STATE BOARD OF TECHNICAL EDUCATION BIHAR

Scheme of Teaching and Examinations for

IVth SEMESTER DIPLOMA IN MECHANICAL ENGINEERING(CAD/CAM)

(Effective from Session 2022-23 Batch)

THEORY

Sr. No.	SUBJECT	SUBJECT CODE	TEACHIN G	EXAMINATI ON-SCHEME							
			Periods per Week	Hours of Exam.	Teacher's Assessment (TA) Marks A	Class Test (CT) Marks B	End Semester Exam (ESE) Marks C	Total Marks (A+B+C)	Pass Marks ESE	Pass Marks in the Subject	Credits
1.	Measurements & Metrology	2025401	03	03	10	20	70	100	28	40	03
2.	Strength of Materials	2025402	03	03	10	20	70	100	28	40	03
3.	Computer Aided Design	2046403	03	03	10	20	70	100	28	40	03
4.	Theory of Machines & Mechanisms	2025404	03	03	10	20	70	100	28	40	03
5.	Tool Engineering	2025405	03	03	10	20	70	100	28	40	03
		Total: · 15					**350**	**500**			**15**

PRACTICAL

Sr. No.	SUBJECT	SUB.JECT CODE	TEACHING SCHEME	EXAMINATION-SCHEME					
			Periods per Week	Hours of Exam.	Practical		Total Marks (PA+ ESE)	Pass Marks in the Subject	Credits
					Internal (PA)	External (ESE)			
6.	Measurements & Metrology Lab	2025406	02 50% Physical 50% Virtual	03	15	35	50	20	01
7.	Material TestingLab	2025407	04 50% Physical 50% Virtual	03	15	35	50	20	02
8.	CAD Lab	2046408	04 50% Physical 50% Virtual	03	15	35	50	20	02
Total: - 10							**150**		**05**

TERM WORK

Sr. No.	SUBJECT	SUBJECT CODE	TEACHING SCHEME	EXAMINATION-SCHEME				
			Periods per Week	Marks of Internal Examiner (PA)	Marks of External Examiner (ESE)	Total Marks (PA+ ESE)	Pass Marks in the Subject	Credits
9.	Minor Project	2046409	04	15	35	50	20	02
10.	Course Under Moocs / Swayam / Others	2046410	04	15	35	50	20	02
Total: -			08			100		**04**
Total Periods per week Each of duration One Hour 33				Total Marks = 750				**24**

MEASUREMENTS & METROLOGY

Subject Code 2025401	Theory						Credits
	No. of Periods Per Week			Full Marks	:	100	03
	L	T	P/S	ESE	:	70	
	03		—	TA	:	10	
	—	—	—	CT	:	20	

Course objectives:

1. To study advances in technology, measurement techniques, types ofinstrumentation devices, innovations, refinements.
2. To study the principles of instrumentation, transducers & measurement of non-electricalparameters like temperature, pressure, flow, speed, force and stress.

