NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Second Year Engineering

(Mechanical Engineering)

Faculty of Engineering and Technology

COURSE OUTLINE

SEMESTER – III

W.E.F 2013 – 2014

SE Semester - III

Name of the Course	Group	Teaching Scheme				Evaluation Scheme					Credits
		Theory		PR	Total						
		TH Hr/W	Tut Hr/W	PR Hr/W	Total	ISE	ESE	ICA	ESE	Total	
Fluid Mechanics	D	3	1	---	4	20	80	---	---	100	4
Engineering Thermodynamics	B	3	---	---	3	20	80	---	---	100	3
Strength of Materials	D	3	1	---	4	20	80	---	---	100	4
Material Science and Metallurgy	D	3	---	---	3	20	80	---	---	100	3
Manufacturing Engineering -I	D	3	---	---	3	20	80	---	---	100	3
Soft Skills - III	C	1	---	2	3	---	---	50	---	50	2
Engineering thermodynamics-Lab.	B	---	---	2	2	---	---	50	---	50	1
Fluid Mechanics Lab.	D	---	---	2	2	---	---	25	25	50	1
Material Science and Metallurgy Lab.	D	---	---	2	2	---	---	25	25	50	1
Workshop Practice -III	D	---	---	2	2	---	---	25	25	50	1
Total		16	2	10	28	100	400	175	75	750	23

ISE: Internal Sessional Examination **ESE:** End Semester Examination **ICA:** Internal Continuous Assessment

SE Semester - IV

Name of the Course	Group	Teaching Scheme				Evaluation Scheme					Credits
		Theory		PR	Total						
		TH Hr/W	Tut Hr/W	PR Hr/W	Total	ISE	ESE	ICA	ESE	Total	
Engineering Mathemathics -III	A	3	1	---	4	20	80	---	---	100	4
Theory of Machines -I	D	3	---	---	3	20	80	---	---	100	3
Applied Thermodynamics	D	3	1	---	4	20	80	---	---	100	4
Basic Electrical Drives and Controls	D	3	---	---	3	20	80	---	---	100	3
Manufacturing Engineering -II	D	3	---	---	3	20	80	---	---	100	3
Machine Drawing Lab.	B	1	---	2	3	---	---	50	---	50	2
Basic Electrical Drives and Controls Lab.	D	---	---	2	2	---	---	50	---	50	1
Applied Thermodynamics Lab.	D	---	---	2	2	---	---	25	25	50	1
Theory of Machines -I Lab	D	---	---	2	2	---	---	25	25	50	1
Workshop Practice- IV	D	---	---	2	2	---	---	25	25	50	1
Total		16	2	10	28	100	400	175	75	750	23

ISE: Internal Sessional Examination **ESE:** End Semester Examination **ICA:** Internal Continuous Assessment

Course Outline

Fluid Mechanics	**FM**
Course Title:	Short Title Course Code
Branch - Mechanical / Automobile Engineering	**Year – Second Year**

Course Description: This course introduces undergraduate students to Fluid Mechanics. The background required includes a sound knowledge of Mathematics (Calculus), Engineering Mechanics and Physics of first year Level. The course aims at imparting knowledge of Fluid properties and analysis of forces inside the fluid.

Teaching Scheme:

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Lecture	3	14	42	4
Tutorial	1	14	14	

Examination scheme:

End semester exam (ESE)	80 Marks	Duration : 03 hours
Internal Sessional exam (ISE)	20 Marks	

Purpose of Course: Degree Requirement

Prerequisite Course(s): Mathematics (Calculus) and Engineering Mechanics at first year level.

Outline of Content: This course contains:

UNIT-1

1.	Fluid properties & Hydrostatic No. of Lectures – 12, Marks: 16	
	a	Fluid properties & its definitions, definition of fluid, Viscosity, Bulk modulus of elasticity, Vapour pressure, Surface tension, Capillarity, Manometers (No numerical on manometers)
	b	Pascal's law, Hydrostatic law its derivation
	c	Total pressure & Centre of pressure on vertical, horizontal, inclined, curved surface its derivation
	d	Concept Of buoyancy & flotation Meta centre, metacentric height its derivation. Stability, unstability, equilibrium of floating & submerged body

UNIT-2

2.	FLUID KINEMATICS AND DYNAMICS No. of Lectures – 08, Marks: 16	
	a	Types of flow, Definition of steady, Unsteady, Uniform, Non uniform, Laminar, Turbulent, Compressible, incompressible, rotational, Irrotational flow, 1D-2D flows, Stream line, Streak line, Path line, concept of Velocity, potential & stream function flow net (no numerical treatment)
	b	Continuity equation for steady, Unsteady, Uniform, Non uniform, Compressible incompressible,2D Euler's equation, Bernoulli's equation along a stream line for incompressible flow
	c	Practical applications of Bernoulli's equation - Pitot tube, Venturi meter, Orifice meter.

UNIT-3

3.	VISCOUS AND BOUNDARY LAYER FLOW No. of Lectures – 08, Marks: 16	
	a	Introduction to flow of viscous fluid through circular pipes, two parallel plates derivation
	b	kinetic and momentum energy correction factor (only theory no numerical)
	c	Power absorbed in viscous flow, viscous resistance to journal bearing, footstep bearing, collar bearing.
	d	Introduction to boundary layer flow, laminar and turbulent boundary layer, laminar sub layer, boundary layer thickness, displacement thickness, momentum thickness, separation of boundary layer. (No numerical treatment)

UNIT-4

4.	Dimensional analysis and Flow through Pipes **No. of Lectures – 07, Marks: 16**	
	a	Introduction to dimensional analysis, dimensional homogeneity, methods of dimensional analysis- Rayleigh's method, Buckingham's π-theorem, dimensionless numbers. (No numerical treatment)
	b	Loss of energy in pipes, loss of energy due to friction, minor energy losses, concept of HGL and TEL, flow through syphon, flow trough pipes in series or compound pipes, equivalent pipe, parallel pipes, branched pipes.
	c	Power transmission through pipes. Water hammer phenomenon (No numerical on water hammer)

UNIT-5

5.	**CENTRIFUGAL AND RECIPROCATING PUMP** **No. of Lectures – 07, Marks: 16**	
	a	Introduction to main parts of centrifugal pump, working & construction of centrifugal pump, types of impellers, types of casings, priming.
	b	Work done on centrifugal pump, various heads and efficiencies of centrifugal pump, minimum starting speed of a centrifugal pump, multistage centrifugal pump, principles of similarity applied to centrifugal pump.
	d	Specific speed, NPSH, cavitations in pumps.
	e	Introduction to main parts of Reciprocating pump, construction & working of Reciprocating pump, classification of Reciprocating pump, slip of reciprocating pump, air vessels. (No numerical on Reciprocating pump)

References

1. Introduction to Fluid Mechanics and Fluid Machines, S.K. Som and G. Biswas, Tata McGraw Hill Education Publishing Company Limited, 2007.
2. Fluid Mechanics, F.M. White, McGraw-Hill, 2005.
3. Fluid mechanics and Hydraulic machines, Dr. R. K. Bansal , Laxmi Publication, Delhi, 2005
4. Fluid Mechanics and Machines, Kotharduraon and Rudramoorthy, New Age Internationals, 2007
5. Hydraulics And Fluid Mechanics Including Hydraulics Machines, Dr. P.N.Modi , Dr. S.M. Seth, Standard Book House / Rajsons Publications p ltd, Delhi, 2011.
6. Fluid Mechanics, Mohanty A.K., Prentice Hall of India, 2005.
7. Fluid Mechanics, Streeter, Tata McGraw Hill (SI).
8. Fluid Mechanics and Hydraulic Machines, S C Gupta, Pearson Publication.

Course Outline

Engineering Thermodynamics	**ET**	
Course Title	Short Title	Course Code

Mechanical / Automobile Engineering	**Second Year**	**Second**
Branch	Year	Semester

Course Description:

The course aims at imparting knowledge of basic Thermodynamics. The background required includes a sound knowledge of Mathematics (Calculus), Physics and Chemistry at Higher Secondary Level. The objectives of the course are to understand thermodynamics concepts, its laws, and their applications and gas/vapor processes.

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Lecture	3	14	42	3

Examination scheme:

End semester exam (ESE)	80 Marks	Duration : 03 hours
Internal Sessional exam (ISE)	20 Marks	20 Marks

Prerequisite Course(s): Fundamental knowledge of Physics, Chemistry and Engineering Mathematics.

