SEMESTER – V

KINEMATICS OF MACHINES ME – 5001

Course Code	**ME – 5001**	Credits: 4	L-3, T-1, P-0
Name of the Course	**KINEMATICS OF MACHINES**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)		**Max. Marks: 50**	

Instructions:-

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section – A

Introduction: Mechanism and machines, kinematics links, kinematic pairs, kinematic chains, plane and space mechanism, kinematic inversion, equivalent linkages, four link planar mechanisms, straight line mechanisms, steering mechanisms, pantograph.

Kinematic Analysis of Plane Mechanisms: Displacement analysis, general plane motion, instantaneous center of velocity, graphical and analytical methods of velocity and acceleration analysis.

Section – B

Cams: Classification of cams and followers, disc cam nomenclature, construction of displacement, velocity and acceleration diagrams for different types of follower motions, analysis of follower motions, determination of basic dimension, synthesis of cam profile by graphical approach, cams with specified contours, tangent and circular arc cams.

Section – C

Gears: fundamental law of gearing, involute spur gears, characteristics of involute action, Interference and undercutting, center distance variation, non standard gear teeth, helical, spiral bevel and worm gears.

Gear Trains: Synthesis of simple, compound and reverted gear trains, analysis of epicyclic gear trains.

Section – D

Kinematic synthesis of Mechanisms. Type, number and dimensional synthesis, function generation, path generation and body guidance two and three position synthesis of four bar and slider crank by graphical and analytical methods, Freudenstein's equation precision position, structural error; Chebychev spacing, transmission angle.

Text Books:

1. Theory of Mechanisms and Machines : Amitabha Ghosh and Ashok Kumar Mallik, Third Edition Affiliated East West Press.
2. Theory of Machines: S.S.Rattan, Tata McGraw Hill.

Reference Books:

1. Mechanism and Machine Theory: J.S.Rao and R.V.Dukkipati Second Edition New age International.
2. Theory of Machines and Mechanisms: Joseph Edward Sigley and john Joseph Uicker, Jr. Second Edition McGraw Hill, Inc.

SEMESTER – V

MACHINE DESIGN – I ME – 5002

Course Code	**ME – 5002**	Credits: 5	L-4, T-1, P-0
Name of the Course	**MACHINE DESIGN – I**		
Lectures to be delivered	**65 (1 Hr Each) (L = 52, T = 13 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)		**Max. Marks: 50**	

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section – A

Selection of Materials: Classification of Engg. Materials, Mechanical properties of the commonly used Engg. materials, B.I.S. system of designation of steel, B.I.S.System of designation of C.I. B.I.S. system of Fits & Tolerances.

Mechanical Joints: ISO Metric Screw Threads, Bolted joints in tension, Eccentrically loaded bolted joints in shear and under combined stresses, Design of power screws.

Section – B

Riveted Joints, Welded Joints Cotter and Knuckle Joints: Design of various types of riveted and welded joints, joints under different static loading conditions, eccentrically loaded riveted joints, design of cotter and knuckle joints. Design of various types of welding joints under different static loading, eccentrically loaded welding joints.

Section – C

Belt, rope and chain drives: Design of belt drives, Flat & V-belt drives, Conditions for Transmission of max. Power, Selection of belt, design of rope drives, design of chain drives with sprockets.

Keys, Couplings and Flywheel : Design of Keys, Flat, Kennedy Keys, Splines, Couplings design Rigid & Flexible coupling, Turning Moment diagram, Coefficient of fluctuation of energy and speed, design of flywheel – solid disk and rimmed flywheels.

Section – D

Clutches: Various types of clutches in use, Design of friction clutches, Disc, Multidisc and Cone type.

Brakes: Various types of brakes, Self energizing condition of brakes, Design of shoe brakes – Internal & external expanding, band brakes.

Text Books:

1. Mechanical Engg. Design – First Metric Editions : Joseph Edward Shigley – Mc Graw Hill Book Co.
2. Design of Machine Elements – V.B.Bhandari – Tata McGraw Hill, New Delhi.
3. PSG Design Data Book.

Reference Books:

1. Engineering design – George Dieter, McGraw Hill Book Co.
2. Product Design and Manufacturing – Edition PHI –A.K.Chitale and R.C.Gupta.
3. Machine Design An Integrated Approach: Robert L.Norton, Second Edition – Addison Wesley Longman.
4. Machine Design : S.G.Kulkarini – Tata McGraw Hill.
5. Machine Design in SI Units Maleev & Hartman 5^{th} edition (edited by O.P.Grover)

Note: The paper setter will be required to mention in the note in the question paper that the use of only PSG Design Data book is permitted.