CONTENTS: THEORY

Unit	Name of Topics	Hrs.
Unit-I	**1.1 Introduction:** Definition of measurement; Significance of measurement. Methods of measurements: Direct & Indirect; Generalized measuring system; Standards of measurements: Primary & Secondary; Factors influencing selection of measuring instruments; Terms applicable to measuring instruments: Precision and Accuracy, Sensitivity and Repeatability, Range, Threshold, Hysteresis, calibration; Errors in Measurements: Classification of errors, Systematic and Random error. **1.2 Measuring instruments**: Introduction; Thread measurements: Thread gauge micrometer; Angle measurements: Bevel protractor, Sine Bar; Gauges: plain plug gauge, ring Gauge, snap gauge, limit gauge; Comparators: Characteristics of comparators, Types of comparators. **1.3 Surface finish**: Definition, Terminology of surface finish, Talysurf surface roughness tester; Co-ordinating measuring machine.	**10**
Unit-II	**2.1 Transducers and Strain gauges:** Introduction of Transducers, Characteristics, classification of transducers, two coil self-inductance transducer, Piezoelectric transducer, Strain gauges & Measurements: Strain gauge, Classification, mounting of strain gauges, Strain gauge rosettes-two and three elements. **2.2 Measurement of force, torque, and pressure:** Introduction to Force measurement: Spring Balance, Proving ring, Load cell; Torque measurement: Prony brake, Eddy current, Hydraulic dynamometer; Pressure measurement**:** Mcleod gauge.	**10**
Unit-III	**3.1 Applied mechanical measurements:** Speed measurement: Classification of tachometers, Revolution counters, Eddy current tachometers; Displacement measurement: Linear variable Differential transformers (LVDT); Flow measurement: Rotameters, Turbine meter; Temperature measurement: Resistance thermometers, Optical Pyrometer. **3.2 Miscellaneous measurements**: Humidity measurement: hair hygrometer; Density measurement: hydrometer; Liquid level measurement: sight glass, Float gauge; Biomedical measurement: Sphygmo monometer.	**08**
Unit-IV	**4.1 Limits, Fits & Tolerances:** Concept of Limits, Fits, and Tolerances; Selective Assembly; Interchangeability; Hole and Shaft Basis System; Taylor's Principle; Design of Plug; Ring Gauges; IS 919- 1993 (Limits, Fits & Tolerances, Gauges} IS 3477-1973; concept of multi gauging and inspection. **4.2 Angular Measurement:** Concept; Instruments for Angular Measurements; Working and Use of Universal Bevel Protractor, Sine Bar, Spirit Level; Principle of Working of Clinometers; Angle Gauges (With Numerical on Setting of Angle Gauges). **4.3 Screw thread Measurements**: ISO grade and fits of thread; Errors in threads; Pitch errors; Measurement of different elements such as major diameter, minor diameter, effective diameter, pitch; Two wire method; Thread gauge micrometer; Working principle of floatingcarriage dial micrometer.	**10**

Unit- V	**5.1 Gear Measurement and Testing:** Analytical and functional inspection; Rolling test Measurement of tooth thickness (constant chord method); Gear tooth Vernier; Errors in gears such as backlash, runout, composite. **5.2 Machine tool testing:** Parallelism; Straightness; Squareness; Coaxially; roundness; run out; alignment testing of machine tools as per IS standard procedure.	**07**
	Total Hours	**45**

References:

1. Mechanical measurements – Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2006.
2. Metrology & Measurement – Annand K Bewoor, Vinay kulakarni, Tata McGraw Hill, New Delhi,2009
3. Principles of Industrial instrumentation and control systems – Channakesava. R. Alavala, DELMAR cenage learning, 2009.
4. Principles of Engineering Metrology – Rega Rupendra, Jaico publishers, 2008
5. Dimensional Metrology – Connie Dotson, DELMAR, Cenage learning, 2007
6. Instrumentation measurement and analysis – B.C. Nakara, K.K. Chaudary, second edition,Tata cgraw Hill, 2005.
7. Engineering Metrology – R.K. Jain, Khanna Publishers, New Delhi, 2005.
8. A text book of Engineering Metrology – I.C. Gupta, Dhanpat Rai and Sons, New Delhi, 2005
9. Metrology for Engineers – J.F.W. Galyer and C. R. Shotbolt, ELBS1
10. Engineering Metrology – K. J. Hume, Kalyani publishers
11. Measurement & Metrology - Rohit Bajaj, FPH
12. Measurement & Metrology - Ram Manohar Pandey, FPH

Course outcomes:

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

CO1 Define accuracy, precision, calibration, sensitivity, repeatability and such relevantterms in metrology.

CO2 Distinguish between various types of errors.

C**O3** Understand the principle of operation of an instrument and select suitable measuring device for a particular application.

CO4 Appreciate the concept of calibration of an instrument.

CO5 Analyze and interpret the data obtained from the different measurements processes and present it in the graphical form, statistical form.