Outline of Content: This course contains:

1	**Introduction to Engineering Thermodynamics No. of Lectures – 9, Marks: 16**	
	a	Scope and applications of thermodynamics, System, surroundings, boundary, control volume, types of system, unit and dimensions.
	b	Macroscopic and Microscopic view point, Thermodynamic Properties, Path function, Point function,
	c	State and Equilibrium, Process, Cycle, Quasi-static process and its significance.
	d	Energy, Flow Energy, Potential energy, Kinetic energy, Heat transfer, sign convention. Numerical.
	e	Work transfer, shaft work, displacement work, power. Numerical.
	f	Zeroth law of thermodynamics, temperature, temperature scales
	g	Numerical on temperature measurement.
	h	Pressure, Absolute and gauge pressure, simple manometer, Bourdon's pressure gauge.
2	**First Law of Thermodynamics No. of Lectures – 8, Marks: 16**	
	a	Joule's experiment, internal energy as a property, 1^{st} law of thermodynamics
	b	First Law applied to closed system undergoing a process/ a cycle, PMM-I
	c	Numerical on application of 1^{st} law to closed system.
	d	Enthalpy and internal energy of an ideal gas, specific heat, Cv and Cp.
	e	Principles of conservation of mass and energy, steady state steady flow process, continuity equation.
	f	Steady flow energy equation (SFEE), applications of SFEE.
	g	Significance of $-\int vdP$, relation between $\int Pdv$ and $-\int vdP$,
	h	Numerical on application of 1^{st} law to steady flow systems.
3	**Second Law of Thermodynamics No. of Lectures – 8, Marks: 16**	
	a	Limitations of First Law, thermal reservoir, heat engine & its efficiency, Refrigerator and Heat pump, Coefficient of Performance.
	b	Statements of second law, Equivalence of statements of second law, PMM-II
	c	Numerical on application of 2^{nd} law.
	d	Reversibility and Irreversibility, Causes of irreversibility, Carnot cycle, Reversed Carnot cycle, their analysis.
	e	Carnot theorem, Absolute temperature scale
	f	Numerical on Carnot cycle, Carnot theorem and temperature scales.
	g	Entropy – Introduction, Law for two isentropic path, Entropy as property,

		Clausius theorem. (No numerical)
	h	Clausius statement, Clausius inequality, Entropy principle
4	**Properties of Ideal Gases** **No. of Lectures – 8, Marks: 16**	
	a	Ideal gas, Laws for an ideal gas, Equation of state, Universal gas constant Characteristic gas constant, Relation between Cp, Cv and R.
	b	Numerical on above syllabus.
	c	Ideal Gas Processes, their presentation on p-v, T-S plane, Analysis for Heat transfer, Work transfer, change in Internal Energy, enthalpy and Entropy – Isobaric, Isochoric and Isothermal processes.
	d	Numerical on above gas processes.
	e	Reversible Adiabatic process, presentation on p-v, T-S plane, Analysis for Heat transfer, Work transfer, and change in Internal Energy, enthalpy and Entropy.
	f	Reversible Polytropic process, presentation on p-v, T-S plane, Analysis for Heat transfer, Work transfer, and change in Internal Energy, enthalpy and Entropy.
	g	Numerical on above gas processes.
	h	Numerical on cyclic gas processes.
5	**Properties of Steam** **No. of Lectures – 8, Marks: 16**	
	a	Pure substance, Phases of pure substances, Phase change diagrams (p-v, p-T, T-s) for water substance at standard atmospheric pressure, sensible heat and latent heat of steam.
	b	Terminology: dry, superheated, wet steam, saturation temperature, critical point and triple point, use of steam table.
	c	Numerical using steam table.
	d	Numerical using Mollier diagram.
	e	Measurement of dryness fraction by using separating and throttling calorimeter. Numerical.
	f	Vapor processes- sketch on P-V, T-S, H-S diagrams, analysis for property changes, heat and work transfer.
	g	Numerical on steam processes
	h	Numerical on steam processes

References:

1	Engineering thermodynamics, P K Nag; Tata McGraw Hill.
2	Thermodynamics, C P Arora;Tata McGraw Hill.
3	Fundamentals of classical thermodynamics, G J Van Wylen, Richard E Sonntag; Wiley.
4	Engineering thermodynamics, Y V C Rao; Universities Press.
5	Engineering thermodynamics, J B Jones and R E Dugan; PHI.
6	Thermodynamics, 6th Edition, Yunus Cengel and M A Boles; Tata McGraw Hill.
7	Basic Engineering Thermodynamics, A. Venkatesh; Universities Press.
8	Basic Thermodynamics" by Dr. Ganesan, Tata McGraw Hill.

Course Outline

Strength of material **SOM**

Course Title: Short Title Course Code

Branch - Mechanical / Automobile Engineering **Year – Second Year**

Course Description: This course introduces undergraduate students to Strength of material. The background required includes a sound knowledge of Mathematics (Calculus), Engineering Mechanics and Physics of first year Level. The course aims at imparting knowledge of strength of materials.

Teaching Scheme:

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Lecture	3	14	42	4
Tutorial	1	14	14	

Examination scheme:

End semester exam (ESE) 80 Marks Duration : 03 hours

Internal Sessional exam (ISE) 20 Marks

Purpose of Course: Degree Requirement

Prerequisite Course(s): Mathematics (Calculus) and Engineering Mechanics at First year level.

Outline of Content: This course contains:

UNIT-1

1.	**Introduction to Strength of material**	**No. of Lectures – 12, Marks: 16**
	a	Concept of stress and strain (linear, lateral, shear and volumetric),Hook's law, Poisson's ra modulus of elasticity, modulus of rigidity, stress-strain diagram for ductile and brittle materials, factor of safety and working stress, concept of 3-D stress state, bulk modulus, in relation Between elastic modulus.
	b	Axial force diagram, stress-strain, deformations in determinate homogeneous and composite bars of following types. 1) Prismatic 2) Linearly varying 3) Stepped section under concentrated loads and self-weights.
	c	Axial stresses and strain in determinate members –axial stress, strain and deformation in following indeterminate, homogeneous and composite bars. 1) Prismatic 2) Linearly varying 3) Stepped section under concentrated loads, self-weights.
	d	Temperature stresses & strain for Prismatic, Linearly varying & composite bars

UNIT-2

2.	**PRINCIPLE STRESSES AND STRAINS**	**No. of Lectures – 08, Marks: 16**
	a	Introduction to Normal and shear stress on any oblique plane, concept of principle plane.
	b	Derivation of expression for principle stresses and planes and plane of max. Shear stress, position of principle plane and plane of max. Shear,
	c	Graphical solution using Mohr's circle of stresses.
	d	Combined effect of shear and bending in beams.
	e	Strain energy and impact-concept of stain energy, derivation and use of expression for deformation of axially loaded members under gradual, sudden and impact loads. Strain energy due to self-weight.

UNIT-3

3.	SHEAR FORCE AND BENDING MOMENT DIAGRAM No. of Lectures – 07, Marks: 16	
	a	Introduction to different types of beams, different types of supports & loads.
	b	Concept and definition of shear force and bending moment in determinant beams due to concentrated loads, UDL, UVL and couple.
	c	Relation between SF, BM and intensity of loading, construction of shear force and bending moment diagram for cantilever, simple and compound beams, defining critical and maximum value and position of point of contra flexure.
	d	Construction of BMD and load diagram from SFD, Construction of load diagram and SFD from BMD.

UNIT-4

4.	BENDING STRESSES No. of Lectures – 07, Marks: 16	
	a	Theory of simple bending, assumptions in bending theory, Derivation of flexural formula
	b	Area center and moment of inertia of common cross section (regular section, T-section, channel section, I-section) with respect to centroidal and parallel axis, bending stress distribution diagram, moment of resistance and section modulus calculations.
	c	Direct and bending stresses in short column with eccentric point loads, concept of core section, middle third rule.
	d	Shear stresses: - Concept, derivation of shear stress distribution formula, shear stress distribution diagram for common cross section, maximum and average shear stresses, shear connection between flange and web.

UNIT-5

5.	TORSION IN CIRCULAR SHAFTS No. of Lectures – 08, Marks: 16	
	a	Stresses, strains and deformations in solid and hollow shafts, homogeneous and composite circular cross-sections subjected to torsion.
	b	Derivation of torsion equation. Stress due to combined torsion, bending and axial force on shafts.
	c	Thin and thick walled pressure vessels: - Stress, strain and deformation in thin wall seamless cylindrical and spherical vessel due to internal fluid pressure, change in volume, constants, effects of additional compressible and incompressible fluid injected under pressure.

REFERENCES

1) Timoshenko, Mechanics of Materials, CBS Publisher &Distributor.
2) Ramamruthum, Strengths of Materials, Dhanpat Rai Publication.
3) Junnarkar & Advi, Mechanics of Structure, Charorar Publication House, ANAND.
4) Bear &Johnson, Mechanics of Materials.
5) Shigley J.E., Mechanical Engineering Design.

