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SHIVAJI UNIVERSITY, KOLHAPUR

A Revised syllabus of

(B.E. Mechanical Engineering)

Structure (Semester III to VIII)

and

Syllabus of

Semester (III and IV)

To be introduced from Academic Year 2014-15

i.e. from June 2014 Onwards

(Subject to the modifications will be made from time to time)

SHIVAJI UNIVERSITY, KOLHAPUR,

Structure of S.E. (MECHANICAL ENGINEERING) **Semester III**

WITH EFFECT FROM THE ACADEMIC YEAR JUNE/JULY 2014-2015

Sr. No.	Course Title	Teaching Scheme				Examination Scheme				
		L	T	P	Total Hrs	TP	TW	OE	POE	Total Marks
1	Engineering Mathematics – III	3	1	-	4	100	25	-	-	125
2	*Electrical Technology	3	-	2	4	100	25	-	-	125
3	Applied Thermodynamics	3	-	2	5	100	25	-	25	150
4	Metallurgy	3	-	2	5	100	25	25	-	150
5	Fluid Mechanics	3	-	2	5	100	25	-	25	150
6	Machine Drawing	-	-	2	2	-	25	-	-	25
7	Computer Graphics	-	-	2	2	-	25	-	-	25
8	*Computer Programming using C++	-	-	2	1	-	25	-	-	25
9	Workshop Practice – III	-	-	2	2	-	25	-	-	25
Total		15	01	14	30	500	225	25	50	800

L: Lecture, T: Tutorial, P: Practical, TP: Theory Paper, TW: Term Work, OE: Oral Exam. , POE: Practical and Oral Exam.

* **Practical's to be conducted alternate weeks. For Electrical Technology And computer Programming C++ Term work assessment consist of 25 marks for each Electrical Technology And computer Programming C++ separately. And combined marks out of 50 obtained by each student should be forwarded to Shivaji University, Kolhapur**

SHIVAJI UNIVERSITY, KOLHAPUR,

Structure of S.E. (MECHANICAL ENGINEERING) **Semester IV**

WITH EFFECT FROM THE ACADEMIC YEAR JUNE/JULY 2014-2015

Sr. No.	Course Title	Teaching Scheme				Examination Scheme				
		L	T	P	Total Hrs.	TP	TW	OE	POE	Total Marks
1	Applied Numerical Methods	3	-	2	5	100	25	-	-	125
2	Analysis of Mechanical Elements	3	-	2	5	100	25	-	-	125
3	Fluid and Turbo Machinery	3	-	2	5	100	25	-	25	150
4	Theory of Machines – I @	3	-	2	5	100	25	-	-	125
5	Machine Tools and Processes	4	-	-	4	100	-	-	-	100
6	Testing and Measurement	-	-	2	2	-	25	25	-	50
7	Computer Aided Drafting	-	-	2	2	-	50	-	-	50
8	Workshop Practice – IV	-	-	2	2	-	25	-	50	75
Total		16	00	14	30	500	200	25	75	800

L: Lecture, T: Tutorial, P: Practical, TP: Theory Paper, TW: Term Work, OE: Oral Exam. , POE: Practical and Oral Exam.

@ Theory paper of 04 (four hour) Durations

Unless mentioned, theory paper examination duration 3 hours

SHIVAJI UNIVERSITY, KOLHAPUR,

Structure of T.E. (MECHANICAL ENGINEERING) **Semester V**

WITH EFFECT FROM THE ACADEMIC YEAR JUNE/JULY 2015-2016

Sr. No.	Course Title	Teaching Scheme				Examination Scheme				
		L	T	P	Total Hrs.	TP	TW	OE	POE	Total Marks
1	Control Engineering	3	-	2	5	100	25	-	-	125
2	Theory of Machine – II	3	-	2	5	100	25	25	-	150
3	Heat and Mass Transfer	3	-	2	5	100	25	-	25	150
4	Machine Design I	3	1	-	4	100	25	-	-	125
5	Manufacturing Engineering @	3	-	2	5	100	25	-	-	125
6	CAD/CAM Laboratory	-	-	2	2	-	25	-	25	50
7	Professional Skill Development	1	-	-	1	-	25	-	-	25
8	Workshop Practice V	-	-	2	2	-	25	-	-	25
9	Mini-project-I	-	-	1	1	-	25	-	-	25
Total		16	01	13	30	500	225	25	50	800

L: Lecture, T: Tutorial, P: Practical, TP: Theory Paper, TW: Term Work, OE: Oral Exam. , POE: Practical and Oral Exam.

@ Theory paper of 04 (four hour) Durations

Unless mentioned, theory paper examination duration 3 hours

SHIVAJI UNIVERSITY, KOLHAPUR,

Structure of T.E. (MECHANICAL ENGINEERING) **Semester VI**

WITH EFFECT FROM THE ACADEMIC YEAR JUNE/JULY 2015-2016

Sr. No.	Course Title	Teaching Scheme				Examination Scheme				
		L	T	P	Total Hrs.	TP	TW	OE	POE	Total Marks
1	Industrial Management and Operation Research	3	1	-	4	100	25	-	-	125
2	Industrial Fluid Power	3	-	2	5	100	25	-	-	125
3	Metrology and Quality Control	3	-	2	5	100	25	25	-	150
4	Machine Design II	3	1	-	4	100	25	25	-	150
5	Internal Combustion Engines	3	-	2	5	100	25	-	25	150
6	Computer Integrated Manufacturing Lab	-	-	2	2	-	25	-	-	25
7	Seminar	-	-	2	2	-	25	-	-	25
8	Workshop Practice – VI	-	-	2	2	-	25	-	-	25
9	Mini-project- II	-	-	1	1	-	25	-	-	25
Total		15	02	13	30	500	225	50	25	800

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SHIVAJI UNIVERSITY, KOLHAPUR,

Structure of B.E. (MECHANICAL ENGINEERING) **Semester VII**

WITH EFFECT FROM THE ACADEMIC YEAR JUNE/JULY 2016-2017

Sr. No.	Course Title	Teaching Scheme				Examination Scheme				
		L	T	P	Total Hrs.	TP	TW	OE	POE	Total Marks
1	Refrigeration and Air Conditioning	3	-	2	5	100	25	-	25	150
2	Mechanical System Design	3	-	2	5	100	25	25	-	150
3	Finite Element Analysis	3	-	2	5	100	25		-	125
4	Elective I	3	-	2	5	100	25	-	-	125
5	Elective II	3	-	2	5	100	25	-	-	125
6	Industrial Training @	-	-	-	0	-	50	-	-	50
7	Project Phase –I	-	-	2	2	-	50	25	-	75
Total		15	00	12	27	500	225	50	25	800

Sr. No.	Elective I	Elective II
1	Experimental Mechanics	Total Quality Management
2	Human and Professional Ethics	Industrial Product Design
3	Automobile Engineering	Advanced FormingProcesses
4	Computational Fluid Dynamics	Design of Thermal Systems
5	Process Equipment Design	Smart Materials
6	Advanced Foundry Processes	Design for Sustainability
7	Introduction to Aircraft Systems	Flexible Manufacturing Systems

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@ Industrial training of minimum two (2) weeks should be done after T.E. (II) in summer vacation and it's assessment will be done in B.E. (I) based on report submitted Work load of the assessment can be assigned to the project seminar guide.

SHIVAJI UNIVERSITY, KOLHAPUR,

Structure of B.E. (MECHANICAL ENGINEERING) **Semester VIII**

WITH EFFECT FROM THE ACADEMIC YEAR JUNE/JULY 2016-2017

Sr. No.	Course Title	Teaching Scheme				Examination Scheme				
		L	T	P	Total Hrs.	TP	TW	OE	POE	Total Marks
1	Mechatronics	3	-	2	5	100	25	25	-	150
2	Energy and Power Engineering	3	-	2	5	100	25	-	-	125
3	Noise and Vibration	3	-	2	5	100	25	25	-	150
4	Elective III	3	-	2	5	100	25	-	-	125
5	Elective IV	3	-	2	5	100	25	-	-	125
6	Project Phase –II	-	-	4	4	-	50	75	-	125
Total		15	00	14	29	500	175	125	00	800

Sr. No.	Elective III	Elective IV
1	Industrial Engineering	Industrial Automation and Robotics
2	Production Management	Cryogenics
3	Fracture Mechanics	Enterprise Resource Planning
4	Reliability Engineering	Micro Electro Mechanical System
5	Advanced I.C. Engine	Advanced Refrigeration
6	Machine Tool Design	Tribology
7	Design of Aircraft Systems	Precision Engineering

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S.E. (MECHANICAL ENGINEERING) **Semester III**

1. ENGINEERING MATHEMATICS – III

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs. per week	**Theory Paper: 100 Marks**
Tutorial: 1 Hr. per week	**Term Work : 25 Marks**

Pre-requisites: Engineering Mathematics-I and Engineering Mathematics-II

Course Objectives:

1. To introduce student about Linear Differential Equations.
2. To study basic concepts of Vector Differential Calculus.
3. To study Properties of Laplace Transform and Transforms of Derivatives and Integral.
4. To study need of Fourier series.
5. To study application of Partial Differential Equations and methods to solve them.

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

1. Understand basic concepts of Linear Differential Equations.
2. Solve Linear Differential Equations with constant coefficients for solving problems in Mechanical engineering fields.
3. Understand Divergence of vector point function and Solenoidal vector fields and Curl of a vector point function and Irrotational.
4. Apply Laplace Transform for solving problems in different engineering fields.
5. Apply fourier series to solve problems related to Mechanical Engineering.
6. Solve Partial Differential Equations related to Mechanical Engineering application.

Unit 1 **[7]**

Linear Differential Equations:

1.1 Linear Differential Equations with constant coefficients Definition, Complementary function and Particular integral (without method of variation of Parameters).

