrial visit (A^2)

Mapping of Course Outcomes to Program Outcomes:

Course Outcomes	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
0MEPC355_1	2													
0MEPC355_2	3	2												
0MEPC355_3									3					
0MEPC355_4									3					
0MEPC355_5								2						
Avg.	2.5	2						2	3					
0MEPC355	3	2						2	3					

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Course Contents

One composite Job of two components consisting of various operations like turning, facing, taper turning, parting, drilling, threading, milling etc with process sheet.
Demonstration of spur gear manufacturing on milling machine.
Industrial visit to study other gear manufacturing process.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Workshop Technology – II	Hajra Choudhury	Media Promoters and publishers	Third	2011
02	Workshop practice	H. S. Bawa	TMH Publications, New Delhi	Second	2011
03	Text Book of Production Engg.	P.C. Sharma	S. Chand Publication	Eleventh	2008
04	Manufacturing Technology Vol 2	P.N.Rao	McGraw-Hill Publishing Ltd	Seventh	2015

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Workshop practice	R. K. Rajput	Laxmi publications pvt. ltd.	Second	2008
02	Workshop technology	R.S. Khurmi & J. K. Gupta	S. Chand & company Ltd.	First	2006
03	Workshop science and materials	Harry Ogden	Pitman books ltd. London	First	1984
04	Metal Cutting- Theory and Practice	A. Bhattacharya	New central book agency pvt. Ltd.	First	Reprint 2008

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Course Details:

Class	T.Y. B. Tech, Semester-V
Course Code and Course Title	**0MEPR356, Mini Project-I**
Prerequisite/s	--
Teaching Scheme: Practical/Tutorial	01/00
Credits	01
Evaluation Scheme: ISE / ESE	50/00

Course Objectives: The course aims:	
01	To address the problems of nearby society/industry/institute and find the required solution.
02	To encourage for creative thinking with confidence, decision making, planning and develop effective communication skills for presentation of project.
03	To train the students to make use of fundamental knowledge of science and engineering for successful completion of the undertaken project.
04	To prepare assembly and detailed drawings/ report by using modern tools.

Course Outcomes (COs): Upon successful completion of this course, the students will be able to:	
0MEPR356_1	**Identify** the real life institutional, societal, industrial problems/issues for sustainable development. **(K^3 A^3)**
0MEPR356_2	**Review** the research literature, formulate, and analyze complex engineering problems to give cost-effective, optimal solution considering societal, health, legal and safety issues. **(K^3 A^3)**
0MEPR356_3	**Function** effectively as an individual or as a team for understanding of the engineering and management principles and apply these to manage the projects by maintaining professional and ethical values. **(S^3 A^2)**
0MEPR356_4	**Communicate** effectively on complex engineering activities, write appropriate project report and make effective presentations. **(S^3)**
0MEPR356_5	**Engage** in life-long learning in the broadest context of technological change. **(A^3)**

Mapping of Course Outcomes to Program Outcomes:

Course Outcomes	Program Outcomes													
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
0MEPR356_1	3	1					3						3	
0MEPR356_2	3	2	1			3								
0MEPR356_3								2	3		3			
0MEPR356_4										3				
0MEPR356_5												3		
Avg.	3	1.5	1			3	3	2	3	3	3	3	3	
0MEPR356	**3**	**2**	**1**			**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	

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Course Contents:

The term work consists of mini project work.

Following are the instructions for the students:

Project Load:

Maximum 5 students in one group are allowed.

Project Definition:

Project work shall be based on any of the following:

1. Design of any equipment /test setup/product
2. Hardware/numerical or theoretical analysis /review of survey study/research and development work

The subject content of the mini project shall be form emerging/thrust areas, topic of current relevance. The completion of work, the submission of the report and assessment should be done at the end of Part-I (First semester).

The project work preferably be extended for mini project II at Sem. VI with same group working under guidance of same faculty assigned for mini project I.

Project assessment:

Project will be assessed by the project guide along with one colleague appointed by the head of department.

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Course Details:

Class	B. Tech. Semester-VI
Course Code and Course Title	**0MEPC310, Design of Machine Elements II**
Prerequisite/s	0MEPC205, 0MEPC252, 0MEPC209, 0MEPC261, 0MEPC301, 0MEPC303
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I/ MSE/ ISE II/ ESE	10/30/10/50

Course Objectives: The course aims:	
01	To impart the basic principles of gear design.
02	To develop skill to design gears using appropriate procedures and design data book.
03	To study the design procedure for the shaft, keys, couplings, and anti-friction bearings.
04	To study the selection procedures for belt and chain drive for different applications.
05	To develop an ability to use the standard procedure for the selection of the belt, pulley, and bearings from the manufacturer's catalogue.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC310_1	**Explain** considerations and methodologies used for the design and selection of gears, shafts, keys, couplings and bearings. **(K^2)**
0MEPC310_2	**Solve** the design problems of gears using design data book. **(K^3)**
0MEPC310_3	**Use** the standard design procedures of shaft, key, coupling, and anti-friction bearings. **(K^3)**
0MEPC310_4	**Select** the belt, pulley, chain and sprocket using manufacturer's catalogue. **(K^3)**
0MEPC310_5	**Solve** design problems of bearings using manufacturer's catalogue. **(K^3)**
0MEPC310_6	**Design** and/or select the components of a transmission system for static and dynamic loading conditions and by using the standard design procedure and design data book. **(K^4)**

Mapping of Course Outcomes to Program Outcomes:

Course Outcomes	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
0MEPC310_1	3													
0MEPC310_2	3	2	1											
0MEPC310_3	3	2												
0MEPC310_4	3	2												
0MEPC310_5	3	2	1											
0MEPC310_6	3	2	2											
Avg.	18	10	4											
0MEPC310	**3**	**2**	**1.3**											

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Course Contents:		
Unit 1	**Spur and Helical Gear** Gear terminology, material selection, types of gear failure. **a) Spur Gear** – Review of gear terminology, types, force analysis, type of gear failure, selection of material, minimum number of teeth, beam strength (Lewis equation), estimation of module based on beam strength, Barth equation, wear strength (Buckingham's equation), estimation of module based wear strength, dynamic tooth load (Spot's equation and Buckingham's equation), calculation of effective load on a gear tooth, gear design for maximum power transmission capacity, methods of gear lubrication, construction of gears such as hub, web, arm, rim type etc., design considerations of gear box. **b) Helical Gear –** Gear terminology, types, formative number of teeth, force analysis, type of gear failure, beam & wear strength, effective load, design of helical gear.	**10 Hrs.**
Unit 2	**Bevel Gear** Gear terminology, types of bevel gears, Guideline for selection of dimensions and minimum number of teeth, force analysis, type of gear failure, beam and wear strength, dynamic load, effective load, design of straight bevel gear, mounting of bevel gear.	**06 Hrs.**
Unit 3	**Worm Gears** Terminology and geometrical relations, standard dimensions and recommendation of worm gearing, force analysis, types of failures, friction, efficiency of worm gear drive, design of worm drive as per IS 7443-1974 based on beam strength and wear strength rating, thermal consideration in worm drive.	**04 Hrs.**
Unit 4	**Design of Shaft, Keys, and Couplings** **a) Shaft -** Types of transmission shaft, selection of material, Design of solid & hollow shafts – strength and torsional rigidity basis, ASME code for shaft design, **b) keys –** types of keys, selection of material, design of keys, splines **c) Couplings -** types of couplings, design of muff, rigid coupling, and flexible bushed pin type flanged coupling.	**06 Hrs.**
Unit 5	**Belt drive and chain drive** **a) Design of Pulley and Selection of Belts –** failure of belt and pulley, Design of pulley- flat and V belt pulley, selection of flat belt, V belt as per the standard manufacturer's catalogue, Introduction to timing belts. **b) Chain drive** – chain and sprocket terminology, failure of chain drive, power rating of roller chain, chain lubrication, design of chain drive	**04 Hrs.**
Unit 6	**Design of Bearings** **a)** Introduction to Tribological consideration in design Friction, Wear, Lubrication.	**10 Hrs.**

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	b) Rolling Contact Bearing - Types, static and dynamic load capacities, Stribeck's equation, equivalent bearing load, load-life relationship, bearing life, load factor, Selection of bearing from manufactures catalogue. Ball and Roller bearing, Design for variable load and speed, Bearings with probability of survival other than 90%. Lubrication and mountings, dismounting and preloading of bearings, Oil seal and packing. **c) Sliding contact bearing** - Bearing material and their properties: Sintered bearing materials, bearing types and their construction details. **d) Hydro-dynamic lubrication -** Basic theory, thick and thin film lubrication, Reynolds's equation, Somerfield Number, Design consideration in hydrodynamic bearings, Raimondi and Boyd method relating bearing variables, Heat balance in journal bearings, Temperature rise.	

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Design of Machine Elements	V. B. Bhandari	Tata Mc- Graw Hill Publication	Fourth	2017
02	Design of Machine Element	J. F. Shigley	McGraw Hill Publication.	Eight	2010
03	Machine Design	R. K. Jain	Khanna Publication	Seventh	2004
04	Machine Design	Pandya Shah	Charotar Publication	Seventh	2009
05	Mechanical Engineering Design	Shigley and C. R. Miscke	Tata Mc- Graw Hill	Eight	2010
06	Design of Machine Elements	M. F. Spotts	Pearsons Edu. Inc.	Eight	2004

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Machine Design An Integrated Approach	R.L Norton	Pearson Education Publication	Second	2007
02	Fundamentals of Machine Component Design	J Marshek	Willey Eastern Ltd.	Third	2011
03	Mechanical Analysis & Design	H.Burr & Cheatam	Prentice Hall Publication.	Second	1997
04	Standard Handbook of Machine Design	J. Shigley, C. Mischke,	McGraw Hill Publication.	Third	2004
05	Design data book	PSG	PSG	--	--
06	Design data book	V.B. Bhandari	Tata Mc- Graw Hill Publication	First	2014

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Course Details:

Class	T. Y. B. Tech. Semester-VI
Course Code and Course Title	**0MEPC311, Mechatronics**
Prerequisite/s	0BSES109, 0MEPC304
Teaching Scheme: Lecture/Tutorial	3/0
Credits	03
Evaluation Scheme: ISE I/ MSE/ ISE II/ ESE	10/30/10/50

Course Objectives: The course aims:	
01	To introduce the developing multidisciplinary field of Mechatronics.
02	To focus on the overview of embedded controllers.
03	To focus on sensor and actuator technologies of mechatronic systems.
04	To study PLC, Ladder diagrams and its applications.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC311_1	**Demonstrate** integration of knowledge from different disciplines in order to realize engineering and consumer products consisting of sensors, actuators etc. **(K^2)**
0MEPC311_2	**Explain** signal conditioning processes and working of different signal conditioning devices. **(K^2)**
0MEPC311_3	**Explain** architectures of Microprocessor, Microcontroller, its applications and instruction sets, types along with basic digital circuits. **(K^2A^2)**
0MEPC311_4	**Apply** fundamentals of ladder diagram and PLC to construct logic for lighting and sequencing operations. **(K^3)**
0MEPC311_5	**Develop** the ladder logic used to program PLC for real time cases such as workstation for stamping, drilling etc. **(K^3)**

Mapping of Course Outcomes to Program Outcomes:

Course Outcomes	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
0MEPC311_1	3	1												
0MEPC311_2	2													
0MEPC311_3	2					1								
0MEPC311_4	3	1												
0MEPC311_5	3	2												
Avg.	**2.6**	**1.3**				**1**								
0MEPC311	**3**	**1**				**1**								

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Course Contents:		
Unit 1	**Introduction to key elements:** Introduction to Mechatronics, Mechatronic systems, Measurement systems, Multi discipline scenario. Transducers and Sensors: Position sensors: Limit switches, Photoelectric switches, Proximity sensors, Pneumatic limit valves and backpressure sensors, Pressure switches, resolvers, Incremental and absolute encoders, Decoders and relays. Displacement sensors: Potentiometer sensors, LVDT, Capacitive displacement sensors, Hall effect sensor. Velocity sensors: Tachogenerator and encoders, Introduction to VFD	**07 Hrs.**
Unit 2	**Signal Conditioning** Signal conditioning process, Operational amplifier (inverting amplifier, non-inverting amplifier, Summing, Integrating amplifier, Differentiating amplifier, Logarithmic amplifier), Protection, Filtering, Data acquisition, Multiplexer, Analog to Digital Converter (ADC), Digital to Analog Converter (DAC). Oscillators to generator sinusoidal, square, triangular and impulse waveforms, 555 timer, Sample and hold, Demultiplexing. Interfacing input output ports, Serial and parallel interfacing requirements, Buffers, Handshaking, Polling and interrupts.	**06 Hrs.**
Unit 3	**Digital Circuits, Microprocessor and Microcontroller** Digital logic, Number systems, Logic gates, Boolean algebra, Application of logic gates, Sequential logic, Flip flops: D, SR, JK and Master slave flip flop. Microprocessor: Organization of a microprocessor system, Architecture & pin diagram of 8085 processor, addressing modes, Instruction types and set Microcontroller: Organization of a microcontroller system, Architecture & pin diagram of 8051 controller, addressing modes, Instruction types and set, Comparison between microprocessor and microcontroller	**07 Hrs.**
Unit 4	**Programmable Logic Controllers (PLC)** Introduction, Definition, PLC system and components of PLC input output module, PLC advantages and disadvantages. Ladder diagram and PLC programming fundamentals: Basic components and symbols, Fundamentals of ladder diagram, Machine control terminology, Update – Solve ladder – Update, Physical components Vs. program components, Light control example, Internal relays, Disagreement circuit, Majority circuit, Oscillator, Holding (sealed or latches) contacts, Always ON always OFF contacts, Nesting of ladders.	**07 Hrs.**
Unit 5	**PLC Programming and its Applications** PLC Input instructions, Outputs, Coils, Indicators, Operational procedures, Contact and coil input output, Programming example, Fail safe circuits, Simple industrial applications. PLC Functions PLC timer functions – Introduction, Timer functions, Industrial applications, Industrial process, Timing applications, PLC control functions – PLC counters and its industrial	**07 Hrs.**

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	applications, Introduction to SCADA and MEMS.	
Unit 6	**Application of mechatronic Systems** Traditional Vs Mechatronic Design, Case studies of Mechatronic system designs, like piece counting system, Pick and place manipulator, Simple assembly task involving a few parts, Part loading / unloading system, Automatic tool and pallet changers etc. Fault finding and troubleshooting.	**06 Hrs.**

Text Book:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Mechatronics	W. Bolton	Pearson Education	Fourth	2012
02	Mechatronics	Mahalik	Tata Mc- Graw Hill	Eight	2006
03	Microprocessor 8085	Gaokar	Prentice Hall of India	Fifth	2004
04	Programmable Logical Controller	Hackworth	Pearson Education	Second	2009

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Mechatronics and Microprocessor	Ramchandran	Willey India	Third	2009
02	Automated Manufacturing Systems	S. Brain Morris	Tata McGraw Hill	First	2001
03	SCADA	Stuart A. Boyer	ISA Publication	Fourth	2011
04	Programmable Logical Controller	Reis Webb	Prentice Hall of India	Fifth	2011

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Course Details:

Class	TY B. Tech, Semester-VI
Course Code and Course Title	**0MEPC312, Industrial Hydraulics and Pneumatics**
Prerequisite/s	0MEPC211, 0MEPC258
Teaching Scheme: Lecture/Tutorial	3/0
Credits	03
Evaluation Scheme: ISE I/MSE/ISE II/ESE	10/30/10/50

Course Objectives: The course aims:	
01	To describe principle, working and applications of hydraulic, pneumatic systems and fluidics.
02	To demonstrate construction and working of hydraulic and pneumatic system components
03	To illustrate hydraulic and pneumatic circuits with its application.
04	To discuss maintenance and safety regulation in hydraulics and pneumatics.
05	To discuss the concept of automation through hydraulic and pneumatic systems

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC312_1	**Explain** the principles, working and applications of hydraulic, pneumatic systems, fluidics and automation through hydraulic and pneumatic systems. **(K^2)**
0MEPC312_2	**Explain** and draw different ISO/JIC symbols used in hydraulic and pneumatic circuits. **(K^2)**
0MEPC312_3	**Explain** safety regulations and troubleshooting in hydraulic and pneumatic system. **(K^2)**
0MEPC312_4	**Explain** the construction and working of hydraulic and pneumatic system components. **(K^3)**
0MEPC312_5	**Construct** the hydraulic and pneumatic circuits for industrial application. **(K^3A^2)**
0MEPC312_6	**Solve** the problems on filter rating, piston force and velocity. **(K^3)**

Mapping of Course Outcomes with Programme Outcomes –

Course Outcomes	Programme Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
0MEPC312_1	2													
0MEPC312_2	2													
0MEPC312_3	2													
0MEPC312_4	2													
0MEPC312_5	3	3	1				2							
0MEPC312_6	3													
Avg.	2.3	3	1				2							
0MEPC312	2	3	1				2							

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Course Contents:		
Unit 1	**Introduction to Fluid Power** a) Classification, general features, applications in various fields of engineering, ISO/JIC Symbols, transmission of power at static and dynamic states, advantages and disadvantages. b) Principle of hydraulic system, basic hydraulic circuit, types of hydraulic fluids and their properties, selection of fluid, effect of temperature on fluids. c) Introduction of pneumatics, physical properties, principles, basic requirement of pneumatic system, basic pneumatic circuit, comparison with hydraulic system.	**07 Hrs.**
Unit 2	**Hydraulic System Elements** a) Classification & types of seals, sealing material, compatibility of seal with fluid, sources of contamination and its control. b) pipes, hoses, strainer, filter, heat-exchanger, reservoir, power pack. c) **Pumps-** types, classification, principal of working, selection of pumps from vane, radial piston, axial piston, screw, ball pump etc. for various applications. d) **Actuators**-linear and rotary, hydraulic motors, types of hydraulic cylinders and their mountings. Calculation of piston Force and velocity. e) Accumulators, intensifier, jack and their applications.	**07 Hrs.**
Unit 3	**Hydraulic Control Elements** a) Requirements of Pressure control, direction control and flow control valves. b) Principle of pressure control valves, directly operated and pilot operated pressure relief valve, pressure reducing valve, sequence valves, counter balance valve. c) Principles and Types of direction Control valves-2/2, 3/2, 4/2, 4/3, 5/2. Open center, close center, tandem center, manual operated, mechanical operated, solenoid, pilot operated direction control valves, check valves. d) Principles of flow control valves, temperature compensated, pressure compensated, temperature and pressure compensated flow control valve.	**07 Hrs.**
Unit 4	**Pneumatic System Elements** **a) Air compressor-** Types, selection criteria, capacity control, piping layout, fitting and connectors. **b) Pneumatic actuators**, Rotary and reciprocating cylinders–types and their mountings, Air motor – types, Comparison with hydraulic and electric motor. **c) Serving of compressed air** – types of filters, regulators, lubricators (FRL unit), mufflers, dryers. **d) Pneumatic Control** - check valves, Direction control valves (two way, three way, four way), Solenoid operated, pilot operated valves, flow control valves, quick exhaust valves, time delay valve, shuttle valve and twin	**07 Hrs.**

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	pressure valve, Impulse Valve.	
Unit 5	**a) Hydraulic Circuits and its Application** i) Regenerative circuit. ii) Speed control circuits – Meter-in, Meter-out, Bleed off, iii) Fast approach and slow traverse. iv) Sequence circuits – Travel dependent and Pressure dependent. v) Synchronizing circuit. **b) Pneumatic Circuits and its Application** i) Speed control circuits ii) Sequence circuits. iii) Time delay circuit. iv) Quick Exhaust circuit v) twin pressure valve circuit.	**07 Hrs.**
Unit 6	a) **Electro Systems-**Introduction to Electro-hydraulic and Electro-pneumatic Systems and PLC. b) **Fluidics-**Introduction to fluidics ,study of simple logic gates, turbulence, amplifiers, pneumatic sensors, applications. c) **Maintenance-** troubleshooting and safety of hydraulic and pneumatic systems.	**07 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Pneumatic Systems-Principles and Maintenance	S. R. Majumdar	Tata McGraw Hill, Publishing Company Ltd. New Delhi	Twenty second	2010
02	Oil Hydraulic Systems-Principles and Maintenance.	S. R. Majumdar	Tata McGraw Hill, New Delhi	Twenty fourth	2012
03	Fluid Power with Application	Anthony Esposito	Pearson Education South Asia, New Delhi	Seventh	2009
04	Fluid Power	Jagadeesha T	Wiley India, New Delhi	First	2013