Course Outline

Material Science and Metallurgy **MSM**

Course Title Short Title Course Code

Branch - Mechanical / Automobile Engineering **Year – Second Year**

Course Description:

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

Teaching Scheme:

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Lecture	3	14	42	3

Examination scheme:

End semester exam (ESE)	80 Marks	Duration : 03 hours
Internal Sessional exam (ISE)	20 Marks	

Prerequisite Course(s): Fundamental knowledge of Engineering Chemistry and Physics

Outline of Content: This course contains:

1 Nature of Metals and Alloys No of Lect – 8, Marks: 16

a Relationship between Structure-Property-Processing-Performance. Elastic and plastic deformation and its mechanism i.e. slip and twinning.

b Relation of crystal structure with plastic deformation i.e. effects of BCC,FCC or HCP structure on plastic deformation.

c Dislocation theory of slippage, strain hardening.

d Crystal defects and their effects on plastic deformation i.e. description of point, line and surface defects.

e Plastic deformation in polycrystalline metals.

f Cold working- recovery, recrystllisation, grain growth and hot working.

g Strengthening mechanisms in metals - solid solution strengthening, Strain hardening.

h Dispersion and precipitation hardening, phase transformation.

2 Properties of Metals and Testing No of Lect – 8, Marks: 16

a Tension test, engineering and true stress-strain curves, evaluation of properties, ductility, brittleness and toughness.

b Types of engineering stress-strain curve, compression test.

c Hardness testings- Brinell hardness Test, Poldi hardness Test, Rockwell hardness Test , Vickers hardness Test.

d Durometers, microhardness. Relation among the various hardness test and hardness to tensile strength.

e Impact test- charpy and izod impact test.

f Fatigue and creep test.

g Non-destructive test of metals-dye penetrant test, magnetic particle test.

h Ultrasonic testing, radiography and eddy current testing.

3 Ferrous Metals and its Alloys No of Lect – 8, Marks: 16

a Iron, allotropy, cooling curves and volume changes of iron.

b Iron-carbon equilibrium dig., critical temperatures, various phase reactions, solubility of carbon in iron.

c Microstructures of slowly cooled steels.

d Non - equilibrium of cooling of steels.

e Cast Irons- types like gray cast iron, nodular cast iron.

f Austempered cast iron, white cast iron, malleable C .I .

g Effects of various parameters on structure and properties of C.I. like carbon equivalent, cooling rate during eutectic reaction and alloying additions.

h Properties, compositions, applications and specifications of C.I.

4 Heat Treatments No of Lect – 8, Marks: 16

a Introduction and principles of heat treatment of steels, processing heat treatments for steels like full annealing, normalizing, process and stress relief anneal, spheroidization. Heat treatments for non-ferrous metals.

b Strengthening heat treatments for steels, isothermal transformation diagram.

c Tempering of martensite, continuous cooling transformations.

d Jominy test for hardenability and its considerations. Quench media, austempering and martempering.

e Surface hardening of steels- flame, induction , laser and electron beam hardening

f Pack, gas and liquid carburizing, nitriding ionnitriding.

g Heat treatment furnaces and atmospheres, classification of furnaces.

h Heat treatment and energy and controlled atmospheres.

5 Alloy Steels and Advanced Materials No of Lect – 8, Marks: 16

a Alloy steels – Limitation of plain carbon steels, effects of major alloying elements in steels.

b Classification of alloying elements, examples of alloy steels.

c Stainless steels –classification ,heat treatment of stainless steels.

d Tool steels-classification, cold work and hot work tool steels.

e High speed tool steels , heat treatment of high speed tool steel, special purpose tool steels.

f Introduction of Advanced materials- types and properties of composite materials.

g High temperature materials.

h Engineering ceramics.

Reference Books:

1. Degarmo's "Materials and processes in manufacturing", by J.T. Black,Ronald A. Kosher, Willey student edition.
2. "Material Science and Metallurgy for Engineers", by V.D.Kodgire, Everest Publishing House. Pune
3. "Introduction to Engineering Materials", by B. K. Agrawal, Tata Mcgraw Hill, New Delhi.
4. "An Introduction to Physical Metallurgy", by S.H. Avner, Tata Mcgraw Hill, New Delhi.
5. "Fundamentals of modern manufacturing materials, processesand systems" , by Mikell P. Groover, Wiley student edition, New Delhi.
6. "Material Science and Metallurgy", by Parashivamurthy K. I., Pearson Publication
7. "Material Science and Metallurgy", by U. C. Jindal, Pearson Publication
8. "Introduction to Materials Science for Engineers", by James F. Shackleford & Madanapalli K. Muralidhara, Pearson Publication
9. "A textbook of Material Science and Metallurgy", by O. P. Khanna, Dhanpat Rai Publication
10. "Metallurgy", by A.S.Gholap and Dr. M.S. Kulkarni, "Nirali Prakashan.

Course Outline

Manufacturing Engineering-I **ME-I**
Course Title Short Title Course Code

Branch - Mechanical / Automobile Engineering **Year – Second Year**

Course Description:
This course provides the basic knowledge of manufacturing processes. Course includes fundamentals of casting processes, Metal forming processes, Welding and joining processes, Metal removing processes, Powder metallurgy.

Teaching Scheme:

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Lecture	3	14	40	3

Examination scheme:

End semester exam (ESE)	80 Marks	Duration : 03 hours
Internal Sessional exam (ISE)	20 Marks	

Prerequisite Course(s): This course is aimed at introducing the Manufacturing processes to undergraduate students. The background expected familiar with Workshop Practice I & II.

Outline of Content: This course contains:

1	**Fundamental of Casting**		**No. of Lect – 8, Marks: 16**
	a	Introduction to Casting process	
	b	Casting terminology	
	c	Pattern and sand casting	
	d	Solidification and Molten metal problems	
	e	Melting furnaces	
2	**Metal forming processes**		**No. of Lect – 8, Marks: 16**
	a	Introduction to metal forming processes	
	b	Rolling processes	
	c	Forging processes	

	d	Extrusion methods
	e	Drawing processes
3	**Welding and joining processes**	**No. of Lect – 8, Marks: 16**
	a	Introduction to welding and joining processes
	b	Welding joints
	c	Fusion welding
	d	Pressure welding
	e	Riveting, Soldering and brazing
4	**Metal removing processes**	**No. of Lect – 8, Marks: 16**
	a	Introduction to Lathe machine
	b	Lathe Machine operations
	c	Milling machine operations
	d	Drilling operations
	e	Grinding operations
	f	Finishing operations operations
5	**Powder metallurgy**	**No. of Lect – 8, Marks: 16**
	a	Introduction to Powder metallurgy
	b	Powder manufacturing process
	c	Powder testing and evaluation
	d	Powder Metal production
	e	Secondary operations

Reference Books

1. Materials and processes in manufacturing , J T Black, Ronald A. Kosher, De Garmos, , Wiley student edition
2. Manufacturing technology , P. N. Rao , vol-I & II McGrow Hill publications
3. A Textbook of Production Engineering , P. C. Sharma, , S. Chand & Company. Ltd.
4. A Textbook of Production Technology , P. C. Sharma, S. Chand & Company. Ltd.
5. Process and Material of Manufacturing, S. Chand Publication. Roy A Lindberg, prentice Hall of india pvt ltd,
6. Elements of Workshop Technology Volume I&II , Hajara Choudhari, Bose S.K.
7. Manufacturing Technology –S. K. Garg- Fire wall media ltd.

8. Fundamental of modern manufacturing, Mikell P groover, Wiely asia student edition
9. Manufacturing process and system, Phillip C Ostawald, jairo Munoz, wiely India.
10. Manufacturing Technology, D.K. Singh, Pearson New Delhi.
11. Manufacturing process Vol-I, H. S. Shah, Pearson New Delhi.
12. Manufacturing Engineering and Technology, Serope Kalpakjian, Pearson New Delhi.
13. Manufacturing Processes, Serope Kalpakjian, Pearson New Delhi.

Soft Skills – III

COURSE OUTLINE

Course Title	Short Title	Course Code
Soft Skills – III	**SK-III**	

Course Description: Through this course we have tried to prepare the students for the industry. Most companies test mathematical and logical ability through an aptitude test. This subject aims at working on these skills of a student through strategies formulae and practice exercises.

Lecture	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
	1	**14**	**14**	**2**

Prerequisite Course(s): Fundamental knowledge of High School Mathematics.