1.2 Homogeneous Linear differential equations.

Unit 2 **[7]**

Applications of Linear Differential Equations with Constant Coefficients:

2.1 The Whirling of Shafts.

2.2 Mass – spring Mechanical system

2.2.1 Free oscillations

2.2.2 Damped Oscillations

2.2.3 Forced oscillations without damping.

Unit 3 **[6]**

Vector Differential Calculus:

3.1 Differentiation of vectors

3.2 Gradient of scalar point function and Directional derivative

3.3 Divergence of vector point function and Solenoidal vector fields.

3.4 Curl of a vector point function and Irrotational.

Unit 4 **[7]**

Laplace Transform:

4.1 Definition, Transforms of elementary functions, Properties of Laplace transform.

4.2 Transforms of derivatives and Integral.

4.3 Inverse Laplace transforms formulae.

4.4 Inverse Laplace transforms by using partial fractions and Convolution theorem.

4.5 Solution of Linear differential equation with constants coefficients by Laplace transforms method.

Unit 5 **[6]**

Fourier Series:

5.1 Definition, Euler's Formulae, Dirchilt's Condition.

5.2 Functions having points of discontinuity

5.3 Change of interval

5.4 Expansion of odd and even periodic functions

5.5 Half range series.

Unit 6 **[7]**

Application of Partial Differential Equations:

6.1 The Wave Equation.

6.1.1 The method of separation of variables.

6.1.2 Fourier Series solution of wave equation.

6.2 One dimensional heat flow equation

6.2.1 The method of separation of variables.

6.2.2 Fourier Series solution of heat equation.

6.3 The Laplace equation in two dimensional heat flow (Steady State).

6.3.1 Solutions of Laplace equations by the Gauss – Siedel iterative method.

Nature of Question paper:

1. There will be two sections carrying 50 marks each.

2. Each section should have three questions having internal option.

TUTORIAL:

1. Tutorial are to be used to get enough practice.
2. In each tutorial make a group of 20 students and for each group minimum 10 problems are to be given on each topic.

TEXT BOOKS:

1. "A Text Book of Applied Mathematics",Vol. I, II and III, J. N. Wartikar and P. N.Wartikar, Vidyarthi Griha Prakashan, Pune.
2. "Higher Engineering Mathematics", Dr. B. S. Grewal ,S. Chand & Company ,40th Edition.
3. "Advanced Engineering Mathematics", H. K. Das, S. Chand Publication, 8th Edition.

REFERENCE BOOKS:

1."Advanced Engineering Mathematics" , Erwin Kreyszig, John Wiley &Sons, Inc. ,9th Edition.

2. "Advanced Engineering Mathematics", Merle C. Potter, OXFORD University Press, 3rd Edition.

S.E. (MECHANICAL ENGINEERING) **Semester III**

2. ELECTRICAL TECHNOLOGY

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs. per week	**Theory Paper: 100 Marks**
Practical: 2 Hrs. per alternate week	**Term work : 25 Marks**

Pre-requisites: Applied Physics

Course Objectives:

1) To understand essential concepts and applications of electrical drives.
2) To understand concept of electrical heating and welding.

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

1) Select the electrical drives for different mechanical processes.
2) Understand concepts of electrical heating and welding.

Unit 1 **[8]**

DC motors:

Construction, Working, Types, Back emf, Speed equation, Torque equation, Speed torque characteristics, Applications, Power losses in d.c. Motors. Need of starter, 3 point starter, 4 point starter, face plate controller. Speed control of D.C. Shunt and series motor (numerical treatment), Thyristorbased speed control for D.C. Motor. Reversal of rotation, Electric braking of shunt and series motor.

Unit 2 **[6]**

Three Phase Induction Motor:

Advantages of induction motor, Construction, Types, Working, Speed equation, Torque equation, Starting torque, Concept of full load torque, Torque speed characteristics, Power stages in motor (Numerical treatment)

Unit 3 **[7]**

Three Phase Induction Motor Control:

Need of starter, Star delta starter, DOL starter, Autotransformer starter, Rotor resistance starter. Speed control methods- Pole changing, Voltage control, VFD (V/f) control, Block schematic of electronic VFD control, Rotor resistance speed control. Reversal of rotation.

Unit 4 **[7]**

Special Purpose Motors:

Features, construction, Working, characteristics, Applications of AC servo motor, DC servo motor, Stepper motor (VR type and PM type). Introduction to BLDC motor and linear induction motor.

Unit 5 **[6]**

Electrical Drives:

Advantages of electrical drives, Types – Individual, group, Multimotordrive.Types of mechanical loads (active, passive), nature of mechanical loads (With respect to speed–torque variation, with respect to duty period), 2 quadrant and 4 quadrant operation of electric machines. Criteria for selection of motors for applications like lathe, Traction, pumps, Conveyors, Lift, etc. Determination of power rating of electric motors for continuous duty – Constant load.

Unit 6 **[6]**

Electric Heating:

Working and construction of - Indirect resistance furnace, Salt bath furnace, Direct arc furnace, Indirect arc furnace, Core type induction furnace, Coreless induction furnace. High frequency eddy current heating.

(Numerical treatment on energy conversion)

TERMWORK:

Minimum six experiments from the following list should be performed.

1. Speed control of d.c. shunt motor by flux control method.
2. Speed control of d.c. shunt motor by armature voltage control.
3. Reversal of rotation of d.c. motor.
4. Load test on d.c. shunt motor.
5. Study of d.c. motor starters.
6. Speed control of 3 phase induction motor
7. Load test on 3 phase induction motor.
8. Reversal of rotation of 3 phase induction motor
9. Study of 3 phase induction motor starter

Self Learning Activity:

1. Study of electric traction system
2. Industrial visit for study of electric furnace.
3. Energy calculations for electric furnace.
4. Study of servo motor control
5. Study of stepper motor control.

TEXT BOOKS:

1. "Text book of Electrical Technology", Vol-II ,B. L. Theraja, S. Chand publication, 1st Edition.

REFERENCE BOOKS:

1. "Electrical Power",S. L. Uppal, DBS Publ.
2. "Utilization of Electric Power", R. K. Rajput, Laxmi publication (p) Ltd., 4th Edition, 2007.
3. "Electrical Technology", U. A. Bakshi , Technical Publication Pune,4th Edition , 2009.

Guidelines to Paper setters:

The question paper will consist of 6 questions with one question per unit.

S.E. (MECHANICAL ENGINEERING) **Semester III**

3. APPLIED THERMODYNAMICS

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs. per week	**Theory Paper: 100 Marks**
Practical: 2 Hrs. per week	**Term Work: 25 Marks**
	Practical and Oral Exam: 25 Marks

Pre-requisites: Applied Physics, Applied Chemistry

Course Objectives:

1. To introduce student about basic physics and chemistry behind thermodynamics.
2. To study basic concepts of thermodynamics and its applications.
3. To study physical significance of entropy term and its application.
4. To study application of first and second law of thermodynamics to various thermodynamic devices like Steam generator, Condenser, Nozzles andTurbines.
5. To study different types of turbines and corresponding velocity diagrams.

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

1. Understand basic concepts of physics and chemistry behind thermodynamics
2. Solveintroductory problems onRankine cycle.
3. Understand functioning of steam generators and condensers.
4. Design the steam nozzle.
5. Understand basic concepts of Impulse turbine.
6. Understand basic concepts of Reaction turbine, Governing and trouble shooting of turbine.

Unit 1 **[8]**

Review of Laws of Thermodynamics:

Zeroth law, first law and Second law of thermodynamics, Statement of third law of thermodynamics. Equivalence andCorrolories of Second Law, Numerical treatment on first and second law, Clausius theorem, Entropy, Clausius inequality, Entropy as a property of system, Entropy of pure substance. T-s and h-s planes, Entropy change in a reversible and irreversible processes, Increase of entropy principle, Calculation of entropy changes of gases and vapours,(numerical treatment should be based on processes) Availability: Available and unavailable energy: availability of a closed and open system, Availability of work and heat reservoirs, Anergy, energy and exergy,(No numerical on Availability)

Unit 2 **[6]**

Properties of Pure Substances and Vapour Power Cycles:

Properties of steam, Use of steam table and Mollier chart, Deviation of real gases from Ideal gases, Equations of state- Vander Waal, Beattie-Bridgemen, VirialandDiterici'sequations, P-V-T surfaces and triple point of water.(Descriptive treatment) Carnot cycle using steam, Limitations of Carnot cycle Rankine cycle, Representation on T-s and h-s planes, Thermal efficiency, Specific steam consumption.

Work ratio, Effect of steam supply pressure and temperature, Condenser pressure on the performance. (Numerical Treatment), Reheat and regenerative steam power cycles.

Unit 3 **[6]**

Steam Generators and Steam Condensers:

Study and classification of Boilers, Thermal efficiency of Boiler (Theoretical and Actual), Functions, Elements of condensing plant, Types of steam condensers, surface and jet condensers, Comparison, Vacuum efficiency, Condenser efficiency, Loss of vacuum, Sources of air leakages, Methods of leak detection, Air extraction methods, Estimation of cooling water required, Capacity of air extraction pump, Air ejectors.

Unit 4 **[5]**

Steam Nozzles:

Functions, Shapes, Critical pressure ratio, Maximum discharge condition, Effect of faction, Design of throat and exit areas, Nozzle efficiency, Velocity coefficient, Coefficient of discharge, Supersaturated flow, Degree of under-cooling and degree of super saturation, Effects of super saturation.

Unit 5 **[8]**

Impulse Turbines:

Principles of operation, Classification, Impulse and reaction steam turbine, compounding of steam turbines. Flow through impulse turbine blades, Velocity diagrams, Work done, Efficiencies, End thrust, Blade friction, Influence of ratio of blade speed to steam speed on efficiency of single and multistage turbines and its condition curve and reheat factors.