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Introduction to Fluid Power	James Johnson	Delmer Thomason Learning, New Delhi	First	2003
02	Pneumatics and Hydraulics	H. L. Stewart	Taraporevala Sons & co, Mumbai	Sixth	2002
03	Industrial Hydraulics	J. J. Pipenger	McGraw Hill, New Delhi	Third	1979
04	Pneumatic Control	Joji P	Wiley India, New Delhi	First	2008
05	Hydraulics And Pneumatics	Andrew Parr	Jaico Publication House, New Delhi	sixth	2002

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Course Details:

Class	TY B. Tech, Sem.-VI
Course Code and Course Title	**0MEPC313, Metrology and Quality Control**
Prerequisite/s	0MEPC205
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I/MSE/ISE II/ESE	10/30/10/50

Course Objectives: The course aims:	
01	To describe the principle and scope of metrology.
02	To study the characteristics & selection of instruments and their uses.
03	To describe the importance of limits, fits and tolerances with regards to gauging.
04	To discuss the concept of quality, quality control and various statistical tools of quality control.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC313_1	**Distinguish** various measuring instruments and their characteristics. **(K^2)**
0MEPC313_2	**Use** various measuring instruments and interpret the data. **(K^3)**
0MEPC313_3	**Explain** the terminologies related to screw thread, gears, surface roughness and select appropriate measuring instruments for checking them. **(K^2)**
0MEPC313_4	**Explain** the terminologies related to quality & quality control.
0MEPC313_5	**Solve** the problems on limits, fits and tolerances. **(K^3)**
0MEPC313_6	**Solve** the problems on acceptance sampling and process control charts. **(K^3)**

Mapping of Course Outcomes to Program Outcomes:

Course Outcomes	Programme Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
0MEPC313_1	3													
0MEPC313_2	3													
0MEPC313_3	3					1								
0MEPC313_4	3													
0MEPC313_5	2	1												
0MEPC313_6	2	1												
Avg.	2.6	1				1								
0MEPC313	**3**	**1**				**1**								

Course Contents:		
Unit 1	**Metrology, Limits, fits and tolerances** Importance and need of measurements, Role of metrology in science, engineering and technology, International standards of length, line and end	**09 Hrs.**

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	measurement, linear measuring instruments, errors in Measurement, Nomenclature in Metrology - True value, Accuracy, Precision, Error, Bias, Uncertainty, Repeatability, Resolution. Interchangeability, selective assembly, limits, fit and tolerances, limit gauging, design of limit gauges.	
Unit 2	**Comparators and Measurement of angles** Features of comparators, classification of comparators, different comparators - Mechanical, Optical, Electrical, Pneumatic and their uses in inspection. Bevel Protractor, Spirit level, Clinometers, angle Decker, angle slip gauges, standard balls and rollers for angle measurement.	**06 Hrs.**
Unit 3	**Straightness, flatness And surface finish Measurement** Concept of straightness and flatness. Use of straight edge, Level beam comparator and auto collimator for testing of flatness of surface plate. Principle of interferometry and application for checking flatness. Surface roughness terminology, specifying roughness on drawings, surface roughness parameters, roughness measurement methods.	**07 Hrs.**
Unit 4	**Screw thread metrology and Gear measurement** screw thread terminology, errors in screw threads, measurement of forms of thread, pitch measurement, measurement of thread diameter with standard wire, screw thread micrometer, Floating carriage micrometer, Measurement of Spur Gears, Run out checking, Pitch measurement, profile checking, backlash checking, tooth thickness measurement, alignment checking, errors in gears, checking of composite errors, Tool maker's microscope and profile projector.	**07 Hrs.**
Unit 5	**Quality Control** Concept of Quality, Quality control and quality assurance, Specification of quality, Factors controlling quality of design and conformance, Cost of quality, Balance between cost and quality and value of quality, QC tools.	**06 Hrs.**
Unit 6	**Statistical Quality Control and Acceptance Sampling** Importance of statistical method in quality control, ND curve, Different types of control charts (X Bar, R, P and C charts), their constructions, Interpretation and applications, Basic concept of sampling inspection, Operating characteristic curves, Conflicting interests of consumer and producer, Producer and consumers risks, Single and double sampling plans.	**07 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Metrology	M. Mahajan	Dhanpat Rai Publications	Ninth	2010
02	Statistical Quality control	M. Mahajan	Dhanpat Rai Publications	Third	2008

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03	Engineering Metrology	I.C. Gupta	Dhanpat Rai Publications	Twentieth	2010
04	Engineering Metrology	P. Narayana	Scitech Publication,	Third	2009

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Statistical Quality control	R.C. Gupta	Dhanpat Rai Publications, New Delhi	Fifteenth	2009
02	Metrology & Measurement	Anand Bewoor	Mc Graw-Hill, New Delhi	Thirteenth	2014
03	Practical Engineering Metrology	K.W.B. Sharp	Pitman, London	First	1973
04	Engineering Metrology	R.K.Jain	Khanna Publication,Delhi	Twentieth	2012

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Course Details:

Class	B. Tech, Semester-VI
Course Code and Course Title	**0MEPE314, Finite Element Analysis**
Prerequisite/s	0MEES208, 0MEPE209, 0MEPE306
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I/MSE/ISE II/ESE	10/30/10/50

Course Objectives: The course aims:	
01	To provides an introduction to finite elements method with a focus on one and two-dimensional problems in structures and heat transfer.
02	To develop the ability to solve one dimensional problems using finite element method
03	To develop the ability to solve two dimensional problems of truss and CST using finite element method.
04	To analyze the results of the analysis using post processing techniques.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPE314_1	**Write** equations of equilibrium, Stress-strain relations and the principle of potential energy and approximations of differential equations. **(K^3)**
0MEPE314_2	**Understand** a basic the limitation of the FE method and the possible error sources in its use and interpret results. **(K^3A^2)**
0MEPE314_3	**Prepare** finite element formulations by considering the 1D and 2D problem, such as Shape function, element stiffness and boundary conditions. **(K^3)**
0MEPE314_4	**Compute** displacements, strain, stress and reaction for two-dimensional truss element and CST element. **(K^3)**
0MEPE314_5	**Solve** 1D, 2D problems for steady state heat conduction. **(K^3)**

Mapping of Course outcome to Programme outcome

Course Outcomes	Programme Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
0MEPE314_1	3													
0MEPE314_2	3													
0MEPE314_3	3	2												
0MEPE314_4	3	2												
0MEPE314_5	3	2												
Avg.	3	2												
0MEPE314	3	2												

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Course Contents:		
Unit 1	**Fundamental Concepts** Introduction, Past, present and future of FEA, stresses and Equilibrium, boundary conditions, strain-displacement relations, stress-strain relations, Temperature effects, Potential energy and equilibrium; the Rayleigh-Ritz method, Galerkins method, Saint-Venant'sprinciple, Von-Misesstress, Gauss elimination method.	**08 Hrs.**
Unit 2	**One Dimensional Problem** Introduction, Finite element modeling (element division, numbering scheme), coordinates and shape functions, the potential energy approach(element stiffness matrix, force terms), Galerkin approach (element stiffness matrix, force terms),Assembly of the global stiffness matrix and load vector, properties of K, the finite element equations; treatment of boundary conditions(types of boundary conditions, elimination approach, penalty approach (Theoretical concept only), multipoint constraints, Quadratic shape functions.	**08 Hrs.**
Unit 3	**Trusses** Plane trusses, Local and Global coordinate systems, formulas for calculating L and M, element stiffness matrix, Stress Calculations, Assembly of the global stiffness matrix,	**05 Hrs.**
Unit 4	**Two-dimensional Problems using Constant Strain Triangles** Introduction, finite element modelling, Constant Strain Triangle (CST), Iso-parametric representation, potential-energy approach, element stiffness, force terms, Galerkin approach, stress calculations, problem modelling and boundary conditions	**08Hrs.**
Unit 5	**Scalar Field Problems** Introduction, steady state heat transfer, One dimensional heat conduction, One dimensional heat transfer in thin fins, Two dimensional steady state heat conduction, two dimensional fins.	**08 Hrs.**
Unit 6	**Model Procedure and result processing-** Introduction, model validity and accuracy, Mesh design and refinement, Element distortion, Result processing, Model checking.	**05Hrs.**

Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Introduction to Finite Elements in Engineering	Chandrapatala, Belgundu	PHI	Third	2012
2	An Introduction to Finite Element Method	J. N. Reddy	McGraw Hill	Third	2012

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Text Books					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
3	Finite Element Analysis – Theory and Practice	M.J.Fagan	Pearson education South Aisa	First	1992
4	A First Course in the Finite Element Analysis	D.L.Logan	CENGAGE Learning	Seventh	2011

References					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Finite Element Methods for Engineers	S.S.Rao	New age publication	First	2007
2	Finite Element Analysis Theory And Application With ANSYS	Saeed Moaveni	Pearson education South Aisa	Third	2004
3	An Introduction to Finite Element Method	J. N. Reddy	McGraw Hill	Third	2012
4	Finite Element Analysis – Theory and Practice	M.J.Fagan	Pearson education South Aisa	First	1992

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Course Details:

Class	T. Y. B. Tech. Semester-VI
Course Code and Course Title	**0MEPE315 Advanced Manufacturing Technology**
Prerequisite/s	0MEPC204, 0MEPC213, 0MEPC305
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I/ MSE/ ISE II/ ESE	10/30/10/50

Course Objectives: The course aims:	
01	To classify and explain various types of non-conventional machining processes and their application.
02	To Rapid Prototyping and types with applications.
03	To familiarize students to physical behavior of composite materials, manufacturing methods

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPE315_1	**Describe** various non-traditional machining processes. (K^2)
0MEPE315_2	**Describe** various types of rapid prototyping process capabilities for industrial usage. (K^2)
0MEPE315_3	**Differentiate** composites with respect to various isotropic materials (K^2)
0MEPE315_4	**Select** appropriate processing techniques used to manufacture composites (K^3)
0MEPE315_5	**Evaluate** various process parameters involved in different nonconventional machining processes. (K^3)

Mapping of Course Outcomes to Program Outcomes:

Course Outcomes	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
0MEPE315_1	2													
0MEPE315_2	2													
0MEPE315_3	2													
0MEPE315_4	3	1												
0MEPE315_5	3	1												
Avg.	2.4	1												
0MEPE315	2	1												

Course Contents:		
Unit 1	**Advanced Machining Processes** Introduction: Historical background of Non Traditional Machining Technologies., Classification, Basic fundamentals of various process, their process capabilities and related comparison.	**07 Hrs.**

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	Mechanical Processes: Processes principles, equipment, processes parameters & Applications of Abrasive Jet Machining, Ultrasonic Machining, Water Jet Cutting, Evaluation of material removal rate (MRR) in AJM (Numerical).	
Unit 2	**Electrochemical Machining (ECM):** Background, Electrochemistry, Classification, Equipment required, Process capabilities, Processes parameters. Application examples of ECM processes, Evaluation of MRR of pure metal in ECM. (Numerical). **Electrical Discharge Machining (EDM):** Fundamental principle, Equipments required mechanism of machining, process parameters, process capabilities, applications. Introduction to wire EDM	**07 Hrs.**
Unit 3	**Laser Beam Machining (LBM):** Material removal mechanism, process parameters, applications, advantages & limitations **Electron Beam Machining (EBM):** Material removal mechanism, process parameters, applications, advantages & limitations	**07 Hrs.**
Unit 4	**Rapid prototyping** Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Classification of Rapid Manufacturing Processes: Additive, Subtractive, Formative, Generic RP process Stereolithography (SL), Selective laser Sintering (SLS), Electron Beam melting (EBM), Fused Deposition Modelling (FDM), Laser Engineered Net Shaping (LENS), Direct Metal Deposition (DMD).	**07 Hrs.**
Unit 5	**Composite Material** Introduction to Composite Materials; Classification of composites, Fibrous Composites, FRP constituents, Reinforcement types, Types of materials (Isotropic, Orthotropic, Anisotropic; Homogeneous and Non-Homogeneous) and terminology used.	**07 Hrs.**
Unit 6	**Processing of composites**-Various processing Techniques, Hand lay-up, Filament winding, Pultrusion, Resin transfer molding, **Testing of Composites**: Mechanical testing of composites, tensile testing, Compressive testing, Intra-laminar shear testing, Inter-laminar shear testing, Fracture testing etc.	**07 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Manufacturing Processes	B.H. Amsteal, Philip F. Ostwald & Myron L. Begeman	John Wiley & Sons	Eight	1987
02	Processes & Materials of Manufacture	A. K. Chitale & R.C. Gupta	Springer Prentice Hall of India	Sixth	2013

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03	Rapid Prototyping: Principle and Applications	Rafique I. Noorani	John Wiley & Sons	First	2005
04	Engineering Materials: Polymers, Ceramics and Composites	A. K. Bhargava	Prentice Hall of India	Second	2005

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Mechanical Metallurgy	George E Dieter	McGraw Hill Education	Third	2013
02	Advanced Manufacturing Processes	G.F. Benidict	Marcel Deker Publisher	First	1987
03	Processes & Materials of Manufacture	Roy A Lindberg	Prentice Hall of India	Third	2007
04	Non-Conventional Machining Processes	P. K. Mishra	Narosa Publication	First	2007
05	Composites Manufacturing : Materials, Product and Process Engineering	Sanjay K Mazumdar	CRC Press New York,	First	2001

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Course Details:

Class	T.Y. B. Tech, Semester-VI
Course Code and Course Title	**0MEPE316, Computational Fluid Dynamics**
Prerequisite/s	0MEPC203, 0MEES206, 0MEPC302, 0MEPC308
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I/ MSE/ ISE II/ ESE	10/30/10/50

Course Objectives: The course aims:	
01	To study the different prediction methods and applications of CFD.
02	To interpret and obtain the exact solution for simple N.S equations.
03	To analyze the different numerical techniques used in CFD.
04	To develop skills in the analysis of fluid systems for lifelong learning

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPE316_1	**Solve** the governing equations for fluid flow. **(K^2)**
0MEPE316_2	**Explain** the methodology of grids generation and discretization. **(K^2)**
0MEPE316_3	**Explain** solution algorithm for pressure velocity coupling in steady flow. **(K^2)**
0MEPE316_4	**Apply** different methods of finite difference methods to fluid flow problems. **(K^3)**
0MEPE316_5	**Apply** and evaluate finite difference methods to Diffusion problems. **(K^3)**
0MEPE316_6	**Apply** turbulence models to engineering fluid flow problems. **(K^3)**

Mapping of Course Outcomes to Program Outcomes:

Course Outcomes	Program Outcomes													
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
0MEPE316_1	3	2												
0MEPE316_2	3													
0MEPE316_3	3													
0MEPE316_4	2	1												
0MEPE316_5	2	1												
0MEPE316_6	3	2												
Avg.	2.7	1.5												
0MEPE316	**3**	**2**												

Course Contents:		
Unit 1	**Introduction to Computational Fluid Dynamics & Principles of Conservation**	**08 Hrs.**

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	Computational Fluid Dynamics: What, When, and Why? CFD Applications, Numerical vs. Analytical vs. Experimental, Modeling vs. Experimentation, typical problems, Summary Equations for Viscous Flow (the Navier-Stokes Equations) Equations for Inviscid Flow (the Euler Equations) Forms of the Governing Equations Particularly Suited for CFD, Working of Commercial CFD Software, Solution methodology-pre-processing, Solver, Post processing	
Unit 2	**Basics of discretization & Grid generation** Basic concepts of discretization, Discretization techniques - Finite difference, Finite volume and Finite element method, Comparison of discretization methods, Transformation of non-uniform grids to uniform grids, General transformation of the equations, Form of the governing equations suitable for CFD, Compressed grids, Boundary fitted co-ordinate systems, Elliptic grid generation, Adaptive grids, Modern developments in grid generation.	**07 Hrs.**
Unit 3	**Finite Difference Method** Finite Difference Formulations: Introductory remarks, Taylor Series Expansions, Finite difference equations, Central Forward, Backward Numerical error, Explicit, Implicit, Semi-implicit (Crank- Nicholson method). Applications of direct, Iterative, Thomas algorithm, Gauss- Jacobi, Gauss-Seidal method. Alternate directional implicit, Applications. 1-D examples, 2-D examples.	**06 Hrs.**
Unit 4	**Finite Volume Method** **i. For Diffusion** Introduction, FVM for 1D steady state Diffusion, FVM for 2 D Diffusion **ii. For Convection Diffusion** Introduction, Steady 1-D Convection and Diffusion, Central Differencing, Upwind Differencing, Hybrid Differencing, Power Law Scheme, QUICK scheme.	**07 Hrs.**
Unit 5	**Introduction to solution algorithms for pressure velocity coupling in steady flows & turbulence and multiphase modeling (Introductory treatment)** Introduction, staggered grid, introduction to SIMPLE, SIMLEC, SIMPLER, PISO algorithms, Modeling of multiphase problems, Level set methods, VOF method. Coupled LS+VOF	**07 Hrs.**
Unit 6	**Introduction to Turbulence and its modeling:** What is turbulence?; Transition from laminar to turbulent flow; Effect of turbulence on time averaged Navier -Stokes equations; Characteristics of simple turbulent flows; Introduction to Turbulent Models like Mixing length Model, k-epsilon model, Reynolds stress equation models, Algebraic stress equation models; Some recent Advances, introduction to LES, DNS.	**07 Hrs.**

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Text Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Computational Fluid Dynamics	Gautam Biswas	Narosa Publishing House, New Delhi	Third	2013
02	Fundamentals of Incompressible Fluid Flow	Babu V	Anne Books Pvt Ltd. New Delhi, India	First	2010
03	Introduction to Fluid Dynamics	Batchelor G. K.	Cambridge University Press. New Delhi, India	Second	1999
04	Fluid Dynamics	Raisinghania M.D.	S Chand & Company, New Delhi	Fifth	2003

Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Computational Fluid Mechanics the Basics with applications	Anderson J. D. Jr.	McGraw Hill Education Pvt. Ltd.	Sixth	2014
02	An introduction to computational fluid dynamics; the finite volume method	H. K. Versteeg and W. Malalasekera	Pearson Publication	Second	2009
03	Numerical heal transfer fluid flow	Suhas V. Patankar	Taylor & Francis	First	2014
04	Computational fluid dynamics	T. J. Chung	Cambridge University Press.	Third	2014
05	Computational Fluid Dynamics: A Practical Approach	Jiyuan Tu, Guan Heng Yeoh, Chaoqun Liu,	Butterworth – Heinemann	Second	2008

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Course Details

Class	B. Tech, Semester- VI
Course Code and Course Title	**0MEPR317, Research Methodology-II**
Prerequisite/s	0MEPR309
Teaching Scheme: Lecture/Tutorial	01/00
Credits	01
Evaluation Scheme: MSE/ESE	20/30

Course Objectives: The course aims:	
01	To develop skills for the selection of appropriate statistical techniques for data processing.
02	To introduce the concept of hypothesis testing.
03	To emphasize the need of interpretation of research results.
04	To discuss the various approaches of research communication.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPR317_1	**Summarize** various tools and techniques used for the analysis of data. (K^2)
0MEPR317_2	**Illustrate** the need of interpretation of research results. (K^2)
0MEPR317_3	**Explain** the concept of hypothesis testing. (K^3)
0MEPR317_4	**Use** various statistical techniques for analyzing the data. (K^3)
0MEPR317_5	**Compare** various ways of research communication. (K^3)

Mapping of Course Outcomes to Program Outcomes:

Course Outcomes	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
0MEPR317_1	3													
0MEPR317_2	2													
0MEPR317_3	3													
0MEPR317_4	3	1												
0MEPR317_5	3													
Avg.	2.8	1												
0MEPR317	3	1												

Course Contents		
Unit 1	**Processing and Analysis of Data** Elements/ types of analysis, statistics in research, measures of central tendency and dispersion, skewness, measures of relationships, regression analysis, correlation and regression,	**05 Hrs.**
Unit 2	**Hypothesis Testing and Other Statistical Techniques** What is a hypothesis? basic concepts concerning testing of hypotheses,	**04 Hrs.**