COURSE CONTENT

Soft Skills – III **Semester-III**

Teaching Scheme **Examination Scheme**

Lecture: 1 hour / week **Internal Continuous Assessment (ICA): 50 Marks**

Unit-I: Arithmetic-1 **No. of Lect. – 3, Marks: 10**

a. Basic Formulae

i. Divisibility Rules
ii. Speed Maths
iii. Remainder Theorem
iv. Different Types of Numbers
v. Applications

b. HCF, LCM and Linear Equations

i. HCF – Successive Division and Prime Factorization Methods

ii. LCM – Successive Division and Prime Factorization Methods
iii. Applications
iv. Linear Equations – Elimination Method
v. Substitution Method
vi. Applications

c. Averages and Mixtures

i. Concept of Average
ii. Faster Ways of Finding It
iii. The Allegation Method
iv. Applications

Unit-II: Arithmetic–II **No of Lect. – 3, Marks: 10**

a. Percentages

i. Concept of Percentage
ii. Working with Percentages
iii. Applications

b. Profit and Loss

i. Difference between Cost and Selling Price
ii. Concept of Profit Percentage and Loss Percentage
iii. Applications

c. Time and Work

i. Basic Time and Work Formula
ii. Relation between Time and Work
iii. Applications

Unit-III: Arithmetic–III **No of Lect. –3, Marks: 10**

a. Permutations and Combinations

i. Sum Rule of Disjoint Counting
ii. Product Rule of Counting
iii. Concept of Factorial

iv. Permutations
v. Linear Permutations
vi. Combinations
vii. Circular Permutations
viii. Applications

b. Probability

i. Definition and Laws of Probability
ii. Mutually Exclusive Events
iii. Independent Events
iv. Equally Likely Events
v. Exhaustive Events
vi. Cards
vii. Dice
viii. Applications

c. Time and Distance

i. Speed
ii. Conversion Factors for Speed
iii. Average Speed
iv. Moving Bodies – Passing, Crossing and Overtaking
v. Relative Speed
vi. Boats and Streams
vii. Applications

Unit-IV: Non-Verbal Reasoning **No of Lect. 2,** **Marks: 10**

a. Analogies

i. Examples
ii. Applications

b. Classification

i. Examples
ii. Applications

c. Sequences

i. Examples
ii. Applications

Unit-V: Analytical Reasoning **No of Lect. – 3, Marks: 10**

a. Analytical Puzzles

i. Classification Puzzles
ii. Ordering Puzzles
iii. Assignment Puzzles
iv. Applications

b. Letter and Number Series

i. Different Types of Letter Series
ii. Different Types of Number Series
iii. Mixed Series

c. Coding and Decoding

i. Letter Coding
ii. Number Coding
iii. Mixed Coding
iv. Odd Man Out
v. Applications

Guide lines for ICA:
ICA will be based on credit tests and assignments submitted by the student in the form of journal.

Reference Books:

1. R. S. Aggarwal, "Quantitative Aptitude", S. Chand Publication, New Delhi, 2012.
2. R. S. Aggarwal, "A Modern Approach to Verbal Reasoning", S. Chand Publication, New Delhi, 2012.
3. R. S. Aggarwal, "A Modern Approach to Non-Verbal Reasoning", S. Chand Publication, New Delhi, 2012.

Lab - Course Outline

Engineering Thermodynamics Lab Course Title	**ET Lab** Short Title & Course Code

Mechanical / Automobile Engineering Branch	**Second Year** Year	**Second** Semester

Course Description:

This lab includes performance and study practical related to Engineering Thermodynamics.

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Laboratory	2	14	28	1
			Total Semester Credits:	1

Evaluation Scheme:

Internal Continuous Assessment (ICA)	50 Marks

Prerequisite Course(s): 11th Physics, 12th Physics

Outline of Content:

This practical contains

Any EIGHT of the following performance practical	
01	**Study and Demonstration of Pressure measuring devices.** Study the principle, construction and working of pressure measurement devices. Demonstrate construction and working of pressure measurement devices practically. Student Activity: Discuss relative merits and demerits of above devices.
02	**Study and Demonstration of Temperature measuring devices.** Study the principle, construction and working of Temperature measuring devices. Demonstrate construction and working of Temperature measuring devices practically. Student Activity: Discuss relative merits and demerits of above devices.
03	**Study and Demonstration of Centrifugal Pump.** Study the principle, construction and working of Centrifugal Pump. Demonstrate construction and working of Centrifugal Pump practically. Student Activity: Discuss application of 1st law to Centrifugal Pump.
04	**Study and Demonstration of Joule's paddle wheel experiment.** Study the Joule's paddle wheel experiment. Demonstrate of Joule's paddle wheel experiment practically. Student Activity: Discuss conclusion of Joule's paddle wheel experiment.
05	**Determination of Dryness fraction using separating throttling calorimeter.** Study the separating throttling calorimeter. Demonstrate of construction, working and determination of dryness fraction using separating throttling calorimeter practically. Student Activity: Discuss merits and demerits of separating throttling calorimeter
06	**Determination and Verification of SFEE for Nozzle.** Study application of SFEE to nozzle. Demonstrate of application of steady flow energy equation to nozzle practically. Student Activity: Verify SFEE using nozzle.
07	**Determination of actual Coefficient of performance of House hold refrigerator.** Study 2nd law of thermodynamics using house hold refrigerator. Demonstrate of application of 2nd law to house hold refrigerator practically. Student Activity: Verify second law using house hold refrigerator.

08	**Numerical Assignment on Unit III (Minimum five Problems)**
09	**Numerical Assignment on Unit IV. (Minimum five Problems)**
10	**Numerical Assignment using steam table/Mollier chart on Unit V. (Minimum five Problems)**

Note: any EIGHT practical from Engineering Thermodynamics Lab shall be conducted during 14 weeks available during semester.

Guide lines for ICA:-
ICA will be based on practical assignments submitted by the student in the form of journal. Evaluation will be based on paper work.

Lab - Course Outline

Fluid Mechanics — Course Title
FM — Short Title & Course Code

Branch - Mechanical / Automobile Engineering
Year – Second Year

Course Description:

This lab includes different fluid mechanics practical's .The course aims at imparting knowledge of Fluid properties and analysis of forces inside the fluid.

Teaching Scheme:

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Laboratory	2	14	28	1

Evaluation Scheme:

Internal Continuous Assessment (ICA)	25 Marks	50 Marks
End Semester exam (ESE) (Practical)	25 Marks	

Prerequisite Course(s): The background required includes a sound knowledge of Mathematics (Calculus), Engineering Mechanics and Physics of first year Level.

Outline of Content: This course contains

1. Experiment on Red wood viscometer
2. Experiment on Reynolds's apparatus
3. Experiment on Bernoulli's theorem
4. Experiment on flow measurement by orifice meter
5. Experiment on flow measurement by venturi meter
6. Experiment on determination of metacentric height of a floating body
7. Trial on centrifugal pumps
8. Experiment on determination of major and minor losses for flow through pipes
9. Study of sharp edged circular orifice / mouthpieces
10. Study of velocity distribution in boundary layer and its thickness.
11. Study of Manometers.

Note: Lab file should contain at list EIGHT experiments from above mentioned list.

ESE (Practical Examination)

• The Practical Examination will comprise of performing the experiment and viva on the Practical's.

Lab - Course Outline

Material Science and metallurgy **MSM LAB**

Course Title Short Title & Course Code

Branch - Mechanical / Automobile Engineering **Year – Second Year**

Course Description:

This lab includes the practicals related to different testing machines. It also includes preparation and study of different microstructures and introduction of furnace.

Teaching Scheme:

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Laboratory	2	14	28	1

Evaluation Scheme:

Internal Continuous Assessment (ICA)	25 Marks
End Semester exam (ESE) ORAL	25 Marks

Prerequisite Course(s): Engineering Chemistry and Engineering Physics

Outline of Content:
This practical contains

S. No.	Group A
1	Tensile test, to compare tensile strength, yield point and ductility of three metallic materials.
2	Brinell or Poldi hardness test on steel, cast iron, brass.
3	Vickers hardness test on steel, cast iron, brass.
4	Rockwell and Rockwell superficial hardness measurement.
5	Izod or Charpy impact test to compare impact values of cast iron and mild steel or alluminium and brass.
6	Erichsen Cupping Test
7	Measurement Non-destructive tests: Dye penetrant test, Magnetic particle testing , ultrasonic testing ,eddy current test.(any two)

S. No.	Group B
8	Micro Specimen Preparation and use of metallurgical microscope
9	Study and drawing microstructure of mild steel, medium carbon, eutectoid steel, hypereutectoid steel .
10	Demonstration of Annealing,Normalising and Hardening of medium carbon steel specimens and measurements of hardness and drawing icrostructures.
11	Jominy Hardenability test.
12	Study and drawing microstructure of white, malleable, gray and ductile cast iron or any four non-ferrous metals.
13	Observe and record the microstructures of heat affected zones of fusion welded joint.

Note: The student should maintain a journal keeping record of <u>any four</u> experiments from <u>group A</u> and <u>group B</u> each.

Guide lines for ESE:-

ESE will be based on practical assignments submitted by the student in the form of journal.

Evaluation will be based on paper work.

Lab - Course Outline

Workshop Practice III **WP-III**

Course Title Short Title & Course Code

Branch - Mechanical / Automobile Engineering **Year – Second Year**

Course Description:

Workshop Practice III covers the basic knowledge and practices on conventional lathe machine in machine shop I (Turning shop), various welding joints and welding processes in welding shop, pattern making practices in carpentry shop and casting practices in foundry shop in order to improve the practical skill of students in different workshops.