Unit 5 **[7]**

Reaction Turbines:

Flow through impulse reaction blades, Velocity diagram, and degree of reaction, Parson's reaction turbine, Back pressure and pass out turbine. Governing of steam turbines.Losses in steam turbines, Performance of steam turbines. Function of diaphragm, Glands, Turbine troubles like Erosion, Corrosion, Vibration, Fouling etc.

TERM WORK

1. Study and Demonstration of water tube and fire tube boilers.

2. Study and Demonstration of boiler mountings,Accessories and steam calorimeters

3. Study and Demonstration of condenser and study of cooling towers

4. Significance and relevance of lubrication properties and systems

5. Test on Grease penetrometer and dropping point apparatus

6. Test on Carbon residue, Cloud and Pour point apparatus.

7. Test on Red wood viscometer and Aniline point apparatus.

8. Determination of flash and fire point of a lubricating oil

9. Study / Trial on steam power plant

10. Report on industrial visit to a steam power plant

Instructions for practical examination

1. Four to five experiments shall be selected for practical examination.

2. The number of students for each practical set up would not be more than four students.

TEXT BOOKS:

1. "Thermal Engineering", Kumar and Vasandani,D. S . Publisher Metropolitan Book Co, Delhi, 3rd Edition.
2. "Thermal Engineering", Mathur and Mehta, Jain Bros. Publishers,Delhi,3rd Edition.
3. "Thermal Engineering", Ballaney P.L, Khanna Publishers, New Delhi, 27th Edition.
4. "Engineering Thermodynamics",P.K. Nag., Tata McGraw Hill, New Delhi, 4th Edition.
5. "Engineering Thermodynamics", D.P.Mishra, Cengage learning, 1st Edition
6. "Principles of Engineering Thermodynamics", Moran,Shapiro,Boetnner, Wiley, 8thEdition
7. "Engineering Thermodynamics", Gupta andPrakash, Nemichandand Sons, 2nd edition.
8. "Thermal Engineering",R. K. Rajput, Laxmi Publications, 3rd Edition.
9. "Steam and Gas Turbines",R. Yadav, CPH Allahabad, 2nd Edition , 2005.
10. "Thermal Engineering", M.M Rathod, Tata McGraw Hill Education Pvt.Ltd, 1stEdition , 2010

REFERENCE BOOKS:

1. "Fundamentals of Thermodynamics", Claus Borgnakke, Sonntag R. E., John Wiley and Sons.
2. "Thermodynamics",Holman, , McGraw Hill, London.
3. "Principles of Engineering Thermodynamics", Moran,Shapiro,Boetnner, Wiley, 8th Edition.
4. "Thermodynamics: an Engineering Approach",Cengel and Boles, Tata McGraw-Hill, New Delhi ,3rd Edition,.
5. "Applied Themodynamics", Estop Mcconkey ,Pearson Education, 5th Edition
6. "Engineering Thermodynamics" G.Rogers Yon Mayhew, Pearson Education, 4th Edition.
7. "Fundamentals of Thermodynamics", R.E.Sonntag,C. Borgnakke, V. Wylen, Wiely India Pvt.Ltd, 6th Edition

S.E. (MECHANICAL ENGINEERING) **Semester III**

4. METALLURGY

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs. per week	**Theory Paper: 100 Marks**
Practical: 2 Hrs. per week	**Term Work: 25 Marks**
	Oral Exam: 25 Marks

Pre-requisites: Applied Physics, Applied Chemistry

Course Objectives:

1. To acquaint students with the basic concepts of Metal Structure
2. To impart fundamental knowledge of Ferrous and Non Ferrous Metal Processing
3. To study applications of different Metals and Alloys
4. To Know Fundamentals of Metallography
5. To develop futuristic insight into Metals

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

1. Understand basic concept of metal structure.
2. Understand fundamental knowledge of Ferrous and Non Ferrous Metal.
3. Selection of Metals and Alloys for different application.
4. Understand need of Heat treatment and various heat treatment processes.

Unit 1 **[7]**

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

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.

Unit 2 **[11]**

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, 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 lowexpansion and controlled expansion alloys.

Unit 3 **[4]**

Principles of Mechanical Testing:

a) Destructive Testing methods:Tensile, Compressive, Impact, Fatigue, Creep, Hardness (Rockwell, Brinell and Vickers)
b) Non- Destructive Testing:Dye Penetrant, Magnetic, Ultrasonic, Radiography, Eddy Current testing.

Unit 4 **[5]**

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.

Unit 5 **[9]**

Heat Treatment Processes:

a) Heat Treatment of Steels
I. Annealing – Types-Full, Partial and Sub critical annealing (Various types) and purposes
II. Normalising- Purposes
III. 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.
IV. Tempering Types, Structural transformations during tempering, purposes
sub zero treatment
V. Surface hardening - Flame and Induction
VI. Chemical heat treatments for case hardening - Carburising, Nitriding, Cyniding, Carbonitriding
b) Heat treatment of Non ferrous Alloys
I. Annealing- Stress relief, Recrystallization and Process annealing
II. Precipitation hardening - Basic requirements, Stages, Common alloys, Variables,theories
c) Heat treatment defects and remedies.

Unit 6 **[4]**

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 extrussion
e) Sintering- Types liquid stage and solid stage sintering
f) Finishing operations: Sizing, Machining, Infiltration and Impregnation

g) Flowcharts for – Self-lubricating bearings, Electrical Contacts, Carbide Tipped Tools, Sintered aluminum products, Filters.

TERM WORK:

1. Tensile testing of M.S. and C.I.
2) Hardness testing (Rockwell and Brinell)
3) Impact testing(Izod and Charpy) of M.S, Brass and Al Alloy.
4) Demonstration of N.D.T. (Minimum two of different NDT tests)
5) Macroscopic Examinations Spark Test.
6) Examination of microstructure of steels and Cast Irons.
7) Examination of microstructure of Non ferrousalloys(Brass, Duralimin, Babbit)
8) Heat treatment of steels (Annealing, Normalizing, Hardening on medium/ high carbon steels
9) Jominy end - quench test for hardenability
10) Observation of various industrial heat treatments processes during industrial visits.
11) Any five assignments on above units are to be included in journal.

TEXT BOOKS:

1. "Introduction to physical metallurgy", S.H.Avner, Mcgraw Hill Book Company Inc, Edition, 2nd , 1974.
2. "Physical metallurgy", Vijendrasingh, Standard Publishers delhi
3. "Material science and engineering",W.D Callister, Wiley India Pvt.Ltd., 5th Edition.
4. "Material science and metallurgy for engineers", V.D.Kodgire, Everest Publishers Pune,12th Edition.
5. "Heat Treatments Principles and Practices", T.V. Rajan / C.P. Sharma, Prentice Hall of India Pvt Ltd, New Delhi,
6. "Material Science and Engineering",V Raghwan., Prentice Hall of India Pvt. Ltd., New Delhi ,3rd Edition, 1995.

RFERENCE BOOKS:

1. "Engineering Metallurgy", R.A. Higgins, Viva Books Pvt. Ltd., New Delhi, 1st Edition ,1998
2. "Physical Metallurgy for Engineers ", D.S.Clark, W. R. Varney, AN East West Press Pvt. Ltd. , New Delhi, 2nd Edition,1962
3. "Heat Treatment of Metals", J L Smith and SC Bhatia , CBS Publisheres and distibutors, New delhi, 1st edition, 2008.

S.E. (MECHANICAL ENGINEERING) **Semester III**

5. FLUID MECHANICS

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs. per week	**Theory Paper: 100 Marks**
Practical: 2 Hrs. per week	**Term Work: 25 Marks**
	Practical and Oral Exam: 25 Marks

Pre-requisites: Applied Physics, Applied Chemistry

Course Objectives:

1. To identify various properties of fluids and their SI units.
2. To state and illustrate fundamentals of Fluid Statics, Kinematics and Dynamics.
3. To identify and explain the fluid properties and concepts of Boundary layer, Drag and Lift force
4. To study the use of Bernoulli's Equation for various applications.
5. To understand the physics of fluid flow and its applications.
6. To get conversant with Internal, External flows and it's applications.

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

1. Understand properties of fluids and classification of flows
2. Formulate and solve equations of the control volume for fluid flow systems
3. Calculate resistance to flow of incompressible fluids through closed conduits and over surfaces
4. Apply fundamentals of compressible fluid flows to relevant systems

Unit 1 **[7]**

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 centre, Condition of Equilibrium of floating and submerged bodies (No Numerical Treatment on fluid Statics)

Unit 2 **[6]**

Fluid Kinematics:

Eulerian and Langragian approach of fluid flow, Flow visualization, Total or material derivative for velocity field, 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, Stream function and velocity potential function.

Unit 3 **[8]**

Fluid Dynamics:

Equation of motion.Integration of Euler's equation as energy equation.Energy correction factor, concept of HGL and THL or TEL, Steady flow through orifice.Orificemeter, Time required to empty the tank through an orifice at its bottom, Venturimeter, Flow over triangular and rectangular notches, Pitot tube. Derivation of momentum equation, momentum correction factor.Applications of momentum equation.

Unit 4 **[7]**

Laminar Flow and Pipe Flow:

A) Laminar Flow: Laminar flow through circular pipes. Laminar flow through parallel plates, Introduction to NavierStoke's equation and its applications

B) Pipe Flow: Energy losses in transition, expansion and contraction (Darcy's and Chezy's equation), Parallel pipe, Siphon pipes, Branching pipes and equivalent pipes, Moody's Diagram.

Unit 5 **[6]**

Boundary Layer Theory and Dimensional Analysis, Similitude

A) Boundary Layer Theory: Boundary layer thickness, its characteristics, laminar and turbulent boundary layers, separation, boundary layer control

B) Dimensional Analysis, Similitude: Dimensionallyhomogeneous equations, Buckingham's Pi-theorem, Calculation of dimensionless parameters. Similitude, complete similarity, Model Scales.