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	procedure for hypothesis testing, flow diagram for hypothesis testing. Introduction ANNOVA, Chi-square test.	
Unit 3	**Interpretation of Research and its Communication** Meaning and need of interpretation, technique of interpretation, precaution in interpretation **Research communication** Significance of research communication, types of research report and its layout - conference paper, journal paper, case studies, technical report, dissertation/ thesis, presentation techniques, patent and other IPRs, steps in writing report, software used for writing reports such as WORD, Latex etc., precautions for writing research reports.	**05 Hrs.**

Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Research Methodology	C. R. Kothari	New Age international	Second	2004
02	Research Methodology: concepts and cases	Deepak Chopra and Neena Sondhi	Vikas Publishing House, New Delhi	First	1998
03	Research Methodology: An introduction for science and engineering students	Stuart Melville and Wayne Goddard	Tata McGraw Hill	First	2000
04	The Essential Guide to Doing Research	Zina O'Leary	SAGE	Fourth	2004

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Research Methodology – a step by step guide for beginners	Kumar R.	SAGE	Third	2012
02	Research Methodology	G. Ramamurthy	Dream Tech Press	First	2009

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Course Details:

Class	T. Y. B. Tech. Semester-VI
Course Code and Course Title	**0MEPC357, Mechanical Measurement Laboratory**
Prerequisite/s	--
Teaching Scheme: Practical/Tutorial	2/00
Credits	01
Evaluation Scheme: ESE/POE	25/25

Course Objectives: The course aims:	
01	To illustrate the importance of linear, thermal, flow and strain measurement and its application
02	To train the students to perform various experiments for mechanical measurements.
03	To illustrate various procedures for obtaining measurement practices.
04	To demonstrate constructional details of various equipment's or instruments used for mechanical measurements.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC357_1	**Demonstrate** the various instruments used for linear, angular, thermal, flow and strain measurements & summarize the various results for respective parameters., **(K^3)**
0MEPC357_2	**Use** Various instruments for measuring Temperature, pressure, Displacement, Torque, Vibration, Velocity, Speed. **(S^2)**
0MEPC357_3	**Function** effectively as an individual, and as a team member for performing laboratory work **(S^2)**
0MEPC357_4	**Communicate** effectively, both orally and in writing journals **(S^2)**
0MEPC357_5	**Engage** in independent and life-long learning in the broadest context of technological change. **(A^2)**
0MEPC357_6	**Follow** professional and ethical principles during laboratory work. **(A^2)**

Mapping of Course Outcomes to Program Outcomes:

Course Outcomes	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
0MEPC357_1	2	2												
0MEPC357_2					1				1			1		
0MEPC357_3									2					
0MEPC357_4										2				
0MEPC357_5												2		
0MEPC357_6								2						
Avg.	2	2			1			2	1.5	2		1.5		
0MEPC357	**2**	**2**			**1**			**2**	**1.5**	**2**		**1.5**		

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Course Contents:

The term work consists of following experiments:

1. Angular speed measurement using stroboscope, photo-electric pick up and magnetic Pick up
2. Temperature and humidity measurement using Anemometer
3. Formation of thermocouple tip and calibration of thermocouple
4. Measurement of temperature using thermocouple, RTD, thermistors and pyrometers.
5. Measurement of displacement using LVDT.
6. Testing of Mechanical pressure gauge using Dead weight pressure gauge tester.
7. Flow Measurement using rotameter, turbine meter and target meter.
8. Force and torque measurement using strain gauges
9. Measurement of various parameters effect on system response using PID Controller.
10. Design of measuring system for pressure, flow, temperature etc

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Introduction to Mechanical Measurements	D. S. Kumar	Wiley Estern, New Delhi	Fifth	2015
02	Mechanical Measurements and Instrumentation	R.K.Rajput	S.K. Kataria & Sons	Eighth	2016
03	A Practical Approach to Test, Measurement and Evaluation	Devinder K Kansal	SSS Publications	Eighth	2016

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Mechanical Measurements and Controls	Thomas G.Backwith	Metropolitan Book Co. Pvt. Ltd	Sixth	2016
02	Measurement and Control Basics	Thomas A. Hughes	The Instrumentation, Systems, and Automation Society	Third	2013
03	Industrial instrumentation	Al Sutko	Delmar Texas	Fifth	2012

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Course Details:

Class	T. Y. B. Tech. Semester-VI
Course Code and Course Title	**0MEPC358, Design of Machine Elements - II Laboratory**
Prerequisite/s	0MEPC205, 0MEPC252, 0MEPC209, 0MEPC261, 0MEPC301, 0MEPC303
Teaching Scheme: Practical/Tutorial	02/00
Credits	01
Evaluation Scheme: ISE / ESE	25/00

Course Objectives: The course aims:	
01	To develop an ability to describe the design procedure of gearbox.
02	To study the design and selection procedure for the shaft, keys and couplings.
03	To study the standard procedure for the selection of the belt, pulley, chain and sprocket and bearings from the manufacturer's catalogue.
04	To arrange industrial visit in gearbox design/ manufacturing industry.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC358_1	**Explain** types of gearboxes and design procedures for optimum design of gearboxes for machine tool applications. **(K^2)**
0MEPC358_2	**Design** the multispeed gearbox. **(K^4)**
0MEPC358_3	**Design** the bevel/worm gearbox. **(K^4)**
0MEPC358_4	**Work** effectively in teams to accomplish the assigned responsibilities in an integral manner. **(S^3)**
0MEPC358_5	**Communicate** effectively about laboratory work in writing journals/technical reports. **(A^3)**

Mapping of Course Outcomes to Program Outcomes:

Course Outcomes	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
0MEPC358_1	3													
0MEPC358_2	3	3	3											
0MEPC358_3	3	3	3											
0MEPC358_4					2				2					
0MEPC358_5										2				
Avg.	9	9	9		2				2	2				
0MEPC358	**3**	**3**	**3**		**2**				**2**	**2**				

Course Contents:

The term work consists of following design projects.

1. **Design project 1 – Design of Multispeed Gearbox.**

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Determination of variable speed range- Graphical representation of speeds- Structure diagram- Deviation diagram- Ray diagram- Selection of optimum ray diagram- Difference between number of teeth of successive gears in a change gear box- Analysis of six speed gear box- Compound ray diagram

A detail design report and A-2 size sheet containing working drawing of details and assembly of a Multispeed Gearbox.

2. Design project 2 – Design of Gear Box

A detail design report and A-2 size sheet containing working drawing of details and assembly of a two-stage gear box. (Bevel gear / Worm and Worm Wheel).

3. Industrial visit

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Design of machine elements	V.B. Bhandari	Tata Mc- Graw Hill Publication	Fourth	2012
02	Design of Machine Element	J.F. Shigley	McGraw Hill Publication.	Eight	2010
03	Mechanical Engineering Design	Shigley and C.R.Miscke	Tata Mc- Graw Hill	Seventh	2010
04	Design of Machine Elements	M.F.Spotts	Pearsons Edu. Inc.	Seventh	2004
05	Design of machine Tools	S.K. Basu and D.K. Pal	Oxford And IBH Publication	Eight	2009
06	Machine Tools Design	N.K. Mehta	Tata Mc- Graw Hill Publication	Eight	2011
07	Mechanical System Design	S.P.Patil,	Jaico Publication House,New Delhi	Second	2004

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Machine Design An Integrated Approach	R.L Norton	Pearson Education Publication	Second	2007
02	Fundamentals of Machine Component Design	J Marshek	Willey Eastern Ltd.	Third	2011
03	Mechanical Analysis & Design	H.Burr & Cheatam	Prentice Hall Publication.	Second	1997
04	Machine Design	Hall, Holowenko	Tata McGraw Hill Publication.	First	2008
05	Standard Handbook of	J. Shigley,	McGraw Hill	Third	2004

Reference Books:					
	Machine Design	C. Mischke,	Publication.		
06	Design data book	PSG	PSG	--	--
07	Design data book	V.B. Bhandari	Tata Mc- Graw Hill Publication	First	2014

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Course Details:

Class	T. Y. B. Tech. Semester-VI
Course Code and Course Title	0MEPC359, **Mechatronics Laboratory**
Prerequisite/s	0BSES109, 0MEPC304
Teaching Scheme: Practical/Tutorial	02/00
Credits	01
Evaluation Scheme: ISE / ESE (OE)	25/25

Course Objectives: The course aims:	
01	To develop an understanding of the basic elements underlying mechatronics systems: Analog and digital electronics, sensors, actuators, microcontrollers and microprocessor.
02	To understand selection criteria for a PLC, applications of PLC and ladder programming.
03	To understand how to interface electromechanical systems to PLC.
04	To gain hands-on experience with commonly used sensors and motors.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC359_1	**Explain** the basics of sensors; signal conditioners, digital circuits, PLC, SCADA, MEMS. (K^2)
0MEPC359_2	**Distinguish** between microprocessor -microcontroller and its applications. (K^2)
0MEPC359_3	**Use** PLC and RS Logix software to formulate and simulate the ladder logic for industrial applications. (S^3)
0MEPC359_4	**Communicate** effectively and work in a team for laboratory activities, write effective reports. (S^3)
0MEPC359_5	**Follow** professional and ethical principals during laboratory and industrial visit. (A^2)

Mapping of Course Outcomes to Program Outcomes:

Course Outcomes	Program Outcomes													
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
0MEPC359_1	2													
0MEPC359_2	2													
0MEPC359_3					3									
0MEPC359_4									2	2				
0MEPC359_5							2	2						
Avg.	**2**				**3**		**2**	**2**	**2**	**2**				
0MEPC359	**2**				**3**		**2**	**2**	**2**	**2**				

Course Contents:

The term work consists of following experiments.

1. Trials on Sensors: Proximity Sensor, RTD

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2. Study of ladder diagrams, symbols and implementation of logic function.(Dual starter or hold on logic)
3. PLC programming on industrial applications based on timers & counters and internal relays.
4. Assignment on PLC Data handling and Fault finding
5. Assignment on SCADA and MEMS.
6. Assignment on Microprocessor & Microcontroller.
7. Fabrication of Simple Mechatronics working project by a group of 4/5 students using hardware & suitable s/w
8. Industrial visit to study Mechatronics system application & submission of visit report.
9. Study of electro pneumatic kit with PLC

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Mechatronics	Mahalik,	TATA McGraw Hill	First	2003
2	Introduction to Mechatronics	Appu Kuttam	Oxford publications	First	2007
3	Fundamentals of Digital circuits	A. Anand kumar	PHI Learning pvt.ltd	Second	2010
4	Mechatronics	Tilak Thakur	Oxford publications	First	2016
5	Mechatronics	K.P.Ramchandran	Wiley India Pvt. Ltd.	Second	2012
6	Microprocessor 8085	Ramesh Gaokar	Penram International Publishing	Fifth	2012

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Mechatronics	W. Bolton,	Pearson education	Fourth	2008
2	Programmable logic controller	Hackworth	Pearson publication	First	2006
3	Programmable logic controller	John Webb	PHI Learning pvt.ltd	Fifth	2010
4	Programmable logic controller	Frank Petruzella	McGraw Hill publication	Fourth	2016

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Course Details:

Class	T.Y. B. Tech, Semester-VI
Course Code and Course Title	**0MEPC360, Industrial Hydraulics and Pneumatics Laboratory**
Prerequisite/s	0MEPC211, 0MEPC258
Teaching Scheme: Practical/Tutorial	02/00
Credits	01
Evaluation Scheme: ISE/ ESE	25/00

Course Objectives: The course aims:	
01	To describe ISO/JIC symbols, construction and working of various components of fluid power systems.
02	To prepare the students to select an appropriate system for an industrial problem.
03	To design a hydraulic and pneumatic system for various applications.
04	To construct hydraulic/pneumatic circuits with electrical and electronic control.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC360_1	**Operate** and control the hydraulic and pneumatic systems. (K^2)
0MEPC360_2	**Identify** circuit components and build Hydraulic & Pneumatic circuits for industrial applications .(K^2 A^2)
0MEPC360_3	**Build** hydraulic and pneumatic circuits with/without electrical / electronic control for automation. (K^3 A^2)
0MEPC360_4	**Engage** in updating the technical knowledge about industrial fluid power. (A^2)
0MEPC360_5	**Communicate** effectively about laboratory work both orally and in writing. (S^2)
0MEPC360_6	Use fluid simulation software to build the circuits. (S^3)

Mapping of Laboratory Outcomes to Program Outcomes: -

Course Outcomes	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
0MEPC360_1	2													
0MEPC360_2	3	2	1			2								
0MEPC360_3	3	2	1			2								
0MEPC360_4												1		
0MEPC360_5										1				
0MEPC360_6					2									
Avg.	2.6	2	1		2	2				1		1		
0MEPC360	3	2	1		2	2				1		1		

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Course Contents:

The term work consists of following experiments.

1. Demonstration of Hydraulic power pack and elements of hydraulic kit.
2. Five circuit preparations on hydraulic trainer kit.
3. Study of hydraulic intensifier and accumulator, Hydraulic jack
4. Study of various elements of pneumatic system such as actuators, compressor, control valves and FRL unit.
5. Five circuit preparations on pneumatic trainer kit.
6. Design of any one hydraulic/Pneumatic system for industrial application
7. Two Circuit preparations using Fluid simulation software.
8. Demonstration of hydraulic/Pneumatic circuit using PLC
9. Industrial visit for applications of pneumatic and hydraulic system and their reports.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Pneumatic Systems-Principles and Maintenance	S. R. Majumdar	Tata McGraw Hill, Publishing Company Ltd. New Delhi	Twenty second	2010
02	Oil Hydraulic systems-Principles and Maintenance.	S. R. Majumdar	Tata McGraw Hill, New Delhi	Twenty fourth	2012
03	Fluid Power with Application	Anthony Esposito	Pearson Education South Asia, New Delhi	Seventh	2009
04	Fluid Power	Jagadeesha T	Wiley India, New Delhi	First	2013

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Introduction to Fluid Power	James Johnson	Delmer Thomason Learning, New Delhi	First	2003
02	Pneumatics and Hydraulics	H.L.Stewart	Taraporevala Sons & co,Mumbai	Sixth	2002
03	Industrial Hydraulics	J. J. Pipenger	McGraw Hill, New Delhi	Third	1979
04	Pneumatic Control	Joji P	Wiley India, New Delhi	First	2008
05	Hydraulics And Pneumatics	Andrew Parr	Jaico Publication House, New Delhi	sixth	2002

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Course Details:

Class	T. Y. B. Tech. Semester-VI
Course Code and Course Title	**0MEPE361, Finite Element Analysis Laboratory**
Prerequisite/s	0MEES208, 0MEPE209, 0MEPE306
Teaching Scheme: Practical /Tutorial	02/00
Credits	01
Evaluation Scheme: ISE / ESE	25/00

Course Objectives: The course aims:	
01	To discuss various finite element methods and meshing techniques.
02	To develop the ability to solve one dimensional problem using finite element method and various modern tools.
03	To develop the ability to solve two dimensional problems of truss and CST using ANSYS
04	To analyze the results of the analysis using post processing techniques.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPE361_1	**Explain** Past, Present and Future of FEA and Types of meshing. **[K^2]**
0MEPE361_2	Formulate and solve one dimensional structural problem**[K^3]**
0MEPE361_3	**Solve** static structural, steady state thermal analysis 1D, 2D problems by using ANSYS and computer programming C++ software **[S^2]**
0MEPE361_4	**Communicate** effectively, both orally and writing journals. **[S^3]**
0MEPE361_5	**Practice** professional and ethical principles during laboratory work. **[A^3]**
0MEPE361_6	**Engage** in independent and lifelong learning in the broadest context of technological change. **[A^3]**

Mapping of Course Outcomes to Program Outcomes:

Course Outcomes	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
0MEPE361_1	2													
0MEPE361_2	3	2												
0MEPE361_3					2									
0MEPE361_4										2				
0MEPE361_5								2						
0MEPE361_6												2		
Avg.	2.5	2			2			2		2		2		
0MEPE361	**3**	**2**			**2**			**2**		**2**		**2**		

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Course Contents:

The term work consists of following assignment / experiments.

1. Assignment on past, present and future of FEA, and Meshing.
2. Finite Element Approach for Stepped bar.

Following experiments need to be performed using modern tools like ANSYS/MATLAB/C++.

3. Stepped bar analysis using Finite Element Software (ANSYS).
4. Computer Program using MATLAB/ C++.
5. Static structural analysis of Truss using ANSYS.
6. Static structural analysis of Beam.
7. Static structural analysis of Plate with a circular hole using ANSYS.
8. Static structural analysis of wall bracket.
9. Buckling Analysis of Column using ANSYS.
10. Buckling Analysis of Column using ANSYS.
11. Steady state analysis of 1D composite wall or 2D Fin using ANSYS.
12. Modal and Harmonic Analysis of Beam.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Ansys Workbench 14.0 for Engineers	Sham Tickoo	Dreamtech Press	First	2013
02	Working with ANSYS: A Tutorial Approach	Divya Zindani	I K International Publishing House Pvt. Ltd	First	2017
03	An Introduction to Finite Element Method	J. N. Reddy	McGraw Hill	Second	2010
04	Finite Element Analysis – Theory and Practice	M. J. Fagan	Longman Scientific & Tech.	Second	2007

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Introduction to Finite Elements in Engineering	Chandrapatala, Belgundu	PHI	Third	2012
02	Practical Finite Element Analysis	Nitin S. ghokhale, S. Deshpande	Finite To Infinite	First	2008
03	Finite Element Modeling for Stress Analysis	Robert D. Cook	John Wiley and Sons Ltd	First	1995
04	Finite Element Analysis Theory and Application	Saeed Moaveni	Pearson Education South Asia	Third	2011

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Course Details:

Class	T. Y. B. Tech. Semester-VI
Course Code and Course Title	**0MEPE362, Advanced Manufacturing Technology Laboratory**
Prerequisite/s	0MEPC204, 0MEPC213, 0MEPC305
Teaching Scheme: Practical	02/00
Credits	01
Evaluation Scheme: ISE / ESE	25/00

Course Objectives: The course aims:	
01	To explain Abrasive jet machining and Ultrasonic machining processes and their applications
02	To impart basic knowledge of Electrochemical machining and Electrical discharge machining processes and their applications.
03	To explain concept of Rapid Prototyping and its applications
04	To manufacture composite sheets/pipes

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPE362_1	**Describe** various non-traditional machining processes and their applications (K^2)
0MEPE362_2	**Illustrate** various types of rapid prototyping process.(K^2)
0MEPE362_3	**Perform** series of manufacturing operations to prepare composite sheet /pipe (K^3)
0MEPE362_4	**Evaluate** the material removal rate for various non-traditional machining processes based on process parameters. (K^3)
0MEPE362_5	**Explain** the work effectively both orally and in writing. (S^2)
0MEPE362_6	**Execute** teams work effectively to accomplish the assigned responsibilities. (A^2)

Mapping of Course Outcomes to Program Outcomes:

Course Outcomes	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
0MEPE362_1	2													
0MEPE362_2	2													
0MEPE362_3	3	2												
0MEPE362_4	3	1												
0MEPE362_5										2				
0MEPE362_6									2					
Avg.	2.5	1.5							2	2				
0MEPE362	3	2							2	2				

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Course Contents:

The term work consists of following assignment / experiments.

