II YEAR – I SEMESTER

ENGINEERING MATHEMATICS – III [VECTOR CALCULUS, PARTIAL DIFFERENTIAL EQUATIONS and FOURIER ANALYSIS]								
Code	Category	Periods			Sessional Marks	End Exam Marks	Total Marks	Credits
		L	T	P				
MEC 211	BS	2	1	0	40	60	100	3

Prerequisite: ENGINEERING MATHEMATICS – I, II

Course Objectives: The knowledge of Mathematics is necessary for a better understanding of almost all the Engineering and Science subjects. Here our intention is to make the students acquainted with the concept of basic topics from Mathematics, which they need to pursue their Engineering degree in different disciplines.

Course Outcomes :

The student will be able to :

CO - 1	Apply gradient, divergence & curl to scalar and vector point functions and also physically interpret their meaning.
CO - 2	Apply the concepts of Vector calculus & the corresponding theorems to evaluate line, surface and flux integrals.
CO - 3	Solve both first & higher order partial differential equations by different techniques and apply to two dimensional heat conduction equations, vibrations of a string etc.
CO - 4	Apply infinite Fourier series to represent discontinuous function which occurs in signal processing & electrical circuits.
CO - 5	Apply the principles of Fourier transforms to Boundary value problems.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	3	1	1									
CO-2	3	1	1									
CO-3	3	1	1									
CO-4	3	1	1									
CO-5	3	1	1									

Course Outcomes	PSO1	PSO2
CO-1	1	
CO-2	1	
CO-3	1	
CO-4	1	
CO-5	1	

CO- Course Outcome; PO- Program Outcome; PSO-Program Specific Outcome; Level- 1: Low, 2: Medium, 3: High

SYLLABUS

UNIT - I	**Periods: 6L+2T=8**

VECTOR DIFFERENTIATION

Scalar and vector point functions – Del applied to scalar point functions – Directional derivative – Del applied to vector point functions – Physical interpretation of divergence and curl – Del applied twice to point functions – Del applied to products of point functions.

Sections: 8.4, 8.5, 8.6, 8.7, 8.8 and 8.9.

UNIT - II	**Periods: 6L+2T=8**

VECTOR INTEGRATION

Integration of vectors – Line integral , circulation, work done – Surface integral , flux – Green's theorem in the plane – Stoke's theorem – Volume integral – Gauss divergence theorem (all theorems without proofs) – Irrotational and solenoidal fields.

Sections: 8.10, 8.11, 8.12, 8.13, 8.14, 8.15, 8.16 and 8.18.

UNIT - III	**Periods: 6L+2T=8**

PARTIAL DIFFERENTIAL EQUATIONS AND THEIR APPLICATIONS

Introduction – Formation of partial differential equations by eliminating arbitrary constants and functions – Solutions of a partial differential equations by direct Integration – Linear equations of the first order (Lagrange's linear equations).

Applications: Method of separation of variables – Vibrations of a stretched string: Wave equation – One dimensional heat flow equation ($\partial u/\partial t = c^2 \, \partial^2 u/\partial x^2$), and two dimensional heat flow equation (i.e. Laplace equation : $\partial^2 u/\partial x^2 + \partial^2 u/\partial y^2 = 0$).

Sections: 17.1, 17.2, 17.4, 17.5, 18.2, 18.4, 18.5, 18. 6 and 18. 7.

UNIT - IV	**Periods: 6L+2T=8**

FOURIER SERIES

Introduction – Euler's formulae – Conditions for a Fourier expansion – Functions having points of discontinuity – Change of interval – Even and odd functions – Half range series – Parseval's formula.

Sections: 10.1, 10.2, 10.3, 10.4, 10.5, 10.6, 10.7 and 10.9.

UNIT - V	**Periods: 6L+2T=8**

FOURIER TRANSFORMS

Introduction – Definition – Fourier integral theorem(without proof) - Fourier sine and cosine integrals – Fourier transforms – Properties of Fourier transforms – Convolution theorem – Parseval's identity for Fourier transforms – Relation between Fourier and Laplace transforms – Fourier transforms of the derivatives of a function – Applications of transforms to boundary value problems.

Sections: 22.1, 22.2, 22.3, 22.4, 22.5, 22.6, 22.7, 22.8, 22.9 and 22.11.

TEXT BOOKS:	
1.	B. S. Grewal, Higher Engineering Mathematics, 43rd edition, Khanna publishers, 2017.
REFERENCE BOOKS:	
1.	N P. Bali and Manish Goyal, A text book of Engineering mathematics, Laxmi publications,
2.	Erwin Kreyszig, Advanced Engineering Mathematics, 10th edition, John Wiley & Sons, 2011.
3.	R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3rdedition, Alpha
4.	George B. Thomas, Maurice D. Weir and Joel Hass, Thomas, Calculus, 13thedition, Pearson Publishers.

MECHANCIAL ENGINEERING DEPARTMENT

II YEAR – I SEMESTER

MATERIAL SCIENCE AND METALLURGY											
Code	**Category**	**Periods**						**Sessional Marks**	**End Exam Marks**	**Total Marks**	**Credits**
		L	**T**	**P**	**E**	**O**	**Total**				
MEC 212	**PC**	**3**	**0**	**0**	**1**	**2**	**6**	**40**	**60**	**100**	**3**

Course Objectives:

To give an insight to the student on the fundamentals of materials, their structure, properties, applications and failure mechanisms. Besides, introduce the different heat treatment methods, classify and study ferrous and non-ferrous alloys, composites and basics of Powder Metallurgy

Course Outcomes: At the end of the course the student will be able to:	
CO-1	**Analyse** the fundamental structures of materials and their properties.
CO-2	**Identify** various phases of alloys accompanied with various heat treatment methods.
CO-3	**Classify & explain** various properties and applications of ferrous and non-ferrous alloys and **identify** the properties of various materials based on their composition.
CO-4	**Analyse** the failure of the given component using failure mechanisms.
CO-5	**Identify & synthesize** the composite material and **explain** the principles of powder Metallurgy components.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	**1**	**2**										
CO-2	**1**	**2**										
CO-3	**1**	**2**				**1**	**1**					
CO-4	**1**	**2**				**1**	**1**					
CO-5	**1**	**2**				**1**	**1**		**1**	**2**		**1**

Course Outcomes	PSO1	PSO2
CO-1	**2**	
CO-2	**2**	
CO-3	**2**	
CO-4	**2**	
CO-5	**2**	

CO- Course Outcome; PO- Program Outcome; PSO-Program Specific Outcome; Level- 1: Low, 2: Medium, 3: High

SYLLABUS

UNIT-I

Engineering Materials: Properties, Classification of Materials, Necessity of alloying, types of solid solutions, Hume Rotherys rules.
Crystalline Solids: Unit cells, Crystal systems, Bravais Lattices, Atomic packing factor, Miller Indices for Crystallographic planes and directions. Crystal Defects: point, line and surface defects, Determination of grain size, effect of grain boundaries on the properties of metal/ alloys.

UNIT-II

Binary Phase Diagrams: Gibbs Phase rule, Lever rule, Invariant reactions, Study of important binary phase diagrams of Cu-Ni-, Al-Cu, Bi-Cd and Fe-Fe_3C.
Heat treatment of steel: Isothermal transformation curves, Annealing, Normalizing, Hardening, Tempering, Austempering and Martempering of steels, Surface hardening of steels: Carburizing, Nitriding, Cyaniding, Flame and induction hardening methods.

UNIT-III

Steels and Cast Irons: AISI-SAE classification of steel, Structure and properties of plain-carbon steels, low alloy steels, Tool steels, Stainless steels, Types of Cast irons: Grey CI, White CI, Malleable and Spheroidal Graphite irons, Alloy cast irons.
Non-ferrous metals and alloys: Structure and properties of Copper and its alloys, Aluminium and its alloys, Titanium and its alloys.