Unit 6 **[6]**

Forces On Immersed Bodies and Compressible Flow

A) **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.

B) Compressible Flow: Propagation of elastic waves, Mach Cone and Mach number. Energy equation of compressible flows. Stagnation pressure, Temperature and density.

TERM WORK

The term work shall consist of the report on any ten experiments from the following:

1.Study and demonstration of Pressure Measuring Devices
2.Flow visualization by plotting of streamline (Heleshaw's apparatus).
3.Reynolds experiment.
4.Verification of Bernoulli's equation.
5.Calibration of venturimeter/Orifice-meter
6.Calibration of notches.
7.Orifice under steady and unsteady flow condition
8.Determination of velocity profile through circular pipes for laminar flow.
9.Determination of minor losses in pips-fittings
10. Determination of coefficient of friction in pipes of different materials.
11. Determination of loss of friction in series/parallel pipes.
12. Demonstration or trial on wind tunnel for measurement of lift and drag on any model.
13. Demonstration on fluid flow by using CFD tools.

TEXT BOOKS:

1. "Fluid Mechanics", K. L. Kumar, S. Chand Publication. New Delhi,2nd Edition , 2000
2. "Theory and Applications of machines", K. Subramanya, , Tata McGraw Hill Publication,1993
3. "Fluid Mechanics", R. K. Bansal, Laxmi publications. New Delhi, 1998.
4. "Fluid Mechanics and Hydraulic Machines", Ramamrutham,.
5. "Fluid mechanics and Hydraulic Machines", Modi and Seth,.
6. "Fluid mechanics and Hydraulic Machinery", R. K Rajput, Laxmi publishers.
7. "Fluid Mechanics", J.F.Douglas, J.M.Gasiorek,J.A.Swaffied, Pearson Education, 4th Eddition.

REFERENCE BOOKS:

1. "Fluid Mechanics", V. L. Streeter and E. B. Wylie, Tata McGraw Hill Pvt Ltd. New Delhi ,2nd Edition , 1997
2. "Introduction to Fluid Mechanics", Edward J. Shaughnessy, Oxford University press
3. "Mechanics of Fluid", Merle C. Potter, Prentis Hall of India,New Delhi ,2nd Edtion .
4. "Fluid Mechanics",Fox and McDonald, John Wiley and Sons, New York , 8th Edition.
5. "Fluid Mechanics", Fraizini, Tata McGraw-Hill, New Delhi, 4th Edition.
6. "Fluid Mechanics", White, Tata McGraw-Hill, New Delhi., 4th Edition
7. "Fluid Mechanics –Fundamentals and Application", Y.A.Cengel, J.M.Cimbala, TMI,
8. "Fundamentals of Fluid Mechanics", B.R. Munson,D.F. Young, T.H.Okiishi Wiley India Pvt.Ltd.
9. "Fluid Mechanics and Machinery",C.S. Ojha, , Oxford University Press.

S.E. (MECHANICAL ENGINEERING) **Semester III**

6. MACHINE DRAWING

Teaching Scheme:	**Examination Scheme:**
Practical: 2 Hrs. per week	**Term Work: 25 Marks**

Pre-requisites: Engineering Graphics

Course Objectives:

1. To study BIS conventions used in machine drawing
2. To find the line/curve of intersection between two solids
3. To study the function of various machine components
4. To study the use of production drawings
5. To study assembly and detail drawings

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

1. Use BIS conventions in machine drawings
2. Find line/curve of intersection between two solids
3. Sketch the various machine components
4. Read and interpret the given production drawings
5. Understand significance of assembly and detail drawings.

Unit 1

Study of B.I.S. (Bureau of Indian Standards) Conventions:

Significance and importance of BIS Conventions, Drawings sheet sizes and layout recommended by BIS. Conventional representation of engineering materials, BIS conventions for sectioning, Types of threads profiles, Internal and external threads, Types of springs, Types gears and gearings, Conventional representation of common features (Splined shaft, Serrated shaft, Knurling, Bearings etc.). BIS methods of Linear- and angular dimensioning. Symbolic representation of welds as per BIS for representation of above conventions.

Unit 2

Interpenetration of Solids:

Introduction, interpenetration of Prism with Prism, Prism with cylinder, Prism with cone, prism with pyramid. (Prisms and Pyramids limited uptoRectangular base), Cylinder with Cylinder, Cone with Cylinder.

Unit 3

Sketching of Machine Component:
Importance of sketching and entering proportionate dimensions on sketches. Sketches of nut, Bolts square and Hexagonal Flanged nuts, Lock nuts, Dome nut, Capstan nut, Wing nut, Castle nut, Split pin, Square headed bolt, Cup headed bolt, T-headed bolt, Types of foundation bolts, Stud, Washer, Set screws, Cap screws. Various types of rivets and

riveted joints, Various types of keys, Socket and spigot (Cotter joint) , Knuckle (pin) joint, Muff coupling, Protected and unprotected Flanged, Coupling, Universal coupling, solid and bush bearing. Plummer block (pedestal bearing), Foot step bearing. Flat and V-belt pulleys, Fast and loose pulleys, speed cone pulleys, Pipe joint for C.I. Flanged, socket and spigot type pipe joint. Union pipe joint and standard pipe-fittings. Students should know the applications of above machine components.

Unit 4

Auxiliary Projection:

Projection on auxiliary vertical and horizontal plane, Auxiliary projection of simple machine components.

Unit 5

Limits, Fits and Tolerances:

Significance of system of limits and fits. Definitions, Types, Recommendations and selections, Tolerances of form and position, surface finish symbols as per BIS, Selection and entering of all these symbols with reference to details and assembly drawings, Tolerancing an individual dimensions of details drawing.

Unit 6

Details and Assembly Drawing:

To prepare detail drawings from given assembly drawing. To prepare assembly drawing from given drawing of details. The number of parts is limited to ten to twelve.

Preparation of detail and assembly drawing from the following details such as:

-Machine tool parts : Tool post, Tailstock, Machine vice, Chucks etc.

-Engine parts: Stuffing box, Crosshead assembly, Piston and connecting rod, etc.

-Miscellaneous parts: Valve assembly, Screw jack, Jigs and fixtures, Pipe vice etc.

Assembly selected should include different types of sections.

TERM WORK:

Sheet No. 1: Sheet Based on BIS conventions

Sheet No. 2: Sketching (Free hand drawing) of various machine components.

Sheet No. 3: Sheet Based on limits, Fits and tolerances (Production Drawing)

Sheet No. 4: To draw details drawing from given assembly.

Sheet No. 5: To draw details and assembly drawing by taking actual measurements and entering Limits, Fits, Tolerances, Surface Finish symbols, Geometrical requirements etc.

Sheet No. 6: Sheet based on auxiliary projection

Sheet No.7: Sheet based on interpenetration of solids.

Note: Use first angle of projection method only.

TEXT BOOKS:

1. P.S. Gill, Machine Drawing., S.K. Kataria and Sons , Delhi, 7th Edition,2008

2. N. D. Bhatt,. Machine Drawing. Charotor Publication House, Bombay, 42th Edition , 2007

3. N. Sidheshwar . P. Kannaiah and V.V. S. Sastry. Machine Drawing, Tata McGraw Hill, New Delhi.

4. R.K. Dhavan, Machine Drawing, S. Chand and Company, 1st Edition, 1996.

5."Production Drawing", Narayana, Kannaiah and Venkata Reddv,New Age International.2nd Edition, 2002.

6. "Machine Drawing", N.D.Junnarkar,Print Pearson Education, 1st Edition.

REFERENCE BOOKS:

1.IS: SP46- Engineering Drawing Practice for Schools and Colleges, B.I.S. Publications.
2.IS: 696- Code of Practice for General Engineering Drawings B.I.S. Publications.
3.IS : 2709-Guide for Selection of Fits, B.I.S. Publications.
4.IS:919- Recommendation for Limits and Fits for Engineering, B.I.S. Publications
5.IS: 8000- Part I, II. III. TV, Geometrical Tolerencingof Technical Drawings -- B.I.S. Publications.
6."Engineering Drawing, with an Introduction to AutoCAD", DhananjayA.Jolhe, Tata McGraw Hill ,2010

S.E. (MECHANICAL ENGINEERING) **Semester III**

7. COMPUTER GRAPHICS

Teaching Scheme:	**Examination Scheme:**
Practical: 2 Hrs. per week	**Term Work: 25 Marks**

Pre-requisites: Engineering Graphics

Course Objectives:

1. To introduce student about computer graphics leading to the ability to understand contemporary terminology, Progress, Issues, and trends.
2. To study basic concepts of computer graphics techniques, focusing on 3D modeling, Image synthesis, and rendering.
3. To study physical significance of Curves and Surfaces.
4. To study need for hidden surface removal.

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

1. Understand basic concepts of computer graphics.
2. Understand graphic devices.
3. Understand importance of Curves and Surfaces.
4. Do three dimensional transformations.

Unit 1

Basics of Computer Graphics: -

Introduction, What is computer Graphics? Area of Computer Graphics, Designand Drawing, Animation Multimedia applications, Simulation, How are picturesactually stored and displayed, Difficulties for displaying pictures.

a. Graphic Devices

Cathode Ray Tube, Quality of Phosphors, CRTs for Color Display, BeamPenetration CRT, The Shadow - Mask CRT, Direct View Storage Tube, Tablets,The light Pen, Three Dimensional Devices.

Unit 2

C Graphics Basics

Graphics programming, Initializing the graphics, C Graphical functions, simpleprograms

a. Simple Line Drawing Methods

Point Plotting Techniques, Qualities of good line drawing algorithms, TheDigital Differential Analyzer (DDA), Bresenham's Algorithm, Generation ofCircles.