1 To study non-traditional machining processes
2 To study the working principles and processing characteristics of non-traditional machining and evaluation of material removal rate
3 Study of different types of Rapid prototyping processes.
4 Preparation of Fiber reinforced Polymer Composites Sheet / Pipe
5 Study of Tensile strength and young's modulus of FRP composites
6 Study of drop weight impact testing
7 Study of microstructure of composite
8 Industrial Visit

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Manufacturing Processes	B.H. Amsteal, Philip F. Ostwald & Myron L. Begeman	John Wiley & Sons	Eight	1987
02	Processes & Materials of Manufacture	A. K. Chitale & R.C. Gupta	Springer Prentice Hall of India	Sixth	2013
03	Rapid Prototyping: Principle and Applications	Rafique I. Noorani	John Wiley & Sons	First	2005
04	Engineering Materials: Polymers, Ceramics and Composites	A. K. Bhargava	Prentice Hall of India	Second	2005

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Mechanical Metallurgy	George E Dieter	McGraw Hill Education	Third	2013
02	Advanced Manufacturing Processes	G.F. Benidict	Marcel Deker Publisher	First	1987
03	Processes & Materials of Manufacture	Roy A Lindberg	Prentice Hall of India	Third	2007
04	Non-Conventional Machining Processes	P. K. Mishra	Narosa Publication	First	2007
05	Composites Manufacturing : Materials, Product and Process Engineering	Sanjay K Mazumdar	CRC Press New York,	First	2001

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Course Details:

Class	T.Y. B. Tech, Semester-VI
Course Code and Course Title	**0MEPE363, Computational Fluid Dynamics Laboratory**
Prerequisite/s	0MEPC203, 0MEPC302, 0MEPC308
Teaching Scheme: Practical/Tutorial	02/00
Credits	01
Evaluation Scheme: ISE / ESE	25/00

Course Objectives: The course aims:	
01	To understand basics of Computational fluid dynamics.
02	To understand the use of various tools for fluid flow and heat transfer simulation.
03	To analyze the fluid flow system with reference to experimental results.
04	To develop the interest for the application of CFD techniques for lifelong learning

Course Outcomes (COs) Upon successful completion of this course, the student will be able to:	
0MEPE363_1	**Develop** the simulation model of fluid flow and heat transfer. **(K^2)**
0MEPE363_2	**Interpret** the fluid flow and heat transfer for steady and unsteady state. **(K^3)**
0MEPE363_3	**Develop** and Interpret the simulation results of 2-D and 3-D model. **(K^3)**
0MEPE363_4	**Communicate** effectively about laboratory work both orally and in writing journals/technical reports. **(A^2)**
0MEPE363_5	**Behave** with highest ethical standards with concern to life- long learning, and awareness of contemporary issues. **(S^2)**

Mapping of Course Outcomes to Program Outcomes:

Course Outcomes	Program Outcomes													
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
0MEPE363_1	3	2												
0MEPE363_2	3	2												
0MEPE363_3	2													
0MEPE363_4										2				
0MEPE363_5								2						
Avg.	2.67	2						2		2				
0MEPC363	**3**	**2**						**2**		**2**				

Course Contents:

The term work consists of following experiments:

1. Introduction to Computational Fluid Dynamics.
2. Development of geometry with design modular.
3. Generation of Mesh with Ansys Mesher.

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4. Fluid flow and heat transfer analysis in Mixing Tee.
5. Fluid Flow and heat transfer analysis in Mixing Tee for Discrete phase model.
6. Heat and fluid flow analysis in Multi-species flow.
7. External fluid flow simulation over an airfoil.
8. Heat dissipation simulation from electronic cooling with natural convection and radiation.
9. Fluid simulation in vertical wind turbine.
10. Fluid flow simulation in Multiphase unsteady environment.
11. Simulation of transient flow model.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Computational fluid dynamics	Gautam Biswas	Narosa Publishing House, New Delhi	Third	2013
02	Fundamentals of incompressible fluid flow	Babu V	Anne Books Pvt Ltd. New Delhi, India	First	2010
03	Introduction to fluid dynamics	Batchelor G. K.	Cambridge University Press. New Delhi, India	Second	1999
04	Fluid Dynamics	Raisinghania M.D.	S Chand & Company, New Delhi	Fifth	2003

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Computational Fluid Mechanics the Basics with applications	Anderson J. D. Jr.	McGraw Hill Education Pvt. Ltd.	Sixth	2014
02	An introduction to computational fluid dynamics; the finite volume method	H. K. Versteeg and W. Malalasekera	Pearson Publication	Second	2009
03	Numerical heal transfer fluid flow	Suhas V. Patankar	Taylor & Francis	First	2014
04	Computational fluid dynamics	T. J. Chung	Cambridge University Press.	Third	2014
05	Computational Fluid Dynamics: A Practical Approach	JiyuanTu, Guan HengYeoh, Chaoqun Liu,	Butterworth – Heinemann	Second	2008

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Course Details:

Class	T.Y.B Tech, Semester-VI
Course Code and Course Title	**0MEPC364, Workshop Practice -VI**
Prerequisite/s	0BSES105, 0BSES155, 0MEPC255, 0MEPC262, 0MEPC355
Teaching Scheme: Lecture/Practical	00/02
Credits	01
Evaluation Scheme: ISE /ESE	25/00

Course Objectives: The course aims:	
01	To prepare the process sheet for manufacturing of given components.
02	To perform different machining operations using different machines.
02	To perform assembly of manufactured components.
04	To manufacture the components with precise dimensional tolerances.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC364_1	**Select** suitable machining operations and prepare the process sheet required to manufacture the components. **(K^4)**
0MEPC364_2	**Perform** series of manufacturing operations independently by controlling key dimensions on a component. **(S^3)**
0MEPC364_3	**Prepare** the assembly of manufactured sub components. **(S^3)**
0MEPC364_4	**Perform** various machining operations precisely with speed and timing. **(S^4)**
0MEPC364_5	**Follow** professional and ethical principles during lab work. **(A^2)**

Mapping of Course Outcomes to Program Outcomes:

Course Outcomes	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
0MEPC364_1	3	2												
0MEPC364_2									3					
0MEPC364_3									3					
0MEPC364_4									2					
0MEPC364_5								2						
Avg.	3	2						2	2.6					
0MEPC364	3	2						2	3					

Course Contents:

To make any one assembly / sub – assembly comprising of minimum three components
a) To prepare process sheets with working drawings of all components.
b) To manufacture the components as per the drawing requiring following operations
i. Turning, ii. Boring iii. Drilling iv. Milling, v. Shaping, vi. Grinding, vii. Tapping, viii. Die threading.

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c) To carry out assembly of all components.
d) For each component, at least one dimension should be monitored within close tolerance.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Workshop Technology – II	Hajra Choudhury	Media Promoters and publishers	Third	2011
02	Workshop practice	H. S. Bawa	TMH Publications, New Delhi	Second	2011
03	Text Book of Production Engg.	P.C. Sharma	S. Chand Publication	Eleventh	2008
04	Manufacturing Technology Vol 2	P.N.Rao	McGraw-Hill Publishing Ltd	Seventh	2015

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Workshop practice	R. K. Rajput	Laxmi publications pvt. ltd.	Second	2008
02	Workshop technology	R.S. Khurmi & J. K. Gupta	S. Chand & company Ltd.	First	2006
03	Workshop science and materials	Harry Ogden	Pitman books ltd. London	First	1984
04	Metal Cutting- Theory and Practice	A. Bhattacharya	New central book agency pvt. Ltd.	First	Reprint 2008

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Course Details:

Class	T.Y. B. Tech, Semester-VI
Course Code and Course Title	**0MEPR365, Mini Project-II**
Prerequisite/s	--
Teaching Scheme: Practical/Tutorial	02/00
Credits	01
Evaluation Scheme: ISE / ESE	00/25

Course Objectives: The course aims:	
01	To address the problems of nearby society/industry/institute and find the required solution.
02	To encourage for creative thinking with confidence, decision making, planning and develop effective communication skills for presentation of project.
03	To train the students to make use of fundamental knowledge of science and engineering for successful completion of the undertaken project.
04	To prepare assembly and detailed drawings/ report by using modern tools.

Course Outcomes (COs): Upon successful completion of this course, the students will be able to:	
0MEPR365_1	**Design**, development and testing of components, systems and or processes using modern tools/ techniques and available resources **(K^4 S^3)**
0MEPR365_2	**Analyze** the results obtained from analytical and or numerical and or experimental methods. **(K^4)**
0MEPR365_3	**Function** effectively as an individual or as a team for understanding of the engineering and management principles and apply these to manage the projects by maintaining professional and ethical values. **(S^3 A^2)**
0MEPR365_4	**Communicate** effectively on complex engineering activities, write appropriate project report and make effective presentations. **(S^3)**
0MEPR365_5	**Engage** in life-long learning in the broadest context of technological change. **(A^3)**

Mapping of Course Outcomes to Program Outcomes:

Course Outcomes	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
0MEPR365_1	3	3	3				3						3	
0MEPR365_2	3	3	3			3								
0MEPR365_3								2	3		3			
0MEPR365_4										3				
0MEPR365_5												3		
Avg.	3	3	3			3	3	2	3	3	3	3	3	
0MEPR365	3	3	3			3	3	2	3	3	3	3	3	

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Course Contents:

Project Load:

Maximum 5 students in one group are allowed.

Project Definition:

Project work shall be based on any of the following:

3. Design of any equipment /test setup/product
4. Hardware/numerical or theoretical analysis /review of survey study/research and development work

The subject content of the mini project shall be form emerging/thrust areas, topic of current relevance. The completion of work, the submission of the report and assessment should be done at the end of Part-I (First semester).

The project work preferably be extended for mini project II at Sem. VI with same group working under guidance of same faculty assigned for mini project I.

Project assessment:

Project will be assessed by the project guide along with one colleague appointed by the head of department.

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Course Details:

Class	T. Y. B. Tech. Semester-IV
Course Code and Course Title	**0MEPR366, Vocational Training**
Prerequisite/s	--
Teaching Scheme:	00
Credits	02
Evaluation Scheme: ESE	25

Course Objectives: The course aims:	
01	To understand and realize an industrial environment.
02	To observe the various industrial processes.
03	To enhance the knowledge and skills for planning of human resources, material resources, production and maintenance.
04	To inculcate the creative thinking to solve industrial problem.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPR366_1	**Explain** the knowledge acquired during industrial training **(K^2)**
0MEPR366_2	**Demonstrate** competency in relevant engineering fields through problem identification and formulation **(K^2)**
0MEPR366_3	**Apply** appropriate techniques, resources, and modern engineering tools to solve industrial problems.**(K^3S^2)**
0MEPR366_4	**Work & communicate** individually or in team in actual industrial environment, showing engineering & management principles. **(S^2)**
0MEPR366_5	**Present** an ability to write technical documents and give oral related to the work completed **(A^2)**
0MEPR366_6	**Demonstrate** the knowledge of professional and ethical responsibilities. **(A^2)**

Mapping of Course Outcomes to Program Outcomes:

Course Outcomes	Program Outcomes													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
0MEPR366_1	3													
0MEPR366_2	3	2			2								2	1
0MEPR366_3	3	2	2	2	2								2	1
0MEPR366_4									2	2	2			
0MEPR366_5									2	2				
0MEPR366_6							2	2				2		
Avg.	3	2	2	2	2		2	2	2	2	2	2	2	1
0MEPR366	**3**	**2**	**2**	**2**	**2**		**2**	**2**	**2**	**2**	**2**	**2**	**2**	**1**

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Course Contents:

Industrial Training

Contents The students have to undergo an industrial training of minimum two weeks in an industry preferably dealing with Mechanical engineering during the semester break after fifth semester and complete within 15 calendar days before the start of sixth semester. The students have to submit a report of the training undergone and present the contents of the report before the evaluation committee constituted by the department. An internal evaluation will be conducted for examining the quality and authenticity of contents of the report and award the marks at the end of the semester.

It is expected that students should undertake small assignment or work related to any of the course related aspect. Report is based on compilation of work carried out related to facility and layout planning, Industrial engineering- time study and motion study, Line efficiency evaluation and improvement, process capability evaluation, Industrial automation, process or machinery modification as identified.

NOTE:

Industrial training of minimum two weeks in an industry during the semester break after fifth semester and complete within 15 calendar days before the start of sixth semester. All students have to present their reports individually in sixth semester.

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Annasaheb Dange College of Engineering and Technology, Ashta

An Autonomous Institute

Curriculum Structure

B. Tech.
MECHANICAL ENGINEERING

SEM VII – SEM VIII
w.e.f. 2020-21

Department of Mechanical Engineering

ANNASAHEB DANGE COLLEGE OF ENGINEERING AND TECHNOLOGY, ASHTA
(An Autonomous Institute)
Department of Mechanical Engineering

Teaching and Evaluation Scheme
B. Tech Mechanical Engineering: Sem - VII

Course Code	Course	Teaching Scheme				Evaluation Scheme				
						Scheme	Theory		Practical	
		L	T	P	Credits		Max	Min. for Passing	Max	Min.for Passing
0MEPC401	Refrigeration and Air conditioning	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEPC402	Internal Combustion Engines	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEPE40*	Professional Elective-III	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEPE40**	Professional Elective-IV	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEOE4***	Open Elective	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEHS412	Human values and Professional Ethics	1	--	--	1	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEPC451	Refrigeration and Air conditioning Laboratory	--	--	2	1	ISE	--		25	10
						ESE	--	POE	25	10
0MEPC452	Internal Combustion Engines Laboratory	--	--	2	1	ISE	--		25	10
						ESE	--	POE	25	10
0MEPE45#	Professional Elective-IV Laboratory	--	--	2	1	ISE	--		25	10
						ESE	--	OE	25	10
0MEPR456	Project-I	--	--	6	8	ISE	--		25	10
						ESE	--	OE	25	10
	Total	**16**	**00**	**12**	**27**	**Total**	**600**		**200**	
	Total Contact Hours/Week: 28 hrs									

Course Category	HS	BS	ES	PC	PE	OE	PR
Credits	01	00	00	08	07	03	08
Cumulative Sum	04	16	40	81	14	03	14

0MEPE40* Professional Elective-III

0MEPE403- Mechanical System Design	**0MEPE404**- Advanced Welding Engineering	**0MEPE405**- Design of thermal System & Optimization

0MEPE40 Professional Elective-IV**

0MEPE406- Noise and Vibration	**0MEPE407**- NDT	**0MEPE408**- Steam Engineering

0MEPE45# Professional Elective-IV Laboratory

0MEPE453- Noise and Vibration	**0MEPE454** - NDT	**0MEPE455**- Steam Engineering

0MEOE4* Open Elective**

0MEOE409- Industrial Management and Operation Research	**0MEOE410**- Industrial Automation and Robotics	**0MEOE411**- Mechanics of Fibrous Composites

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B Tech - ST - 01102

Teaching and Evaluation Scheme
B. Tech Mechanical Engineering: Sem- VIII

Course Code	Course	Teaching Scheme				Evaluation Scheme				
						Scheme	Theory (Marks)		Practical (Marks)	
		L	T	P	Credits		Max	Min. for Passing	Max	Min. for Passing
0MEPC413	Industrial Engineering	3	1	--	4	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEPC414	Smart Materials	3	1	--	4	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEPE41*	Professional Elective-V	3	--	--	3	ISE I	10	40	--	--
						MSE	30		--	--
						ISE II	10		--	--
						ESE	50		--	--
0MEPE45#	Professional Elective-V Laboratory	--	--	2	1	ISE	--		50	20
						ESE	--	OE	50	20
0MEPR459	Project-II	--	--	8	8	ISE	--		100	40
						ESE	--	OE	100	40
Total		**09**	**02**	**10**	**20**	**Total**	**300**		**300**	
Total Contact Hours/Week: 21 hrs										

Course Category	HS	BS	ES	PC	PE	OE	PR
Credits	00	00	00	08	04	00	9
Cumulative Sum	04	16	40	89	18	03	22
%	2.08	8.33	20.83	46.36	9.38	1.56	11.46

0MEPE41* Professional Elective-V		0MEPE45# Professional Elective-V Laboratory	
0MEPE415	Vehicle Dynamics	0MEPE457	Vehicle Dynamics
0MEPE416	Solar Technology	0MEPE458	Solar Technology

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B.Tech-ST-02102

Course Details:

Class	B. Tech, Sem-VII
Course Code and Title	**0MEPC401,Refrigeration and Air Conditioning**
Prerequisite/s	0MEPC202,0MEPC302
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I/MSE/ISE II/ESE	10/30/10/50

Course Objectives: The course aims :	
01	To illustrate different refrigeration & air conditioning systems, refrigerants & their commercial applications.
02	To explain the selection of equipments, refrigerants according to application.
03	To explain the technologies associated with air distribution used in air conditioning systems
04	To provide the fundamental concepts for estimating the performance of refrigeration & air conditioning systems.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC401_1	**Explain** the need and application of multi-pressure, multi evaporator refrigeration system **(K^2)**
0MEPC401_2	**Explain** the basics of air distribution techniques used in air conditioning systems. **(K^2)**
0MEPC401_3	**Select** refrigerant and refrigeration equipments for various applications. **(K^3)**
0MEPC401_4	**Apply** the fundamentals of thermodynamics & heat transfer to refrigeration and air conditioning systems.**(K^3)**
0MEPC401_5	**Analyze** the performance of various refrigeration & air conditioning systems using psychrometric chart, steam table, p-h charts etc.**(K^4)**

Course Contents:		
Unit 1	**Basics of refrigeration** Laws, general equations, processes, equations applied to processes, applications of refrigeration. Carnot cycle, reversed Carnot cycle, simple vapor compression cycle: schematic & on p-h & T-s chart, effect of suction & discharge pressures , effect of sub-cooling & superheating on performance of the system, liquid to suction vapor heat exchanger, calculations and performance of above cycles, actual vapor compression cycle, Bell Coleman - Reversed Brayton cycle, air cycles for aircrafts. Vapor absorption system- aqua ammonia system, lithium bromide -water vapor absorption system, crystallization.	**09 Hrs.**
Unit 2	**Multi Pressure System** Removal of flash gas, flash inter-cooling, water-intercooling, sub-cooling, multistage (two stages), multi-evaporator (at same & different temperatures) and cascade system (two stage) .Introduction to cryogenic engineering and application, Claude cycle, Linde cycle.	**06 Hrs.**

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Unit 3	**Refrigerants** Classification, desirable properties like thermodynamic, physical, & chemical, comparison among commonly used refrigerants, nomenclature of refrigerants, and selection of refrigerants, effect on ozone depletion and global warming, international protocols on these issues, alternative refrigerants and secondary refrigerants.	**03 Hrs.**
Unit 4	**Psychrometry & Human Comfort** Psychrometry - moist air as a working substance, psychrometric properties of air, use of psychrometric tables and charts, processes, combinations and calculations, ADP, coil condition line, sensible heat factor, bypass factor, air washer and it's applications. Human Comfort - Thermal exchange between human body and environment, factors affecting comfort, Effective temperature comfort chart and modified comfort chart.	**09 Hrs.**
Unit 5	**Heating & Cooling Load Calculations** Design of air conditioning systems, inside and outside design condition, different heat sources, RSHF, GSHF, ERSHF, room apparatus dew point and coil apparatus dew point, ventilation and infiltration, cooling load estimation. Introduction to unitary products viz. room/split and packaged air conditioners, central air conditioning systems, variable refrigerant flow systems (VRF).Insulation- importance, types and applications.	**08 Hrs.**
Unit 6	**Air Distribution System** Re-circulated air, ventilation air, importance of air ventilation, duct work, duct material, use of friction loss & rectangular equivalent of round duct, duct system for AC & process industry, principle of duct sizing, ideal velocity of air in duct, pressure drops in duct design, ISHRAE standard for duct designing, duct layout, heat recovery system in recirculation of air. Accessories -diffusers, dampers, filters etc. duct systems for auditorium, assembly shop.	**07 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Refrigeration and Air Conditioning	C. P. Arora	Mc- Graw Hill Education (India) Pvt. Ltd.	Third	2008
02	Refrigeration and Air Conditioning	Arora Domkundwar	Dhanpat Rai & Co Ltd	Seventh	2006
03	Refrigeration and Air Conditioning	R.S.Khurmi	S Chand & Company Ltd	Fifth	2011
04	Refrigeration and Air Conditioning	S.N.Sapali	PHI Learning Private Limited	Second	2014

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Basic Refrigeration and Air Conditioning	P.N. Ananthnarayan	Mc- Graw Hill Education (India)	Fourth	2013

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Reference Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
			Pvt. Ltd.		
02	Air Conditioning Engineering	W. P. Jones	Spon Press	Fifth	2001
03	Air Conditioning Principles and Systems- An Energy Approach	Edward G Pita	John Wiley & Sons Inc	Second	1993
04	Handbook Of Air Conditioning and Refrigeration	Shan K. Wang	McGraw-Hill Education	Second	2000
05	Principles of Refrigeration	Roy J. Dossat	Pearson Education India	Fourth	2002

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Course Details:

Class	B. Tech. Sem –VII
Course Code and Course Title	**0MEPC402, Internal Combustion Engines.**
Prerequisite/s	0BSES111, 0MEPC202, 0MEPC203, 0MEPC302
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I/ MSE/ ISE II/ ESE	10/30/10/50

Course Objectives: The course aims:	
01	To illustrate constructional details and various types of internal combustion engine.
02	To explain air standard and actual cycles for IC engines.
03	To introduce combustion phenomenon in SI engine and CI engines.
04	To impart knowledge about various engine performance characteristics and its testing