UNIT-IV

Plastic Deformation: Slip, Twinning, critical resolved shear stress. Strain hardening and other strengthening mechanisms
Material Failure Mechanisms: Ductile and Brittle fracture, Ductile to Brittle transition, fundamental concepts of creep and fatigue failure, creep curve.

UNIT-V

Composite Materials: Classification, Matrices and reinforcements, polymer matrix composite, ceramic matrix composite and metal matrix composites, Fabrication methods of composites.
Powder Metallurgy: Principles of Powder Metallurgy Process, Basic steps in Powder Metallurgy, Powder Manufacture, Powder Blending, Powder Compaction, Sintering, Advantages & limitations.

TEXT BOOKS:

1. Introduction to Physical Metallurgy, S.H. Avner, Tata McGraw Hill edition
2. Material Science and Metallurgy for Engineers, V.D. Kodgire & S.V. Kodgire, Everest Publishing House.
3. Materials Science and Engineering: An Introduction, William D. Callister Jr., David G. Rethwisch, wiley

REFERENCES:

1. Material Science and Engineering, L.H.Van Vleck, 5th edition, Addison Wealey (1985).
2. Structure and Properties of Materials, R.M. Rose, L.A.Shepard and J.Wulff Vol.1, John Willey (1966).
3. Essentials of Material Science, A.G. Guy ,McGraw-Hill (1976).
4. Material Science and Engineering, V. Raghavan ,Printice Hall of India
5. Essential of Materials science and engineering - Donald R.Askeland - Cengage.

WEB REFERENCES:

1. http://www.edinformatics.com/
2. http://materials.npl.co.uk/
3. http://www.wwcomposites.com/

II YEAR – I SEMESTER

ENGINEERING MECHANICS											
Code	Category	Periods						Sessional Marks	End Exam Marks	Total Marks	Credits
		L	T	P	E	O	Total				
MEC 213	PC	2	1	0	2	4	9	40	60	100	3

Prerequisite: Physics

Course Objectives: To enable the students understand and distinguish different force systems, evaluate the conditions required for their equilibrium, apply the concepts of dry friction, determine the properties of surfaces and solids, distinguish between particle and rigid body mechanics and further apply the principles of dynamics to bodies in motion.

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

CO-1	Determine the resultant force for the given coplanar and non-coplanar force systems.
CO-2	Determine the forces in the given 2D-trusses using the method of joints and sections; and calculate the forces required to keep the given body in equilibrium by considering friction.
CO-3	Calculate the centroid and moment of inertia of the plane surfaces including composite areas and also determine the mass moment of inertia for the given solid.
CO-4	Determine the kinematic and kinetic parameters of the given particle under rectilinear and curvilinear translations; and calculate the velocities of bodies under collision.
CO-5	Determine the kinematic and kinetic parameters of the given rigid bodies under rectilinear and curvilinear translations; and also SHM.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	2	2										
CO-2	2	2										
CO-3	2	2										
CO-4	2	2										
CO-5	2	2										

Course Outcomes	PSO1	PSO2
CO-1	2	
CO-2	2	
CO-3	2	
CO-4	2	
CO-5	2	

CO- Course Outcome; PO- Program Outcome; PSO-Program Specific Outcome; Level- 1: Low, 2: Medium, 3: High

UNIT –I

STATICS:

Introduction to Engineering mechanics, Scalar and vector quantities, vector operations

Statics of Particles: Fundamental concepts and principles- Resultant of coplanar concurrent forces and non-concurrent forces, free body diagrams, Equilibrium of particles. Resultant of concurrent forces in space (vector method).

Statics of rigid bodies: Moments and Couples-Varignon's theorem – Free body diagram- Equivalent force and couple – Types of supports and their reactions – Equilibrium of Rigid bodies in two dimensions. Principles of superposition and transmissibility.

UNIT –II

ANALYSIS OF TRUSSES AND FRICTION:

Trusses: Definition of a truss - Simple Trusses - Analysis of planar Trusses - Method of joints- Method of sections.

Friction: Characteristics of Dry Friction, Problems related to dry friction - Wedges – ladders.

UNIT - III

PROPERTIES OF SURFACES AND SOLIDS:

Centroids & Centre of Gravity: Centroids of lines & areas, C.G of volumes –determination by first principles, composite areas.

Moment of Inertia: Moment of inertia of an area- Radius of gyration - Parallel and perpendicular axis theorems – Polar moment of inertia - Mass moment of inertia.

UNIT –IV

DYNAMICS OF PARTICLES:

Displacements, Velocity and acceleration, their relationship – relative motion – Rectilinear and Curvilinear motion.

Newton's laws – D'Alembert's Principle-Work-Energy Equation of particles – Impulse and Momentum –Impact of elastic bodies- Impact - direct and central impact – coefficient of restitution.

UNIT - V

DYNAMICS OF RIGID BODIES:

Rotation of rigid body, General plane motion –Velocity and Acceleration- Absolute and Relative motion method. Equilibrium of rigid bodies in plane motion- Newton's Laws- D'Alembert's Principle-Work Energy Principle-Principle of impulse momentum for rigid bodies in plane motion. Simple harmonic motion.

Text Books:

1. Engineering Mechanics by S. Timoshenko and D.H.Young, McGraw-Hill

2. Vector Mechanics for Engineers: Statics and Dynamics by Ferdinand P.Beer & E. R. Johnston (9th Edition), Tata McGraw-Hill International Edition.

3. Engineering Mechanics by S.S.Bhavikatti, New age international publishers

4. Engineering Mechanics – Statics and Dynamics by A.K.Tayal.

Reference Books:

1. Engineering Mechanics – STATICS by J. L. Meriam and L. G. Kraige, Wiley India edition
2. Engineering Mechanics – DYNAMICS by J. L. Meriam and L. G. Kraige, Wiley India edition
3. Engineering Mechanics – Statics and Dynamics by Irving Shames, Prentice Hall of India
4. Engineering Mechanics by K.L.Kumar, McGraw-Hill.

MECHANCIAL ENGINEERING DEPARTMENT

II YEAR – I SEMESTER

MECHANICS OF SOLIDS											
Code	**Category**	**Periods**						**Sessional Marks**	**End Exam Marks**	**Total Marks**	**Credits**
		L	**T**	**P**	**E**	**O**	**Total**				
MEC 214	**PC**	**2**	**1**	**0**	**2**	**4**	**9**	**40**	**60**	**100**	**3**

Prerequisite: Mathematics-I & II

Course Objectives:

The objective is to provide the fundamental principles involved in Mechanics of Solids to enable them to apply in the study of advanced subjects. Further the objective is also to make the students understand the effect of forces on deformable bodies under various loading conditions, and thus calculate various types of stresses such as direct stresses, bending stresses, torsional stresses and evaluate deflection of beams.

Course Outcomes:

Student will be able to:

CO-1	Determine the principal stresses and strains on an oblique plane for a given structure/mechanical components under complex loading conditions.
CO-2	Evaluate the effect of shear force and bending moment on various beams for all types of loading to determine bending stress and shear stresses.
CO-3	Evaluate the slope and deflection induced in the beams by using Double integration, Macaulay's and Moment Area method.
CO-4	Determine the torsional stresses in shafts and further estimate the crippling loads in short and long columns under both direct and eccentric loading.
CO-5	Evaluate the hoop and longitudinal stresses in thin and thick cylinders due to internal and external pressures.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	2	2							2	2		1
CO-2	2	2							2	2		1
CO-3	2	2							2	2		1
CO-4	2	2							2	2		1
CO-5	2	2	1						2	2		1

Course Outcomes	PSO1	PSO2
CO-1	2	
CO-2	2	
CO-3	2	
CO-4	2	
CO-5	2	

CO- Course Outcome; PO- Program Outcome; PSO-Program Specific Outcome;Level- 1: Low, 2: Medium, 3: High

UNIT – I

Stresses and Strains: Stress – Strain, Stress Strain diagram for ductile and brittle materials, Poisson's ratio, Elastic constants and their relationship, Generalized Hook's law, Factor of safety, Strain energy, Impact loading, Deformation of simple, compound bars and tapered bar of uniform circular cross section. Thermal stresses, Stresses on an inclined plane under uni-axial, bi-axial, pure shear & combined loading, principal stresses & strains, Mohr's circle for plane stresses.