STRENGTH OF MATERIALS

Subject Code	Theory						Credits
2025402	No. of Periods Per Week			Full Marks	:	100	03
	L	T	P/S	ESE	:	70	
	03	—	—	TA	:	10	
	—	—	—	CT	:	20	

Course objectives:

1. To understand the concept of Simple Stresses and Strains.
2. To understand the concept of Strain Energy.
3. To understand the concept of Shear Force and Bending Moment Diagrams.
4. To understand the concept of Theory of Simple Bending and Deflection of Beams.
5. To understand the concept of Torsion in Shafts and Springs.
6. To understand the concept of Thin Cylindrical Shells.

CONTENTS: THEORY

Unit	Name of Topics	Hrs
Unit- I	**1.1 Simple Stresses and Strains:** Types of forces; Stress, Strain and their nature; Mechanical properties of common engineering materials; Significance of various points on stress –strain diagram for M.S. and C.I specimens; Significance of factor of safety; Relation between elastic constants; Stress and strain values in bodies of uniform section and of composite section under the influence of normal forces; Thermal stresses in bodies of uniform section and composite sections; Related numerical problems on the above topics. **1.2 Strain Energy: Strain** energy or resilience, proof resilience and modulus of resilience Derivation of strain energy for the following cases: i) Gradually applied load, ii) Suddenly applied load, iii) Impact/ shock load; Related numerical problems.	**08**
Unit- II	**2.1 Shear Force & Bending Moment Diagrams**: Types of beams with examples: **a)** Cantilever beam, **b)** Simply supported beam, **c)** Over hanging beam, **d**) Continuous beam, **e)** Fixed beam; Types of Loads – Point load, UDL and UVL; Definition and explanation of shear force and bending moment; **2.2 Calculation of shear force and bending moment and drawing the S.F and B.M. diagrams by the analytical method only for the following cases: a**) Cantilever with point loads, **b)** Cantilever with uniformly distributed load, **c)** Simply supported beam with point loads**, d)** Simply supported beam with UDL, **e)** Over hanging beam with point loads, at the centre and at free ends, **f)** Over hanging beam with UDL throughout, **g)** Combination of point and UDL for the above; Related numerical problems.	**10**
Unit-III	**3.1 Theory of Simple Bending and Deflection of Beams**: Explanation of terms: Neutral layer, Neutral Axis, Modulus of Section, Moment of Resistance, Bending stress, Radius of curvature; As assumptions in theory of simple bending; Bending Equation $M/I = \sigma/Y = E/R$ with derivation; calculations of bending stress, modulus of section and moment of resistance; Calculation of safe loads and safe span and dimensions of cross- section; Definition and explanation of deflection as applied to beams; Deflection formulae without proof for cantilever and simply supported beams with point load and UDL only (Standard cases only); Related numerical problems.	**10**

Unit- IV	**4.1 Torsion in Shafts and Springs:** Definition and function of shaft; Calculation of polar M.I.for solid and hollow shafts; Assumptions in simple torsion; Derivation of the equation**T / J = G*θ / L =τ / r**; Problems on design of shaft based on strength and rigidity; Numerical Problems related to comparison of strength and weight of solid and hollow shafts; Classification of springs; Nomenclature of closed coil helical spring; Deflection formula for closed coil helical spring (without derivation); stiffness of spring; Numerical problems on closed coil helical spring to find safe load, deflection, size of coil and number of coils.	**10**
Unit- V	**5.1 Thin Cylindrical Shells:** Explanation of longitudinal and hoop stresses in the light of circumferential and longitudinal failure of shell; Derivation of expressions for the longitudinal and hoop stress for seamless and seam shells; Related numerical Problems for safe thickness and safe working pressure (Related simple problems only)	**07**
	Total Hours	**45**

Reference Books:

1 Strength of Materials – D.S. Bedi, Khanna Book Publishing Co. (P) Ltd., Delhi, 2017

2. Strength of Materials – B.C.Punmia, A K Jain Laxmi Publica- tions, New Delhi, 2013

3. Strength of Materials – S. Ramamrutham, Dhanpat Rai & Publication New Delhi

4. Strength of Materials – R.S. Khurmi, S.Chand Company Ltd. Delhi

5. A Text Book strength of Material – R.K. Bansal, Laxmi Publication New Delhi.

6. Strength of Materials - Ravi Agarwal, FPH

7. Mechanics of Materials - Roshan Sinha, FPH

Course outcomes

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

CO1 Compute stress and strain values and find the changes in axial, lateral and volumetric dimensions of bodies of uniform section and of composite section under the influence of normal forces.

CO2 Calculate thermal stresses, in bodies of uniform section and composite sections.

CO3 Define resilience, proof – resilience and modulus of resilience and obtain expressions for instantaneous stress developed in bodies subjected to different loads.

CO4 Compute shear force and bending moment at any section of beam and draw the S.F. & B.M diagrams of for UDL and Point loads.

CO5 Calculate the safe load, safe span and dimensions of cross section.

CO6 Compare strength and weight of solid and hollow shafts of the same length and material andcompute the stress and deflection of the closed coil helical spring.

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Computer Aided Design

Subject Code	Theory						Credits
2046403	No. of Periods Per Week			Full Marks	:	100	03
	L	T	P/S	ESE	:	70	
	03	—	—	TA	:	10	
	—	—	—	CT	:	20	

Course objectives:

1. To acquire knowledge for generating high quality images of massive geometric models in a short time.
2. To learn about the concepts of surface modeling, physically based modeling and surface visualization.

CONTENTS: THEORY

Unit	Name of Topics	Hrs.
Unit-I	**1.1 Fundamentals of CAD:** Introduction, Benefits of CAD, Computer configuration for CAD applications, CAD Software, Automation; Design process; Application of computers for design, Design workstation; Graphic terminal. **1.2 CAD Software:** Definition of system software and application software; CAD database and structure. **1.3** Historical Development, Geometric Modeling, Explicit and Implicit Equations, Intrinsic Equations, Parametric Equations, Coordinate Systems.	**11**
Unit-II	**2.1 Transformations:** Translation, Rotation, Scaling, Symmetry and Reflection, Homogeneous Transformations, **2.2** Orthographic Projections, Axonometric Projections, Oblique Projections, Perspective Transformation.	**07**
Unit-III	**3.1 Curve Design:** Fundamental of Curve Design, Parametric Space of a Curve, **3.**2 Blending Functions, Reparameterization, Space Curves, Straight lines, Spline Curves, Bezier Curves,B-Spline Curve, Rational Polynomials, and NURBS.	**08**
Unit-IV	**4.1 Surface Design:** Fundamental of Surface Design, Parametric Space of a Surface, **4.**2 Reparameterization of a Surface patch, Sixteen Point form, Four Curve Form, Plane surface, Cylindrical and Ruled Surfaces, Surface of Revolution, Bezier Surface, B-Spline Surface.	**09**
Unit-V	**5.1 Solid Modeling:** Topology and Geometry, Set Theory, Boolean Operators, Set-membership Classification, Euler operators, **5.**2 Graph Based Models, Boolean Models, Instances and Parameterized Shapes, Cell Decomposition and Spatial Occupancy Enumeration, Sweep Representation, Constructive Solid Geometry, Boundary Representation.	**10**
	Total Hours	**45**

Reference Books:

1. CAD/CAM: Computer-Aided Design and Manufacturing, Groover M.P. &Zimmers Jr, Prentice hall of India
2. CAD/CAM Principles and Applications, P.N.Rao, Tata McGraw-Hill
3. Computer Aided Design: A Conceptual Approach, Jayanta Sarkar,CRC Press
4. Design Theory and Methods using CAD/CAE: The Computer Aided Engineering Design , Kuang-Hua Chang, Academic Press.