Unit 3

Two Dimensional Transformations and Clipping and Windowing

What is transformation?, Matrix representation of points, Basic transformation,Need for Clipping and Windowing, Line Clipping Algorithms, The midpointsubdivision Method, Other Clipping Methods, Sutherland – HodgemanAlgorithm, Viewing Transformations

a. Graphical Input Techniques

Graphical Input Techniques, Positioning Techniques, Positional Constraints,Rubber band Techniques.

Unit 4

Event Handling And Input Functions

Introduction, Polling, Event queue, Functions for handling events, Polling taskdesign, Input functions, Dragging and fixing, Hit detection, OCR.

a. Three Dimensional Graphics

Need for 3-Dimensional Imaging, Techniques for 3-Dimesional displaying,Parallel Projections, Perspective projection, Intensity cues, Stereoscope effect,Kinetic depth effect, Shading.

Unit 5

a. Curves and Surfaces

Shape description requirements, Parametric functions, Bezier methods, Bezier curves, Bezier surfaces, B-Spline methods

b. Solid Area Scan Conversion and Three Dimensional Transformations

Solid Area Scan Conversion, Scan Conversion of Polygons, Algorithm Singularity, Three Dimensional transformation, Translations, Scaling, Rotation, Viewing Transformation, The Perspective, Algorithms, Three Dimensional Clipping, Perspective view of Cube.

Unit 6

a. Hidden Surface Removal

Need for hidden surface removal, The Depth - Buffer Algorithm, Properties that help in reducing efforts, Scan Line coherence algorithm, Span – Coherence algorithm, Area-Coherence Algorithms, Warnock's Algorithm, Priority Algorithms.

TERM WORK:

I. Should contain at least 6 assignments (one per unit) covering the syllabus.

PRACTICAL:

II. Should contain at least 10 programs developed using C++. Some Sample practical are listed below.

1. Write a program with menu option to input the line coordinates from the user to generate a lineusing Bresenham's method and DDA algorithm. Compare the lines for their values on the line.
2. Develop a program to generate a complete circle based on

   a. Bresenham's Circle Algorithm
   b. Midpoint Circle Algorithm
3. Implement the Bresenham's/DDA algorithm for drawing line (programmer is expected to shift the origin to the center of the screen and divide the screen into required quadrants).
4. Write a program to implement a stretch band effect. (A user will click on the screen and drag the mouse/arrow keys over the screen coordinates. The line should be updated like rubber-band and on the right-click gets fixed).
5. Write program to perform the following 2D and 3D transformations on the given input figure
   a. Rotate through θ.
   b. Reflection
   c. Scaling
   d. Translation.
6. Write a program to demonstrate shear transformation in different directions on a unit squaresituated at the origin.
7. Develop a program to clip a line using Cohen-Sutherland line clipping algorithm between $(x_1,y_1)(x_2, y_2)$ against a window $(x_{min}, y_{min})(x_{max}, y_{max})$.
8. Write a program to implement polygon filling.
9. Write a program to generate a 2D/3D fractal figures (Sierpinski triangle, Cantor set, Tree etc).
10. Write a program to draw Bezier and B-Spline Curves with interactive user inputs for control polygon defining the shape of the curve.

TEXT BOOKS:

1. "C Graphics and Projects" , B M Havaldar , Anmol publication.
2. "Computer Graphics",Hearn and Baker, Published by Dorling Kindersley pvt. Ltd., 2nd Edition
3. "Computer Graphics for Scientists and Engineers", Asthana and Sinha, New Age International(P) Ltd. Publishers, New Delhi, 2nd Revised Edition

REFERENCE BOOKS:

1. "Principles of Interactive Computer Graphics", NewmanandSproull, Mc Graw Hill Education.

S.E. (MECHANICAL ENGINEERING) **Semester IV**

8. COMPUTER PROGRAMMING USING C++

Teaching Scheme:	**Examination Scheme:**
Practical: 2 Hrs. per alternate week	**Term Work: 25 Marks**

Pre-requisites: Basic Electronics and Computer Programming in 'C'.

Course Objectives:

1. To develop and enhance the programming skills amongst the students in general as well as application of it in the field of Mechanical Engineering.
2. To introduce an object oriented programming language.

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

1. Develop algorithms for solving problems using object oriented language.
2. Apply their knowledge and programming skills to solve various computing problems in the field of Mechanical Engineering.

TERM WORK:

1. Assignment based on Object-Oriented programming: Introduction, Basic concepts, Benefits, Object-oriented languages, Applications.
2. Minimum 1 program on Input / Output and arithmetic expressions, Hierarchy of operators, branching and loop control statements.
3. Classes and Objects: Introduction, structures and classes, Declaration of class, Member functions; Defining the object of a class; accessing a member of a class; Array of class objects. Minimum three programs on Structure, Class and Objects.
4. Use of Pointers with Array and Function, Friend function. Minimum 1 program on pointers with Arrays and Function.
5. Inheritance: Single Inheritance, Multilevel Inheritance, Multiple Inheritance, Hybrid Inheritance, Hierarchical Inheritance; Types of base classes: Direct, Indirect; Types of derivation: Public, Private, Protected, Virtual base classes. Minimum two programs on Inheritance.
6. Overloading: Function overloading with various data types, Arguments; Operator overloading: Assignment operator; Arithmetic and comparison operators. Minimum two programs on Overloading.
7. Polymorphism: Virtual functions; Abstract Base Classes, Constructor under Inheritance, Destructor under Inheritance. Minimum two programs on Polymorphism.

TEXT BOOKS:

1. "Object Oriented Programming", E. Balguruswami, Tata McGraw Hill Publication.
2. "Let us C++" ,Yashwant Kanitkar ,BPB Publication.
3. "C++ Programming",Alstevanswiely India,7th Edition.
4. "Object oriented Programming with C++", Sourav Sahay, Oxford University Press.
5. "Object-Oriented Programming in C++", Rajesh K Shukla, Wiley India

REFERENCE BOOKS:

1. “Professional C++”, Solterwiely India.

S.E. (MECHANICAL ENGINEERING) **Semester III**

9. WORKSHOP PRACTICE-III

Teaching Scheme:	**Examination Scheme:**
Practical: 2 Hrs. per Week	**Term Work: 25 Marks**

Pre-requisites: Engineering Graphics, Basic Mechanical Engineering.

Course Objectives:

1. To study Patterns, Core boxes, Preparation of Pattern for solid casting.
2. To study Sand testing, Size analysis, Moisture percentage,Permeability Test.

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

1. Understand types of patterns and Core boxes,Materials used, Pattern Allowances.
2. Understand Permeability Test, Green Compressive strength, Preparation of green sand mold.

Course Contents:

1. Study of Patterns – Types, Materials used, Pattern Allowances, Construction and color code.
2. Study of Core boxes: Types, Allowances
3. Preparation of Pattern for solid casting
4. Sand testing for green sand and core sand
    a. Size analysis. Grain fineness Number
    b. Moisture percentage
    c. Preparation of standard Specimen
    d. Permeability Test
    e. Green Compressive strength
    f. Clay content
    g. Preparation of green sand mold
    h. Mould Hardness
5. Foundry visit to study pattern shop, sand making and moulding.

NOTE:

1. The load of workshop practice III will be allotted to the teaching faculty.
2. Assessment of journal based on above term work and industrial visit report is to be done by the teaching Faculty.
3. Term work will consists of Jobs on pattern making carrying 15 marks , Journal 15 marks and Internal oral 20 marks

S.E. (MECHANICAL ENGINEERING) **Semester IV**

1. APPLIED NUMERICAL METHODS

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs. per week	**Theory Paper: 100 Marks**
Practical: 2 Hrs. per week	**Term Work: 25 Marks**

Pre-requisites: Engineering Mathematics-I, Engineering Mathematics-II, and Engineering Mathematics-III.

Course Objectives:

1. To introduce numerical methods for solving linear and non-linear equations.
2. To apply the knowledge of these methods to solve practical problems with suitable software.
3. To introduce numerical methods for evaluating definite integrals.

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

1. Identify, classify and choose the most appropriate numerical method for solving a problem.
2. Solve the Mechanical Engineering problems using softwares.

Unit 1 **[7]**

A. **Errors:** Introduction, Types of errors, Rules for estimate errors, Error propagation, Error in the approximation of function

B. **Roots of Equation:**
   a. Bracketing Method: Bisection Method, False position method
   b. Open method: Newton Raphson's, Multiple Roots, Iteration system of non- linear Equations, Secant method.

C. Roots of polynomial: Muller's Method

Unit 2 **[5]**

Linear Algebraic Equation:

1. Gauss Elimination Method- Naïve Gauss Elimination, Pitfalls of Elimination, Techniques of improving solutions, Gauss- Jordan method
2. Matrix Invention- LU decomposition, Gauss Sedial, Jacobi Iteration method

Unit 3 **[8]**

A. Curve Fitting:
   i. Least Square Regression – Linear regression, Polynomial Regression
   ii. Interpolation – Newton's divided difference, Interpolating polynomial, Languages interpolating polynomial

B. Statistics:

Mean and standard deviation, Addition and multiplication laws probabilities, Binomial, Poisson and normal distribution.

Unit 4 **[7]**

Numerical Differentiation and Integration

a. Newton's cote's Integration of equation: Trapezoidal rule, Simpson's rules , Integration unequal segments.
b. Integration of Equation: Romberg's Integration and Gauss Quadrature.
c. Numerical differentiation, Differentiation formulae, Richardson extrapolation, Derivation of unequally spaced data, Forward difference, Central difference, Backward difference, Backward difference.

Unit 5 **[6]**

Ordinary Differential Equation:

a. Taylor's series method, Picard's Method, Runge-Kutta method, Euler's Method, Improved polygon method, System of equation
b. Boundary value and Eigen value problem, Shooting Method, Finite Difference Method, Eigen value problem based on polynomial method, Power method.