UNIT-II

Analysis of Beams: Types of beams and loads, Shear Force and Bending Moment diagrams for cantilever, simply supported and over hanging beams,
Theory of pure bending, flexural formula, shear stress distribution in beams (rectangle, circular, I & T sections).

UNIT – III

Deflection of beams: Relation between curvature, slope and deflection, deflection of simply supported, cantilever and overhanging beams by double integration method, Macaulay's method, moment area method-application to simple cases.

UNIT -IV

Torsion and columns: Introduction to pure torsion, torsional formula, torsion of circular and hollow shafts.
Theory of columns – long and short columns, Euler's theory, crippling load, Rankine's theory.

UNIT-V

Thin & Thick cylinders: Stress & Strains in thin cylinders & spherical shells.
Introduction to thick cylinder –Lame's equation, cylinder subjected to internal and external pressures.

Text Books:

1) "A Text Book of Strength of Materials, R.K. Bansal, Lakshmi Publications Pvt. Ltd,

New Delhi

2) Strength of materials, R.K. Rajput, S. Chand Ltd. Publications.

References:

1) Mechanics of Materials, Gere & Timoshenko, CBS Publishers.
2) Strength of Materials, S.S. Ramamrutham & R, Narayanan, Dhanpat Rai publications.
3) Strength of Materials, Dr. Sadhu Singh, Khanna Publications
4) "Engineering Mechanics of solids" Egor P. Popov, Second edition, Prentice hall of India Pvt. Ltd, New Delhi.
5) Mechanics of materials, Jhonston Beer and Mazurek Dewol 6th Edition

Web References:

1) http://nptel.ac.in/courses/Webcourse• contents/IIT• ROORKEE/strength%20of%20materials/homepage.htm
2) http://www.aboutcivil.org/solid• mechanics.html
3) http://web.mit.edu/emech/dontindex• build/
4) http://web.aeromech.usyd.edu.au/AMME2301/Documents/
5) http://www.faadooengineers.com/threads/9673• Mechanics• of• Solids• Lecture• Notes• Pdfs• Full• Notes• All• Units• Download
6) http://www.ijee.ie/OnlinePapers

MECHANCIAL ENGINEERING DEPARTMENT

II YEAR – I SEMESTER

BASIC THERMODYNAMICS											
Code	**Category**	**Periods**						**Sessional Marks**	**End Exam Marks**	**Total Marks**	**Credits**
		L	**T**	**P**	**E**	**O**	**Total**				
MEC 215	**PC**	**2**	**1**	**0**	**2**	**4**	**9**	**40**	**60**	**100**	**3**

Prerequisite: Engineering Physics - I

Course Objectives:

To provide the student with a simplistic and practical approach to the fundamental subject of thermodynamics and create an interest and intuitive understanding of the nuances of this core subject which deals with energy and its different forms and to solve any real time engineering problems.

Course Outcomes:

The Student will be able to:

CO-1	Classify thermodynamic systems & analyze the interaction between system & surroundings.
CO-2	Apply the first law of thermodynamics to both flow & non flow process and evaluate the energy interactions between system & surroundings
CO-3	Apply the second law of thermodynamics and evaluate efficiency and COP of systems.
CO-4	Assess the entropy generation & exergy distraction in a thermodynamic process.
CO-5	Evaluate the properties of gas mixture and further apply gas laws to compute the change in properties of system undergoing a process.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	**2**	**2**										
CO-2	**2**	**2**										
CO-3	**2**	**2**										
CO-4	**2**	**2**					1					
CO-5	**2**	**2**										

Course Outcomes	PSO1	PSO2
CO-1	-	-
CO-2	-	-
CO-3	-	-
CO-4	-	-
CO-5	–	–

CO- Course Outcome; PO- Program Outcome; PSO-Program Specific Outcome; Level- 1: Low, 2: Medium, 3: High

SYLLABUS

UNIT – I

Basic Concepts-System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Cycle, Quasi – static Process, Energy in State and in Transition, Work and Heat, Path and Point functions.

UNIT-II

Zeroth Law of Thermodynamics – Concept of equality of Temperature –Reference Points – PMM I - Joule's Experiments – First law of Thermodynamics – Corollaries – First law applied to a flow system – Steady Flow Energy Equation, throttling & free expansion processes. Limitations of the First Law.

UNIT – III

Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence, Corollaries, PMM-II, Carnot's principle, Reversibility and Irreversibility, Causes of Irreversibility, Carnot cycle, Carnot theorem, Corollary of Carnot theorem.

UNIT -IV

Claussius theorem, Entropy-a property, Claussius Inequality, Principle of Entropy Increase, Application of entropy principle.

Availability and Irreversibility –Quality of energy, Dead state, Availability in non-flow & flow processes, Gouy–stodola equation.

UNIT-V

Perfect Gas & Gas mixtures: – Equation of State, Characteristic and Universal Gas constants – various Non-flow processes, properties, end states, Heat and Work Transfer, changes in Internal Energy and enthalpy – Deviations from perfect Gas Model – Vander Waals Equation of State. Gas mixtures-Daltons law and Gibbs-Dalton law, apparent molecular weight and gas constant, specific heats of gas mixture, volumetric & gravimetric analysis of gas mixtures, adiabatic mixing of perfect gases.

TEXT BOOKS:

1. Engineering Thermodynamics, P.K.Nag ,Tata McGraw Hill publication.
2. Engineering Thermodynamics, Cengel & Boles,TMH publications.

REFERENCES:

1. Thermal Science & Engineering, Dr.D.S.Kumar ,S.K.Kataria & sons publication.
2. Thermal Engineering, R.K.Rajput S.Chand & Co.

WEB REFERENCES:

1. http://nptel.ac.in/courses/112108148/
2. http://nptel.ac.in/courses/112105123/
3. http://nptel.ac.in/courses/112104113/
4. http://highered.mheducation.com/sites/007352932x/student_view0/index.html
5. http://physics-animations.com/Physics/English/thermo.htm
6. https://www.youtube.com/watch?v=CmaTnV4m93E
7. http://wps.prenhall.com/wps/media/objects/2688/2752944/Web_Tutorials/06_A01.swf

MECHANCIAL ENGINEERING DEPARTMENT

II YEAR – I SEMESTER

MANUFACTURING PROCESSES											
Code	**Category**	**Periods**						**Sessional Marks**	**End Exam Marks**	**Total Marks**	**Credits**
		L	**T**	**P**	**E**	**O**	**Total**				
MEC 216	**PC**	**3**	**0**	**0**	**2**	**2**	**7**	**40**	**60**	**100**	**3**

Prerequisite: Engineering Mechanics

Course Objectives:

To acquaint the students with the fundamentals of manufacturing concepts and understand various processes such as casting, forming, welding and additive manufacturing

Course Outcomes:

The Student will be able to:

CO-1	Explain casting process, identify different types of patterns and evaluate gating system design
CO-2	Differentiate various casting processes and identify the casting defects.
CO-3	Distinguish welding processes and analyze different weld defects.
CO-4	Illustrate various bulk metal forming processes and categorize various sheet metal operations
CO-5	Interpret additive manufacturing and compare different Additive Manufacturing processes.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	2	1						1	1	1		1
CO-2	1	1						1	1	1		1
CO-3	2	1						1	1	1		1
CO-4	1	1						1	1	1		1
CO-5	1	1						1	1	1		1

Course Outcomes	PSO1	PSO2
CO-1	2	
CO-2	1	
CO-3	2	
CO-4	1	
CO-5	1	

CO- Course Outcome; PO- Program Outcome; PSO-Program Specific Outcome;Level- 1: Low, 2: Medium, 3: High

SYLLABUS

UNIT – I

Casting: Sand casting procedure, Pattern-its types, Pattern materials, pattern allowances- Basic problems, Sand mould making machines, sand properties testing procedures, Gating system, Gating ratio-problems and its design, Riser types & design methods-problems, Cores, Casting solidification-problems, Types of core sands.