SEMESTER – V

FLUID MACHINES **ME – 5003**

Course Code	**ME – 5003**	Credits : 4	L-3, T-1, P-0
Name of the Course	**FLUID MACHINES**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)		**Max. Marks: 50**	

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section – A

Impact of free jets: Impulse – momentum principle, jet impingement – on a stationary flat plate and on a hinged plate – on a moving flat plate – at the centre of a stationery vane, a moving vane and a series of vanes Jet striking tangentially at the tip of a stationery vane and a moving vane, jet propulsion of ships.

Impulse Turbines: Classification – impulse and reaction turbines, water wheels, component parts, construction, operation and governing mechanism of a Pelton wheel, work done, effective head available head and efficiency of a pelton wheel, design aspects, speed ratio, flow ratio, jet ratio number of jets, number of buckets and working proportions, Performance Characteristics, Numerical Problems.

Section – B

Francis Turbines: Component parts, construction and operation of a Francis turbine, governing mechanism, work done by the turbine runner, working proportions and design parameters, slow medium and fast runners, degree of reaction, inward/outward radial flow reaction turbines, Performance Characteristics.

Propeller and Kaplan turbines: Component parts, construction and operation of a Kaplan turbine, differences between the Francis and Kaplan turbines, draft tube – its functions and different forms, Performance Characteristics.

Section – C

Dimensional Analysis and Model Similitude: Dimensional homogeneity, Rayleigh's method and Buckingham's Pitheorem, model studies and similitude, dimensionless numbers and their significance. Unit quantities, specific speed and model relationships for turbines, scale effect cavitations – its causes, harmful effects and prevention, Thomas cavitation number.

Hydraulic systems: Function, construction and operation of: Hydraulic accumulator, hydraulic intensifier, hydraulic crane, hydraulic lift and hydraulic press, Hydraulic ram.

Section – D

Centrifugal Pumps: Classification, velocity vector diagrams and work done, hydraulic and manometric efficiency, vane shape, head capacity relationship and pump losses, pressure rise impeller, minimum starting speed, multi-stage pumps, Similarity relations and specific speed, net positive suction head, cavitation and maximum suctions lift, performance characteristics.

Reciprocating Pumps: Construction and operational details, discharge coefficient, volumetric efficiency and slip, work and power input, effect of acceleration and friction on indicator diagram (pressure – stroke length plot) air vessels and their utility. Centrifugal Vs. reciprocating pumps.

Text Books:

1. Hydraulics and Fluid Mechanics – Modi & Seth, Pub. – Standard Book House, N.Sarak, Delhi.
2. Hydraulic Machines – V.P.Vasandani.

Reference Books:

1. Hydraulic Machines – Jagdish Lal.
2. Introduction to Fluid Mechanics and Fluid Machines: S.K.Somand G.Biswas, Tata McGraw Hill.
3. Fluid Mechanics and Fluid Power Engineering – D.S.Kumar, S.K.Kataria and Sons.

SEMESTER – V

INTERNAL COMBUSTION ENGINES ME – 5004

Course Code	**ME – 5004**	Credits : 4	L-3, T-1, P-0
Name of the Course	**INTERNAL COMBUSTION ENGINES**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)		**Max. Marks: 50**	

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section – A

Introduction: I.C.Engines and their classification, Piston – Cylinder Arrangement and Related Terms, parts and their functions, Cycle of operation of four stroke and two stroke Engines, Applications. Analysis of Air Standard Otto, Diesel and Dual Cycles, Air Standard Efficiency and Mean Effective Pressure, Deviation of Actual Engine Cycle from Ideal Cycle, Valve Timing Diagrams for I.C.Engines, Wankel Engine.

Two Stroke Engines: Principle of working, Scavenging and Scavenging Methods, Port Timing Diagram, Merits and Demerits, Applications, Comparison with Four Stroke Engines.

Section – B

Carburetion and Fuel Ignition Systems: Purpose, Main Requirements and Principle of a Carburetor, Constructional and Operational Details of a Single jet Carburetor, Compensating Devices, Salient Features and Comparative Merits/Demerits of Battery Ignition system and Magneto Ignition System, Timings and Spark Advance, Introduction to Basic Electronic Petrol Injection System, and Multipoint Fuel Injection System.

Fuel Injection in CI Engines: Requirements of Diesel Fuel Injection System, Air Injection and Airless Injection systems, constructional and Operational Details of Fuel Pump and Fuel Atomizer.