Course outcomes

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

CO1 Understand the geometric modeling, translation, rotation, scaling, reflection, symmetry and such relevant terms in CAD.

CO2 Distinguish between curve and surface design.

C**O3** Understand the Spline, Bezier, NURBS curve.

CO4 Appreciate the concept of surface patching in surface designing.

CO5 Visualize the 3D model in CAD software.

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THEORY OF MACHINE & MECHANISMS

Subject Code 2025404	Theory						Credits
	No. of Periods Per Week			Full Marks	:	100	03
	L	T	P/S	ESE	:	70	
	03	—	—	TA	:	10	
	—	—	—	CT	:	20	

Course objectives:

1. To understand different types of cams and their motions and also to draw cam profiles for various motions.
2. To understand the mechanism of various types of drives available for transmission of power.
3. To understand the design of Brakes, Dynamometers, Bearings and Clutches and their function and working.
4. To understand the need for balancing of masses in the same plane
5. To know different types of governors.

CONTENTS: THEORY

Unit	Name of Topic	Hrs
Unit-I	**Cams and Followers:** **1.1** Concept; Definition and application of Cams and Followers; Classification of Cams and Followers; Different follower motions and their displacement diagrams like uniform velocity, SHM, uniform acceleration and Retardation; **1.2** Drawing of profile of radial cam with knife- edge and roller follower with and without Offset with reciprocating motion (graphical method).	**06**
Unit-II	**Power Transmission:** 2.1 Types of Drives – Belt, Chain, Rope, Gear drives & their comparison; Belt Drives - flat belt, V– belt & its applications; Material for flat and V-belt; Angle of lap, Belt length. Slip and Creep; Determination of Velocity Ratio, Ratio of tight side and slack side tension; Centrifugal tension and Initial tension; Condition for maximum power transmission (Simple numerical); 2.2 Chain Drives – Advantages & Disadvantages; Selection of Chain &Sprocket wheels; Methods of lubrication; Rope Drives –Types, applications, advantages & limitations of Steel ropes. 2.3 Gear Drives – Spur gear terminology; Types of gears and gear trains, their selection for different applications; Train value & Velocity ratio for compound, reverted and simple epicyclic gear train; Methods of lubrication; Law of gearing;	**12**
Unit-III	**Flywheel and Governors** 3.1 Flywheel - Concept, function and application of flywheel with the help of turning moment diagram for single cylinder 4-Stroke I.C. Engine (no Numerical); Co- efficient of fluctuation of energy, Coefficient of fluctuation of speed and its significance; 3.2 Governors: Types and explanation with neat sketches (Centrifugal, Watt and Porter); Concept, function and applications& Terminology of Governors; Comparison between Flywheel and Governor.	**10**

Unit-IV	**Brakes, Dynamometers, Clutches & Bearings:** 4.1 Function of brake sand dynamometers; Types of brakes and Dynamometers; Comparison between brakes and dynamometers; Construction and working of shoe brake, ii) Band Brake, iii) Internal expanding shoe brake iv) Disc Brake; v) Concept of Self Locking & Self energizing brakes; Numerical problems to find braking force and braking torque for shoe &band brakes; 4.2 Construction and working of Rope Brake Dynamometer, Hydraulic Dynamometer, Eddy current Dynamometers; 4.3 Clutches- Uniform pressure and Uniform Wear theories; Function of Clutch and its application; Construction and working of Single plate clutch, ii) Multiplate clutch, iii) Centrifugal Clutch iv) Cone clutch and v) Diaphragm clutch. (Simple numerical on Single and Multiplate clutch); Bearings Simple Pivot, Collar Bearing iii) Conical pivot. Torque & power lost in friction (no derivation). Simple numerical.	**10**
Unit-V	**Balancing & Vibrations:** 5.1 Concept of balancing; Balancing of single rotating mass; Graphical method for balancing of several masses revolving in same plane; 5.2 Concept and terminology used in vibrations Causes of vibrations in machines; their harmful effects and remedies.	**07**
	Total Hours	**45**