UNIT-II

Melting furnaces: Blast, cupola, electric arc and electro-magnetic induction furnaces.
Other casting processes: Permanent mould casting – Die casting, Shell casting and Centrifugal casting processes, Investment casting, vacuum sealed casting, Continuous casting processes. Advantages and applications of each casting process. Casting defects, Inspection and Non Destructive Testing.

UNIT – III

Metal joining processes:
Brazing, Soldering and Braze welding and their applications.
Welding – Introduction, Arc welding principle and processes (MMAW, TIG, GMAW, SAW and PAW), Types of metal transfer in GMAW, Gas welding and Gas cutting. Basic problems on duty cycle and number of passes. Resistance welding (spot, seam, projection, upset and flash welding techniques) and problems on heat generation. Solid state welding processes (Friction welding, Friction stir welding and Explosion welding,), Weld defects – Inspection and testing.

UNIT -IV

Bulk metal forming processes: Nature of plastic deformation, hot working and cold working. Rolling – Principle, Rolling stand arrangement, Forging – Principle, Forging operations–Types of Forging. Extrusion- Principle and types, wire drawing, rod and tube drawing, swaging.
Sheet metal forming : shearing, deep-drawing, bending, squeezing, press working and its classification, types of dies, press tool operations – cutting operations (blanking, punching, notching etc.), shaping operations (embossing, coining, spinning, stretch forming etc.)

UNIT-V

Additive manufacturing: Introduction to Reverse Engineering, Rapid Prototyping, Traditional Manufacturing vs Additive Manufacturing, Need-Classification-Additive Manufacturing Technology in product development-Materials for Additive Manufacturing Technology – Tooling – Applications, need of pre and post processing of AM parts.

TEXT BOOKS:

1. Manufacturing Engineering & Technology, Serope Kalpak Jian, 7th Edition, Addition Wesley Edition.
2. Manufacturing Technology-Foundry, Forming and Welding, P.N. Rao, 4th Edition,Tata McGraw - Hill Publishing Company.
3. Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, 2nd Ed. (2015), Ian Gibson, David W. Rosen, Brent Stucker.

REFERENCES:

1. Materials and Processes in Manufacturing, De Garmo, Black and Kohsen 4th Edition, Prentice Hall of India.
2. Manufacturing Science (English) 2nd Edition, Amithaba Ghosh and Asok Kumar Mallik, East West Press Pvt. Ltd.
3. Principles of Metal Casting, Hein and Rosenthol, 5th Edition, Tata McGraw Hill India.
4. Additive Manufacturing Technologies. Rapid Prototyping to Direct Digital Manufacturing, Ian Gibson, David W.Rosen, Brent Struker, Springer New York Heidelberg Dordrecht London.

WEB REFERENCES:

1. www.wri.org.in
2. http://link.springer.com/book/10.1007%2F978-1-4419-1120-9

MECHANCIAL ENGINEERING DEPARTMENT

II YEAR – I SEMESTER

MECHANICS OF SOLIDS-LAB											
Code	Category	Periods						Sessional Marks	End Exam Marks	Total Marks	Credits
		L	T	P	E	O	Total				
MEC 217	PC	0	0	3	0	1	4	50	50	100	1.5

Course Objectives:

The objective of the lab is to enable the students to observe and determine the response of the material under different loads and measure the mechanical properties of materials which include tensile strength, impact strength, hardness, stiffness and elastic constants etc..

Course Outcomes:

Students will be able to:

CO-1	Measure and analyze the various properties of materials under tensile/compressive loads.
CO-2	Determine the modulus of rigidity of a material by subjecting it to a twisting Moment and also for a given spring material.
CO-3	Determine the hardness and impact strength of a given material.
CO-4	Determine modulus of elasticity of a given beam material.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	2	1		1				1		2		1
CO-2	2	1		1				1		2		1
CO-3	2	1		1				1		2		1
CO-4	2	1		1				1		2		1

Course Outcomes	PSO1	PSO2
CO-1	1	1
CO-2	1	1
CO-3	1	1
CO-4	1	1

CO- Course Outcome; PO- Program Outcome; PSO-Program Specific Outcome;Level- 1: Low, 2: Medium, 3: High

List of Experiments (any 10 Experiments)

1. To study the stress- strain characteristics of materials under tensile load by using UTM.
2. Determination of compressive strength of wood by using UTM.
3. Determination of hardness using Brinnels hardness tester.
4. Determination of hardness using Rockwell's hardness tester.
5. Determination of Vickers hardness number by using Vickers hardness tester.
6. Impact test by using Izod method.
7. Impact test by using Charpy method.
8. To find stiffness and modulus of rigidity by conducting compression tests on springs.
9. Torsion tests on circular shafts.
10. To conduct shear test on mild steel bar using UTM.
11. To determine modulus of elasticity of given wooden bar by using the principle of simply supported beam
12. To determine modulus of elasticity of given mild steel bar by using the principle of simply supported beam
13. To determine modulus of elasticity of given wooden bar by using the principle of cantilever beam.
14. To determine modulus of elasticity of given mild steel bar by using the principle of cantilever beam.

II YEAR – I SEMESTER

MANUFACTURING LAB											
Code	Category	Periods						Sessional Marks	End Exam Marks	Total Marks	Credits
		L	T	P	E	O	Total				
MEC 218	PC	0	0	3	0	1	4	50	50	100	1.5

Course Outcomes: At the end of the course the student will be able to:	
CO-1	**Prepare** sand mould & castings for different patterns.
CO-2	**Evaluate** the properties of moulding sand to check its suitability.
CO-3	**Produce** a spectrum of weld joints by using manual arc welding and spot welding processes.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	1		2					2		3		
CO-2	1			3				2		3		
CO-3	1		2					2		3		

Course Outcomes	PSO1	PSO2
CO-1	1	
CO-2	1	2
CO-3	1	

CO- Course Outcome; PO- Program Outcome; PSO-Program Specific Outcome; Level- 1: Low, 2: Medium, 3: High

List of Experiments:

1) Preparation of sand mould for solid flange
2) Preparation of sand mould for stepped cone pulley
3) Preparation of sand mould for hallow pipe
4) Moisture content test
5) Clay content test
6) Green compression and Shear Strength test
7) Sieve analysis
8) V-Butt joint in manual arc welding
9) Corner weld joint in manual arc welding
10) Double lap weld joint in manual arc welding
11) Spot welding of sheet metal

References: Manufacturing Technology, P.N.Rao, Mc Graw-Hill Book Company.