Teaching Scheme:

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Laboratory	2	14	28	1

Evaluation Scheme:

Internal Continuous Assessment (ICA)	25 Marks
End Semester exam (ESE) (ORAL)	25 Marks

Prerequisite Course(s): WP-I, WP-II, Engineering Drawing, Engineering Materials.

Outline of Content:

This practical contains

1. **Carpentry shop**

Preparation and manufacturing of solid wooden pattern for foundry shop involving Wood Turing lathe machine.

2. **Foundry Shop**

Mould making Practice: Preparation of mould of above pattern, casting from this mould. Actual weight calculation, yield & casting of item should be performed.

3. **Welding Shop**

One job on welding (fabrication) preparing a component comprising welding joints such as shoe rack, book rack, stands for flower pots, house hold applications, stools etc.(Group of 4 to 5 Students)

4. **Machine shop-I (Turning Shop)**

One job (by each Student) consisting of Turning, Thread Cutting (Internal, External), Facing, Plain turning, Taper turning, Step Turning, chamfering, Grooving, Drilling, boring, Reaming, Knurling etc. operations.

Note:

1. Candidates are required to finish the job to the following limits

   Machine Shop: + 0.5mm or -0.5mm

   CNC Machine: +0.01mm or -0.01mm
2. Workshop book to be submitted comprising of Job drawing, process sheet for a given job along with the sketches of tools used for operations.
3. CNC Programming restricted to class only.

Reference Books:

1. Element of Workshop Technology Volume I and II -Hajara Chaudhary and Bose S.K., Asia Publishing House.

2. Production Technology Volume I and II –P.N.Rao, Tata McGraw Hill Publication.

3. Production Technology- R.K.Jain, Khanna Publications.

4. Production Technology- P.C.Sharma, Khanna Publication.

5. Workshop Technology-Chapman W.A.J., ELBS Publication.

6. Production Technology- HMT, Tata McGraw Hill Publication.

Course Outline

Engineering Mathematics-III **EM-III**
Course Title Short Title Course Code

Course Description:
This course provides the elementary level knowledge of Linear Differential Equations, Transforms, Statistics and Probability Distributions. Course includes solution of n^{th} order linear differential equations, solution of one and two dimensional heat equation, Laplace transform, Fourier transform, and probability distribution and basic of vector differentiation.

	Hours per Week		No. Of Weeks		Total Hours		Semester Credits
Lecture	3		14		40		4
Tutorial	1	1	14	14	14	14	

Examination scheme:

End semester exam (ESE)	80 Marks	Duration : 03 hours
Internal Sessional exam (ISE)	20 Marks	20 Marks

Prerequisite Course(s): Engineering Mathematics-I, Engineering Mathematics-II.

Outline of Content: This course contains:

1.	**Linear Differential Equations No of Lect – 8, Marks: 16**	
	a	Introduction to nth order Linear Differential Equation, Auxiliary Equation, Complimentary Functions
	b	Solution of nth order L.D.E using General Method
	c	Particular Integral using short cut Methods
	d	Solution of 2^{nd} order L.D.E using Variation Parameter Methods
	e	Solution of Cauchy's D.E.
	f	Solution of Legendre's D.E

2.	**Applications of Linear Differential Equations and Partial Differential equations No of Lect – 8, Marks: 16**	
	a	Mathematical Model of mass spring system and its solution
	b	Introduction to One Dimensional Heat Flow equation and its solution using method of separation of variables
	c	Introduction to Two Dimensional Heat Flow equation and its solution using method of separation of variables

3.	**Laplace Transform No of Lect – 8, Marks: 16**	
	a	Definition of Laplace Transform, Existence of Laplace Transform, Laplace Transform of standard Functions.
	b	Theorems and properties of Laplace transform and its use.
	c	Inverse Laplace Transform of standard functions.
	d	Properties of Inverse Laplace Transform and its use.
	e	Laplace Transform of Unit Step Functions.
	f	Solution of Differential equations using Laplace Transform .

4.	**Statistics and Probability distributions** **No of Lect – 8, Marks: 16**	
	a	Introduction to Mean, Mode, Median standard deviation, Variance, Coefficient of Variation.
	b	Moments, Skewness and Kurtosis.
	c	Correlation and Regression.
	d	Introduction to Binomial, Poisson's Distributions
	e	Introduction to Normal Distributions

5.	**Fourier Transform and Vector Differentiation** **No of Lect – 8, Marks: 16**	
	a	Introduction to Fourier Integral theorem Fourier Transforms, Fourier Cosine Transforms, Fourier Sine Transform and their inverse.
	b	Gradient of Scalar point function.
	c	Directional Derivatives of scalar point functions
	d	Divergence and curl of vector field
	e	Solenoidal and Irrotational vecor fields

Reference Books:

1. H.K. Dass - Advanced Engineering Mathematics (S. Chand Publication) New Delhi, 2008.
2. Erwin Kreyszig - Advanced Engineering Mathematics (Wiley Eastern Ltd.) Tenth Edition.
3. B.S. Grewal - Higher Engineering Mathematics, Khanna Publication, Delhi, 42nd Edition,2012.
4. Wylie C.R. & Barrett - Advanced Engineering Mathematics - Mc Graw Hill, 6th Revised edition ,1995.
5. B.V. Raman - Engineering Mathematics - Tata Mc- Graw – Hill, 2007.
6. A Text Book of Engineering Mathematics, By N. P. Bali, Laxmi Publication,2004 .

Course Outline

Theory of Machines-I **TOM-I**

Course Title Short Title Course Code

Branch - Mechanical / Automobile Engineering **Year – Second Year**

Course Description:

This course provides the elementary level knowledge of Theory of Machines. Course includes introduction to kinematics of machines and mechanisms, various methods of velocity and acceleration analysis of plane mechanisms. Friction and friction devices are also included in the syllabus. One unit on belt, rope and chain drives cover the necessary details of these power transmitting devices.

Teaching Scheme:

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Lecture	3	14	42	3

Examination scheme:

End semester exam (ESE)	80 Marks	Duration : 03 hours
Internal Sessional exam (ISE)	20 Marks	

Prerequisite Course(s): Knowledge of vector algebra and Engineering Mechanics.

Outline of Content:

This course contains:

1	**Simple Mechanisms**	**No. of Lectures – 9, Marks: 16**
	a	Introduction, Kinematics, Kinetics, Static & Dynamics, Machine, Kinematic link or element, Type of links, Structure, Difference Between a Machine and a structure, Types of Constrained Motions, Classification of Kinematic Pairs.
	b	Kinematic Chain, Types of Joints in a Chain, Types of Kinematic Chains, Mechanism, Number of Degrees of Freedom for Plane Mechanisms, Application of Kutzbach Criterion to Plane Mechanisms, Grubler's Criterion for Plane Mechanisms.
	c	Inversion of Mechanism, Four Bar Chain or Quadric Cycle Chain, Inversions of Four Bar Chain, Single Slider Crank Chain, Inversions of Single Slider Crank Chain, Double Slider Crank Chain, Inversions of Double Slider Crank Chain(no numerical treatment)
	d	Introduction, Relative & Absolute velocity, Velocity of a point on a link by Instantaneous Centre of Rotation (ICR) method, Properties of ICR, Location of ICRs, Space and Body Centrodes
	e	Kennedy's or Three Centers in Line Theorem, ICR method for different Mechanisms
	f	Relative Velocity Method, Relative Velocity of Two Bodies Moving in Straight Lines, Motion of a Link, Velocity of a Point on a Link by Relative Velocity Method, Velocities in a Four bar mechanism, Slider Crank Mechanism & other inversions, Rubbing Velocity at a Pin Joint, Mechanical Advantage
2	**Acceleration in Mechanisms**	**No. of Lectures – 8, Marks: 16**
	a	Introduction to Linear, Angular, Centripetal, Tangential acceleration, Acceleration Diagram for a Link, Acceleration of a Point on a Link,