References:

1. Theory of machines – S.S .Rattan ,Tata McGraw-Hill publications.
2. Theory of machines – R.K.Bansal ,Laxmi publications
3. Theory of machines – R.S. Khurmi&J.K.Gupta ,S.Chand publications.
4. Dynamics of Machines – J B K Das, Sapna Publications.
5. Theory of machines – Jagdishlal, Bombay Metro – Politan book Ltd.
6. Theory of Machines & Mechanisms - Shishir Kumar, FPH
7. Theory of Machines & Mechanisms - Sanjay Goel, FPH

Course outcomes:

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

CO1 Know different machine elements and mechanisms.

CO2 Understand Kinematics and Dynamics of different machines and mechanisms.

CO3 Select Suitable Drives and Mechanisms for a particular application.

CO4 Appreciate concept of balancing and Vibration.

CO5 Develop ability to come up with innovative ideas.

CO6 Understand different types of cams and their motions and also draw cam profiles for various motions.

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TOOL ENGINEERING

Subject Code	Theory						Credits
2025405	No. of Periods Per Week			Full Marks	:	100	03
	L	T	P/S	ESE	:	70	
	03	—	—	TA	:	10	
	—	—	—	CT	:	20	

Course objectives:

1. To understand metal cutting and forming process and factors affecting machinability.
2. To develop knowledge of tools, dies and tool materials.
3. To understand processes for increased productivity and quality.

CONTENTS: THEORY

Unit	Name of Topics	Hrs.
Unit-I	**1.1 Metal Cutting:** Mechanics of Metal cutting; requirements of tools; cutting forces; types of chips; chip thickness ratio; shear angle; simple numerical only; types of metal cutting process; orthogonal; oblique and form cutting. **1.2 Cutting fluids:** types; characteristics and applications. **1.3 Tool wear:** Types of wear; Tool life; Tool life equations	12
Unit-II	**2.1 Machinability:** definition; factors affecting machinability; machinability index. **2.2 Tool materials:** Types; characteristics; applications; Heat treatment of tool steels; Specification of Carbide tips; Types of ceramic coatings. **2.3 Cutting Tool Geometry:** Single point cutting tool; drills; reamers; milling; cutters.	10
Unit-III	**3.1 Types of dies and construction:** Simple Die; Compound Die; Progressive Die; Combination Die. **3.2 Punch & Die mountings:** pilots; strippers; misfeed detectors; Pressure Pads; Knock outs; stock guide; FeedStop; guide bush; guide pins.	07
Unit-IV	4.1 **Die Design Fundamentals:** Die Operations; blanking; piercing; shearing; cropping; notching; lancing; coining; embossing; stamping; curling; drawing; bending; forming; Die set; Die shoe; Die area; Calculation of clearances on die and punch for blanking and piercing dies; Strip layout; Calculation of material utilization factor.	06
Unit-V	**5.1 Forming Dies:** Bending methods; Bending Dies; bend allowance; spring back; spanking; bending pressure; pressure pads; development of blank length. **5.2 Drawing:** operations; Metal flow during drawing; Calculation of Drawing blank size; variables affecting metal flow during drawing; single action and double action dies; combination dies. **5.3 Fundamentals of other Tools:** Constructional features of - Pressure Die casting dies; metal extrusion dies; injection molding dies; forging dies; plastic extrusion dies.	10
	Total Hours	45

Reference Books:

1. Tool Design - Donaldson Anglin, Tata McGraw Hill.
2. Production Technology- H.M.T.Jain, Tata McGraw Hill.
3. A Text Book of Production engineering – P.C. Sharma, S.Chand & Co.
4. Production Technology, R.K.Jain, Khanna Publishers. Course outcomes:
5. Tool Engineering - Prasant Banka, FPH

Course outcomes

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

CO1 Understand concepts, principles and procedures of tool engineering.

CO2 Classify and explain various tools and tool operations.