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC402_1	**Compare** the different thermodynamic cycles in I.C. engines, (K^2)
0MEPC402_2	**Describe** the impact of vehicular pollution and ways to reduce or control the pollution, (K^2)
0MEPC402_3	**Explain** the fuel supply systems and requirement in the engine, (K^3)
0MEPC402_4	**Explain** the combustion mechanism of S.I. and C.I. engines (K^3)
0MEPC402_5	**Evaluate** the performance parameters of I.C. engine (K^4)

Course Contents:		
Unit 1	**Introduction to I.C. Engines:** Introduction, Classification of I. C. Engines, applications, Selection of IC Engine for different applications, Engine specifications. Engine Cycles, Deviation of actual cycles from air standard cycles, Valve timing diagram for high and low speed engine, Port timing diagram. (Numerical on cycles)	**05 Hrs.**
Unit 2	**Fuel systems for S.I. and C.I. Engines** Engine fuel requirements, complete carburetor, Derivation for calculation of A/F ratio, Calculation of main dimensions of carburetors, Effect of altitude on Air fuel ratio. Electronic Petrol injection system (MPFI) – components such as sensors, ECU etc., merits and demerits **Fuel Systems for C.I. Engines** Requirements of injection system, Types of injection systems – Individual pump, Common rail and Distributor systems, Unit injector, Types of fuel nozzles- single hole, multi hole, pintle, and pintaux, Formation of Spray, Atomization and penetration. Governing of C.I. engines. Electronic diesel injection system. Calculations of main dimension of fuel injection system.	**09 Hrs.**
Unit 3	**Combustion in S. I. Engines.** Stages of combustion, Ignition lag, Flame propagation, Factors affecting flame speed, Abnormal combustion, Influence of engine design and operating variables on detonation, Fuel rating, Octane number, Fuel additives, HUCR, Requirements of combustion chambers of S.I. Engines and	**07 Hrs.**

	its types.	
Unit 4	**Combustion in C.I. Engines** Stages of combustion, Delay period, Factors affecting delay period, Abnormal combustion- Diesel knock, Influence of engine design and operating variables on diesel knock, Comparison of abnormal combustion in S.I. and C.I. Engines, Cetane number, Additives. Requirements of combustion chambers for C.I. Engines and its types	**07 Hrs.**
Unit 5	**Performance Testing of Engines** Performance parameters, I. S. Standard Code10000 (I to XI) to 10004 for testing of engines), Measurement of performance parameters like torque, power, Volumetric Efficiency, Mechanical Efficiency, BSFC, Brake and Indicated Thermal efficiencies. Numerical on Heat Balance Sheet and engine performance, Performance curves. Introduction to Supercharging and Turbo-charging	**07 Hrs.**
Unit 6	**Engine Emission and Control** S.I. engine emission (HC, CO, NOx) Control methods- Evaporative (ELCD), Thermal, Catalytic converters, C.I. Engines Emission (CO, NOx, Smog, Particulate), Control methods- Chemical, EGR, Standard pollution Norms like EURO, Bharat stage norms, Introduction to alternative fuels for I.C. engines, Introduction to Electric Vehicle.	**07 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Internal Combustion engines	Mathur and Sharma	Dhanpat Rai Publi. Delhi.	First	1994
02	Internal Combustion engines	V. Ganesan	Tata McGraw Hill Publi	Fourth	2012
03	Internal Combustion engines	Domkundwar	Dhanpat Rai and Sons	First	1999
04	Internal Combustion engines	Ramlingam	SciTech Publi	Second	2008

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Internal Combustion Engines	J. B. Heywood	McGraw Hill Education	First	Reprint 2017
02	Engg. Fundamentals of the I.C. Engines	W.W. Pulkrabek	Pearson education	First	2003
03	Internal Combustion Engines – Applied Thermosciences	Colin R. Ferguson Allan T. Kirkpatrick	Wiley-Blackwell	Third	2015
04	Introduction to Internal Combustion Engines	Richard Stone	Palgrave Macmillan	Third	1999
05	Internal Combustion Engine Handbook: Basics, Components, Systems, and Perspectives	Richard Van Basshuysen, Fred Schäfer	SAE International	First	2016

Course Details

Class	B. Tech, Sem.-VII
Course Code and Course Title	**0MEPE403, Mechanical System Design**
Prerequisites	0MEPC205, 0MEPC209, 0MEPC301, 0MEPC303, 0MEPC309, 0MEPC358
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I/MSE/ISEII/ESE	10/30/10/50

Course Objectives: The course aims:	
01	To explain aesthetic, ergonomic and creativity considerations in product design.
02	To provide the design procedure of pressure vessel using IS2825 codes.
03	To explain the standard design procedure for mechanical systems.
04	To describe the statistical and design optimization techniques.

Course Outcomes (COs): After successful completion of this course, the student will be able to:	
0MEPE403_1	**Interpret** various design considerations used for designing typical mechanical systems considering aesthetical and ergonomical aspects. (K^2)
0MEPE403_2	**Derive** appropriate procedure for design of mechanical systems using various theories of failure. (K^3)
0MEPE403_3	**Design** mechanical systems for different requirements.(K^4)
0MEPE403_4	**Compare** various design solutions for a given mechanical system.(K^4)
0MEPE403_5	**Evaluate** optimum design solution for a give mechanical system considering product quality and performance.(K^5)

Course Contents		
Unit 1	**Aesthetic and Ergonomic Consideration in Design** Basic types of product forms, designing for appearance, shape, design features, materials, finishes, proportions, symmetry, contrast etc. Morgon's colour code. Ergonomic considerations- Relation between man, machine and environmental factors. Design of displays and controls. Practical examples of products or equipments using ergonomics and aesthetic design principles. Creativity concept in designing.	**06 Hrs.**
Unit 2	**Pressure Vessel Design** Thin and thick cylinders, failure criteria of vessels, Lame's equation, Clavarino's and Birnie's equation, autofrettage and compound cylinders, types of pressure vessels-horizontal and vertical, classification of pressure vessel as per IS2825, 1969.Introduction to design of pressure vessels as per IS codes, shell and end closures, effect of opening and nozzles in shell and covers, types of pressure vessel support.	**09 Hrs.**
Unit 3	**Design of Braking and Clutch System** **(1) Brakes -** Design consideration in brakes, Band, Internal expanding shoe, external contracting shoe. Thermal consideration and rating of brakes. **(2) Clutches** – Types, design requirement of friction clutches, selection criteria, torque transmitting capacity of single plate, multidisc clutch, cone clutch and centrifugal clutch.	**08 Hrs.**

Unit 4	**Design Of Belt Conveyor System** Classification of material handling equipment, types of conveyors, design of belt conveyors – power requirements, tension take up unit, idler pulley	**06 Hrs.**
Unit 5	**Statistical Techniques in Design** Frequency distribution-histogram and frequency polygon , units of measurement of central tendency and dispersion , standard variable, population combination, design and natural tolerances, design for assembly, mechanical reliability and factor of safety, system reliability block diagram.	**07 Hrs.**
Unit 6	**Optimum Design** Objectives of optimum design- Johnsons Method of Optimum Design (MOD), Adequate and optimum design. Primary, Subsidiary and Limit equations- Optimum design with normal specifications of simple machine elements like tension bar, transmission shaft, helical spring. Introduction to optimum design with Langrange Multiplier.	**06 Hrs.**

Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Design of machine elements	V.B. Bhandari	Tata Mc- Graw Hill Publication	Third	2012
02	Mechanical Engineering Design	Shigley and C.R.Miscke	Tata Mc- Graw Hill	Eighth	2010
03	Design of Machine Elements	M.F.Spotts	Pearsons Edu. Inc.	Eighth	2004
04	Design of Machine Elements	P. Kannaiah	Scitech Publication.	Second	2008
05	Design of Machine Element	J.F. Shigley	McGraw Hill Publication.	Eighth	2010
06	Machine Design	R. K. Jain	Khanna Publication	Seventh	2004
07	Process Equipment Design	M. V. Joshi	Machmillan India Ltd.,New Delhi	Third	1996

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Mechanical System Design	S.P.Patil,	Jaico Publication House,New Delhi	First	2004
02	Theory and Design of pressure vessels	John F.Harve	CBS Publishers	First	2001
03	Principles of machine tool	Sen. Bhattacharya	New central book agency	Fifth	2011
04	Design data book	PSG	PSG	--	--
05	Design data book	V.B. Bhandari	Tata Mc- Graw Hill Publication	First	2014
06	IS Codes for Pressure Vessel Design	--	--	--	--

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Course Details:

Class	B. Tech, Sem.-VII
Course Code and Course Title	**0MEPE404- Advanced Welding Engineering.**
Prerequisite/s	0MEPC204, 0MEPC213
Teaching Scheme: Lecture/Tutorial	3/0
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Objectives: The course aims:	
01	To illustrate the physics and mechanism of metal transfer in welding.
02	To explain the selection of appropriate welding process for specific material.
03	To examine and suggest various advanced non-conventional welding processes for specific cases.
04	To develop the skills of solving the weld design and quality assurance related problems.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPE404_1	**Model** mechanism of metal transfer of soldering, brazing process. **(K^3)**
0MEPE404_2	**Choose** the appropriate welding process and consumables for given alloy system. **(K^3)**
0MEPE404_3	**Analyze** the effect of welding parameters on metallurgical characteristics of weldments with selection of proper filler materials and select the appropriate welding processes for welding different types of ferrous alloys **(K^4)**
0MEPE404_4	**Infer** the metallurgical behavior of different alloy system under different welding processes and their influence on mechanical properties of weldments. **(K^4)**
0MEPE404_5	**Design** the optimum configurations for weldments. **(K^4)**

Course Contents:		
Unit 1	**Review of conventional welding process:** gas welding, arc welding, MIG, TIG welding. Resistance welding. Electro slag welding, friction welding, heat affected zone, soldering & brazing: capillary, wetting action, metallurgy of solders, solder joint design, soldering techniques, metallurgy of braze alloy.	**06 Hrs.**
Unit 2	**Special welding processes:** Electron beam welding, Plasma arc welding, Laser welding, Ultrasonic welding, Diffusion bonding, Atomic hydrogen welding, Explosive welding.	**08 Hrs.**
Unit 3	**Weldability of ferrous alloys:** Weldability of plane carbon steels, mild steels, medium and high carbon steels, alloy steels, stainless steels, Selection of consumables for various grades of steels, cast iron, Methods of welding for cast iron, Selection of consumables for cast iron	**07 Hrs.**
Unit 4	**Weldability of nonferrous alloys:** Weldability of aluminum alloys, Metallurgical behavior during welding, Selection of welding process, Selection of consumables, Weldability of copper and its alloys, Weldability of brasses, bronzes, Welding of dissimilar copper alloys	**07 Hrs.**

Unit 5	**Design and fabrication of weld joint:** Designing weld joint with stress distribution, Welding parameter layer, sequence, expansion, contraction, Selection of rates of deposition, Residual stresses in welded structures.	**08 Hrs.**
Unit 6	**Indian standards for welding process and consumables selection:** Indian standards for welding electrodes, fluxes, Selection of welding consumables, Case studies for consumables selection	**06 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Welding Technology	N K Srinivasan	Khanna Publisher	Fourth	2008
02	Welding Engineering and Technology	R S Parmar	Khanna Publisher	Fifth	2004
03	Welding Technology	O.P.Khanna	Dhanpat Rai Publications	Sixth	2011
04	Welding	David J Hoffman	Pearson Education	Second	2017

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Welding Technology	R. L. Little	Tata Mcgraw Hill Education Pvt. Limited	First	2005
2	Introduction To Physical Metallurgy	Sidney H Avner	Mcgraw Hill Education Pvt. Limited	Second	1997
3	Fracture and Fatigue of Welded Joints and Structures	K Macdonald	Wood head Publishing	Fourth	2011
4	Welding metallurgy	Sindo Kou	Wiley (CBS Publisher and distributors Pvt. Ltd)	Second	2016

Course Details:

Class	B. Tech, Sem.-VII
Course Code and Title	**0MEPE405, Design of Thermal System & Optimization**
Prerequisite/s	0MEPC202, 0MEPC210, 0MEPC302,
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I/MSE/ISE II/ESE	10/30/10/50

Course Objectives: The course aims:	
01	To develop ability among the students, to learn Design of Thermal System
02	To enable the students to simulate Thermal System.
03	To acquaint with Optimization and Performance Evaluation of Thermal Systems

Course Outcomes (COs):- Upon successful completion of this course, the student will be able to,	
0MEPE405_1	**Explain** the Thermal System Characteristics. (K^2)
0MEPE405_2	**Calculate** the Characteristics of Thermal Systems. (K^3)
0MEPE405_3	**Compute** Operating variables in Thermal Systems at Steady State (K^3)
0MEPE405_4	**Solve** Optimization Problems on Heat Rejection in Power Generation (K^3)
0MEPE405_5	**Design and Analyze** Heat Transfer Equipments (K^4)

Course Contents:		
Unit 1	**Introduction to Thermal System** Various Thermal System; basic characteristics and their analysis, types	**07 Hrs.**
Unit 2	**System Simulation** Description, uses. Continuous and discrete systems. Deterministic and stochastic systems. Steady state and dynamic systems	**05 Hrs.**
Unit 3	**Modeling & Simulation of Thermal Systems** Modeling & Simulation of various thermal systems from unit 1	**07 Hrs.**
Unit 4	**Design of Component & System from Specific Application Area** Design of component matching and various thermal systems from unit 1. Economic aspects in design of thermal system	**09 Hrs.**
Unit 5	**Optimization** Objective functions, constrains, operating conditions, mathematical formulation. Optimization methods- calculus methods, search method	**07 Hrs.**
Unit 6	**Optimization of Thermal Systems** Considerations, approaches. Examples on heat rejection in power generation. Setting up mathematical statement: Air compressor	**07 Hrs.**

Text Books

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Design and Optimisation of Thermal Systems	Yogesh Jaluria	MacGraw Hill	Second	2007
02	Thermal System Design	Wilbert Stoecker	MacGraw Hill	Third	2011

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Sr. No.	Title	Author	Publisher	Edition	Year of Edition
03	Thermal Design and Optimization	Adrian Bejan	John Wily & Sons Inc.	-	1996

Reference Books

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Design and Simulation of Thermal Systems	N.V. Suryanarayana, Oner Arici	MacGraw Hill, Education	-	2002
02	HVAC Systems Design Handbook	Roger W. Haines Michael E. Myers	MacGraw Hill, Education	Fifth	2009
03	Essentials of Thermal System Design and Optimization	C. Balaji	CRC Press	-	2011
04	Design of Fluid Thermal Systems	William S. Janna	Cengage Learning India Private Limited	Fourth	2015

Course Details:

Class	B. Tech, Sem.-VII
Course Code and Course Title	**0MEPE406, Noise and Vibration**
Prerequisite/s	0MEPC212, 0MEPC303
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I/MSE/ISE II/ESE	10/30/10/50

Course Objectives:	
01	To explain concepts of mechanical vibration.
02	To provide knowledge of vibration analysis techniques.
03	To acquaint with the principles of vibration measuring instruments.
04	To describe principles of sound, noise and measurement techniques.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPE406_1	**Describe** the basic concepts of noise and vibration, **(K^2)**
0MEPE406_2	**Explain** different noise and vibration measuring instruments, **(K^2)**
0MEPE406_3	**Determine** natural frequency of mechanical vibrating system/element , **(K^3)**
0MEPE406_4	**Compute** the parameters of vibration isolation system , **(K^3)**
0MEPE406_5	**Analyze** vibratory response of mechanical system/element.**(K^4)**

Course Contents:		
Unit 1	**Introduction to Vibrations** Importance and scope, concepts and terms used, vibration classification, steps involved in vibration analysis, SHM, vector method of representing harmonic motions, complex method of representing vibration, fourier series and harmonic analysis, free vibrations, damped free vibrations, types of damping, logarithmic decrement and damping materials.	**06 Hrs.**
Unit 2	**Single degree forced vibration: Damped and Undamped** Types of excitation, forced excitation, support excitation, excitation due to unbalance in machines, response of systems to above types of harmonic excitations, transmissibility, force transmissibility and motion transmissibility, vibration isolators, commercial isolation materials and shock mounts.	**07 Hrs**
Unit 3	**Two Degree Free and Forced Vibration** **(1) Undamped free vibrations:** Principal modes and natural frequencies, co-ordinate coupling and principal co-ordinates. **(2) Undamped forced vibrations:** Harmonic excitation, vibration, dampers and absorbers, dynamic vibration absorber, tuned and un-tuned type	**08 Hrs.**
Unit 4	**Introduction to Multi DOF System** Continuous Systems, Introduction to vibrations of strings, bars, shafts and beams; Mathematical model for vibration of Euler's beam and its solution (natural and forced vibration), Mode shapes and natural frequencies, forced vibration of beams carrying concentrated harmonic forces. Numerical methods in vibrations (Rayleigh, Rayleigh-Ritz and Holzer's method)	**08 Hrs.**
Unit 5	**Vibration Measurement**	**06 Hrs.**

	Instruments for measurement of displacement, velocity, acceleration and frequency of vibration, sensors and actuators, exciters, FFT analyzer. impact hammer test for natural frequency measurement, introduction to condition monitoring and fault diagnosis	
Unit 6	**Introduction to Noise** Plane acoustic waves, derivation of plane wave equation, relationships between acoustic pressure, particle displacement and velocity, velocity of plane acoustic waves, specific acoustic impedance, relations between sound power, sound intensity and sound pressure. sound power, sound intensity, sound pressure levels. addition and subtraction of sound pressure levels, transmission phenomena, normal incidence, reflection at the surface of a solid, standing wave patterns, non auditory effects of noise on people, auditory effects of noise, noise standards and limits, ambient emission noise standards in India, introduction to sound reduction at source , at path and at receiver. (only theoretical treatment on this unit)	**07Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Mechanical Vibrations	Rao S.S.,	Wiley Publishing Co	Forth	1990
02	Mechanical Vibration	Dr. V. P. Singh	S. Chand and Sons, New Delhi.	Fifth	2007
03	Mechanical Vibration	G. K. Grover	Nemchand and Brothers Roorkee	Second	1972
04	Mechanical Vibration and Noise Engineering	A. G. Ambekar	PHI	First	2006
05	Engineering Vibration	Inmann Daniel J	Pearson	Forth	2001
06	Mechanical Vibration	Austin Church	Wiely Eastern	Second	1963
07	Mechanical Vibrations	J.P. Den Hartog	McGrawhill Book Company Inc.	First	1956
08	Fundamentals of Acoustics	Kinsler Lawrence E. & Frey Austin R.	Wiley Eastern Ltd.	Second	1987.