Section – C

Combustion Process: Stages of combustion in S.I.Engines, Flame Ignition and Propagation, Effect of Engine Variables on Flame Speed, Pre-Ignition and Detonation, Engine Variables Affecting Detonation, Theories of Detonation, Highest Useful Compression Ratio and Octane Rating of Fuels. Combustion in CI Engines, Effect of Operating Variables on Delay Period and Diesel Knock, Comparison between Knocking in SI and CI Engines, Rating of Diesel Fuel – Cetane Number and Diesel Index.

Cooling and Lubrication Systems: Need for Cooling, Classification of Cooling Systems – Thermo System, Radiator and Air-Cooling Systems. Function of a Lubricating System, Splash and Pressure Lubrication System, Wet and Dry Sump Lubrications, Lubrication of different Engine Parts, S.A.E. Rating of Lubricants.

Section – D

Engine Testing and Performance: Purpose of Testing, Performance Parameters: Brake Power, Indicated Power, Mechanical Efficiency, Fuel and Air Consumption. Thermal Efficiency and Specific Fuel consumption. Heat balance Calculations and Performance Maps. Supercharging: Objective, Effects and its limits in SI and CI Engines, Numerical Problems.

Engine Pollution and Alternative Fuels: Pollutants from SI and CI Engines, Methods of Emission Control, Alternate Fuels – Alcohol, LPG, Hydrogen, CNG, Biogas, Relative Merits and Demerits of these Fuels.

Text Books:

- Internal Combustion Engines – V.Ganeshan, Mc. Graw Hill.
- Automobile Engg. Vol.-II, Dr. Kirpal singh, Standard Publishers Distributors, Delhi.
- Internal Combustion Engines – Mathur and Sharma, Dhanpat Rai and Sons.

Reference Books:

- Internal Combustion Engines – Romalingum, Scitech Publication.
- IC Engines – Maleev, McGraw Hill.
- Mechanics of Automotive Engines – Srockan.

SEMESTER – V

MANUFACTURING TECHNOLOGY – II ME – 5005

Course Code	**ME – 5005**	Credits: 4	L-3, T-1, P-0
Name of the Course	**MANUFACTURING TECHNOLOGY – II**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time: 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)		**Max. Marks: 50**	

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section – A

Mechanism of Metal Cutting: Deformation of metal during machining, nomenclature of lathe, milling tools, mechanics of chip formation, built-up edges, mechanics of orthogonal and oblique cutting, Merchant cutting force circle and shear angle relationship in orthogonal cutting, factors affecting tool forces. Cutting speed, feed and depth of cut, surface finish. Temperature distribution at tool chip interface. Numericals on cutting forces and Merchant circle.

Section – B

Cutting Tool Materials and Cutting Fluids: Characteristics of tool materials, various types of cutting tool materials, coated tools, cutting tool selection, Purpose and types of cutting fluids, basic actions of cutting fluids, effect of cutting fluid on tool life, selections of cutting fluid.
Tool Wear and Machinability: Types of tool wear, tool life, factors governing tool life, Machinability: Definition and evaluation, Economics of machining, Numericals on tool life.

Section – C

Gear Manufacturing: Introduction, methods of manufacture, Gear generation and forming: Gear cutting by milling, single point form tool, gear hobbing and shaping, Gear finishing operations: Gear shaving, gear burnishing, gear grinding, lapping.
Jigs & Fixtures: Introduction, location and location devices, clamping and clamping device, Drill Jigs, Milling Fixtures.

Section – D

Unconventional Machining Processes: Abrasive jet machining: Principles, applications, process parameters, Ultrasonic machining: Principles, applications, analysis of process parameters. Electro-chemical machining and grinding: Principles, classifications, choice of electrolytes, applications. Electric discharge machining: Principles, selection of tools materials and dielectric fluid. Electron beam machining: Generation of electron beam, relative merits and demerits. Laser beam machining: Principles and applications.

Text Books:

- Manufacturing Technology – Metal cutting and machine Tools: P.N.Rao, Tata McGraw hill, New Delhi.
- Introduction to Jig and Tool Design : Kempster M.H.A., Hodder & Stoughton, England.

Reference Books:

- Principles of Machine Tools – F.C.She & A.Bhattacharya, Tata McGraw Hill, New Delhi.
- Manufacturing Engineering & Technology, Kalpakjian, Scrope Addison – Wesly Publishing Co. New York.
- Modern Machining Processes: P.C.Pandey &H.S.Shan, Tata McGraw Hill Company, New Delhi.
- Text Book of Production Engineering: P.C.Sharma, S.Chand & Sons……..