Unit 6 **[7]**

Partial Differential Equation:

a. Finite Difference – Elliptical equation, Laplace's equation, Liebmen's Method, Secondary variables, Boundary condition.
b. Finite Difference- Parabolic Equation , Explicit Method- Bender- Schmidt method, Implicit method- Crank Nicolson Method

(No numerical treatment on crank Nicolson method)

TERM WORK:

Students are expected to solve at least two problems of different method by developing computer programs on each unit. (Algorithm, Flow charts, Computer code)

TEXT BOOKS:

1. "Higher Engineering Mathematics", Dr.B.S.Grewal, Khanna Publishers, New Delhi,7th Edition,2005.
2. "Numerical Methods", Dr.B.S.Grewal, Khanna Publishers, New Delhi,7th Edition,2005.
3. "Numerical Methods", E Balguruswamy Tata McgrawHill Publication Company Ltd.,8th Edition,2002.

4. "Numerical Methods", S.Arumugam,A. Thangapandi Isaac and A.Somasundaram, Scitech Publications India Pvt.Ltd.,Chennai, 2nd Edition,2007.
5. "Numerical Methods", Dr. V.N.Vedamurthy. Vikas Publication
6. "Numerical Methods", G.Haribaskaran, Laxmi Publications Pvt.Ltd, New Delhi, 1st Edition,2006.

REFERENCE BOOKS:

1. "Applied Numerical Methods with MATLAB for Engineers and Scientists", S.C.Chapra,Tata McGraw Hill Education Pvt.Ltd.,New Delhi, 3rd Edition,2012.
2. "Numerical Analysis Theory and Applications",R.L.Burden and J.D.Faires, Cengage Learning India Pvt.Ltd.,New Delhi,1st Edition,2005.
3. "Applied Numerical Methods Using MATLAB", W.Y.Yang, W.cao and J.Morris, Wiley India Pvt.Ltd.,New Delhi, 1st Edition,2005.
4. "Numerical Mathematics and Computing", Ward cheney, Cengage Learning India Pvt.Ltd.,New Delhi,7th Edition.

S.E. (MECHANICAL ENGINEERING) **Semester IV**

2. ANALYSIS OF MECHANICAL ELEMENTS

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs. per week	**Theory Paper: 100 Marks**
Practical: 2 Hrs. per week	**Term Work: 25 Marks**

Pre-requisites: Engineering Mechanics

Course Objectives:

1. To gain knowledge of different types of stresses, Strains and deformation induced in Mechanical Components due to external loads.
2. To study the distribution of various stresses in Mechanical Elements.
3. To study the effect of component dimensions and shape on stresses and deformations.

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

1. Demonstrate fundamental knowledge about various types of loading and stresses induced.
2. Draw SFD and BMD for different types of loads and support conditions.
3. Compute and analyze stresses induced in mechanical components.
4. Analyze buckling and bending phenomenon in columns and beams.

Unit 1 **[6]**

Stresses and Strains:

Concept of Stress and Strain, (Linear, Lateral, Shear and Volumetric), Hooke's Law, Poisson's ratio, Modulus of Elasticity, Modulus of Rigidity, Stress-strain diagram for ductile and brittle material, Factor of safety, Working stress. Normal and shear stresses, Thermal Stresses, Complementary shear stress, Bulk Modulus, Inter-relationship between elastic constants.

Unit 2 **[7]**

A) Torsion: Basic assumptions, Torsion formula, Hollow and solid circular shafts, Angular deflection

B) Shear Force and Bending Moment: Concept and definition of shear force and bending moment in determinate beams due to concentrated , UDL and uniformly varying load.

Unit 3 **[7]**

Stresses in Beams:

A) Bending Stresses: Symmetric pure bending of beams, Flexure formula, moment of resistance of cross-sections, Simple built-up section, Design of rectangular and circular(solid and hollow) sections; L, I and T sections

B) Shear Stresses: Distribution of shear stresses in beams of various commonly used sections such as circular. I, T, and angles.

Unit 4 **[8]**

Principal Stresses and Strains:

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, Combined effect of shear and bending in Beam, Theories of elastic failure (Without derivation).

Unit 5 **[6]**

Deflection of Beams:

Strain curvature and moment curvature relation, Solution of beam deflection problem by Double integration method, Area moment method. (Simply Supported Beam and Cantilever.)

Unit 6 **[6]**

A) Columns: Euler's formula for different end connections, Concept of equivalent length, Eccentric loading, Rankine formula.

B) Energy Methods: Strain energy for uniaxial stress, Pure bending (Simply Supported Beam and Cantilever.), Shear stresses (Direct Shear and Pure torsional), Use of energy theorem to determine deflections and twists of shafts

TERM WORK:

A term work shall consist of report on the assignments given below.

1. Stresses and strains.
2. Torsion.
3. Shear force diagram
4. Bending moment diagram.
5. Bending stresses in beams
6. Shear stresses in beams.
7. Principal stresses and theories of failures.
8. Deflection of beams.
9. Columns.
10. Strain Energy

TEXTBOOKS:

1. "Strength of Materials", S. Ramamruthum, DhanpatRai and Sons, New Delhi.
2. "Strength of Materials", R. K. Bansal, Laxmi Publication, 4th Edition.
3. "Strength of Materials", Khurmi Gupta, S. Chand Publication.
4. "Strength of Materials", R.K. Rajput, S. Chad Publication.

5. “Mechanics of structure”, S.B Junnerkar,Charotar Publication House.
6. “Strength of Materials”, S. S. Bhavikatti, Vikas Publication House.
7. “Strength of Materials”, Timoshenko and Young, CBS Publication.
8. “Mechanics of Materials”, S. S. Ratan, Tata McGraw Hill Publication, 2009.
9. “Strength of Materials”,B. K. Sarkar, McGraw Hill Publication, 2003
10. “Strength of Materials”, L. S. Negi, McGraw Hill Publication, 2008.

REFERANCE BOOKS:

1. “Strength of Materials”, Beer and Johnson, CBS Publication.
2. “Strength of Materials”, G.H. Rider,Mac Millan India Ltd.
3. “Strength of Materials”, Nag and Chanda, Willey India Publication.
4. “Advanced Mechanics of Materials”, Boresi, Willey India Publication.
5. “Strength of Materials”, Den Hartong, McGraw Hill Publication.
6. “Mechanical analysis and design”, H. Burr and John Cheatam, PHI, New Delhi.

S.E. (MECHANICAL ENGINEERING) **Semester IV**

3. FLUID AND TURBO MACHINERY

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs. per week	**Theory Paper: 100 Marks**
Practical: 2 Hrs. per week	**Term Work: 25 Marks**
	Practical and Oral Exam: 25 Marks

Pre-requisites: Fluid Mechanics, Applied Thermodynamics

Course Objectives:

1. To learn the working principles of Impulse and Reaction water turbines and also to study its velocity triangles .To study design parameters related to Turbines
2. To understand the concept of Centrifugal pumps and its construction. To understand MPSH and NPSH terms related to centrifugal pumps
3. To study equations for specific speed of various turbines and pumps. To understand performance characteristics of various turbines and pumps.
4. To illustrate the concept of centrifugal compressor, Axial compressors. To understand various parameters related to rotodynamic air compressors
5. To discuss the working of Gas Turbines and know its various configurations. To determine the efficiencies of gas turbines

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

1. Understand working principle of Impulse and Reaction turbine.
2. Understand the concept of Centrifugal pumps and various efficiencies related to it.
3. Understand the concept of centrifugal and Axial compressors.
4. Understand working of Gas Turbines and know its various configurations.

Unit 1 **[7]**

Impulse Water Turbines:

Impact of Jet, Euler's equation for work done in Rotodynamic Machines classification of waterturbines,Pelton wheel, its construction and working, velocity triangles. Types, Peltonwheel 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, Model Testing, Unit quantities, Specific speed of turbine and performance characteristics of turbine.

Unit 2 **[7]**

Reaction Water Turbines:

Principle of operation, Construction and working of Francis and Kaplan Turbine, Effect ofmodification of velocity triangles on runner shape, Draft tube, Cavitation calculation ofvarious efficiencies, Power, Discharge, Blade angles, Runner dimensions etc.

Governing ofFrancis and Kaplan turbine. Draft tube-types and analysis. Model Testing, Specific speed of turbine and performance characteristics of turbine.

Unit 3 **[6]**

Centrifugal Pumps:

Working principles, Construction, Types, Various heads, Multistage pumps, Velocity triangles, Minimum starting speed, Cavitation, Maximum permissible suction head (MPSH) and Net positive suction head (NPSH). Methods of priming,calculations of efficiencies, Discharge, Blade angles, Head, Power required, Impeller dimensions etc. Specific speed and performance characteristics of pumps.

Unit 4 **[8]**

Air Compressors:

Application of compressed air, classification of compressor, Reciprocating compressors,construction , Work input, Necessity of cooling , Isothermal efficiency, Heat rejected,Effect ofclearance volume, Volumetric efficiency, Necessity of multistaging, construction,Optimum intermediate pressure for minimum work required, After cooler, Free airdelivered, air flow measurement, Capacity control. Roots blower and vane blower(Descriptive treatment)

Unit 5 **[7]**

Rotodyanamic Air Compressors:

Centrifugal compressor, velocity diagram. Theory of operation, losses, Adiabaticefficiency, Effect of compressibility, Diffuser, Prewhirl, Pressure coefficient, Slip factor,performance.Axial flow compressors, Velocity diagram, Degree of reaction, Polytropicefficiency, Surging, Chocking, Stalling, Performance, Comparison with centrifugal.

Unit 6 **[5]**

Gas Turbines:

Working principles, Applications, Open, Closed cycle and their comparison. Cyclemodified to Regeneration, Reheat, Intercooling performance. Calculation of gas turbinework ratio, Efficiency etc.Types of fuels for gas Turbine Introduction to Jet engine.

TERM WORK:

Any seven experiments from 1 to 8.