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Theory of Machines	Thomas Bevan	CBS Publishers, New Delhi.	Third	reprint 2005
02	Theory of Machines and Mechanism	Shigley	Oxford International	Third	2009
03	Theory of Machines and Mechanism	G.S. Rao and R.V. Dukipatti	New Age Int. Publications Ltd. Delhi.	Second	1992
04	Mechanical Vibrations	Singiresu S.Rao	Pearson Education	Sixth	2004
05	Noise and Vibration Control	Leo L. Beranek	Tata Mc- Graw Hill	Second	1956

Course Details:

Class	B. Tech, Sem.-VII
Course Code and Course Title	**0MEPE407 NDT**
Prerequisite/s	0MEPC204, 0MEPC213,
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I / MSE / ISE II / ESE	10/30/10/50

Course Objectives: The course aims:	
01	To make aware about non-destructive testing techniques,
02	Illustrate the significance of longitudinal and shear wave in crack detection,
03	Interpret the techniques of magnetization & demagnetization, skin effect in magnetic particle inspection,
04	Select the suitable radiation process for specific engineering components.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPE407_1	**Choose** the appropriate testing techniques as per raw material and manufacturing process. **(K^3)**
0MEPE407_2	**Apply** the ultrasonic wave theory for flaw determination using angle probes and calibration blocks **(K^4).**
0MEPE407_3	**Compute** the applications of eddy current testing technique. **(K^4)**
0MEPE407_4	**Examine** the different inspection techniques under radiography test. **(K^4)**
0MEPE407_5	**Analyze** the surface and subsurface discontinuities by magnetic particle and dye penetrant inspection test. **(K^4).**

Course Contents:		
Unit 1	**Introduction:** What is NDT, comparison and difference between DT & NDT, Importance and scope of NDT, Methods, problems and difficulties of NDT, Selection of NDT process, Future and economic aspects of NDT	**04 Hrs.**
Unit 2	**Ultrasonic testing:** Principle, wave propagation, types of waves, frequency, velocity, wavelength, reflection, divergence, attenuation, mode conversion in ultrasonic, UT testing methods, contact testing and immersion testing, normal beam and straight beam testing, angle beam testing, dual crystal probe testing, resonance testing, through transmission testing, pulse echo testing, instruments used in UT, accessories such as transducers, testing of materials such as products like plates and round bars, weld joints, castings, forgings UT of non metals, defects in different products.	**08 Hrs.**
Unit 3	**Radiography testing:** Basic principle, Electromagnetic radiation sources: X-ray source, production of X-rays, high energy, X-ray source, gamma ray source, radiography, Standards, advantages and limitations, panoramic exposure, real time radiography, films used in industrial radiography, quality of a good radiograph, film processing interpretation, evaluation of test results, Inspection techniques like SWSI, DWSI, DWDI,	**08 Hrs.**

Unit 4	**Eddy current testing :** Principle of ECT, physical aspects of ECT like conductivity, permeability, resistivity, inductance, inductive reactance, impedance etc, field factor and lift of effect edge effect, end effect, impedance plane diagram in brief, Depth of penetration of ECT: relation between frequency and depth of penetration in ECT, Equipments and accessories, various application of ECT such as conductivity measurement, hardness measurement, defect detection, coating thickness measurement, coating of materials etc.	**08 Hrs.**
Unit 5	**Magnetic particle testing:** Principles of MPI, basic physics of magnetism, permeability, flux density, cohesive force, magnetizing force, resistivity, residual magnetism etc., methods of magnetization, magnetization techniques such as head shot technique, cold shot technique, central conductor testing, magnetization using products using yokes, direct method magnetism, indirect method of magnetization. Continuous testing of MPI, residual technique of MPI, system sensitivity, checking devices in MPI, interpretation of MPI, indications, advantage and limitation of MPI.	**08 Hrs.**
Unit 6	**Dye penetrant testing:** Principles of DPT, qualification, of penetrant testing consumable, properties required in a good penetrant and development which are used as consumable in dye penetrant testing, types developers, use of various types of penetrant and developers for various application, DPT technique, test procedure, interpretation and evaluation of penetrant test indication such as relevant indications, non relevant indications, false indication, safety precaution required in penetration testing.	**06 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Basics of Non-Destructive Testing	Lari, Kumar	S.K. Kataria & Sons	Fourth	2013
02	Non-Destructive Testing Techniques	Ravi Prakash	New Age International Private Limited	Fourth	2010
03	Non-destructive Evaluation - A tool in Design, Manufacturing and Service	D.E. Bray and R. K. Stanley	CRC Press,	Eighth	1996
04	Non-Destructive Testing	Ramchandran S.	AIR WALK Publications (India)	First	2017

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Non-destructive testing	Krant krammer	McGraw Hill Education	Fifth	2012
02	Practical NDT	Baldev Raj	Narosa Book Distributors	Fourth	2010
03	Ultrasonic Testing of Materials	Josef Kraut kramer, Herbert	Springer-Verlag	Fourth	1990

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Reference Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
		Krautkramer			
4	Non-Destructive Test and Evaluation of Materials	J Prasad, C. G. Krishnadas Nair	McGraw Hill Education	Second	2011

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Course Details:

Class	B. Tech, Sem-VII
Course Code and Course Title	**0MEPE408- Steam Engineering**
Prerequisite/s	0MEPC202,0MEPC210, 0MEPC302
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I/ MSE/ ISE II/ ESE	10/30/10/50

Course Objectives: The course aims:	
01	To apply fundamental knowledge of thermal engineering and heat transfer to study steam system components.
02	To comprehend with Indian boiler regulations act.
03	To acquaint with new techniques used for steam generation
04	To recognize different types of nozzle.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPE408_1	**Explain** working of different boilers, their mountings and accessories. **(K^2)**
0MEPE408_2	**Illustrate** different types of condenser, cooling tower & Feed water treatment **(K^3)**
0MEPE408_3	**Identify** different techniques used for steam generation **(K^3)**
0MEPE408_4	**Solve** numerical related to pressure , area and velocity of nozzle different types of nozzle **(K^3)**
0MEPE408_5	**Analyze** thermal efficiency of different Vapour cycles. **(K^4)**

Course Contents:		
Unit 1	**Vapour power cycle** Review of Carnot and Rankine cycle, principle methods of increasing thermal efficiency, deviation of actual cycle from theoretical cycle, efficiencies, requirement of ideal working fluid, binary Vapour cycle, regenerative feed heating cycles, optimum feed water temperature, erosion and corrosion of blades and its prevention, reheating and regenerative cycles, practical feed heating systems.	**07Hrs.**
Unit 2	**Steam Generators** Classification of boilers, boiler details, merits and demerits of fire tube and water tube boilers, boiler mountings and accessories, efficiency of the chimney, draught losses, types of boiler draught, ash precipitator. Performance of Boilers: Evaporation, equipment evaporation, boiler efficiency, boiler trial and heat balance, Introduction to IBR	**07Hrs.**
Unit 3	**Steam Nozzles** Types of Nozzles, flow of steam through nozzles, condition for maximum discharge, expansion of steam considering friction, super saturated flow	**07Hrs.**

	through nozzles, general relationship between area, velocity and pressure	
Unit 4	**Steam Condensers and Cooling Towers** Dalton's law of partial pressure, function and classification of condensers, construction and working of surface condensers. Sources of air leakage and its effect, concept of condenser efficiency, Quantity of cooling water Required, Design Calculations for Surface Condenser, vacuum efficiency (numerical). Cooling Towers. - Construction and working of forced, natural and induced draught cooling tower.	**07 Hrs.**
Unit 5	**Feed Water Treatment & Direct Energy Conversion** **Feed Water Treatment** Necessity of feed water treatment, different impurities found in feed water, effect of impurities, pH & its role in corrosion and scale formation, Internal & external water treatment systems. **Direct Energy Conversion** Introduction-thermoelectric converters, thermo-ionic converters, magneto hydrodynamics generators, hydrogen fuel cells, direct and indirect oxidation fuel cells	**07 Hrs.**
Unit 6	**Waste heat Recovery** Selection criteria for waste heat recovery technologies – recuperators – Regenerators – economizers – plate heat exchangers – thermic fluid heaters – Waste heat boilers – classification, location, service conditions, design Considerations – fluidized bed heat exchangers – heat pipe exchangers – heat pumps – sorption systems.	**07 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Thermodynamics: An Engineering Approach	Yunus A. Cengel	McGraw Hill	Eighth	2015
02	Engineering Thermodynamics	P. K. Nag	McGraw Hill	Fifth	2013
04	Engineering Thermodynamics	D.S. Kumar	S.K. Kataria and Sons	Fourth	2012

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Fundamentals of Thermodynamics	Richard E. Sonntag, Claus Borgnakke	New Age International	Seventh	2009
02	Applied Thermodynamics	Onkar Singh	New Age International	Third	2009
03	Fundamentals of Thermodynamics	Borhnakke, Sonnatag	Wiley Publication	Seventh	2009
04	Introduction to Thermal	M.J. Moran, H.N.	Wiley Publication	Tenth	2013

Reference Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
	System Engineering	Shapiro, B.R. Munson, D.P. Dewitt			
05	Fundamentals of Engineering Thermodynamics	Michael J. Moran, Howard N. Shapiro, Daisie D. Boettner, Margaret B. Bailey	John Wiley & Sons, Inc.	Eighth	2014

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Course Details:

Class	B. Tech, Sem.-VII
Course Code and Course Title	**0MEOE409, Industrial Management & Operation Research**
Prerequisite/s	0BSBS102, 0BSBS113, 0MEES201
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I/ MSE/ ISE II/ ESE	10/30/10/50

Course Objectives: The course aims:	
01	To introduce the basics of management in organizations.
02	To introduce the basics of Entrepreneurship Development, SSI (Small Scale Industries) and Safety practices followed at workplace.
03	To develop OR models & demonstrate their applications.
04	To Solve various types of industrial problems and discrepancy related with Operational Management.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEOE409_1	**Explain** the principles of management in organizations. (K^2)
0MEOE409_2	**Describe** structure of small scale industries and Entrepreneurship development program (K^2)
0MEOE409_3	**Explain** the basics of EDP, SSI and Safety guidelines. (K^2)
0MEOE409_4	**Formulate** Linear Programming problems for various OR models. (K^3)
0MEOE409 _5	**Solve** various types of problems related with Operational Management. (K^3)
0MEOE409 _6	**Solve** simple Project management and Replacement analysis problems. (K^3)

Course Contents:		
Unit 1	**Functions of Management and Marketing Management,** **Management:** Definition of Management, Management environment. **Planning:** Need, Objectives, Strategy, Policies, Procedures, Steps in Planning. **Organizing**: Process of Organizing importance and principle of organizing, Departmentation, Organizational relationship. **Staffing** : Nature, Purpose, Scope, Human resource management, Policies. **Leading:** Communication process, Barriers, Remedies, Motivation- Importance, Theories, Herzberg's theory, Maslow's theory, McGrager's theory. **Marketing Management:** Marketing Concepts –Objective –Types of markets – Market Segmentation, Market strategy, Market Research, Salesmanship, and Advertising.	**08 Hrs.**
Unit 2	**Materials Management, EDP, SSI and Industrial Safety** **Materials Management**: Definition, Scope, advantages of materials management, functions of materials management, Purchase Objectives, 5-R Principles of purchasing, Functions of Purchase department. **EDP:** Concept of an entrepreneur, Entrepreneurship development, Qualities required to become entrepreneurs, **SSI:** Definition, Procedure to start Small Scale Industry. Assistance and incentives offered to SSI, Problems of SSI, Feasibility report writing	**08 Hrs.**

	Industrial Safety – Reasons for accidents, Prevention of accidents, Promotion of Safety mindset.	
Unit 3	**Introduction to OR and Linear Programming Problems** **Introduction**: History and development of OR, Applications, modeling in OR, OR models and their applications. **Linear Programming Problems:** Formulation of problem, Graphical solution, Simplex procedure for maximization and minimization, Big M Method (Only theoretical treatment), Duality concept.	**05 Hrs.**
Unit 4	**Assignment Model and Transportation Model** **Assignment Model:** Mathematical statement, Methods to solve balanced and unbalanced assignment problems, Maximization problems, Assignment with restrictions, Traveling salesman problem. **Transportation Model:** Mathematical formulation, methods to obtain initial basic feasible solution (IBFS), NWCR, Least Cost and VAM, Conditions for testing optimality, MODI method for testing optimality solution of balanced and unbalanced problems,	**08 Hrs.**
Unit 5	**Decision Theory and Sequencing** **Decision Theory:** Introduction, Pay off table, Opportunity loss or regret table, Decisions under uncertainty, Laplace criterion, Maximin or Minimax principle, Maximax or Minimin principle, Hurwicz principle, Decisions under risk–maximum likelihood criteria, Expectation principle, Expected opportunity loss, decision trees. **Sequencing:** Sequencing of n jobs on two machines, n jobs on three machines	**08 Hrs.**
Unit 6	**Project Management:** Introduction to PERT and CPM, critical Path calculation, float calculation and its importance. **Replacement theory:** Computation Replacement - need, Replacement of items whose maintenance cost increases with time (with and without considering time value of money), Replacement of items that fail suddenly	**05 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Introduction to Operation Research	Hamdy A. Taha	Prentice Hall India Publication, New Delhi	Eighth	2011
2	Operations Research	D.S. Hira & P.K. Gupta	S. Chand & Co., New Delhi	Fifth	2011
3	Industrial Engineering and Production Management	M.T.Telsang	S. Chand & Co., New Delhi	Fourth	2013
04	Production and operation management	R.B.Khanna	PHI	Second	2015

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Business Management	J.P. Bose, S. Talukdar	New Central Agencies (P) Ltd.,	Third	2010

Reference Books:					
			Delhi		
2	Operation Research	J.K. Sharma	McMillan India Publication, Delhi	Eighth	2011
3	Operations Research	Manohar Mahajan	Dhanapat Rai And Sons, Delhi	Eighth	2009
04	Production and operation management	S.N.Chary	Tata Mc grawhill Delhi	Fifth	2015

Course Details:

Class	B. Tech, Sem.-VII
Course Code and Course Title	**0MEOE410, Industrial Automation & Robotics**
Prerequisite/s	0BSES111, 0BSES109, 0BSES103, 0BSES153, 0BSES157, 0BSES160
Teaching Scheme : Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I / MSE/ ISEII / ESE	10/30/10/50

Course Objectives: The course aims:	
01	To train the students from different branches of engineering in the areas of automation robotics and control systems.
02	To provide the knowledge of sensors, controllers, hydraulic and pneumatic systems required for implementing automation.
03	To provide knowledge of robotic arms and their applications in different disciplines of engineering.
04	To provide the basic knowledge of robot programming.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEOE410_1	**Explain** basic elements of automation systems, types of automation, advanced automation functions and low cost automation. (K^2)
0MEOE410_2	**Comprehend** effectively utilization of hydraulic and pneumatic systems in automation. (K^2)
0MEOE410_3	**Explain** electrical and electronic devices of automated control systems. (K^2)
0MEOE410_4	**Comprehend** specifications, characteristics, applications, anatomy and related attributes of industrial robot. (K^2)
0MEOE410_5	**Explain** the end effectors, grippers, gripper selection and design. (K^2)
0MEOE410_6	**Interpret** different programming methods, program statements and different application areas of robotic system. (K^2)
0MEOE410_7	**Analyze** of transfer lines with and without storage buffers (K^3)

Course Contents:		
Unit 1	**Introduction to automation** Automated manufacturing systems, fixed /programmable/ flexible automation, need of automation, basic elements of automated systems-power, program and control. Low cost automation, advanced automation functions, levels of automation, ten strategies for automation, transfer line, analysis of transfer line, automated assembly line.	**07 Hrs.**
Unit 2	**Sensors and controllers in automation** Introduction, transducers and sensors, sensors in automation and their applications, continuous and discrete control, programmable logic controllers.	**05 Hrs.**
Unit 3	**Hydraulic and pneumatic systems for automation**	**09 Hrs.**

	Basic laws and principles, basic hydraulic and pneumatic system, hydraulic systems elements, hydraulic circuits for engineering applications, pneumatic system elements, pneumatic circuits for engineering applications.	
Unit 4	**Fundamentals of industrial robots** Specifications and characteristics, configurations, criteria for selection, robotic control systems: drives, robot motions, actuators, power transmission systems, dynamic properties of robots- stability, control resolution, spatial resolution, accuracy, repeatability, compliance, work cell control, interlocks.	**07 Hrs.**
Unit 5	**Robot end effectors** End effectors- types, grippers, various process tools as end effectors, robot end effectors interface, active and passive compliance, gripper selection and design.	**07 Hrs.**
Unit 6	**Robot programming, applications and recent trends in automation** Lead through method, robot program as a path in space, methods of defining positions in space, applications of robot in different disciplines of engineering, Internet of things, industry 4.0	**07 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Automation, Production Systems & Computer Integrated Manufacturing	Mikell P. Groover	PHI Learning Pvt. Ltd. New Delhi	Third	2012
2	Industrial Robotics, Technology, Programming & Applications	Groover, M.P. Weiss, M. Nagel, R.N. & Odrey, N.G. Ashish Dutta	Tata McGraw Hill Education Pvt. Ltd. New Delhi	Second Edition	2012
3	Pneumatic Systems- Principles and Maintenance	S. R. Majumdar	Tata McGraw Hill, Publishing Company Ltd. New Delhi	Twenty second	2010
4	Oil Hydraulic Systems- Principles and Maintenance	S. R. Majumdar	Tata McGraw Hill, New Delhi	Twenty fourth	2012
5	Introduction to Fluid Power	James Johnson	Delmer Thomason Learning, New Delhi	First	2003

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Reference Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Robot Technology Fundamentals	Keramas ,James G.	Thomson Learning-Delmar) ISBN: 981-240-621-2	Second Edition	2002
2	Introduction To Robotics Mechanics & Control	J. J. Craig	Pierson Education	Third Edition	2004
3	Robotics-Control, Sensing, Vision and Intelligence	Fu, K. S. Gonzalez, R.C. & Lee	(McGraw Hill Intl. Ed.) ISBN:0-07-100421-1	Second Edition	2010
4	Robotics Technology and Flexible Automation	S. R. Deb	Tata McGraw-Hill Education Pvt. Ltd. New Delhi	Second Edition	2010
5	Industrial hydraulic	J. J. Pipenger	McGraw Hill	Third	1979

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Course Details:

Class	B. Tech, Sem.-VII
Course Code and Course Title	**0MEHS412, Human Values and Professional Ethics**
Prerequisite/s	-----
Teaching Scheme : Lecture/Tutorial	01/00
Credits	01
Evaluation Scheme: ISE I / MSE/ ISEII / ESE	10/30/10/50

Course Objectives: The course aims:	
01	To create an awareness on Professional Ethics and Human Values.
02	To help students understand the Harmony of life.
03	To understand Existence as Co-existence of mutually interacting units.
04	To study the moral issues and decisions confronting individuals and organizations in profession.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEHS412_1	**Understand** the core human values that shape the ethical behavior of a person. **(A^2)**
0MEHS412_2	**Learn** the need of Human values and Professional ethics in life. **(A^2)**
0MEHS412_3	**Understand** Harmony at Four levels of life. **(A^2)**
0MEHS412_4	**Understand** how values act as an anchor of actions for life. **(A^2)**
0MEHS412_5	**Comply** with the moral issues and problems in profession and find the solution to those problems **(A^2)**

Course Contents:		
Unit 1	**Course Introduction** Need, basic guidelines, content and process for value education, Moral values, Social, Environmental, Economic values, Purusharth, Duty, Justice, Equality. A look at basic aspirations: self-exploration, happiness and prosperity, Fulfillment of human aspirations.	**03 Hrs.**
Unit 2	**Understanding the Harmony** Thoughtful human being harmony, sentient, attitude and its importance in relationship, significance of restraint and health (Yama and Niyama), Egoism, Altruism, Universalism (idea of Sarvodaya and Vasudevkutumbakam), The problem of hierarchy of values and their choice (View of Pt Madan Mohan Malviya and Mahatma Gandhi), human goal settings and life management techniques.	**04 Hrs.**
Unit 3	**Understanding professional Ethics** Harmony at various levels and understanding professional ethics, creating environmentally aware engineers, humanistic universal education, humanistic universal education, natural acceptance of human values, ethical human conduct.	**03 Hrs.**
Unit 4	**Competence of professional Ethics** Management models for present technologies, strategies for integrating humans in family and at all levels of existence, relevance of the above strategies in becoming responsible engineers, technologists and managers.	**02 Hrs.**

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Unit 5	**Motivation:** Contribution of ancestors in science and technology development to raise self-esteem in Indian context.	**02 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	A foundation course in Human Values and professional Ethics,	R.R Gaur, R Sangal, G P Bagaria	Excel books, New Delhi,	Third	2010
2	Jeevan Vidya ek Parichay",	A Nagraj	Divya Path Sansthan, Amarkantak.	First	1998

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Indian Ethos and Modern Management, Reprinted	B L Bajpai	New Royal Book Co., Lucknow.	First	2008
2	Fundamentals of Ethics for Scientists & Engineers ,	E G Seebauer & Robert L. Berry	Oxford University Press	Third	2000
3	Engineering Ethics (including Human Values),	M Govindrajran, S Natrajan & V.S. Senthil Kumar	Eastern Economy Edition, Prentice Hall of India Ltd.	First	2004
4	Foundations of Ethics and Management,	B P Banerjee,	Excel Books.	Second	2005

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Course Details:

Class	B. Tech, Sem-VII
Course Code and Course Title	**0MEPC451,Refrigeration and Air Conditioning Laboratory**
Prerequisite/s	0MEPC202, 0MEPC302
Teaching Scheme: Practical	02
Credits	01
Evaluation Scheme: ISE / ESE	25/25

Course Objectives: The course aims:	
01	To impart fundamentals of refrigeration & air conditioning system
02	To give hands on practice for operating the refrigeration & air conditioning system.
03	To provide the knowledge for calculating the performance of refrigeration & air conditioning systems.
04	To make the students acquainted with actual components used in refrigeration & air conditioning systems.