CO3 Select proper tool and a die for a given manufacturing operation to achieve highest productivity.

CO4 Estimate tool wear and tool life.

MEASUREMENTS & METROLOGY LAB

Subject Code	Theory						Credits
2025406	No. of Periods Per Week			Full Marks	:	50	01
	L	T	P/S	Internal (PA)	:	15	
		—	02	External (ESE)	:	35	
	—	—	—		:		

Course Objectives:

To understand techniques for precise measurement of the dimensions of various objects and shapes.

Course Content: Practical's

S.No. Topics for practical's

1. Measure the diameter of a wire using micrometer and compare the result with digital Micrometer.
2. Measure the angle of the machined surface using sine bar with slip gauges.
3. Measure the angle of a V-block / Taper Shank of Drill / Dovetail using universal bevel protractor.
4. Measure the dimensions of ground MS flat/cylindrical bush using Vernier Caliper compare with Digital/Dial Vernier Caliper.
5. Measure the geometrical dimensions of V-Thread using thread Vernier gauge.
6. Measure the thickness of ground MS plates using slip gauges.

Reference Books:

1. Engineering Metrology – R. K. Jain
2. Engineering precision metrology – R. C. Gupta
3. A Hand book of Industrial Metrology – ASME

Course outcomes:

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

CO1 Measure various component of linear measurement using Vernier callipers and Micrometer.

CO2 Measure various component of angle measurement using sine bar and bevel Protractor

CO3 Measure the geometrical dimensions of V-thread and spur gear

MATERIAL TESTING LAB

Subject Code 2025407	Theory						Credits
	No. of Periods Per Week			Full Marks	:	50	02
	L	T	P/S	Internal (PA)	:	15	
		—	04	External (ESE	:	35	
					:		

Course Objectives:

1. To identify the type of material based on its grain structure
2. To learn the procedure for identifying the cracks in the material
3. To understand various material testing methods to determine mechanical properties such as yield stress, Ultimate stress, percentage elongation, Young's Modulus etc.

Content: Practical's

S.No. Topics for practical's

1. Prepare a specimen and examine the microstructure of the Ferrous and Non- ferrous metals using the Metallurgical Microscope.
2. Detect the cracks in the specimen using (i) Visual inspection and ring test (ii) Die penetration test (iii) Magnetic particle test.
3. Determination of Rockwell's Hardness Number for various materials like mild steel, high carbon steel, brass, copper and aluminum.
4. Finding the resistance of materials to impact loads by Izod test and Charpy test.
5. Torsion test on mild steel – relation between torque and angle of twist determination of shearmodulus and shear stress.
6. Finding Young's Modulus of Elasticity, yield points, percentage elongation and percentage reduction in area, stress strain diagram plotting, tests on mild steel.
7. Determination of modulus of rigidity, strain energy, shear stress and stiffness by load deflection method (Open & Closed coil spring)
8. Single or double Shear test on M.S. bar to finding the resistance of material to shear load.

Reference Books:

1. Measurement system (Application and Design) – Ernest O Doebelin.
2. Strength of Materials – R.S. Khurmi, S.Chand Company Ltd. Delhi
3. A Text Book strength of Material– R.K. Bansal, Laxmi Publication New Delhi

Course outcomes

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

CO1 Identify the given specimen by viewing the micro structure using metallurgical microscope CO2 Identify the cracks in the specimen using different techniques

CO3 Determine the various types of stress and plot the stress strain diagram for mild steel.