1. Study and trial on Pelton wheel.
2. Study and trial on Francis/ Kaplan turbine
3. Trial on Centrifugal pump
4. Study and demonstration of reciprocating pump and hydraulic ram
5. Study and trial on reciprocating compressor
6. Study and trial on centrifugal blower
7. Study of hydraulic devices- Intensifier, Accumulator, Hydraulic jacks, Press, Crane.
8. Study of other types of pumps- Gear pump, Jet pump, Submersible pump, Air lift pump.
9. Industrial visit to Pump/Turbine Manufacturing Industry or Hydro Power Plant.

TEXT BOOKS:

1. "Hydraulic Machines", V.P. Vasantdani, Khanna Publishers, 1996.

2. “Fluid flow machines”, N.S. Govindrao, Tata McGraw-Hill,1983.
3. “Steam and gas Turbines”, R. Yadav, Central Publishing House, Allahabad, 6th Edition , 1997 .
4. “Gas Turbines”, V. Ganeshan, Published by TMH Education Pvt. Ltd. , 3rd Edition.
5. “Thermal Engg.”, Kumar vasantdani, Khanna publisher
6. “Thermal Engg.”,P.L. Balleny, Khannapublisher. , 20th Edition
7. “Gas turbines and Compressor”, Cohen and Rogers, Saravanamutto Publisher
8. “Thermodynamics and Heat Engines”, R. Yadav, Vol-II, Central Publishing House.
9. “Fluid mechanics and hydraulic machines”, Modi and Seth, Sstandard Book House, 2004
10. “Thermal Engineering”, R K Rajput, Laxmi Publication.
11. “Fluid Mechanics and Hydraulic Machines”, S.C. Gupta , Pearson Education, 1st Edition
12. “Fluid Mechanics and hydraulic machines”,R. K. Rajput , S. Chand Publication.
13. “Fluid Mechanics and hydraulic machines”,R. K. Bansal, L.P. Pub. House.
14. “Turbo machines”,Pai, Willey India .

REFERENCES BOOKS:

1. “Turbo machines”, S.M. Yahya , Tata Mc Graw Hill , 2005
2. “Fans, compressor and turbine”, S. M. Yahya,Tata Mc Graw Hill , 2005

S.E. (MECHANICAL ENGINEERING) **Semester IV**

4. THEORY OF MACHINES-I

Teaching Scheme:	**Examination Scheme:**
Lectures: 3 Hrs. per week	**TheoryPaper: 100 Marks***
Practical: 2 Hrs. per week	**Term Work: 25 Marks**

Pre-requisites: Engineering Mechanics, Applied Physics

Course Objectives.

1. To represent kinematic behavior of different machine elements and mechanisms.
2. To select various Power transmitting devices.
3. To explain types of Cam with followers and select according to their applications.
4. To compare types of Governing mechanisms.
5. To analyze effect of friction in Mechanisms and machines

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

1. Understand different types of mechanisms and their applications
2. Analyze kinematic theories of mechanism,
3. Design cam with follower for different applications
4. Select different power transmitting elements according to application
5. Select different governing mechanisms according to application.

Unit 1 **[5]**

Basic Concept of Mechanisms:

Links, kinematic pair (lower and higher), Kinematic chain, Mechanism, inversion, Types of constraints, Grubbler's criterion, Inversions of slider crank chain, Double slider crank chain, Four bar, Steering gear mechanisms, Analysis of Hooke's joint.

Unit 2 **[10]**

Velocity and Acceleration in Mechanisms:

Graphical analysis of Velocity and acceleration for different mechanisms using relative velocity and acceleration method, Coriolis' component of acceleration, Klein's construction for slider crank mechanism, Velocity analysis by Instantaneous center method.

Unit 3 **[5]**

Friction:

Introduction of friction, Friction in pivot bearings, Inclined plane theory, Friction in screws.

Unit 4 **[8]**

Cams:

Types of cams and followers, Profiles of cams for specified motion of different followers, Spring load on the follower, Jumping of follower.

Unit 5 **[6]**

Belts and Dynamometers:

Types of belt drives, Calculation of power transmitted, Belt tension ratio, Actual tension in a running belt, Centrifugal and initial tension in belt, Slip and creep of belt,

Classification of dynamometers, Study of rope brake absorption dynamometer and belt transmission dynamometer.

Unit 6 **[6]**

Governors:

Types of governors, Porter and Hartnell governor, Controlling force and stability of governor, Hunting, Sensitivity, Isochronism, Governor effort and power, Insensitiveness of governors.

TERM WORK:

A term work shall consist of report on any ten of the following:

1. Study of basic mechanisms. (Demonstration of models, Actual mechanisms, etc.)
2. One A3 size sheet of Velocity problems by relative velocity method. (Minimum 4 problems)
3. One A3 size sheet of Velocity problems by Kliens construction and Insatantaneous center method. (Minimum 4 problems)
4. One A3 size sheet of Acceleration problems by relative acceleration method. (Minimum 4 problems)
5. Verification of ratio of angular velocities of shafts connected by Hooks joint.
6. One A3 size sheet of Problems on cam profile. (Minimum 4 problems)
7. Experiment on Governor characteristics for Porter or Hartnell governor.
8. Experiment on Cam Profile
9. Experiment on belt drives.
10. Experiment on Dynamometer
11. Computer aided analysis of simple mechanisms.

TEXT BOOKS:

1. "Theory of Machines", Ratan S.S, Tata McGraw Hill New Delhi, 2nd Edition.
2. "Theory of Machines", P.L.Ballany, Khanna Publication, New Delhi, 2nd Edition.
3. "Theory of Machines", V.P. Singh, DhanpatRai and Sons.
4. "Theory of Machines", H.G.Phakatkar, Nirali Publication. Pune
5. "Theory of Machines", Dr. R.K.Bansal, Laxmi Publication.
6. "Theory of Machines", Thomas Bevan, CBS Publishers, New Delhi.
7. "Theory of Machines and Mechanism", G.S. Rao and R.V. Dukipatti, "New Age Int.Publications Ltd., New Delhi.
8. "Theory of Machines", Shah and Jadhawani, DhanpatRaiand Sons

REFERENCE BOOKS:

1. “Theory of Machines and Mechanism”, Shigley, McGraw Hill, New York
2. “Theory of Machines”, Abdullah Shariff, McGraw Hill, New Delhi.

Note: (*)Indicates Theory Paper of Four Hours Duration.

S.E. (MECHANICAL ENGINEERING) **Semester IV**

5. MACHINE TOOLS AND PROCESSES

Teaching Scheme:	**Examination Scheme:**
Lectures: 4 Hrs. per week	**Theory Paper: 100 Marks**

Pre-requisites: Basic Mechanical Engineering.

Course Objectives:

1. To introduce different methods of Molding and Casting.
2. To introduce forming and Plastic Shaping processes.
3. To study various Metal Removal Processes and Machine tools.
4. To study Nonconventional Machining

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

1. Understand Importance of casting as manufacturing Process.
2. Understand different types of forming and Plastic Shaping processes.
3. Understand Basic working principle, Configuration, Specification and classification of machine tools.
4. Understand Working Principle and Applications of nontraditional machining.

Unit1 **[11]**

Casting Processes:

a. Importance of casting as manufacturing Process, advantages and limitations of casting processes, foundry layouts and mechanization

b. Types of moulding and core making sands and their properties, Green sand CO_2 sand, oil sand, Cold box process, investment casting, moulding machines and core making machines.

c. Gating

-Components of gating system, functions and importance of runners and risers, solidification control devices: chills, ceramics bricks, directional solidification

d. Introduction to permanent mould casting process

-Gravity and pressure die-casting

-Centrifugal casting

-Continuous casting

e. Melting and Pouring

Types of fuel fired melting furnaces

-Working, Melting practices and Metallurgical control in Cupola furnace, oil/gas fired furnaces, Induction and Arc Furnace

-Metal pouring equipments

f. Cleaning-fettling and inspection of casting

Unit2 **[11]**

Forming Processes:

a. Rolling – Introduction , Hot and cold Rolling, Rolling Mill Classification, Defects in Rolling,

b. Forging- Introduction, Hand Forging Operations, Forging Machines (board Hammer, Air and Steam, Hydraulic Hammer) Open and Closed Die Forging, Defects in Forging

c. Extrusion- Introduction, Direct , Indirect , Tube , Impact and Hydraulic Extrusion, Defects in Extrusion

d. Drawing – Introduction and Types of Wire, rod and pipe drawing, Defects in Drawing.

Unit 3 **[04]**

Plastic Shaping:

Introduction to blow moulding, injection moulding, extrusion, calendaring and thermo forming

Unit 4 **[11]**

Machine Tools for Metal Cutting:

a. Lathe: Introduction, Working principle, types, specifications, principle parts, accessories, attachments, and various lathe operations, Calculations of Change gears for thread cutting.

b. Capstan, turret lathe- Principle parts, Working, comparison with centre lathe, Turret indexing mechanism, Bar feeding mechanism, Turret tool holders.

c. Boring Machines-Horizontal and vertical boring machine, Construction and operation, boring tools and bars. Introduction to Jig boring-machine

d. Drilling Machines - Classification of drilling machines, Construction and working of radial drilling machine, Variousaccessories and various operations.

Unit 5 **[11]**

Machine Tools for Metal Cutting:

a. Shaping Machine - Types-crank shaper, hydraulic shaper, Crank and slotted link quick return mechanism, Table feed mechanism, Variousoperations.

b. Planing Machine- Types-standard double housing planer, principle parts, table drive and feed mechanism, Variousoperations.

c. Milling Machine - Classification of milling machines, construction and working of column and knee type, milling machines, milling operations, Study of standard accessories-dividing head, Rotary table, Gear cutting on milling machine, Change gear calculations, vertical milling attachment for horizontal milling machine

d. Gear Manufacturing Processes -Study of various processes like gear shaping, Gear hobbing. Gear finishing processes –Gear shaving, Gear burnishing and gear rolling.