Course Outcomes (COs) Upon successful completion of this course, the student will be able to,	
0MEPC451_1	**Identify** the components used in refrigeration & air conditioning systems. **(K^2)**
0MEPC451_2	**Determine** the performance of various refrigeration & air conditioning systems **(K^3)**
0MEPC451_3	**Follow** professional and ethical principles during laboratory work. **(A^2)**
0MEPC451_4	**Communicate** effectively, both orally and in writing journals **(S^2)**
0MEPC451_5	**Function** effectively as an individual, and as a team member for producing technical reports. **(S^3)**
0MEPC451_6	**Engage** in independent and life-long learning in broadest context of technological change. **(A^2)**

Course Contents:

1. Determine the COP of refrigeration system.
2. Evaluate the performance of heat pump test rig.
3. Evaluate the performance of ice plant test rig.
4. Evaluate the performance of cascade refrigeration system.
5. Determine the performance of air conditioning test rig.
6. Demonstration of various refrigeration & air conditioning systems like domestic refrigerator, water cooler, split AC.
7. Demonstration and hands-on practice of tools used in refrigeration & air conditioning system.
8. Demonstration of refrigeration equipments, controls and safety devices used in refrigeration & air conditioning system.
9. Visit to actual sites related to refrigeration or air conditioning system.
10. Market survey of various refrigeration & air conditioning systems.

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Text Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Refrigeration and Air Conditioning,	C. P. Arora	Mc- Graw Hill Education (India) Pvt. Ltd.	Third	2008
02	Refrigeration and Air Conditioning	Arora Domkundwar	Dhanpat Rai & Co Ltd	Seventh	2006
03	Refrigeration and Air Conditioning	R.S.Khurmi	S Chand & Comapny Ltd	Fifth	2011
04	Refrigeration and Air Conditioning	S.N.Sapali	PHI Learning Private Limited	Second	2014

Reference Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Basic Refrigeration and Air Conditioning	P.N. Ananthnarayan	Mc- Graw Hill Education (India) Pvt. Ltd.	Fourth	2013
02	Air Conditioning Engineering	W. P. Jones	Spon Press	Fifth	2001
03	Air Conditioning Principles and Systems- An Energy Approach	Edward D Pita	John Wiley & Sons Inc	Second	1993
04	Handbook Of Air Conditioning and Refrigeration	Shan K. Wang	McGraw-Hill Education	Second	2000
05	Principles of Refrigeration	Roy J. Dossat	Pearson Education India	Fourth	2002

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Course Details:

Class	B. Tech. Sem-VII
Course Code and Course Title	**0MEPC452, Internal Combustion Engines Laboratory**
Prerequisite/s	0BSES111, 0MEPC202, 0MEPC203, 0MEPC302
Teaching Scheme: Practical	02
Credits	01
Evaluation Scheme: ISE / ESE	25/25

Course Objectives: The course aims:	
01	To explain and demonstrate the construction and working of various engine systems of internal combustion engines.
02	To demonstrate and hands on practice to conduct trial on internal combustion engines setup.
03	To provide knowledge to calculate the performance parameter of internal combustion engines.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC452_1	**Identify** the different components of internal combustion engine. **(K^2)**
0MEPC452_2	**Interpret** the experimental results of I. C. Engine performance testing. **(K^3)**
0MEPC452_3	**Use** modern technique to analyze the performance parameters of I. C. Engine. ***(S^2)***
0MEPC452_4	**Communicate** effectively, both orally and in writing journals, **(S^3)**
0MEPC452_5	**Engage** in independent and life-long learning in the broadest context of technological change. **(A^3)**
0MEPC452_6	**Follow** professional and ethical principles during laboratory work **(A^3)**

Course Contents:

1. Demonstrate constructional details of I.C. engines
2. Demonstration of Engine systems: Air, exhaust, Cooling, Lubrication.
3. Demonstration of ignition systems, starting systems.
4. Demonstration of Carburetor and Petrol injection system.
5. Demonstration of fuel injection system of diesel engine.
6. Conduct trial on slow speed diesel engine to calculate heat balance sheet.
7. Conduct trial on high-speed petrol engine to calculate performance parameter.
8. Conduct Morse test on four stroke petrol engine.
9. Conduct trial on computer-controlled engine.
10. Visit to engine manufacturing or maintenance center.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Internal Combustion engines	Mathur and Sharma	Dhanpat Rai Publi. Delhi.	First	1994
02	Internal Combustion	V. Ganesan	Tata McGraw Hill	Fourth	2012

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	engines		Publi		
03	Internal Combustion engines	Domkundwar	Dhanpat Rai and Sons	First	1999
04	Internal Combustion engines	Ramlingam	SciTech Publi	Second	2008

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Internal Combustion Engines	J. B. Heywood	McGraw Hill Education	First	Reprint 2017
02	Engg. Fundamentals of the I.C. Engines	W.W. Pulkrabek	Pearson education	First	2003
03	Internal Combustion Engines – Applied Thermosciences	Colin R. Ferguson Allan T. Kirkpatrick	Wiley-Blackwell	Third	2015
04	Introduction to Internal Combustion Engines	Richard Stone	Palgrave Macmillan	Third	1999
05	Internal Combustion Engine Handbook: Basics, Components, Systems, and Perspectives	Richard Van Basshuysen, Fred Schäfer	SAE International	First	2016

Course Details:

Class	B. Tech, Sem.-VII
Course Code and Course Title	**0MEPE453, Noise and Vibration Laboratory**
Prerequisite/s	0MEPC212, 0MEPC303, 0MEPC259, 0MEPC352
Teaching Scheme: Practical	02
Credits	01
Evaluation Scheme: ISE/ ESE	25/25

Course Objectives:	
01	To explain the basic concept of vibration analysis.
02	To give hands on practice for utilization of vibration measuring instruments.

Course Outcomes:	
Upon successful completion of this course, the student will be able to,	
0MEPE453_1	**Illustrate** and Carry out measurement of various vibration parameters, **(K^3)**
0MEPE453_2	**Use** FFT analyzer to capture different vibration parameters, **(S^2)**
0MEPE453_3	**Function** effectively as an individual, and as a team member for performing laboratory work,**(S^3)**
0MEPE453_4	**Communicate** effectively, both orally and in writing journals, **(S^3)**
0MEPE453_5	Engage in independent and **life-long learning** in the broadest context of technological change.**(A^3)**
0MEPE453_6	Follow **professional and ethical principles** during laboratory work, **(A^3)**

Course Contents:

1. Experiment on equivalent spring mass system.
2. Determine of logarithmic decrement for single DOF damped system.
3. Determine damping effect on a system under forced vibration with viscous damping.
4. Experiment on free vibration of a coupled pendulum to determine natural frequency.
5. Experiment on free vibration of a double pendulum to determine natural frequency.
6. To determine natural frequency of torsional vibration of two rotor without damping.
7. Measurement of vibration parameter by FFT analyzer.
8. Condition monitoring and fault diagnose in a rotating system using vibration measuring technique.
9. Determination of natural frequency by Impact hammer test using FFT analyzer.
10. Measurement of noise by using noise measuring instruments.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Mechanical Vibrations	Rao S.S.,	Wiley Publishing Co	Fourth	1990
02	Mechanical Vibration	Dr. V. P. Singh	S. Chand and Sons, New Delhi.	Fifth	2007
03	Mechanical Vibration	G. K. Grover	Nemchand and	Second	1972

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			Brothers Roorkee		
04	Mechanical Vibration and Noise Engineering	A. G. Ambekar	PHI	First	2006
05	Engineering Vibration	Inmann Daniel J	Pearson	Fourth	2001
06	Mechanical Vibration	Austin Church	Wiely Eastern	Second	1963
07	Mechanical Vibrations	J.P. Den Hartog	McGrawhill Book Company Inc.	First	1956
08	Fundamentals of Acoustics	Kinsler Lawrence E. & Frey Austin R.	Wiley Eastern Ltd.	Second	1987.

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Theory of Machines	Thomas Bevan	CBS Publishers, New Delhi.	Third	reprint 2005
02	Theory of Machines and Mechanism	Shigley	Oxford International	Third	2009
03	Theory of Machines and Mechanism	G.S. Rao and R.V. Dukipatti	New Age Int. Publications Ltd. Delhi.	Second	1992
04	Mechanical Vibrations	Singiresu S.Rao	Pearson Education	Sixth	2004
05	Noise and Vibration Control	Leo L. Bernack	Tata Mc- Graw Hill	Second	1956

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Course Details:

Class	B. Tech, Sem.-VII
Course Code and Course Title	**0MEPE454 NDT Laboratory**
Prerequisite/s	0MEPC204, 0MEPC213, 0MEPC260
Teaching Scheme: Practical	02
Credits	01
Evaluation Scheme: ISE / ESE	25/25

Course Objectives: The course aims:	
01	To make aware about non-destructive testing methods.
02	To acquaint students for conducting visual inspection.
03	To conduct defect detection using magnetic particle inspection and dye penetrant test.
04	To acquire the skills of conducting the ultrasonic testing of given component

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPE454_1	**Explain** about various methods of Non Destructive Testing.**(K^2)**
0MEPE454_2	**Inspect** surface as well as sub surface flaws of the components.**(K^3)**
0MEPE454_3	**Identify** use of suitable non-destructive method for particular application.**(S^3)**
0MEPE454_4	**Use** nondestructive techniques in maintenance practices in industry.**(S^3)**
0MEPE454_5	**Follow** the professional practices like maintaining a laboratory journal and completion of work on time.**(A^2)**

Course Contents:

1. Microscopic examination of metals
2. Illustration of the surface defects using the Visual Testing
3. Examination of the surface defects using the Liquid Penetrant Testing
4. Determination of Surface and Subsurface Defects using the Magnetic Particle Inspection.
5. Basic Calibration of the Ultrasonic Testing Machine using Angle beam probes
6. Young's Modulus and Poisson's Ratio Determination using the Trough Transmission
7. Calibration of Normal Beam probe and thickness measurement with UT
8. Determination of the defects in the Welded Joints using the UT

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Basics of Non-Destructive Testing	Lari, Kumar	S.K. Kataria & Sons	Fourth	2013
02	Non-Destructive Testing Techniques	Ravi Prakash	New Age International Private Limited	Fifth	2010
03	Welding Technology	O.P.Khanna	Dhanpat Rai Publications	Sixth	2011
04	Welding	David J Hoffman	Pearson Education	Second	2017

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Reference Books:					
Sr. No	**Title**	**Author**	**Publisher**	**Edition**	**Year of Edition**
01	Nondestructive testing	Krant krammer	McGraw Hill Education	Fifth	2012
02	Practical NDT	Baldev Raj	Narosa Book Distributors	Sixth	2009
03	Ultrasonic Testing of Materials	Josef Krautkramer, Herbert Krautkramer	Springer-Verlag	Fourth	1999
04	Non-Destructive Test and Evaluation of Materials	J Prasad, C. G. Krishnadas Nair	McGraw Hill Education	Second	2011

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Course Details:

Class	B. Tech, Sem.-VII
Course Code and Course Title	**0MEPE455, Steam Engineering Laboratory.**
Prerequisite/s	0MEPC202, 0MEPC210, 0MEPC302, 0MEPC351.
Teaching Scheme: Practical	02
Credits	01
Evaluation Scheme: ISE/ ESE	25/25

Course Objectives:	
01	To demonstrate different equipment's related with steam engineering
02	To familiarize with different measuring instruments used in steam engineering
03	To comprehend knowledge about different types of calorimeter
04	To enhance computation tendency of steam properties.

Course Outcomes:	
Upon successful completion of this lab, the student will be able to,	
0MEPE455 _1	**Demonstrate** different measuring instrument used in various test setup. **(K^2)**
0MEPE455 _2	**Experiment with** steam nozzle, boiler and steam condenser to study their performance. **(K^3)**
0MEPE455 _3	**Examine** dryness fraction of steam by using separating, throttling and bomb calorimeter. **(K^4)**.
0MEPE455 _4	**Communicate** effectively, both orally and in writing journals. **(S^3)**
0MEPE455 _5	Engage in independent and **life-long learning** in the broadest context of technological change. **(A^3)**
0MEPE455 _6	Follow **professional and ethical principles** during laboratory work. **(A^3)**

Course Contents:

1. Determination of calorific value by using bomb calorimeter
2. Measurement of dryness fraction of steam using separating & throttling calorimeter.
3. Performance testing of boiler
4. Investigation of nozzle efficiency of convergent/convergent-divergent type nozzle
5. Performance evaluation of surface condenser.
6. To study cooling tower and find its efficiency
7. Flue gas analysis using emission measuring instruments
8. Performance testing of centrifugal blower
9. Visit minimum two industry to study and experience some of the above listed systems

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Thermodynamics: An Engineering Approach	Yunus A. Cengel	McGraw Hill	Eighth	2015
02	Engineering	P. K. Nag	McGraw Hill	Fifth	2013

	Thermodynamics				
03	Engineering Thermodynamics	D.S. Kumar	S.K. Kataria and Sons	Fourth	2012
04	Engineering Thermodynamics	Ethirajan R.	Prentice Hall India Learning Pvt. Ltd.	Second	2005

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Fundamentals of Thermodynamics	Richard E. Sonntag, Claus Borgnakke	New Age International	Seventh	2009
02	Applied Thermodynamics	Onkar Singh	New Age International	Third	2009
03	Fundamentals of Thermodynamics	Borhnakke, Sonnatag	Wiley Publication	Seventh	2009
04	Introduction to Thermal System Engineering	M.J. Moran, H.N. Shapiro, B.R. Munson, D.P. Dewitt	Wiley Publication	Tenth	2013
05	Fundamentals of Engineering Thermodynamics	Michael J. Moran, Howard N. Shapiro, Daisie D. Boettner, Margaret B. Bailey	John Wiley & Sons, Inc.	Eighth	2014

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Course Details:

Class	B. Tech. Sem-VII
Course Code and Course Title	**0MEPR456, Project-I**
Prerequisite/s	All Courses
Teaching Scheme: Practical	06
Credits	08
Evaluation Scheme: ISE / ESE	25/25

Course Objectives: The course aims:	
01	To offer students a glimpse into real world problems and challenges that need a technology based solutions
02	To develop the proficiency in the students for the problem formulation.
03	To prepare the students for effective completion of the project with the observations, discussions, decision making process & use of software's
04	To develop the team building, communication and management skills of the students

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPR456_1	**Choose & construct** the real life institutional or industrial problems relevant to the societal and environmental issues for sustainable development. **(K^3 A^2)**
0MEPR456_2	**Formulate, analyze** complex engineering problems and give cost-effective optimal solution. **(K^4 A^3)**
0MEPR456_3	**Design** of components, system or processes that meet the specified needs by using advance tools/ techniques/ resources **(K^4 S^3)**
0MEPR456_4	**Interpret** the impact of solution by considering environmental issues, societal aspects like health, safety etc. **(K^5 A^2)**
0MEPR456_5	**Function** effectively as an individual or as a team for understanding of the engineering and management principles and apply these to manage projects maintaining professional and ethical principles. **(S^3 A^2)**
0MEPR456_6	**Communicate** effectively on complex engineering activities, design the documentations, write the reports and make effective presentations. **(S^3)**

Course Contents:

- A batch of maximum two groups of four **to six** students per group, shall work under one faculty member of department. The group of less than four students is strictly not allowed.
- Project-I work can be a design project / experimental project and or computer simulation project on Mechanical engineering or any of the topics related with mechanical engineering stream.
- Project-I consists of literature review to formulate the problem and submission of preliminary report. Report should highlight scope, objectives, methodology, approach and tools to be used like software and other and expected results and outcome along with timeframe. One copy of the report should be expected to submit to Project guide and one

copy should remain with project group.

- The project -I work is to be extended for Project -II at B. Tech. (Mech.) Sem-VIII with same group working under guidance of same faculty member assigned for Project-I.

Project work submitted by students shall include;

1. ***Work Diary***: Work Diary maintained by group and countersigned by the guide weekly. The contents of work diary shall reflect the efforts taken by project group for
   a. Searching suitable project work
   b. Brief report preferably on journals/ research or conference papers/ books or literature surveyed to select and bring up the project.
   c. Day to day activities carried out related to project work for entire Sem.
2. ***Synopsis***: The group should submit the synopsis in following prescribed format.
   a. Title of Project
   b. Names of Students
   c. Name of Guide
   d. Relevance
   e. Present Theory and Practices
   f. Proposed work
   g. Expenditure
   h. References

The synopsis should consist of minimum **eight** review papers. The synopsis shall be signed by each student in the group, approved by the guide and endorsed by the Head of the Department.

3. ***Presentation & report***: The group has to make a presentation in front of the faculty members and review panel member at the time of Review's.

Project-I Report Format:

Project-I report should be of 25 to 30 pages (typed on A4 size sheets). For standardization of the project-I reports the following format should be strictly followed.

1. Page Size: Trimmed A4
2. Top Margin: 1.00 Inch
3. Bottom Margin: 1.32 Inches
4. Left Margin: 1.5 Inches
5. Right Margin: 1.0 Inch
6. Para Text: Times New Roman 12 Point . Font
7. Line Spacing: 1.5 Lines
8. Page Numbers: Right Aligned at Footer. Font 12 Point. Times New Roman
9. Headings: Times New Roman, 14 Point , Bold Face
10. References: References should have the following format

For Papers: Authors, "Title of Paper", " Journal/Conference Details", Year
For Books: Authors, "Title of Book", Publisher, Edition

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Important Notes:
• Project group should continue maintaining a work diary for project and should write (a) Book referred (b) Company visited (c) Person contacted (d) Paper referred (e) Creative thinking. • Work diary along with Project -I report shall be assessed at the time of ESE examination

Assessment Tools: Project Synopsis Assessment Rubric, Project-I Assessment Rubric, External Oral Examination

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Course Details:

Class	B. Tech, Sem.-VIII
Course Code and Course Title	**0MEPC413, Industrial Engineering**
Prerequisite/s	0MEPC204, 0MEES208, 0MEPC305, 0MEPC355
Teaching Scheme: Lecture / Tutorial	03/01
Credits	04
Evaluation Scheme: ISE I/MSE/ISE II/ESE	10/30/10/50

Course Objectives: The course aims:	
01	To introduce the various tools and technique of industrial engineering.
02	To develop managerial skills relevant to the industry.
03	To make students familiar with various lean manufacturing techniques.
04	To teach how to applying industrial engineering techniques to real/ practical problems.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPC413_1	**Apply** industrial engineering tools to calculate and improve productivity, (K^2)
0MEPC413_2	**Estimate** the process time with by different methods, (K^3)
0MEPC413_3	**Plan** production activities using tools like capacity and aggregate planning, (K^3)
0MEPC413_4	**Decide** the plant location and design appropriate type of layout and recommend suitable material handling system, (K^3)
0MEPC413_5	**Apply** different project management techniques, (K^3)
0MEPC413_6	**Apply** different lean manufacturing tools, (K^3)

Course Contents:		
Unit 1	**Introduction of Industrial Engineering and Productivity** Industrial Engineering Definition, Scope, Role of industrial engineer, Tools and techniques of I.E. Productivity- concept, objective, factors affecting productivity, tools & techniques to improve productivity, value analysis & value Engineering.	**07 Hrs.**
Unit 2	**Method Study** Objectives of method study, various recording techniques, therblings, micro-motion study, MEMO motion study, principles of motion economy. **Work Measurement** Definitions, objectives, activity and elements, performance rating, rating methods, allowances, work sampling, PMTS, workplace ergonomics.	**07 Hrs.**
Unit 3	**Capacity and aggregate planning and scheduling of operations** Introduction, measures of capacity, capacity strategies, overcapacity & under capacity factors. Aggregate planning, Aggregate planning strategies. Sequencing problems, n jobs 2 Machines, n jobs 3 Machines, scheduling, forward & backward scheduling. (Numerical)	**07 Hrs.**
Unit 4	**Facility Planning** Plant site selection, Factors influencing selection, optimum decision on choice of site & analysis, principle & objective of plant layout, types of plant layout, MHS.	**06Hrs.**
Unit 5	**Inventory Control and Network Techniques**	**08 Hrs.**

	Inventory valuation by LIFO and FIFO, ABC analysis, MRP, make or buy decision (Theoretical). Network Techniques: CPM and PERT, Construction, Time cost tradeoff (Numerical.)	
Unit 6	**Introduction to Lean manufacturing** JIT, SMED, 5S, Kaizen, 6 sigma, kanban, Management Information System, Total productive maintenance, Poka-Yoke.	**07 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Industrial Engineering and Management	Khanna O. P.	Dhanpat Rai Publications(P) Ltd, New Delhi	Revised	2003
02	Industrial Engineering and Production Management	Martand Telsang	S. Chand & Company Ltd., New Delhi	Revised	2006
03	Global Management Solutions Demystified	Dinesh Seth, Subhash Rastogi	Cengage learning publications.	Second	2009
04	Industrial Engineering Handbook	H.B. Maynard and Others	Tata McGraw Hill Publication	Fourth	2009

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Hand Book of Industrial Engineering	Gavrial Salvendy	John Wiley and Sons, New York,	--	2007
02	Industrial Engineering	M. I. Khan	New age international(P) Ltd, New Delhi	Reprint	2004
03	Introduction To Work Study	International Labour Office	International Labour Office,1969	Digitalized	2008
04	Operations research	D.S.Hira and Gupta	Chand & Co. New Delhi.	Seventh	1976

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Course Details:

Class	B. Tech, Sem.-VIII
Course code and Course Title	**0MEPC414, Smart Materials**
Prerequisite/s	0MEPC205
Teaching Scheme: Lecture/Tutorial	03/01
Credits	04
Evaluation Scheme: ISEI/MSE/ISEII/ESE	10/30/10/50

Course Objectives: The course aims:	
01	To explain smart materials and their types used in practice.
02	To present the concept of classification of smart materials as HBLS and LBHS.
03	To discuss application of smart materials as sensors, actuators , transducers and their integration schemes.
04	To demonstrate practical applications of smart systems.