MECHANCIAL ENGINEERING DEPARTMENT

II YEAR – II SEMESTER

ENGINEERING MATHEMATICS – IV

[COMPLEX VARIABLES, PROBABILITY & SAMPLING]

[common to Mechanical, Civil and Chemical]

Code	Category	Periods						Sessional Marks	End Exam Marks	Total Marks	Credits
		L	T	P	E	O	Total				
MEC 221	BS	2	1	0	2	4	9	40	60	100	3

Prerequisite: Complex Numbers, Differentiation, Integration, Binomial expansions

Course Objectives: The knowledge of Mathematics is necessary for a better understanding of almost all the Engineering and Science subjects. Here our intention is to make the students acquainted with the concept of basic topics from Mathematics, which they need to pursue their Engineering degree in different disciplines.

Course Outcomes:

The student will be able to:

CO - 1	Evaluate the limit, derivative and integral of complex functions
CO - 2	Formulate the finite difference form of the given differential equation in various forms and further use different interpolation formulae to find the missing value.
CO - 3	Apply various numerical methods for solving differentiation & integration problems.
CO - 4	Apply probability theorems to evaluate the probability of an event and determine the statistical parameters like mean, variance etc. in various probability distributions.
CO - 5	Analyze the Statistical data by using statistical tests (based on small sample and largesample) and draw valid inferences based on the analysis of statistical data.

Mapping of course outcomes with program outcomes:

Course Outcomes	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO - 1	1	1										
CO - 2	2	3		1								
CO - 3	3	2										
CO - 4	2	3		2							1	
CO - 5	2	3		2							1	

Course Outcomes	PSO1	PSO2
CO-1		
CO-2	2	1
CO-3	2	
CO-4	1	2
CO-5	1	2

CO- Course Outcome; PO- Program Outcome; PSO-Program Specific Outcome; Level- 1: Low, 2: Medium, 3: High

UNIT-I: FUNCTIONS OF A COMPLEX VARIABLE: [12 Lectures]

Complex function, Real and Imaginary parts of Complex function, Limit, Continuity and Derivative of a Complex function, Cauchy-Riemann equations, Analytic function, entire function, singular point, conjugate function, Cauchy-Riemann equations in polar form, Harmonic functions, Milne-Thomson method, Simple applications to flow problems- Applications to flow problems – some standard transformations(Translation, Inversion and reflection , Bilinear transformations and its fixed points).

Sections:20.1, 20.2, 20.3, 20.4, 20.5, 20.6 and 20.8.

UNIT – II: COMPLEX INTEGRATION & SERIES OF COMPLEX TERMS [12 Lectures]

Complex integration - Cauchy's theorem - Cauchy's integral formula – Series of complex terms: Taylor's series, Maclaurin's series expansion, Laurent's series (without proofs) Zeros of an analytic function, Singularities of a complex function, Isolated singularity, Removable singularity, Poles, pole of order m, simple pole, Essential singularity.

Sections : 20.12, 20.13, 20.14 , 20.16 and 20.17.

UNIT – III : NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS [12 Lectures]

Numerical solution of Ordinary Differential equations: Picard's Method, Taylor's series method, Euler's Method, Runge-Kutta Method, Predictor-Corrector Methods, Milne's Method.

Sections: 32.1,32.2,32.3,32.4,32.732.8 and 32.9

UNIT-IV: PROBABILITY AND DISTRIBUTIONS [12 Lectures]

Introduction – Basic Terminology – Probability and set notations – Addition Law of probability – Independent events – Baye's theorem – Random variable – Discrete probability distribution: Binomial distribution - Continuous probability distributions: Poisson distribution and Normal distribution(mean , variance , standard deviation and their properties without proofs).

Sections: 26.1, 26.2, 26.3, 26.4, 26.5, 26.6, 26.7, 26.8, 26.9, 26.14, 26.15 and 26.16.

UNIT-V: SAMPLING THEORY [12 Lectures]

Introduction – Sampling distribution – Testing a hypothesis – Level of significance – Confidence limits – Test of Significance of Large samples -Test of significance of single mean, difference of means ,single proportion, difference of proportions – Confidence limits for unknown mean – Small samples – Students t-distribution – Significance test of a sample mean – Significance test of difference between sample means – chi square test – Goodness of fit.

Sections:27.1, 27.2, 27.3, 27.4, 27.5, 27.7,27.8, 27.11, 27.12,27.13, 27.14, 27.15, 26.16, 27.17 and 27.18.

Textbook:

1.B. S. Grewal, "*Higher Engineering Mathematics*", 43rd edition, Khanna publishers, 2017.

Reference Books:

1. N P. Bali and Manish Goyal, "A text book of Engineering Mathematics" ,Laxmi publications, latest edition.
2. Erwin Kreyszig, "*Advanced Engineering Mathematics*", 10th edition, John Wiley & Sons, 2011.
3. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3rd edition , Alpha Science International Ltd., 2002.
4. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13th edition ,
Pearson Publishers.

MECHANCIAL ENGINEERING DEPARTMENT

II YEAR – II SEMESTER

BASIC ELECTRICAL ENGINEERING											
Code	**Category**	**Periods**						**Sessional Marks**	**End Exam Marks**	**Total Marks**	**Credits**
		L	**T**	**P**	**E**	**O**	**Total**				
MEC 222	**ES**	**2**	**1**	**0**	**1**	**3**	**7**	**40**	**60**	**100**	**3**

Course Objectives: To acquaint the students with the analysis of circuits by using KCL & KVL, operation and applications of DC & AC machines.

Course Outcomes:

Students will be able to:

CO1	Explain the basic concept of DC electrical circuits and fundamentals
CO2	Explain the basic concept of AC circuits and fundamentals
CO3	Explain the behavior of the magnetic circuits
CO4	**Analyze** the working and performance characteristics of DC machines
CO5	**Evaluate** the industrial application of AC machines

Mapping of course outcomes with program outcomes

COURSE OUTCOMES	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2											
CO2	**2**											
CO3	**2**											
CO4	**1**	**2**										
CO5	1	**2**										

Course Outcomes	PSO1	PSO2
CO-1		
CO-2		
CO-3		
CO-4		
CO-5		

SYLLABUS

UNIT I

Electric Circuits: Circuit Elements, Types of Sources and Transformation, Basic Law's, Passive Networks (R, L and C), KVL, Voltage Division, KCL, Current Division, Mesh and Nodal analysis.

UNIT II

AC Circuits: Representation of sinusoidal waveforms, peak and RMS values, Phasor representation of AC quantities, real power, reactive power, apparent power, power factor. Three Phase balanced circuits, voltage and current relations in star and delta connections.

UNIT III

Magnetic Circuits: Definitions of magnetic circuit, Reluctance, Magneto-motive force, magnetic flux, Simple problems on magnetic circuits. Faraday's laws of Electromagnetic Induction, Induced E.M.F., Dynamically induced E.M.F.

UNIT IV

D.C. Machines: Working principle D.C. Generator, E.M.F equation of D.C. generator, Losses and efficiency, working principle of D.C. Motors, Significance of back E.M.F., Torque equation of D.C. Motors, Swinburne's test.

UNIT – V

AC Machines: Working Principle of Transformer, EMF equation of transformer, OC and SC tests, Working Principle of Induction Motor, Torque Equation Working Principle of Alternator, Voltage Regulation by EMF method.

TEXT BOOKS:

1. Essentials of Electrical and Computer Engineering by David V. Kerns, JR. J. David Irwin/Pearson.
2. Principles of Electrical and Electronics Engineering by V. K. Mehta, S. Chand& Co.

REFERENCES:

3. Electrical and Electronics Technology- E. Hughes PSN Publ.
4. Introduction to Electrical Engineering – M.S Naidu and S. Kamakshi, TMH Publ.
5. Basic Electrical Engineering by Kothari and Nagarath, TMH Publications, 2nd Edition.