SEMESTER – V

KINEMATICS OF MACHINES LAB ME – 5006

Course Code	**ME – 5006**	Credits: 2	L-0, T-0, P-2
Name of the Course	**KINEMATICS OF MACHINES LAB**		
Lectures to be delivered	26 hours of Lab sessions		
Semester End Examination	Maximum Time: 3 hrs.	Max. Marks: 50	Min. Pass Marks : 20
Laboratory	Continuous Assessment (based on Lab work 30%, Lab record 25%, Viva 25%, Attendance 20%)	Max. Marks: 50	Min. Pass Marks: 25

Instructions for paper setter/Candidates

Laboratory examination will consist of two parts:

i) Performing a practical examination assigned by the examiner (50% marks).
ii) Viva-voce examination (50% marks).

Viva-voce examination will be related to the practicals performed/projects executed by the candidate related to the paper during the course of the semester.

List of Experiments:

1. To study various types of kinematic links, Pairs, Chains and Mechanisms.
2. To study inversions of 4 Bar Mechanisms, Single and Double slider crank mechanisms.
3. To plot slider displacement, velocity and acceleration against crank rotation for Single Slider Crank mechanism.
4. To find Coefficient of friction between Belt and Pulley.
5. To study various type of Cam and Follower arrangements.
6. To plot follower displacement vs cam rotations for various Cam Follower systems.
7. To generate spur gear involute tooth profile using simulated gear shaping process.
8. To study various types of gears – Helical, worm & bevel gears.
9. To study various types of gear trains – simple, compound, reverted, epicyclic and differential.
10. To study the working of Screw Jack and determine its efficiency.

SEMESTER – V

FLUID MACHINES LAB **ME – 5007**

Course Code	**ME – 5007**	Credits : **2**	**L-0, T-0, P-2**
Name of the Course	**FLUID MACHINES LAB**		
Lectures to be delivered	**26 hours of Lab sessions**		
Semester End Examination	**Maximum Time: 3 hrs.**	**Max. Marks: 50**	**Min. Pass Marks : 20**
Laboratory	**Continuous Assessment (based on Lab work 30%, Lab record 25%, Viva 25%, Attendance 20%)**	**Max. Marks: 50**	**Min. Pass Marks: 25**

Instructions for paper setter/Candidates

Laboratory examination will consist of two parts:

i) Performing a practical examination assigned by the examiner (50% marks).
ii) Viva-voce examination (50% marks).

Viva-voce examination will be related to the practicals performed/projects executed by the candidate related to the paper during the course of the semester.

List of Experiments:

1. To study the constructional details of a Pelton turbine and draw its fluid flow circuit.
2. To draw the performance characteristics of Pelton turbine constant head, constant speed and constant efficiency.
3. To study the constructional details of a Francis turbine and draw its fluid flow circuit.
4. To draw the constant head, constant speed and constant efficiency performance characteristics of Francis turbine.
5. To study the constructional details of a Kaplan turbine and draw its fluid flow circuit.
6. To draw the constant head, speed and efficiency curves for a Kaplan turbine.
7. To study the constructional details of a Centrifugal Pump and draw its characteristic curves.
8. To study the constructional details of a Reciprocating Pump and draw its characteristic curves.
9. To study the constructional details of a Hydraulic Ram and determine its various efficiencies.
10. To study the constructional details of a Centrifugal compressor.

SEMESTER – V

I.C.ENGINES LAB **ME – 5008**

Course Code	**ME – 5008**	Credits: 2	**L-0, T-0, P-2**
Name of the Course	**I.C.ENGINES LAB**		
Lectures to be delivered	**26 hours of Lab sessions**		
Semester End Examination	**Maximum Time: 3 hrs.**	**Max. Marks: 50**	**Min. Pass Marks : 20**
Laboratory	**Continuous Assessment (based on Lab work 30%, Lab record 25%, Viva 25%, Attendance 20%)**	**Max. Marks: 50**	**Min. Pass Marks: 25**

Instructions for paper setter/Candidates

Laboratory examination will consist of two parts:
i) Performing a practical examination assigned by the examiner (50% marks).
ii) Viva-voce examination (50% marks).

Viva-voce examination will be related to the practicals performed/projects executed by the candidate related to the paper during the course of the semester.

