SEMESTER III

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1	BS	MA19301	Transforms and Boundary Value Problems	3	1	0	4
2	PC	ME19301	Thermodynamics	3	1	0	4
3	PC	ME19302	Manufacturing Processes	3	0	0	3
4	PC	ME19303	Engineering Materials and Metallurgy	3	0	0	3
5	PC	ME19304	Fluid Mechanics and Hydraulic Machines	3	0	0	3
6	MC	MC19301	Value Education	2	0	0	0
Practical							
7	PC	ME19305	Manufacturing Processes Laboratory	0	0	2	1
8	PC	ME19306	Fluid Mechanics and Machinery Laboratory	0	0	2	1
9	EE	EN19301	English Proficiency Course Laboratory	0	0	2	1
			Total	**17**	**2**	**6**	**20**

SEMESTER IV

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1	BS	MA19404	Numerical Methods	3	1	0	4
2	PC	ME19401	Applied Thermodynamics	3	0	0	3
3	PC	ME19402	Mechanics of Materials	3	0	0	3
4	PC	ME19403	Kinematics of Machinery	3	1	0	4
5	PC	ME19404	Metal Cutting Processes	3	0	0	3
6	MC	MC19401	Environmental Science and Engineering	3	0	0	0
Practical							
7	PC	ME19405	Thermal Laboratory	0	0	2	1
8	PC	ME19406	Metal Cutting Processes Laboratory	0	0	2	1
9	PC	ME19407	Strength of Materials Laboratory	0	0	2	1
			Total	**18**	**2**	**6**	**20**

SEMESTER III

MA19301 TRANSFORMS AND BOUNDARY VALUE PROBLEMS 3 1 0 4

COURSE OBJECTIVES

To enable the students to

- introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems
- acquaint the students with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic
- formulate Partial Differential Equations and use Mathematical tools for the solution of PDE that model several physical processes
- develop the modeling of one dimensional equation of heat conduction, wave equation and two dimensional Laplace equation
- develop Z- transform techniques which will perform the same task for discrete time systems as Laplace Transform does for continuous systems, a valuable aid in analysis of continuous time systems

UNIT I FOURIER SERIES 12

Dirichlet's conditions ; General Fourier series ; Odd and even functions ; Half range series ; Complex form of Fourier Series ; Parseval's identity ; Harmonic Analysis.

UNIT II FOURIER TRANSFORMS 12

Fourier integral theorem (without proof) ; Fourier transform pair ; Convolution theorem ; Parseval's identity ; Sine and Cosine transforms - Properties ; Transforms of elementary functions.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations ; Lagrange's linear equation ; Solutions of four standard types of first order partial differential equations ; Linear partial differential equations of second order with constant coefficients.

UNIT IV FOURIER SERIES SOLUTION TO PARTIAL DIFFERENTIAL EQUATIONS 12

Solutions of One-dimensional wave and heat equation ; Steady state two-dimensional heat equation.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS 12

Z;transforms - Elementary properties ; Inverse Z;transform - Convolution theorem ; Formation of difference equations ; Solution of difference equations using Z;transform.

TOTAL PERIODS: 60

COURSE OUTCOMES

At the end of the course, the students will be able to

- derive Fourier series, their possible forms of representations of periodic functions.
- identify and formulate a function in frequency domain whenever the function is defined in time domain.
- formulate and solve partial differential equations that occur in many engineering applications
- model wave and heat equations, solve certain boundary value problems and use the solution methods in engineering applications.
- demonstrate the use of Z-transform to convert discrete functions into complex frequency domain representation

TEXT BOOKS

1. Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
2. Grewal. B.S, "Higher Engineering Mathematics", 41st Edition, Khanna Publications. Delhi,(2011).

REFERENCES

1. Narayanan S., Manickavasagam Pillai.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" ,Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.
2. Larry C. Andrews, Bhimsen K. Shivamoggi, "Integral Transforms for Enginears", SPIE Optical Engineering press, Washington USA (1999).
3. Ramana. B.V., "Higher Engineering Mathematics", Tata Mc-GrawHill Publishing Company limited, New Delhi (2010).
4. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education (2007).