MECHANCIAL ENGINEERING DEPARTMENT

II YEAR – II SEMESTER

APPLIED THERMAL ENGINEERING-1											
Code	**Category**	**Periods**						**Sessional Marks**	**End Exam Marks**	**Total Marks**	**Credits**
		L	**T**	**P**	**E**	**O**	**Total**				
MEC 223	**PC**	**2**	**1**	**0**	**2**	**4**	**9**	**40**	**60**	**100**	**3**

Prerequisites:

Engineering Mathematics, Engineering Mechanics, Basic Thermodynamics

Course Objective: To acquaint the student with the fundamentals of pure substance, property variation due to phase change and apply these basics in the study of vapor power cycles, refrigeration cycles and thermal power plant equipments like turbines and condensers.

Course Outcomes: At the end of the course the student will be able to:	
CO-1	**Identify** the phase change process of a pure substance on property plots and **determine** the steam properties using steam table and mollier chart.
CO-2	**Analyze** the working of a simple vapour cycle and further **apply** thermodynamic techniques to enhance its performance.
CO-3	**Distinguish** the various classes of nozzles and condensers, **evaluate** their performance and further **select** suitable nozzle or condenser for specific application.
CO-4	**Compare** the functioning of different classes of steam turbines, compounding techniques and also **evaluate** their performance.
CO-5	**Distinguish** the various refrigeration cycles and **analyze** their performance and further explain psychometric terms, processes and different air conditioning systems.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	1	1							1	2		1
CO-2	2	2							1	2		1
CO-3	2	2							1	2		1
CO-4	2	2							1	2		1
CO-5	2	2				1	1		1	2		1

Course Outcomes	PSO1	PSO2
CO-1		
CO-2		
CO-3		
CO-4		
CO-5		

CO- Course Outcome; PO- Program Outcome; PSO-Program Specific Outcome; Level- 1: Low, 2: Medium, 3: High

SYLLABUS **Periods(L+T)**

UNIT-I **(12+3)**

Properties of Pure Substance: Definition of pure substance, phase change of a pure substance, property diagrams for phase change process- T-v, p-v, p-T, T-s, h-s (Mollier diagram), p-v-T surface of pure substance, formation of steam, terms relating to steam formation, external work done during evaporation, internal latent heat, internal energy of steam, entropy of steam, thermodynamic process of steam-isobaric and isentropic processes only, determination of dryness fraction-throttling calorimeter, separating and throttling calorimeter.

UNIT-II **(9+3)**

Vapor Power Cycles: Simple steam power cycle, Rankine cycle, steam rate, heat rate and thermal efficiency, actual vapor cycle process, comparison of Rankine – Carnot cycles, mean temperature of heat addition, methods for improving efficiency of Rankine cycle - reheat cycle, regenerative cycle, reheat-regenerative cycle, feed water heaters, characteristics of ideal working fluid.

UNIT-III **(12+3)**

Steam Nozzles: Types of nozzles- Flow through nozzles- Condition for maximum discharge- Nozzle efficiency- Super saturated flow in nozzles- Relationship between area velocity and pressure in nozzle flow- Under expansion & over expansion.

Steam Condensers: Introduction, vacuum, Classification of condensers-Jet and surface condensers, Sources and effects of air leakage in condensers, Vacuum efficiency and Condenser efficiency, Determination of mass of cooling water.

UNIT-IV **(14+4)**

Steam Turbines: Introduction, classification of steam turbines, compounding of turbines.
Impulse Turbines: Velocity diagrams and performance parameters, condition for maximum blade efficiency for single stage impulse turbine, velocity diagram for velocity compounded impulse turbine.

Reaction Turbines: Velocity diagram, degree of reaction, Parson's reaction turbine, condition for maximum blade efficiency of Parson's turbine.

UNIT-V **(12+3)**

Refrigeration: Fundamentals of refrigeration, refrigeration systems, Coefficient of performance, standard rating of refrigeration, air refrigeration systems- closed and open systems, reversed Carnot cycle, Bell-colemn cycle, vapor compression refrigeration system,

T-s, p-h diagrams, factors effecting performance of vapor compression refrigeration system, simple Vapor absorption refrigeration system, properties of common refrigerants.

Psychrometry and air-conditioning: Psychometric terms, psychometric chart and psychometric processes, description ofSummer, Winter and year around air conditioning systems.

Text Books:

1. R. K. Rajput, Thermal Engineering 10th edition, Laxmi publication (P) Ltd. 2017.

2. P. K. Nag, Basic and Applied Thermodynamics 2nd edition, Tata McGraw Hill Education (P) Ltd. 2009.

Reference books:

1.Yunus A. Cengel and Michael A. Boles, Thermodynamics, An Engineering approach 8th edition, Tata McGraw Hill Education (P) Ltd. 2015.

2.G.Rogers and Mahew ,EngineeringThermodynamics,Work& Heat transfer 4th edition,Pearsons education India(P)Ltd.2002.

3.Thermodynamics and Heat Engines volume 2-R.Yadav-Central book depot.

Web resources:

1. http://nptel.ac.in/courses/112105123/

2. http://nptel.ac.in/courses/112104117

3. http://nptel.ac.in/downloads/112105129/

MECHANCIAL ENGINEERING DEPARTMENT

II YEAR – II SEMESTER

KINEMATICS OF MACHINERY											
Code	**Category**	**Periods**						**Sessional Marks**	**End Exam Marks**	**Total Marks**	**Credits**
		L	**T**	**P**	**E**	**O**	**Total**				
MEC 224	**PC**	**2**	**1**	**0**	**2**	**4**	**9**	**40**	**60**	**100**	**3**

Prerequisite: Engineering Mechanics

Course Objectives:

To acquaint the students with the fundamentals of mechanisms and their kinematic analysis. Further this study is extended to specific applications like steering mechanisms, Hooke's joint, cams, gears and gear trains.

Course Outcomes:

The Student will be able to:

CO-1	Identify the kinematic pairs & evaluate the mobility of a planar mechanism and further describe the inversions of 4-bar chain, single-slider and double slider crank chains.
CO-2	Analyze applications of mechanisms with lower pairs like straight line mechanisms, steering mechanisms, copier mechanism & Hooke's joint.
CO-3	Analyze the given planar mechanism for calculating the kinematic parameters by Instantaneous centre method and Relative velocity method.
CO-4	Design cam profiles based on the prescribed motion of the follower and determine the kinematic parameters of Tangent cams with roller follower and circular arc cam with flat faced follower.
CO-5	Calculate all the gear parameters related to spur gear, and determine the speed & torques in epicyclic gear trains using tabulation method.

Mapping of Course Outcomes with Programme Outcomes.

High-3, Medium-2, Low-1

COURSE OUTCOMES	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3							1	1		1
CO2	1	2							1	1		1
CO3	2	3	2						1	1		1
CO4	2	3	3						1	1		1
CO5	1	2	1						1	1		1

Course Outcomes	PSO1	PSO2
CO-1	1	
CO-2	1	
CO-3	2	
CO-4	2	
CO-5	2	

SYLLABUS

UNIT – I

Mechanisms and Machines: Introduction; Mechanism and machine; Rigid and resistant bodies; Link; Kinematic pair; Degrees of freedom; Classification of kinematic pairs; Kinematic chain; Linkage, mechanism and structure; Mobility of mechanisms. Application of Kutzbach Criterion to Plane Mechanisms. Grubler's Criterion for Plane Mechanisms. Grashof 's law.

Inversions of Mechanisms: The four-bar chain; Mechanical advantage; Transmission angle; The slider-crank chain; Double slider-crank chain.

UNIT-II

Mechanism with lower pairs: Pantograph – straight line motion mechanisms – exact straight line motion mechanisms- Peaucellier mechanism, Approximate straight line motion mechanisms-Watt mechanism. Condition for correct steering-Davis & Ackerman's steering gear mechanisms.