		Acceleration in the Four bar Mechanisms
	b	Acceleration in the Slider Crank Mechanism and other inversions
	c	Introduction to Coriolis Component of Acceleration, magnitude and direction, Coriolis Component of Acceleration for different mechanisms
	d	Klien's Construction, different cases of slider crank mechanisms
3	**Inertia Forces in Reciprocating Parts No. of Lectures – 8, Marks: 16**	
	a	Introduction, D-Alembert's Principle, Analytical Method for Velocity and Acceleration, Forces on the Reciprocating Parts of an Engine
	b	Equivalent Dynamical System, Determination of Equivalent Dynamical System of Two Masses by Analytical Method, Correction Couple, Analytical Method for Inertia Torque
	c	Mechanisms with Lower Pairs, Pantograph, Straight Line Mechanism, Approximate Straight Line Motion Mechanisms, Steering Gear Mechanism
	d	Universal or Hooke's Joint, Double Hooke's Joint
4	**Friction No of Lectures – 9, Marks: 16**	
	a	Introduction, Types of Friction, Friction Between Lubricated Surfaces, Limiting Friction, Laws of Solid Friction, Laws of Fluid Friction, Coefficient of Friction, Limiting Angle of Friction, Angle of Repose, Friction of a Body Lying on a Rough Inclined Plane, Efficiency of Inclined Plane
	b	Screw friction, Terminology of screw, Screw Jack, Torque requirements, Efficiency, Friction of a V-thread
	c	Friction in Journal Bearing- Friction Circle, Friction of Pivot and Collar Bearing, Flat Pivot Bearing, Conical Pivot Bearing, Trapezoidal or Truncated Conical Pivot Bearing, Flat Collar Bearing
	d	Friction Clutches, Single Disc or Plate Clutch, Multiple Disc Clutch, Cone Clutch, Centrifugal Clutch
5	**Belt, Rope and Chain Drives No. of Lectures – 8, Marks: 16**	

	a	Introduction, Selection of a Belt Drive, Types of Belt Drives, Types of Belts, Material used for Belts, Types of Flat Belt Drives, Velocity Ratio, Slip of Belt, Creep of Belt
	b	Length of an Open Belt Drive and Cross Belt Drive, Power Transmitted, Ratio of Driving Tensions, Angle of Contact, Centrifugal Tension, Condition For the Transmission of Maximum Power, Initial Tension
	c	V-belt drive, Advantages and Disadvantages, Driving Tensions for V-belt,Rope Drive, Fiber Ropes, Advantages, Sheave for Fiber Ropes, Wire Ropes
	d	Chain Drives, Kinematic of Chain Drive, Classification, Advantages and Disadvantages, Terminology, Chain Speed and Angular Velocity of Sprocket, Length of Chain

Reference Books:

1. Theory of Machines, S. S. Rattan, Tata McGraw Hill, New Delhi.
2. Theory of Mechanisms & Machines, Jagdish Lal, Metropolitan Book Co.
3. Theory of Machines, Longman's Green & Co., London.
4. Theory of Machines, W. G. Green, Blackie & Sons, London
5. Theory of Machines, V.P. Singh, Dhanpat Rai & Co.
6. Theory of Machines and Mechanisms, Shigley, J.E and Uicker, J.J, McGraw-Hill International Book Co.
7. Mechanisms and Machines theory, Rao J.S. and Dukkipati R.V, Wiley Eastern Ltd.
8. The Theory of Machines through solved problems by J.S.Rao. *New age international publishers.*
9. *A text book of Theory of Machines by Dr.R.K.Bansal. Laxmi Publications (P) Ltd.*
10. Theory of Machines by Sadhu Singh, Pearson Publication

Course Outline

Applied Thermodynamics	**AT**
Course Title	Short Title Course Code
Mechanical/Automobile Engineering	**Second Year** **Second**
Branch	Year Semester

Course Description:

This course imparts knowledge of Applied Thermodynamics to undergraduate students. The background required includes a sound knowledge of course in Engineering Thermodynamics and use of Steam tables. The objectives of the course are to understand various real-life applications of basic Thermodynamics including Reciprocating and rotary Air compressors, Boilers, Steam power plant, etc.

Teaching Scheme:

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Lecture	3	14	42	4
Tutorial	1	14	14	

Examination scheme:

End semester exam (ESE)	80 Marks	Duration : 03 hours
Internal Sessional exam (ISE)	20 Marks	20 Marks

Prerequisite Course(s):

Fundamental knowledge of Physics and Engineering Thermodynamics.

Outline of Content: This course contains

1	**Boiler and Boiler Performance**	**No. of Lectures – 8, Marks: 16**
	a	Steam Power Plant layout, Classification and selection of boilers, Stocker fired boiler.
	b	Modern boilers with various fossil fuels, IBR act, Energy conservation opportunities, waste heat recovery boiler.
	c	Boiler performance - Equivalent evaporation, boiler efficiency (direct and indirect Method).
	d	Numerical on boiler performance.
	e	Heat balance for a boiler.
	f	Numerical on boiler Heat balance.
	g	Boiler Draught, Natural & Artificial draught, losses, Condition for maximum discharge through chimney.
	h	Numerical on draught.
2	**Vapor Power Cycle and Steam Condenser**	**No. of Lectures – 8, Marks: 16**
	a	Fundamentals of Vapor Processes, Steam power cycles- Carnot Cycle, Rankine cycle.
	b	Analysis of Rankine cycle for work ratio, efficiency, Power output, specific steam consumption, heat rate. Comparison of Rankine and Carnot cycle.
	c	Numerical on Rankine cycle
	d	Methods to improve Rankine cycle efficiency - Regeneration, Reheating, Co-generation. (Elementary treatment)
	e	Numerical on reheat Rankine cycle, regenerative Rankine cycle.
	f	Condenser, classification of condenser, Necessity of condenser, Vacuum measurement, Condenser efficiency, Vacuum efficiency, Calculation of cooling water required.
	g	Air leakage and its effect on condenser performance, Air extraction pump,

		cooling towers.
	h	Numerical on condenser performance.
3	**Compressible Flow and Steam Nozzle**	**No. of Lectures – 8, Marks: 16**
	a	Compressible fluid flow, Static and Stagnation properties, numerical.
	b	Sonic velocity, Mach number, type of nozzles and diffusers.
	c	One dimensional steady isentropic flow through nozzles and diffusers, Critical pressure ratio, maximum discharge, choked flow.
	d	Numerical on flow through nozzles and diffusers.
	e	Effect of variation in back pressure on nozzle characteristics, Effect of friction and nozzle Efficiency.
	f	Numerical on Effect of friction and nozzle Efficiency.
	g	Super saturated flow, Fanno line, Rayleigh lines (No numerical).
	h	Normal and oblique shock losses. (No numerical)
4	**Reciprocating Air Compressor**	**No. of Lectures – 8, Marks: 16**
	a	Introduction, use of compressed air, terminology used in compressor, Classification of compressors.
	b	Construction and working of single stage compressor, Thermodynamic analysis of reciprocating air compressor without clearance volume, Isothermal Efficiency, Double acting Compressor.
	c	Numerical of reciprocating air compressor without clearance.
	d	Effect of clearance, analysis of reciprocating air compressor with clearance volume, volumetric efficiency, FAD, Actual Indicator diagram.
	e	Numerical of reciprocating air compressor with clearance.
	f	Improvements in volumetric efficiency, multistage compression, Condition for minimum work of compression, Intercooler, after cooler, heat rejected.
	g	Numerical on reciprocating air compressor.
	h	Numerical on reciprocating air compressor.

5	**Rotary air Compressor**	**No. of Lectures – 7, Marks: 16**
	a	Introduction, classification of rotary compressors; construction, working, analysis and application of roots blower.
	b	Construction, working, analysis and application of vane type compressor
	c	Construction, working, analysis and application of screw type compressor
	d	Introduction, classification of fans and blowers, Fan characteristics.
	e	Construction and working of centrifugal fan and axial flow fan.
	f	Numerical only on fan.
	g	Numerical only on fan.

References:

1	Thermodynamics: an Engineering Approach, Y A Cengel and M A Boles, Tata McGraw Hill.
2	Applied Thermodynamics for Engineering Technologists, T. D. Eastop and A. McConkey, Pearson Education India
3	Power Plant Engineering, P K Nag, Tata McGraw Hill.
4	Power Plant Technology, M. M. El-Wakil, Tata McGraw Hill.
5	Thermal Engineering, R K Rajput, Laxmi Publication New Delhi.
6	Steam & Gas Turbines & Power Plant Engineering, R. Yadav, Central Publishing House, Allahabad
7	Engineering Thermodynamics, P.K. Nag, Tata McGraw Hill
8	Course in Thermal Engineering, C. P. Kothandaraman, Domkundwar, Domkundwar S, Dhanpat Rai & Company (P) Limited.

Course Outline

Basic Electrical Drives & Controls **BEDC**

Course Title Short Title Course Code

Branch - Mechanical / Automobile Engineering **Year – Second Year**

Course Description:

This course provides the elementary level knowledge of Basic Electrical Drives & Controls. Course includes introduction to Electric power measurement, Electric Energy measurement, Illumination DC Machines. The course also introduces students to concept of Single phase & three phase transformers & Three Phase Induction Motor, Single phase Induction motors & Synchronous Generator**,** Special purpose machines, Sensors, Robotics, DAS and Relays.

Teaching Scheme:

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Lecture	3	14	42	3

Examination scheme:

End semester exam (ESE)	80 Marks	Duration : 03 hours
Internal Sessional exam (ISE)	20 Marks	

Prerequisite Course(s): Elements of Electrical and Electronics Engineering

.