CO4 Determine the torsion, bending, impact and shear values of given materials

CO5 Determine the modulus of rigidity, strain energy, shear stress and stiffness of coil spring

CAD LAB

Subject **Code** **2046408**	Theory						Credits
	No. of Periods Per Week			Full **Marks**	:	50	**02**
	L	**T**	**P/S**	**Internal (PA)**	**:**	**15**	
		—	**04**	**External (ESE)**	**:**	**35**	
	—	—	—		:		

Course Objectives:

1. To review and train in CAD modeling.
2. To develop skill to use software to create 2D and 3D models.

Course Content: Practical's

S.No. Topics for practical's

1. INTRODUCTION to CAD Sketcher.
2. Solid modeling –Extrude, Revolve, Sweep, etc and Variation sweep, Loft , etc,
3. **Surface modeling** –Extrude, Sweep, Trim .etc. and Mesh of curves, Free form etc,
4. Feature manipulation – Copy, Edit, Pattern, Suppress, History operations etc,
5. Assembly-Constraints, Exploded Views, Interference check, Drafting-Layouts, Standard & Sectional Views, Detailing & Plotting.
6. Exercises in Modeling and drafting of Mechanical Components - Assembly using Parametric and feature based Packages like SOLID WORKS /SOLID EDGE/ CATIA /PRO-E / AUTODESK INVENTOR/ NX / etc.

Reference Books:

1. Machine Drawing – P.S. Gill S. K. Kataria& Sons, Delhi., 17th Revised edition,2001.
2. Mechanical Draughtsmanship - G.L. Tamta Dhanpat Rai& Sons, Delhi,1992.
3. Inside AutoCAD – D. Raker and H. Rice, BPB Publications, New Delhi,1985.
4. CAD/CAM/CIM – P. Radhakrishnan, S. Subramaniyan & V. Raju, New Age International Pvt.Ltd., New Delhi, 3rdEdition.
5. Engineering AutoCAD, A.P. Gautam & Pradeep Jain, Khanna Book Publishing Co.,Delhi.

Course outcomes:

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

CO1 Explain the 2D, 3D commands and features of CAD software.

CO2 Create 3D solid model and find the mass properties of simple's solids.

CO3 Understand the constraints during assembling.

CO4 Exposure of Parametric and feature based Packages using assembly of 3D model.

TERM WORK

MINOR PROJECT.

Subject Code 2046409	Theory						Credits
	No. of Periods Per Week			Full Marks	:	50	02
	L	T	P/S	Internal (PA)	:	15	
		—	04	External (ESE)	:	35	
	—	—	—		:		

Course objectives:

The projects if done right can help enthusiastic Mechanical engineering students to develop the skills/profile needed for an exciting career in core technologies. Since practical skills are very important to work on core industries, experts tend to analyze candidate's performance based on their project experience during the interviews.

These projects provide an excellent opportunity to learn and showcase your practical skills to your future interviewers easily. If spent qualitatively you can build a very innovative electrical project and get a great learning experience. By doing so, you will not only develop an innovative project but also develop valuable skills needed for a successful career in core technologies related to electrical engineering. The best way to master a subject is by doing projects. Through a project you not only get a deeper understanding of the subject but also gain hands-on practical experience. If you are looking to do internships in college, the best way to catch the companies' attention is through projects.

Projects are generally done as a combined team effort. Two or more students work under a guide or a staff to get a certain result. By doing a project, you will

- Understand your subject better
- Get practical experience
- Chance to showcase your skills
- Learn about team work, communication skills and responsibilities When companies look for interns, they prefer students who have good understanding of the subject with at least some hands-on experience. The best to achieve both is by doing projects.

There is no fixed time to do a project. You can do it right from your first year in college. If you are looking to do a technical project, then the best time to start would be mid second year. It's not mandatory that you do many projects but make sure that you at least do one project. A lot of students tend to do few small projects from their second year and do a big project in their final year. By showcasing your projects, you can even look for internships while in college.

You can do any kind of projects based on your interests or subjects. The best way to go about this is to figureout what you are interested in. So, the first step is to find your interest and then do projects in your area of interest. Find your area of interest and then do a project in that field.

TERM WORK

COURSE UNDER MOOCS / SWAYAM / OTHERS.

Subject Code	Theory						Credits
2046410	No. of Periods Per Week			Full Marks	:	50	02
	L	T	P/S	Internal (PA)	:	15	
		—	04	External (ESE)	:	35	
	—	—			:		