Hooke's joint: Ratio of shaft velocities – maximum and minimum speed of driven shaft – condition for equal speeds – Angular acceleration of driven shaft – Double Hooke's joint.

UNIT – III

Velocity Analysis: Relative velocity method – velocity of point on a link- application of relative velocity method to simple mechanisms – rubbing velocity of a joint – Instantaneous centre method – body centrode and space centrode - velocity of point on a link by Instantaneous centre method, location of Instantaneous centre - three centres in line theorem and application of the method for simple mechanisms.

Acceleration Analysis: Acceleration diagrams of a link - acceleration diagrams for simple mechanisms-coriolis component of acceleration - acceleration diagram for slotted lever quick return mechanism-Klein's Construction.

UNIT -IV

Cams: Classification of followers and cams – terms used in radial cams – displacement, velocity and acceleration diagrams when the follower moves with uniform velocity, uniform acceleration and retardation, simple harmonic motion – construction of cam profiles.

Cams with specified contours: Tangent cam with roller follower – circular arc cam with flat faced follower.

UNIT-V

Toothed gearing: Classification of toothed wheels – terms used in gears - law of gearing – velocity of sliding of teeth – forms of teeth – Cycloidal and involute teeth– length of path of contact-arc of contact– contact ratio- interference in involute teeth - minimum number of teeth to avoid interference.

Gear trains:-Simple, compound and reverted gear trains – epicyclic gear train – velocity ratio of epicyclic gear train-sun and planet wheels – torques in epicyclic gear train-Differential of an automobile.

TEXT BOOKS:

1. Theory of Machines, S. S. Rattan ,3rd edition, McGraw-Hill Publications, New Delhi.
2. Theory of Machines, Thomas Bevan 3rd edition, CBS Publishers & Distributors, New Delhi.

REFERENCES:

1. Theory of Machines and Mechanisms, Shigley J. E. and John Joseph Uicker, 2nd edition McGraw-Hill international edition.
2. Theory of Machines, Dr.R.K. Bansal & Dr. J.S. Brar, 5th edition, Laxmi publications(P) LTD, New Delhi.
3. Theory of Machines, R.S.Khurmi & J.K.Gupta, 14th edition, S Chand & CO Ltd Publisher.
4. Mechanism and Machine Theory, J. S. Rao and R. V. Dukkipati, 2nd edition New Age International.

WEB REFERENCES:

1. www.mekanizmalar.com
2. www.museum.kyoto-u.ac.jp
3. Makezine.com

MECHANCIAL ENGINEERING DEPARTMENT

II YEAR – II SEMESTER

METAL CUTTING, MACHINE TOOLS & METROLOGY											
Code	**Category**	**Periods**						**Sessional Marks**	**End Exam Marks**	**Total Marks**	**Credits**
		L	**T**	**P**	**E**	**O**	**Total**				
MEC 225	**PC**	**3**	**0**	**0**	**2**	**2**	**7**	**40**	**60**	**100**	**3**

Prerequisite: Manufacturing Processes, Material Science/Metallurgy, Physics, Chemistry

Course Objectives:

To make the students acquainted with the basic concepts of metal cutting, tool nomenclature, standards and tool performance.

Further giving them an overall idea of constructional features of different machine tools such as lathe, drilling, milling, shaping and grinding and parameters related to the machining processes.

The course further deals with basics of Measurements, Metrology, Measuring devices and the concepts of various measurement systems & standards with regards to realistic applications.

Course Outcomes:

The Student will be able to:

CO - 1	Apply the basics of engineering in computing the cutting parameters, stress, strain, velocity and forces and identify the types of chips in machining process.
CO - 2	Describe the cutting tool geometry, evaluate tool-life and compute machining time and cost estimations.
CO - 3	Distinguish different machine tools – their kinematic systems and operations and further demonstrate the application of various tool and work holding devices.
CO - 4	Identify various surface finishing operations applicable for work-pieces to meet the required design specifications.
CO - 5	Classify and choose appropriate method and instruments for inspection of various gear elements and thread elements, further, understand the standards of length, angles, evaluation of surface finish and measure the parts with various comparators.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	3	1	1	1					1	1		
CO-2	1	1	1	1					1	2		
CO-3	1	1	1	1					1	2		
CO-4	2	1	1	1					1	1		
CO-5	2	1	1	1					1	1		

Course Outcomes	PSO1	PSO2
CO-1	2	
CO-2	2	
CO-3	2	
CO-4	1	
CO-5	2	

CO- Course Outcome; PO- Program Outcome; PSO-Program Specific Outcome; Level- 1: Low, 2: Medium, 3: High

SYLLABUS

UNIT-I

Mechanics of Metal Cutting:

Classification of machining processes, machine tools, cutting conditions, cutting parameters, production of geometrical shapes, types of chips, orthogonal and oblique cutting, forces in metal cutting, measurement of cutting forces – Dynamometers, Merchant circle diagram, shear angle, velocity relationships, specific cutting energy, stress and strain in chip.

UNIT –II

Cutting Tool & Tool Life

Friction in metal cutting, temperature in metal cutting, measurement of interface temperature, tool wear, tool life, tool failure, cutting fluids, machinability, surface finish, economics of machining, geometry of single-point (ASA, ORS (ISO Old) & NRS (ISO New) systems) and multi-point cutting tools, tool materials.

UNIT-III

Machine Tools

Lathes, capstan & turret lathe and drilling machine's – principle and working, kinematics of lathe and drilling machines, classification, operations, work holding & tool holding devices.

Shaper, planner & slotter, machines - principle and working, kinematics of shaping, planning and slotting machines, classification, operations, work holding & tool holding devices.

Milling machines - principle and working, kinematics of milling machines classification, operations, work holding & tool holding devices, dividing head, indexing, types of indexing.

UNIT-IV

Finishing and super-finishing processes

Finishing operation - Working principle of grinding machines, merits and de-merits, types of abrasives, bond materials, grit grade and structure of grinding wheels, specifications of grinding wheels.

Super-Finishing Operations – lapping, honing, super finishing, polishing, burnishing, buffing, tumbling, abrasive belt grinding.

UNIT-V

Metrology

Measurements Straightness measurement, Slip gauges, , Squareness testing, Optical bevel protractor, Sine bar, Angle gauges, Autocollimator, Angle dekkor, Flatness measurement, Roundness measurement.

Comparators -- Twisted strip mechanical comparator, Optical lever comparator, Optical projector, Electric comparator, Pneumatic comparator.

Measurement of screw threads, major diameters, Minor diameters and effective diameter, Pitch, Limit gauges for internal and external threads, Tool maker's microscope.

Measurement of spur gears, pitch, profile, tooth thickness.

Surface texture: Parameters, sampling length, Specification, Order of geometrical irregularities, Stylus instruments Profilometer, CMM, Tomlinson Surface meter and Taylor-Hobson Talysurf for surface roughness measurement. .

Text Books

1. Fundamentals of Metal Machining and Machine Tools by Geoffrey Boothroyd, International Student Edition, Mc Graw-Hill Book Company.