Outline of Content: This course contains:

1	**Electric power measurement, Electric Energy measurement, Illumination No of Lect – 8, Marks: 16**	
	a	Three phase power measurement by single watt meter method, two Watt meter method, three watt meter method.
	b	Effect of load power factor on wattmeter reading. Measurement of reactive power by one wattmeter method.
	c	Single phase energy meter (construction and working).
	c	Various term related to illumination, types
	d	Requirement of good lighting scheme, special purpose lighting.
2	**DC Machines,Special purpose machines No of Lect – 9, Marks: 16**	
	a	Constructional, Working principle of D.C.generator, Types of D.C. generator EMF Equation of D.C. Generator (Theoretical concept only).
	b	Working principle of D.C.Motor, back EMF, EMF Equation Types of D.C.Motor, and torque equation for D.C.Motor.
	c	Characteristics of Shunt, series, compound motors, methods for speed control of D.C. Shunt and series motor & applications of DC motor.
	d	Explain the necessity of starter and types.
	e	Principle, working and application of stepper motor, servo motor.
3	**Single phase & Three phase transformers & Three Phase Induction Motor No of Lect – 9, Marks: 16**	
	a	Working Principle & Construction of Single phase transformer & derive EMF equation. Efficiency of Transformers & condition for maximum efficiency of Transformer
	b	Types of Transformer connection star / star, delta / delta, star / delta, delta / star connections, V-V and Scott connections.
	c	Constructional features of induction motor and Working principle of three phase induction motor, types
	d	Define slip and derive torque equation , explain torque slip characteristics, power stages
	e	Explain different types of starters and applications of induction motors.

4	**Single phase Induction motors & Synchronous Generator** **No of Lect – 8 Marks: 16**	
	a	Principle of operation, types, and applications.
	b	Constructional features (Salient and Non-salient) of alternators and principle of operation.
	c	Pitch Factor or Chording Factor & Distribution Factor or winding factors, EMF equation.
	d	Alternator on load, concept of synchronous reactance and impedance, Phaser diagram of loaded alternator.
	e	Voltage regulation of alternator by Direct loading method and synchronous impedance method.
5	**Sensors, Robotics,DAS and Relays** **No of Lect – 8, Marks: 16**	
	a	Proximity sensors, Light sensors,
	b	Hall effect sensors, Ultrasonic sensors.
	c	Robotics, Block diagram and operation of Data acquisition system.
	d	Electromechanical control relays, solid state relays, Timing and Latching relays.

References:

1	B L Theraja and A K Theraja, "A Text book of Electrical Technology- Vol-I", S. Chand, 1ST Edition, 2001
2	B L Theraja and A K Theraja, "A Text book of Electrical Technology- Vol-II", S. Chand, 1ST Edition, 2001
3.	Ashfaq Husain, Fundamental of Electrical Engineering,Dhanpat Rai & co.
4	Electrical machines D P Kothari and I J Nagrath, Tata McGraw Hill, Third Edition
5	Electrical Machinery S.K. Bhattacharya TTTI Chandigad
6	Electrical Technology Edward Hughes Pearson Education
7	Art and Science of Utilization of Electrical Energy H Pratap Dhanpat Rai and Co, Third Edition

Course Outline

Manufacturing Engineering-II **ME-II**
Course Title Short Title Course Code

Branch - Mechanical / Automobile Engineering **Year – Second Year**

Course Description:
This course provides the basic knowledge of Advance manufacturing processes. Course includes fundamentals of metal cutting, Design of jigs and fixtures, Sheet metal working, Gear manufacturing and CNC machine, Unconventional machining processes.

Teaching Scheme:

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Lecture	3	14	40	3

Examination scheme:

End semester exam (ESE)	80 Marks	Duration : 03 hours
Internal Sessional exam (ISE)	20 Marks	

Prerequisite Course(s): This course is aimed at introducing the Manufacturing processes to undergraduate students. The background expected familiar with Workshop Practice I & II and Manufacturing Engineering-I.

Outline of Content: This course contains:

1	**Theory of metal cutting**	**No. of Lect – 8, Marks: 16**
	a	Introduction to single point cutting tool
	b	Angle & forces of single point cutting tool
	c	Tool life & Tool wear
	d	Measurement of cutting forces
	e	Cutting power
2	**Design of jigs and fixtures**	**No. of Lect – 8, Marks: 16**
	a	Introduction to jigs and fixtures
	b	Design principle
	c	Clamping
	d	Drill bushes
	e	Fixtures
3	**Sheet metal working**	**No. of Lect – 8, Marks: 16**
	a	Introduction to press tools
	b	Design of dies
	c	Selection of die and presses
4	**Gear manufacturing and CNC machine**	**No. of Lect – 8, Marks: 16**
	a	Introduction to broaching
	b	Gear manufacturing
	c	Introduction to Numerical controls and machine centers
5	**Unconventional machining processes**	**No. of Lect – 8, Marks: 16**
	a	Mechanical Processes
	b	Thermal processes
	c	Electrochemical machining
	d	Electric discharge machining

Reference Books:

1. Workshop technology – Raghuwanshi vol-1 &2, Dhanpatrai , New delhi.
2. Workshop technology – Hajra Choudhary vol-1 &2, Media promoters, Mumbai
3. Plastic technology- W.J. Patton

4. Manufacturing technology (Foundary forming & welding) P. N. Rao, McGraw Hill publications, New Delhi
5. Manufacturing science- Ghosh and Malik
6. P. C. Sharma, A Textbook of Production Engineering by - S. Chand & Company. Ltd.
7. P. C. Sharma, A Textbook of Production Technology by - S. Chand & Company. Ltd.
8. Production Technology- R K Jain, Khanna, publication.
9. Materials and processes in manufacturing , J T Black, Ronald A. Kosher, DeGarmos, Wiley student edition
10. Fundamental of modern manufacturing , Mikell P groover, , Wiely asia student edition
11. Manufacturing process and system , Phillip C Ostawald, jairo Munoz, , wiely india
12. Manufacturing Technology, D.K. Singh, Pearson New Delhi.
13. Manufacturing process Vol-I, H. S. Shah, Pearson New Delhi.
14. Manufacturing Engineering and Technology, Serope Kalpakjian, Pearson New Delhi.
15. Manufacturing Processes, Serope Kalpakjian, Pearson New Delhi.

Course Outline

Machine Drawing — **MD**

Course Title — Short Title & Course Code

Branch - Mechanical Engineering — **Year – Second Year**

Course Description:

This course provides the elementary level knowledge of Machine Drawing. Course includes introduction to machine drawing, dimensioning, elements of production drawing, types of fits, surface roughness, conventional representation of machine components, riveted joints and welded joints. The course also introduces students to study sequences of preparing the assembly drawing and bill of materials.

Teaching Scheme:

	Hours per Week	No. of Weeks	Total Hours
Lecture	1	14	14

Prerequisite Course(s): Knowledge of Engineering Graphics

Outline of Content:

This course contains:

1	**Introduction to Machine Drawing** **No. of Lectures – 1**
	Introduction to Machine Drawing, Types of Machine Drawing, Sheet layout and Sketching - Sheet layout – Sheet sizes, Margin, Border lines, Title block , Scale and Scale drawing , Sketching and its materials.
2	**Dimensioning** **No. of Lectures – 1**
	Dimensioning terms and notations, General rules for dimensioning, placing of dimensions, methods of dimensioning common features such as diameters,radii,position of holes, curved surfaces, key way, taper features, etc.
3	**Assembly Drawing** **No. of Lectures – 3**
	Introduction, Types of Assembly drawing, Accepted norms to be observed for assembly drawing, Sequences of preparing the assembly drawing, Bill of materials.
4	**Elements of Production Drawing** **No of Lectures – 2**
	Introduction to Geometric tolerances and Dimensional tolerances, Representation of Geometric tolerances and Dimensional tolerances on a drawing.
5	**Fits** **No. of Lectures – 2**
	The Indian standard system of limits and fits, Types of fits, Selection of fits, Hole basis system and Shaft basis system.
6	**Surface Roughness** **No. of Lectures – 2**
	Terminology for surface roughness, Machining symbols, Roughness symbols, values, and grades recommended by BIS, Representation of Surface Roughness on drawing.
7	**Conventional Representation of machine Components** **No. of Lectures – 1**
	Screw Threads, springs, Gears, Bearings, etc.
8	**Riveted joints and Welded joints** **No. of Lectures – 2**

	Introduction to Riveting, Forms and proportion of rivet heads, Types of riveted joints, Introduction to welded joints, Representation of welded joints.

Reference Books:

1. Machine Drawing, N. D. Bhatt, Chorotar Publishing House, Anand, India.
2. Mechanical Engineering Design, J. E. Shingle & C. R. Mischke,Tata McGraw Hill Publications, New Delhi.
3. Machine Drawing, N. Sidheswar & Kannaiah, Tata McGraw Hill Publications, New Delhi.
4. Machine Drawing, N. D. Junnarkar, Pearson Education.