List of Experiments:

1. To study the constructional details and working principles of two-stroke/four stroke petrol engine.
2. To study the constructional details and working of two-stroke/four stroke diesel engine.
3. Analysis of exhaust gases from single cylinder/multicylinder diesel/petrol engine by Orsat Apparatus.
4. To prepare heat balance sheet on multi-cylinder diesel engine/petrol engine.
5. To find the Indicated Power (IP) on multi-cylinder petrol engine/diesel engine by Morse Test.
6. To prepare variable speed performance test of a multi-cylinder/single cylinder petrol engine/diesel engine and prepare the curves (i) BP, IP, FP, vs speed. (ii) Volumetric Efficiency and Indicated Specific Fuel Consumption vs speed.
7. To find FP of a multi-cylinder diesel engine/petrol engine by Willian's line method and by motoring method.
8. To perform constant speed performance test on a single cylinder/multi cylinder diesel engine and draw curves of (i) BP vs fuels rate, air rate and A/F and (ii) BP Vs. mech efficiency and bsfc.
9. To measure CO. & Hydrocarbons in the exhaust of 2 stroke / 4 stroke petrol engine.
10. To find intensity of smoke from a single cylinder / multicylinder diesel engine.

SEMESTER – V

MANUFACTURING PRACTICE – II **ME – 5009**

Course Code	**ME – 5009**	Credits: 3	**L-0, T-0, P-2**
Name of the Course	**MANUFACTURING PRACTICE – II**		
Lectures to be delivered	**26 hours of Lab sessions**		
Semester End Examination	**Maximum Time: 3 hrs.**	**Max. Marks: 50**	**Min. Pass Marks : 20**
Laboratory	**Continuous Assessment (based on Lab work 30%, Lab record 25%, Viva 25%, Attendance 20%)**	**Max. Marks: 50**	**Min. Pass Marks: 25**

Instructions for paper setter/Candidates

Laboratory examination will consist of two parts:
i) Performing a practical examination assigned by the examiner (50% marks).
ii) Viva-voce examination (50% marks).

Viva-voce examination will be related to the practicals performed/projects executed by the candidate related to the paper during the course of the semester.

List of Experiments:

1. To measure a gap gauge with slip gauges.
2. To measure the height of a circular spigot.
3. To calibrate a micrometer.
4. To measure a plug screw gauge.
5. To check a straight edge.
6. To check a engineer square.
7. To measure the angle of taper plug with sine bar.
8. To check a form gauge by projections including the construction of the projections drawing.
9. To check a sine bar.
10. To measure the pitch error of a screw gauge (plug or Ring).
11. To measure the form and angle of a plug screw gauge by optical methods.
12. To calibrate dial gauge.
13. To compare the two slip gauges using an optical flat.
14. To test the flatness of a surface plate using a block level.

SEMESTER –V

AUTOCAD LABORATORY **ME – 5010**

Course Code	**ME – 5010**	Credits: 2	**L-0, T-0, P-2**
Name of the Course	**AUTOCAD LABORATORY**		
Lectures to be delivered	**26 hours of Lab sessions**		
Semester End Examination	**Maximum Time: 3 hrs.**	**Max. Marks: 50**	**Min. Pass Marks : 20**
Laboratory	**Continuous Assessment (based on Lab work 30%, Lab record 25%, Viva 25%, Attendance 20%)**	**Max. Marks: 50**	**Min. Pass Marks: 25**

Instructions for paper setter/Candidates

Laboratory examination will consist of two parts:
i) Performing a practical examination assigned by the examiner (50% marks).
ii) Viva-voce examination (50% marks).

Viva-voce examination will be related to the practicals performed/projects executed by the candidate related to the paper during the course of the semester.

List of Experiments:

1. Setting up of drawing environment by setting drawing limits, drawing units, naming the drawing naming layers, setting line types for different layers using various type of lines in Engineering drawing, saving the file with dwg. extension.
2. Layout drawing of a building using different layer and line colors indicating all Building details name the details using text commands, Make a title Block.
3. To Draw Orthographic projection drawings (Front, Top and side) of boiler safety valve giving name the components of the valve.
4. Make an Isometric dimensioned drawing of a connecting Rod using Isometric grid and snap.
5. Draw quarter sectional isometric view of a cotter joint.
6. Draw different types of bolts and nuts with internal and external threading in Acme and square threading standards. Save the bolts and nuts as blocks suitable for insertion.
7. Draw 3D models by extruding simple 2D objects, dimension and name the objects.
8. Draw a 3D model of a machine component using 3D primitives and using commands like Union. Subtraction, Revolve, Slice, Rotate 3D etc. Calculate surface Area, Mass, Centre of Gravity and Mass moment of inertia using inquiry commands render the figure made and attach a material to the figure.
9. Draw a spiral by extruding a circle.
10. Draw an assembly. Drawing of a machine part in 3D, different components of the machine are to be made in separate layers.