2. Workshop Technology (Machine Tools) Vol II, (10th Edition) by B. S. Raghu Vamshi, Dhanpat Rai & Co (P) Ltd.

3. I.C. Gupta, A Text Book of Engineering Metrology, Dhanpat Rai & Sons, Delhi.

REFERENCES:

1. Production Engineering by P.C. Sharma, S. Chand and Company

2. Metal cutting and Machine Tool Engineering, Pakirappa, Durga Publishing House.

3. Metal Cutting Principles by M.C. Shaw, MIT Press, Cambridge.

4. Advanced Methods of Machining by J. A. Mc Geough, Chapman & Hall Publishers.

5. Manufacturing Engineering & Technology, 7th Edition, Serope Kalpakjian, Steven Schmid, Pearson, © 2014.

6. Fundamentals Of Modern Manufacturing: Materials, Processes, And Systems, Mikell P. Groover.

WEB REFERENCES:

1. https://www.slideshare.net/ArvindChavan/introduction-to-metrology-106089384
2. https://nptel.ac.in/courses/112/106/112106179/

MECHANCIAL ENGINEERING DEPARTMENT

II YEAR – II SEMESTER

MECHANICAL ENGINEERING DRAWING											
Code	**Category**	**Periods**						**Sessional Marks**	**End Exam Marks**	**Total Marks**	**Credits**
		L	**T**	**P**			**Total**				
MEC 226	**PC**	**1**		**4**			**8**	**40**	**60**	**100**	**3**

Prerequisite: Engineering Drawing

Course Objectives:

Introducing the practice of representing the inner details of machine elements through sectional views. Practice standard empirical formulae of the screw threads, screwed fasteners, riveted joints and further extending this to the drawing of temporary fasteners like Keys, Cotter-joints, Pin-joints, couplings, shaft bearings, machine elements and their assembly drawings. The course also includes the introduction to limits, fits, tolerances and surface roughness which form a pivotal role in production drawings.

Course Outcomes:
The Student will be able to:

CO-1	Draw the orthographic views and sectional views of mechanical components.
CO-2	Draw various thread profiles, Screwed fasteners, locking arrangements, foundation bolts and riveted joints.
CO-3	Draw various temporary fasteners such as cotter joints, pin joints and couplings.
CO-4	Draw Assembly drawings of various engine components and machine tool components.
CO-5	Draw the production drawings indicating limits, geometrical tolerances and surface roughness and also prepare process sheets.

Mapping of Course Outcomes with Programme Outcomes.
High-3, Medium-2, Low-1

COURSE OUTCOMES	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**1**	**1**								**2**		**1**
CO2	**1**		**1**							**2**		**1**
CO3	**1**	**1**	**1**							**2**		**1**
CO4	**1**	**2**	**1**							**2**		**1**
CO5	**1**	**1**	**1**							**2**		**1**

Course Outcomes	PSO1	PSO2
CO-1	1	1
CO-2	2	1
CO-3	2	1
CO-4	2	1
CO-5	2	1

SYLLABUS

UNIT – I

Introduction to machine drawing and production drawing. Orthogonal views, Half sectional and full sectional views of machine parts.

UNIT-II

Screw Threads, Screw Fasteners, Locking arrangements, Foundation bolts and Riveted joints using standard Empirical formulae.

UNIT – III

Keys, Cotter-joints, Pin-joints, Shaft couplings: Box and split muff couplings, Flanged couplings, Flexible couplings, Universal and Oldham couplings.

UNIT -IV

Drawings of assembled views for the part drawings of the following

Stuffing box, Cross head, Eccentric, Petrol Engine connecting rod, Screws jack, Shaper tool head slide, Gate valve.

UNIT-V

Limits, Fits and Tolerances, Geometrical Tolerances, Surface Roughness. Production drawings of Spur, Bevel and Helical gears, Swivel bracket, Revolving Centre, Preparation of process sheets.

TEXT BOOKS:

1. Machine Drawing by N. D. Bhatt, V. M. Panchal, Charotar Publishing House Pvt. Ltd.
2. Production Drawing by K.L.Narayana, P.Kannaiah and K.VenkataReddy, New age international Publishers.

REFERENCES:

1. Textbook of Machine Drawing by K.C. John, PHI Learning.
2. Machine Drawing by K.L Narayana, P. Kannaiah and K. Venkata Reddy, New age international Publishers.
3. A Text Book of Machine Drawing by Dr. R.K. Dhawan, S.Chand Publications.

WEB REFERENCES:

1. http://www.rajaroy.co.in/p/machine-drawing.html

II YEAR – II SEMESTER

MACHINE TOOLS LAB											
Code	Category	Periods						Sessional Marks	End Exam Marks	Total Marks	Credits
		L	T	P	E	O	Total				
MEC 227	PC	0	0	3	0	1	4	50	50	100	1.5

Course Objective:
To Study and practice the various operations that can be performed on Lathe and also to investigate the influence of machining parameters on chip formation, cutting forces and shear angle on different Machine tools.

Course Outcomes: The student will be able to

CO-1	Perform facing, turning, taper turning, knurling, forming and thread cutting operations on the given work-piece and also generate tool geometry (tool angles) on a tool blank using lathe.
CO-2	Generate chips through machining process and analyze their characteristics by varying the machining parameters on various work-piece materials.
CO-3	Analyze the cutting forces experienced by the cutting tool for varying cutting parameters in machine tools (lathe, drilling and milling machines).
CO-4	Measure and analyze the cutting tool temperature and shear angle of the given cutting tool for various cutting parameters in lathe and shaping machines.

Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1				3				1	1	2		1
CO-2	2	3		3				1	1	2		1
CO-3	2	3		3				1	1	2		1
CO-4	2	3		3				1	1	2		1

Course outcomes	PSO1	PSO2
CO-1	1	2
CO-2	3	3
CO-3	3	3
CO-4	3	3

List of Experiments:

1. Step turning on lathe
2. Taper turning and knurling on lathe
3. Thread cutting and forming on lathe

4. Step turning and knurling on a round bar using capstan lathe
5. Grinding of a single point cutting tool
6. Experimental study of chip formation in turning
7. Measurement of cutting forces on lathe
8. Measurement of torque and thrust on drilling machine
9. Measurement of cutting forces on milling machine
10. Measurement of shear angle on lathe
11. Measurement of shear angle on shaper
12. Measurement of cutting tool temperature on lathe

References: P.N.Rao, Manufacturing Technology, volume 2 and 3rd edition, Mc Graw-Hill Book Company.

MECHANCIAL ENGINEERING DEPARTMENT

II YEAR – II SEMESTER

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB											
Code	**Category**	**Periods**						**Sessional Marks**	**End Exam Marks**	**Total Marks**	**Credits**
		L	**T**	**P**	**E**	**O**	**Total**				
MEC 228	**ES**	**0**	**0**	**3**	**0**	**1**	**4**	**50**	**--**	**50**	**1.5**

Course Objectives: To acquaint the students with the analysis of circuits by using KCL & KVL, operation and applications of DC & AC machines, various indicating instruments and the concepts of diodes & transistors

Course Outcomes: At the end of the course the student will be able to:	
CO-1	Ability to design and analyze simple electrical circuits
CO-2	Ability to determine the speed characteristic of different electrical machines.
CO-3	To design simple circuits involving diodes and transistors.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	2	2	1	2		1	1	1		2	2	1
CO-2	2	2	1	2		1	1	1		2	2	1
CO-3	2	2	1	2		1	1	1		2	2	1

Course Outcomes	PSO1	PSO2
CO-1		
CO-2		
CO-3		

CO- Course Outcome; PO- Program Outcome; PSO-Program Specific Outcome; Level- 1: Low, 2: Medium, 3: High

LIST OF EXPERIMENTS

1. Verification of KVL and KCL.
2. Load test on DC Shunt machine.
3. Swinburne's test.
4. OC and SC test on Transformer.
5. Regulation of alternator by EMF method.
6. 3 Phase Induction Motor load test.
7. Applications of CRO (i) Voltage measurement (ii) Time measurement (iii) Frequency measurement
8. V-I characteristics of PN Junction diode in forward and reverse bias conditions
9. V-I and regulation characteristics of Zener diode.
10. Ripple factor calculation of Half wave and center tapped full wave rectifiers
11. Input and output characteristics of a transistor connected in Common Emitter configuration.
12. Verification of AND, OR, NOT logic gates using discrete components.