Lab Course Outline

Machine Drawing Lab — **MD LAB**

Course Title — Short Title & Course Code

Branch - Mechanical Engineering — **Year – Second Year**

Course Description:

This lab includes drawing sheets related to assembly and details of a machine unit such as couplings, bearings, lathe parts, screw jack, vices, valves, etc. The course also introduces students to study sequences of preparing the assembly drawing and bill of materials.

Teaching Scheme:

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Lecture	2	14	28	2

Examination scheme:

Internal Continuous Assessment (ICA) 50 Marks

Prerequisite Course(s): Knowledge of Engineering Graphics

Outline of Content:

This lab contains

Machine Drawing Lab

Sheet No. 1 and 2- Assembly and details of a machine unit.

This project consisting of a full imperial size sheets each involving assembly drawing with a part list, overall dimensions, and detailed drawing of couplings, bearings, lathe parts, screw jack, vices, valves, etc. manufacturing tolerances, surface finish symbols, and geometric tolerances should be specified so as to make it a working drawing.

Sheet No. 3 and 4- Assembly and details of a machine unit.

This project consisting of a full imperial size sheets each involving assembly drawing with a part list, overall dimensions, and detailed drawing of couplings, bearings, lathe parts, screw jack, vices, valves, etc. manufacturing tolerances, surface finish symbols, and geometric tolerances should be specified so as to make it a working drawing.

Assignment:

It should contain all the machining symbols, tolerances and welding symbols, etc. on A4 size sheet.

Note: All the four sheets and assignment must be completed during 14 weeks available during semester.

Guide lines for ICA:

ICA will be based on four drawing sheets and assignment submitted by the student in the form f journal.

Reference Books:

1. Machine Drawing, N. D. Bhatt, Chorotar Publishing House, Anand, India.
2. Mechanical Engineering Design, J. E. Shingle & C. R. Mischke,Tata McGraw Hill Publications, New Delhi.
3. Machine Drawing, N. Sidheswar & Kannaiah, Tata McGraw Hill Publications, New Delhi.
4. Machine Drawing, N. D. Junnarkar, Pearson Education.

Lab - Course Outline

Basic Electrical Drives & Controls **BEDC LAB**

Course Title Short Title & Course Code

Branch - Mechanical / Automobile Engineering **Year – Second Year**

Course Description:

This lab includes elementary level knowledge of Basic Electrical Drives & Controls by study the practicals.

Teaching Scheme:

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Laboratory	2	14	28	1

Evaluation Scheme:

Internal Continuous Assessment (ICA) 50 Marks

Prerequisite Course(s): Elements of Electrical and Electronics Engineering

Outline of Content:

This practical contains

Basic Electrical Drives & Controls

1) Speed control of DC Shunt motor by armature control and flux control methods.
2) Load test on DC Shunt Motor.
3) Load test on DC Series Motor.
4) Measurement of active power in a three phase balanced inductive load using two wattmeter methods.
5) Regulation of an alternator by synchronous impedance method.
6) Regulation of an alternator by Direct Loading method.
7) Load Test on three Phase Induction Motor
8) Study of D.C. Motor Starters & Three Phase Induction Motor Starter.

Note: All the eight experiments must be completed during 15 weeks available during semester.

Lab - Course Outline

Applied Thermodynamics Lab	**AT LAB**	
Course Title	Short Title & Course Code	
Mechanical/Automobile Engineering	**Second Year**	**Second**
Branch	Year	Semester

Course Description:

This lab includes performance practical and study practical related to Applied Thermodynamics.

Teaching Scheme:

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Laboratory	2	14	28	1

Evaluation Scheme:

Internal Continuous Assessment (ICA)	25 Marks
End Semester exam (ESE) (Oral)	25 Marks

Prerequisite Course(s):

11^{th} standard Physics, 12^{th} standard Physics, Engineering Thermodynamics.

Outline of Content:
This Lab contains

Following **THREE** performance practical	
01	Determination of heating value of a solid / liquid fuel using Bomb Calorimeter.
02	Exhaust gas analysis using Gas Analyzer OR Orsat Apparatus.
03	Determination of Isothermal and Volumetric efficiency of reciprocating air compressor.
Any FIVE of the following study practical	
04	Study of boiler draught.
05	Study of High pressure boiler.
06	Study of Steam condensers and cooling towers.
07	Study of Steam Nozzles and diffusers.
08	Study of Steam Power Plant.
09	Visit to any thermal power plant, prepare a detailed visit report.
10	Evaluation of Boiler efficiency by Direct and Indirect Method (Through Numerical).

Note:

FIVE Compulsory Assignment on **EACH** unit shall be included in the journal. Each assignment should have at least **FIVE** solved numerical. These assignments should be thoroughly conducted over tutorial sessions under teacher guidance.

Guide lines for ESE:-

End Semester Examination (ESE) **(Oral Exam)** will be based on practical and assignment submitted by the student in the form of journal.

Evaluation will be based on paper work.

Lab – Course Outline

Theory of Machines-I	**TOM-I LAB**
Course Title	Short Title & Course Code

Branch - Mechanical / Automobile Engineering **Year – Second Year**

Course Description:

This lab includes drawing sheets related to velocity and acceleration analysis of various mechanisms. Experiments on determination of mass moment of inertia and slip & creep in belt drive are also included. In addition two assignments, one on inversions of mechanisms and one on study of various clutches are also added.

Teaching Scheme:

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Laboratory	2	14	28	1

Evaluation Scheme:

Internal Continuous Assessment (ICA)	25 Marks
End Semester exam (ESE) ORAL	25 Marks

Prerequisite Course(s): Engineering Mathematics, Physics

Outline of Content:

This practical contains

Theory of Machines-I Lab

1. **Drawing sheets on ICR method (2 problems), relative velocity and acceleration method (4 problems) and Klein's construction (2 problems)**
2. **To study the various inversions of kinematic chains. (Assignment)**
3. **To determine slip and creep for a belt-pulley combination.**
4. **To determine mass moment of inertia of compound pendulum.**
5. **To determine mass moment of inertia of rigid body by using bifilar or trifilar suspension method.**
6. **To study the different types of clutches.(Assignment)**

Note: All the six experiments must be completed during 15 weeks available during semester.

Guide lines for ESE:-

ESE will be based on practical assignments submitted by the student in the form of journal. Evaluation will be based on paper work.

Lab - Course Outline

Workshop Practice IV	**WP-IV**
Course Title	Short Title & Course Code
Branch - Mechanical / Automobile Engineering	**Year – Second Year**

Course Description:

Workshop Practice IV covers the basic knowledge and practices on conventional machines like Lathe, Milling, Drilling, Shaper, and Grinding Machines in machine shop II as well as CNC machines like CNC Lathe, CNC Milling in CNC shop along with CNC Job development and programming in order to improve the practical skill of students in different workshops.

Teaching Scheme:

	Hours per Week	No. of Weeks	Total Hours	Semester Credits
Laboratory	2	14	28	1

Evaluation Scheme:

Internal Continuous Assessment (ICA)	25 Marks
End Semester exam (ESE) (Practical)	25 Marks

Prerequisite Course(s): WP-I, WP-II, WP-III, Engineering Drawing, Engineering Materials.

Outline of Content:

This practical contains

1. **Machine shop-II**

One composite job by each student involving different machining operations on Lathe, Milling, Drilling, Shaper, Grinding Machines

2. **CNC Lathe**

One job for programming and manufacturing on CNC lathe machine for each student consisting operations like Turning, Thread Cutting (Internal or External), Facing, Plain turning, Taper turning, Step Turning, Chamfering, Grooving, Drilling etc. operations.

3. **VMC (CNC Milling)**

One job for programming and manufacturing on VMC, CNC Milling machine for each student performing drilling, tapping, milling etc

Note:

4. Candidates are required to finish the job to the following limits

   Machine Shop: + 0.5mm or -0.5mm

   CNC Machine: +0.01mm or -0.01mm

5. Workshop book to be submitted comprising of Job drawing, process sheet for a given job along with the sketches of tools used for operations.
6. CNC Programming restricted to class only.

Guide lines for ESE:-

End Semester Examination (ESE) **(Practical Examination)** will be based on above mention practical list in CNC shop and conventional machine shop which will perform by students during the current semester. The students must be performing the practical in front of the examiner. The workshop instructors will only provide the raw material, tools, and equipments to students and also arrange the set up required for conducting workshop practical in CNC shop and conventional machine shop.

Reference Books:

1. Element of Workshop Technology Volume I and II -Hajara Chaudhary and Bose S.K., Asia Publishing House.

2. Production Technology Volume I and II –P.N.Rao, Tata McGraw Hill Publication.

3. Production Technology- R.K.Jain, Khanna Publications.

4. Production Technology- P.C.Sharma, Khanna Publication.

5. Workshop Technology-Chapman W.A.J., ELBS Publication.

6. Production Technology- HMT, Tata McGraw Hill Publication.