Course Outcomes (COs):- After successful completion of this course, the student will be able to,	
0MEPC414 _ 1	**Explain** the concepts of smart materials. **(K^2)**
0MEPC414 _ 2	**Describe** the method of classification of smart materials and the respective characterizes. **(K^2)**
0MEPC414 _ 3	**Determine** effective utilization of various smart materials in the process of design of smart systems. **(K^3)**
0MEPC414 _ 4	**Apply** conceptual method of integration of sensors, actuators and transducers to form a smart system. **(K^3)**
0MEPC414 _ 5	**Identify** the effectiveness of various smart materials for engineering applications **(K^3)**

Course Contents:		
Unit 1	**OVERVIEW OF SMART MATERIALS** Introduction, components of smart systems – sensors, actuators, transducers, MEMS, introduction to piezoelectric materials, magnetostrictive smart materials, active smart polymers, shape memory alloys.	**05 Hrs.**
Unit 2	**TYPES OF SMART MATERIALS** Introduction to HBLS (high bandwidth low strain) generating smart materials- piezoelectric and magnetostrictive materials, LBHS (low bandwidth high strain) generating smart materials- shape memory alloys and electro-active polymers.	**05 Hrs.**
Unit 3	**ACTUATORS BASED ON SMART MATERIALS** HBLS based actuators- Piezoelectric actuators- induced strain actuation model, unimorph and bimorph actuators, actuators embedded in composite laminate. Magnetostrictive actuators - mini actuators, thermal instabilities, magnetorstrictive composites, MEMS based actuators. LBHS based actuators: Shape memory alloy based actuators, Electro-active polymer.	**10 Hrs.**
Unit 4	**SENSORS BASED ON SMART MATERIALS** Sensors based on HBLS smart materials- Piezoelectric sensors, magnetostrictive sensors, MEMS sensors, Sensors based on LBHS smart	**07 Hrs.**

	materials- shape memory alloy based encoders and EAP based sensors.	
Unit 5	**INTEGRATION OF SMART SENSORS AND ACTUACTORS** Case studies to advanced smart materials - active fiber composites, energy harvesting actuators, energy scavenging sensors, self-healing smart materials.	**08 Hrs.**
Unit 6	**APPLICATION OF SMART MATERIAL** Structural applications of smart materials, structural acoustic control, and vibration control applications. Aerospace and transportation applications.	**07 Hrs.**

Text Books

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1.	Smart materials and structures	Gandhi, Thompson and Gandhi, Chapmann	Hall London Springer	First	1992
2	Smart Structures and materials	Bryan Culshaw"	Artech House Publishers	First	2004
3	Smart Materials and Technologies	D. Michelle Addington and Daniel L. Schodek	Elsevier, Architectural Press	First	2005
4	Smart Sensors and Actuators	Francisco Andre Correa Alegria	I F T publishers	First	2014
5	Smart Material Systems and MEMS: Design and development Methodologies	Vardhan K. K.J.Vinoy and	John Willey and Sons Ltd.	First	2006

Reference Books

Sr. No.	Title	Author	Publisher	Edition	Year of Edition
01	Smart Structures: Physical Behaviour, Mathematical Modelling and Applications	Paolo Gaudenzi	Willey	First	2009
02	Piezoelectricity	Cady, W.G.	Dover Publications	Second	1964
03	Intelligent structures for aerospace - A technology overview and assessment	Crawley. Edward F.	AIAA	First	1994

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Course Details:

Class	B. Tech, Sem.-VIII
Course Code and Course Title	**0MEPE415, Vehicle Dynamics**
Prerequisite/s	0MEPC303
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISEI / MSE/ ISEII/ ESE	10/30/10/50

Course Objectives:	
01	To explain the basics of vehicle dynamics.
02	To explain braking characteristics of vehicle.
03	To make aware of different handling conditions such as under steer, over steer.
04	To examine the effect of excitation sources on vehicle ride characteristics.
05	To make aware about recent trends in vehicle dynamics.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPE415_1	**Explain** fundamentals of vehicle dynamics and vehicle performance in motion, **(K^2)**
0MEPE415_2	**Describe** recent trends in vehicle dynamics. **(K^2)**
0MEPE415_3	**Evaluate** performance characteristics of vehicles according to different conditions, **(K^3)**
0MEPE415_4	**Illustrate** different braking & handling characteristics of vehicle, **(K^4)**
0MEPE415_5	**Identify** suspension& ride excitation sources, **(K^4)**

Course Contents:		
Unit 1	**Introduction** Introduction to vehicle dynamics, Fundamental approach to modeling-lumped mass, Coordinate systems, Newton's second law, Dynamic axle loads, Power limited acceleration- engines, Traction limited acceleration, Transverse weight shift due to drive torque	**06 Hrs.**
Unit 2	**Performance Characteristics of Road Vehicles** Power for propulsion, Traction and tractive effort, Road performance curves: Acceleration, Gradability & Drawbar Pull, Determination of CG, Weight distribution, Stability of vehicle on slope, Dynamics of vehicles on banked tracks, Stability of vehicle taking a turn, Gyroscopic effects	**07 Hrs.**
Unit 3	**Braking Performance** Basic equations (Constant deceleration, deceleration with wind resistance), Energy / Power absorbed during braking, Braking forces, Brake factor, Federal requirements for braking Performance, Brake proportioning, Estimation of braking efficiency, Braking of vehicle - Braking applied to rear wheels, Front wheels and all four wheels, Braking of vehicle moving in a curved path	**07 Hrs.**
Unit 4	**Handling Characteristics** Steering geometry, Steering system models, Steady state handling: Low speed turning, Off tracking, High speed cornering, Neutral steer, Under steer and over steer, Steady state response, Yaw velocity, Lateral	**07 Hrs.**

	acceleration, Curvature response, Jack-knifing in articulated vehicle, Vehicle test for handling performance	
Unit 5	**Suspension Characteristics** Suspension kinematics, Suspension types, Solid axles, Independent suspensions, Excitation sources, Vehicle response properties – Suspension isolation, Suspension stiffness, Suspension damping, Suspension nonlinearities, Rigid body bounce/pitch motions, Bounce/pitch frequencies, Human response to vibrations, vehicle ride models- Two degree freedom model for sprung & unsprung mass,	**08 Hrs.**
Unit 6	**Recent trends in vehicle dynamics** Stability control systems, Introduction of vehicle sensors, Central tire inflation systems, Vehicle dynamics simulations	**07 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Fundamentals of Vehicle Dynamics	Thomas D. Gillespie	Society of Automotive Engineers	Second	2012
02	Theory of Ground Vehicles	J. Y. Wong	John Wiley and Sons Inc., New York	Fourth	2001

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Fundamentals of Vehicle Dynamics	Thomas D. Gillespie	Society of Automotive Engineers	Second	2012
02	Theory of Ground Vehicles	J. Y. Wong	John Wiley and Sons Inc., New York	Fourth	2001
03	The Multi Body Systems Approach to Vehicle Dynamics	Blundell, M. and Harty, D.	Elsevier Publications	First	2011
04	Tyre and Vehicle Dynamics	Hans Pacejka	SAE Publications	Second	2011
05	An Introduction to Modern Vehicle Design	Julian Happian-Smith	Butterworth-Heinemann	First	2002

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Course Details:

Class	B. Tech, Sem.-VIII
Course Code and Course Title	**0MEPE416, Solar Technology**
Prerequisite/s	0MEPC202, 0MEPC210, 0MEPC302
Teaching Scheme: Lecture/Tutorial	03/00
Credits	03
Evaluation Scheme: ISE I/MSE/ISE II/ESE	10/30/10/50

Course Objectives:	
01	To explain significance of renewable sources of energy and technologies for their utilization
02	To expose students conceptualize and design solar energy appliances and equipment.
03	To describe economics of solar energy system.
04	To develop a professional insight about solar energy technologies.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPE416_1	**Explain** the impact of use of non-renewable sources on environment. **(K^2)**
0MEPE416_2	**Explain** Solar PV technology. **(K^2)**
0MEPE416_3	**Utilize** the technical skills attained in carrying out energy audit.**(K^3)**
0MEPE416_4	**Analyze** solar flat plate collector system performance. **(K^4)**
0MEPE416_5	**Design** standalone solar energy system. **(K^4)**

Course Contents:		
Unit 1	**Introduction:** Renewable energy sources: Indian scenario, need, characteristics and challenges in the successful utilization of renewable energy sources, economics, subsidies and incentives available. **Solar energy resource:** Energy from the sun, solar extraterrestrial radiation, spectral distribution, earth sun angles, observer sun angles, tilt factor, solar radiation intensity incident on tilted surface, measurement of solar radiation.	**07 Hrs.**
Unit 2	**Low temperature applications of solar thermal energy** Water and air heating, flat plate collectors, classification, types, losses, performance evaluation, storage, testing and standards.	**06 Hrs.**
Unit 3	**Medium and high temperature applications of solar thermal energy** Concentrating collectors, classification, types and suitability, tracking, performance evaluation, industrial process heating systems, solar thermal power generation, technologies, storage issues and challenges in the commercialization.	**08 Hrs.**

Unit 4	**Solar photovoltaic conversion** Basic semiconductor physics, a generic photovoltaic cell, modules and arrays, use of solar cell in various instruments, impact of temperature and shading on the performance of a PV module, standalone and grid connected solar photovoltaic systems, components.	**06 Hrs.**
Unit 5	**Solar PV Systems design** Design standalone solar PV system, calculations and technical aspects, design grid connected system calculations and technical aspects.	**07 Hrs.**
Unit 6	**Auditing and economics of energy** Types of energy audits, methodology, instruments used in energy auditing, role of non-conventional energy sources in energy conservation, protocol, carbon credits and clean development mechanism (cdm). **Economic analysis:** Simple payback period, return on investment, dynamic value of money, discount rate cash flows, time value of money, formulae relating present and future cash flows - single amount, uniform series, life cycle cost.	**08 Hrs.**

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Solar Energy	Sukhatme S.P	Tata McGraw Hill New Delhi	Third	1996
02	An Introduction to Power Plant Technology	Rai G.D.	Khanna Publishers,	Third	1996
03	Principles of solar engineering	Krieth and Krieder	Tata McGraw Hill New Delhi	Second	1996
04	Solar Engineering of Thermal Processes	Duffie John A. and Beckman William A	John Wiley and Sons, Inc.	Second	1991

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Handbook of solar energy, Springer				
02	Energy conservation-related booklets Published by National productivity Council (NPC) & Petroleum Conservation Research Assn.(PCRA).				
03	Solar Energy	Walker Andy	John Willey and sons	First	2013

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Course Details:

Class	B. Tech, Sem.-VIII
Course Code and Course Title	**0MEPE457, Vehicle Dynamics Laboratory**
Prerequisite/s	0MEPC303, 0MEPE415
Teaching Scheme: Practical	02
Credits	01
Evaluation Scheme: ISE/ESE	50/50

Course Objectives:	
01	To gain knowledge of dynamics of vehicle required for stability of vehicle and human comfort.
02	To identify the effect of different parameters on performance characteristics of road vehicles.
03	To gain knowledge of the testing procedure for noise, vibration.
04	To understand vehicle performance under different conditions.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPE457_1	**Compute** dynamic axle load when vehicle in motion, **(K^3)**
0MEPE457_2	**Evaluate** performance characteristics of road vehicles, **(K^4)**
0MEPE457_3	**Determine** the acceleration and braking performance of a vehicle when provided with specifications, **(K^4)**
0MEPE457_4	**Illustrate** the effect of suspension system on ride characteristics, **(K^4 S^4)**
0MEPE457_5	**Communicate** effectively, both orally and in writing journals.**(A^2)**

Course Contents:

1. To find acceleration performance of a vehicle at specific conditions.
2. To determine of CG, weight distribution, stability of vehicle on slope.
3. To measure vibrations in passenger compartment for different operating conditions.
4. To evaluate efficiency of braking system.
5. To carryout vehicle performance test on chassis dynamometer.
6. To demonstrate vehicle suspension system.
7. To describe active roll control system and traction control system.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Fundamentals of Vehicle Dynamics	Thomas D. Gillespie	Society of Automotive Engineers	Second	2012
02	Theory of Ground Vehicles	J. Y. Wong	John Wiley and Sons Inc., New York	Fourth	2001

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Reference Books:					
Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Fundamentals of Vehicle Dynamics	Thomas D. Gillespie	Society of Automotive Engineers	Second	2012
02	Theory of Ground Vehicles	J. Y. Wong	John Wiley and Sons Inc., New York	Fourth	2001
03	The Multi body Systems Approach to Vehicle Dynamics	Blundell, M. and Harty, D.	Elsevier Publications	First	2011
04	Tyre and Vehicle Dynamics	Hans Pacejka	SAE Publications	Second	2011
05	An Introduction to Modern Vehicle Design	Julian Happian-Smith	Butterworth-Heinemann	First	2002

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Course Details:

Class	B. Tech, Sem.-VIII
Course Code and Course Title	**0MEPE458, Solar Technology Laboratory**
Prerequisite/s	0MEPC202, 0MEPC210, 0MEPC302
Teaching Scheme: Practical	02
Credits	01
Evaluation Scheme: ISE I / ESE	50/50

Course Objectives:	
01	To apply solar energy concepts for various applications.
02	To compare different solar energy systems.
03	To optimize solar energy systems and its economics.
04	To make students acquainted with energy audit concepts.

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPE458_1	**Measure** solar irradiation selecting proper equipment.**(K^3)**
0MEPE458_2	**Evaluate** performance of flat plate collector and concentrating collector. **(K^4)**
0MEPE458_3	**Evaluate efficiency of standalone solar PV system.**
0MEPE458_4	**Identify and measure** performance parameters of solar PV module. **(S^3)**
0MEPE458_5	**Conduct** energy audit for energy conservation. **(A^3)**

Course Contents:

1. Demonstration of measurement of solar radiation.
2. Performance analysis of flat plate/evacuated tube solar water heating system.
3. Performance analysis of concentrating collectors.
4. Identifying and measuring the parameters of a solar PV module in the field
5. Estimating the effect of Sun tracking on energy generation by solar PV modules
6. Efficiency measurement of standalone solar PV system
7. Energy audit of any one energy consuming/manufacturing industry.

Text Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Solar Energy	Sukhatme S.P	Tata McGraw Hill New Delhi	Third	1996
02	An Introduction to Power Plant Technology	Rai G.D.	Khanna Publishers,	Third	1996
03	Principles of solar	Krieth and	Tata McGraw Hill	Second	1996

	engineering	Krieder	New Delhi		
04	Solar Engineering of Thermal Processes	Duffie John A. and Beckman William A	John Wiley and Sons, Inc.	Second	1991

Reference Books:

Sr. No	Title	Author	Publisher	Edition	Year of Edition
01	Handbook of solar energy, Springer				
02	Energy conservation-related booklets Published by National productivity Council (NPC) & Petroleum Conservation Research Assn.(PCRA).				
03	Solar Energy	Walker Andy	John Willey and sons	First	2013

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Course Details:

Class	B. Tech. Sem-VIII
Course Code and Course Title	**0MEPR459, Project-II**
Prerequisite/s	All Courses
Teaching Scheme: Practical	08
Credits	08
Evaluation Scheme: ISE/ ESE	100/100

Course Objectives: The course aims:	
01	To offer students a glimpse into real world problems and challenges that need a technology based solutions
02	To develop the proficiency in the students for the problem formulation.
03	To prepare the students for effective completion of the project with the observations, discussions, decision making process & use of software's
04	To develop the team building, communication and management skills of the students

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:	
0MEPR459_1	**Estimate** financial management of project by applying the engineering & management principles **(K^4 A^2)**
0MEPR459_2	**Development** of system or processes that meet the specified needs by using advance tools/ techniques/ resources **(K^5 S^3)**
0MEPR459_3	**Compare** theoretical evaluations or simulations with actual experimental results by applying engineering concepts. **(K^5 S^3)**
0MEPR459_4	**Engage** in independent and life-long learning in the project development & management. **(A^3)**
0MEPR459_5	**Function** effectively as an individual or as a team for understanding of the engineering and management principles and apply these to manage projects maintaining professional and ethical principles. **(S^3 A^2)**
0MEPR459_6	**Communicate** effectively on complex engineering activities, write effective reports, design documentation and make effective presentations, **(S^3)**

Course Contents:

- Project-II is a continuation of project-I started in the seventh Sem.
- Project work may consist of fabrication and experimental work or exhaustive analysis of system in the context of 2-3 factors identified while formulating problem by them or supported by industry.
- Project work-II consists of two reviews based on work. In the first review, progress of the project work done is to be assessed and in second review, the complete assessment (quality, quantum and authenticity) of the thesis is to be evaluated.
- Each group has to present the work carried out and analysis results obtained in final project evaluation.
- Students have to prepare final project report under the guidance of the project guide. Project report should consist of assembly and details drawing of product/setup/prototype prepared by using CAD software. It should also include bill of material, all geometrical dimensions, limit, fit and tolerances.

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Project work submitted by students shall include;

1. ***Work Diary***: Work Diary should be maintained by group and countersigned by the guide weekly. The contents of work diary shall reflect the efforts taken by project group for
   a. Summary of literature review. (Attach list of journal or conference papers)
   b. Brief report of feasibility studies carried to implement the conclusion.
   c. Rough Sketches/ Design Calculations/ Testing reports/ Experimentation results.
2. ***Presentation & report***: The group has to make a presentation in front of the faculty members and review panel member at the time of Reviews. There will be two reviews in the semester to evaluate the project One copy of the Project-II report should be submitted to Department, One copy to Guide and one copy should remain with each student of the project group.

Report Format:

Project-II report should be of 50 to 60 pages (typed on A4 size sheets). For standardization of the project-II reports the following format should be strictly followed.

1. Page Size: Trimmed A4
2. Top Margin: 1.00 Inch
3. Bottom Margin: 1.32 Inches
4. Left Margin: 1.5 Inches
5. Right Margin: 1.0 Inch
6. Para Text: Times New Roman 12 Point Font
7. Line Spacing: 1.5 Lines
8. Page Numbers: Right Aligned at Footer. Font 12 Point. Times New Roman
9. Headings: Times New Roman, 14 Point , Bold Face
10. References: References should have the following format

For Papers: Authors, "Title of Paper", " Journal/Conference Details", Year
For Books: Authors, "Title of Book", Publisher, Edition

Important Notes:

- Project group should continue maintaining a diary for project and should write (a) Books referred (b) Company visited (c) Person contacted (d) Computer work done (e) Paper referred (f) Creative thinking.
- The Work diary along with Project Report shall be assessed at the time of ESE examination
- Student should publish their project work by preparing manuscript in peer reviewed journals.

Assessment Tools: Project-II Assessment Rubric, External Oral Examination

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