Unit 6 **[04]**

Nonconventional Machining:

Fundamental principle, machining unit, tool material, advantages, limitations and applications of Abrasive Jet Machining, Electrical Discharge machining, Electro- Chemical machining, Laser beam machining, Ultrasonic machining, Water jet machining

Note:

1. The Workshop practice IV should cover the practical based on this syllabus, the load of which shall be allotted to teaching staff .

2. Separate answer sheets should be provided one for modules 1,2,3and one for 4,5,6.

TEXT BOOKS:

1. "Manufacturing Technology- Foundry, Forming and Welding, Vol. I", P. N. Rao, Tata McGraw-Hill, New Delhi,3rd edition, 2009.
2. "Principles of Foundry Technology", P.L. Jain, Tata McGraw-Hill, NewDelhi, 2nd Edition.
3. "A Textbook of Production Technology (Manufacturing Processes)", P.C. Sharma, S. Chand and Company Pvt.Ltd, New Delhi.7th Edition,2010.
4. "Foundry technology", O. P. Khanna, Dhanapat Rai Publications Pvt.Ltd, New Delhi.17th Edition, 2013.
5. "Workshop Technology vol. II", B.S. Raghuvanshi, Dhanapat Rai Publications Pvt.Ltd, New Delhi.10th Edition, 2000.
6. "Workshop Technology vol. II", W. A. J. Chapman, Viva Books Pvt.Ltd,New Delhi,1st Edition,2001.
7. "Elements of Workshop Technology vol. II", S.K.Hajra Choudhury and A.K. Hajra Choudhury , Media promoters and Publishers Pvt.Ltd,New Delhi,13th Edition,2012.
8. "Production technology", R. K. Jain, Khanna Publishers, Delhi, 15th Edition,2000.

REFERENCE BOOKS:

1. "Principles of metal casting", Haineand Rosenthal, Tata McGraw-Hill Book, Company. New Delhi.
2. ASTM Volumes on Welding, casting, forming and material selection.
3. ASM Handbook," Volume- 15, 1988, Casting.
4. "Workshop Technology", W.A.J.Chapman, CBS Publishing and Distributors, N. DelhiVol.I [ISBN-13:9788123904016]2001, Vol.II [9788123904115] 2007 andVol.III [9788123904122] 1995.
5. "Machine Tools and Manufacturing Technology" , Steve F. Krar, Mario Rapisarda, Albert F. Check

S.E. (MECHANICAL ENGINEERING) **Semester IV**

6. TESTING AND MEASUREMENT

Teaching Scheme:	**Examination Scheme:**
Practical: 2 Hrs. per week	**Term Work : 25 Marks**
	OralExam: 25 Marks

Pre-requisites: Applied Thermodynamics, Fluid Mechanics, Applied Physics

The Journal based on experiments listed below is to be submitted as part of term work.

Expt. Content

No.

1. Angular speed measurement using Stroboscope, Photo-electric pick up and magneticpick up.
2. Formation of Thermocouple tip and Calibration of Thermocouple.
3. Measurement of temperature usingThermocouple RTD, Thermistors and pyrometers.
4. Testing of Mechanical pressure gauge using Dead weight pressure gauge tester.
5. Vacuum measurement using Mc-Lead gauge and Pirani gauge.
6. Measurement of displacement using LVDT.
7. Flow measurement using, Rotameter, Turbine meter and Anemometer and Target meters.
8. Force and torque measurement using strain gauges.
9. Vibration testing using contact and non-contact type instruments.
10. Design of measuring system for pressure, Flow temperature etc.
11. Two home assignments on sensing devices, Sensing elements and transducers.

TEXT BOOKS:

1. "Mechanical Measurement", Beckwith and Buck, Pearson Education Asia,5th Edition,2001.
2. "Mechanical Measurement and Control" D.S. Kumar, Metropolitan Book Co.Pvt.Ltd.,New Delhi,4th Edition,2007.
3. "Mechanical Measurements", Shirohi and Radha Krishnan H.C., New Age International, New Delhi, 3rd Edition,2007.
4. Engineering Practices Laboratory Kannaiah, Scitech Publication.

REFERENCE BOOKS:

1. "Measurement Systems", Doebelin Emesto, McGraw Hill International Publication Co. New York,4th Edition,1990

2. “Mechanical Measurement and Control” , A.K. Sawhney and P. Sawhney, Dhanpat Rai and Company Pvt.Ltd.,New Delhi, 12th Edition,2010.
3. “Theory and design for mechanical measurements”, Richard S. Figliola, Donald E. Beasley, Wiley India Edition.

S.E. (MECHANICAL ENGINEERING) **Semester IV**

7. COMPUTER AIDED DRAFTING

Teaching Scheme:	**Examination Scheme:**
Practical: 2 Hrs. per week	**Term Work : 50 Marks**

Pre-requisites: Engineering Graphics, Machine Drawing
Course Objectives: To understand:

1. Importance of CAD tool
2. To develop an ability to:
3. Create 2-D drawings
4. Create 3-D models of machine components
5. Create assembly of simple machine components

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

1. Analyze and interpret design data.
2. Draw 2D drawings and 3D models.
3. Use modern engineering techniques, tools and skills for engineering practice.

UNIT 1
Basic Commands to Draw 2D Objects:

Units, Limits, Point, Line, Circle, Arc, Ellipse, Polygon, Polyline, Spline etc.

UNIT 2
Edit/Modify Commands

Erase, Trim, Extend, Scale, Break, Fillet, Chamfer, Offset, Copy, Move, Mirror, Array, Hatch etc.

UNIT 3
Viewing Commands:

Zoom, Pan, Rotate etc.

Other Commands:

Line type, Text, Text style, Dimensioning, Dimension style, Leader, Layers etc.

UNIT 4
Assembly of 2D Components:

Block, Insert etc.

UNIT 5
Geometric Dimensioning and Tolerancing For 2-D Objects:

Straightness, Flatness, Perpendicularity, Angularity, Roundness, Concentricity, Cylindricity, Run out, Profile, Parallelism,etc. Machining Symbols.

UNIT 6
Introduction to 3D Modeling:

Extrude, Cut, Revolve, Union, Rib, Fillet, Chamfer, UCS etc.

TERM WORK:

1. Computer aided drafting of four simple components and print out of the same on A4 size sheet.
2. Drawing of details and assembly containing 6-8 major components with bill of material. Print out of the same on A3 size sheet.
3. 3-D drawing of one simple component and plotting its 2-D views along with 3-D object drawing. Print out of the same on A4 size sheet.
4. Production drawing of minimum one machine component with G.D.andT's and machining symbols. Print out of the same on A4 size sheet.

Note: Latest drafting software like Auto cad and any 3-D modeling software are to be used.

TEXT BOOKS:

1. "Machine drawing", N.D. Bhat and V.M. Panchal, Charotar Publication House, Anand, 42nd Edition,2007 .
2. "Machine drawing", Basudeb Bhattacharyya, Oxford university press.

REFERENCE BOOKS:

1. "Auto cad 2014 for Engineers and Designers", Sham Tickoo, Dreamtech press, New Delhi,2014.

2. "Auto Cad 2014", Ellen Finkelsten, Wiley India

3. "Help Manuals and Tutorials of referred software"

S.E. (MECHANICAL ENGINEERING) **Semester IV**

8. WORKSHOP PRACTICE - IV

Teaching Scheme:	**Examination Scheme:**
Practical: 2 Hrs. per week	**Term Work: 25 Marks**
	Practical and Oral Exam: 50 Marks

Pre-requisites: Machine Tool and Processes.

TERM WORK:

1. Study of Gating and Risering System
2. Study of Casting defects.
3. One job of plain turning, taper Turning, external threading and knurling operation with its process sheet.
4. Assignment on thread manufacturing processes and gear train calculations.
5. Study of Construction, Mechanism and Application of following machines (any two)
    a. Drilling Machine
    b. Boring Machine
    c. Milling Machine
6. Study and demonstration of shaper/planer (mechanisms and stroke).
7. Industrial visit to study Plastic Shaping, Casting, Forming, Conventional Machine Shop and gear manufacturing processes

NOTE:

1. The load of workshop Practice IV will be allotted to the teaching faculty and will be assisted by workshop Instructor for completing the jobs
2. Assessment of journal based on above term work and industrial visit report is to be done by the teaching Faculty.
3. Term work will consist of Jobs carrying 15 marks and journal 10 marks.
4. POE will be on basis of Job done (25 Marks) and Oral based on job and journal (25 Marks)

EQUVALANCE FOR SE MECH PART-I OLD

WITH S.E.(MECH) PARTI&PART II REVISED FROM 2014-2015

SHIVAJI UNIVERSITY, KOLHAPUR

Sr. No.	S.E. (Mechanical) Part I Old Course Subjects	Equivalent subjects in Revised course	Remark
1	Engineering Mathematics -III	Engineering Mathematics - III	
2	Applied Thermodynamics	Applied Thermodynamics	
3	*Electrical Technology And Computer Programming C++	*Electrical Technology	
4	Machine Drawing		
5	Manufacturing Processes	Machine Tools and Processes	
6	Fluid Mechanics	Fluid Mechanics	

EQUVALANCE FOR SE MECH PART-II OLD

WITH S.E.(MECH) PARTI&PART II REVISED FROM 2014-2015

SHIVAJI UNIVERSITY, KOLHAPUR

Sr. No.	S.E. (Mechanical) Part II Old Course Subjects	Equivalent subjects in Revised course	Remark
1	Analysis of Mech. Elements	Analysis of Mechanical Elements	
2	Numerical Methods	Applied Numerical Methods	
3	Metallurgy	Metallurgy	
4	Machine Tool	Machine Tools and Processes	
5	Theory of Machines – I	Theory of Machines – I	
6	Fluid & Turbo Machinery	Fluid and Turbo Machinery	
7	Computer Aided Drafting		
8	Workshop Practice IV	Workshop Practice - IV	