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	1	3	2
CO2	3	3	2	1	-	-	-	-	-	-	-	1	3	2
CO3	3	2	3	2	-	-	-	-	-	-	-	1	3	2
CO4	3	2	2	2	-	-	-	-	-	-	-	1	3	2
CO5	3	3	2	2	-	-	-	-	-	-	-	1	3	2

ME19301 **THERMODYNAMICS** **3 1 0 4**

COURSE OBJECTIVES

To enable the students to

- acquire knowledge on the basic thermodynamic concepts like processes, zeroth law, first law and application of thermodynamic system.
- comprehend about the second law, Carnot cycle and the concept of entropy.
- analyze the properties of pure substance and operations of steam power cycle.
- distinguish between ideal and real gases and their thermodynamics relations.
- understand the concepts of psychrometry properties and processes.

UNIT I BASIC CONCEPT AND FIRST LAW 12

Basic concepts - concept of continuum, macroscopic approach; Thermodynamic systems - closed, open and isolated, Property, state, path and process, quasi-static process, work, modes of work; Zeroth law of thermodynamics – concept of temperature and heat ,Concept of ideal and real gases; First law of thermodynamics – application to closed and open systems, internal energy, specific heat capacities, enthalpy; steady flow process with reference to various thermal equipments.

UNIT II SECOND LAW 12

Second law of thermodynamics – Kelvin's and Clausius statements of second law; Reversibility and irreversibility; Carnot theorem - Carnot cycle, reversed Carnot cycle, efficiency, COP; Thermodynamic temperature scale; Clausius inequality; concept of entropy- entropy of ideal gas, principle of increase of entropy ; availability.

UNIT III PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE 12

Properties of pure substances – Thermodynamic properties of pure substances in solid, liquid and vapour phases, phase rule, P-V, P-T, T-V, T-S, H-S diagrams; PVT surfaces-thermodynamic properties of steam; Calculations of work done and heat transfer in non-flow and flow processes; Standard Rankine cycle; Reheat and regenerative cycle.

UNIT IV IDEAL AND REAL GASES AND THERMODYNAMIC RELATIONS 12

Gas mixtures – properties ideal and real gases, equation state, Avagadro's Law, Vander Waal's equation of state, compressability factor, compressability chart; Dalton's law of partial pressure - exact differential; T-D relations, Maxwell's relations ;Clausius Clapeyron equations, Joule –Thomson coefficient.

UNIT V PSYCHROMETRY 12

Psychrometry and psychrometric charts - property calculations of air vapour mixtures, Psychrometric process; Sensible heat exchange processes; Latent heat exchange processes; Adiabatic mixing; evaporative cooling.

TOTAL PERIODS : 60

COURSE OUTCOMES

At the end of this course, students will be able to

- understand the basic thermodynamic concepts like process, zeroth law, first law, thermodynamic systems.
- demonstrate the real time applications of second law, carnot cycle and the concept of entropy.
- differentiate the properties of pure substances and steam power cycle.
- implement the properties of ideal and real gas in thermodynamic relation.
- apply the psychrometric concepts in various processes.

TEXT BOOKS

1. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi, 2017.
2. YunusA.Cengel, "Thermodynamics – An Engineering Approach" , Tata McGraw Hill, New Delhi, 2019.

REFERENCES

1. Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2017.
2. Venwylen and Sontag, "Classical Thermodynamics", Wiley Eastern, 2002.
3. Holman.J.P., "Thermodynamics", 3rd Ed. McGraw-Hill, 1995.
4. Rathakrishnan.E, "Fundamentals of Engineering Thermodynamics", Second Edition, PHI Learning Pvt.Ltd, 2005

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	-	-	-	-	-	-	2	3	2
CO2	3	3	3	3	-	-	-	-	-	-	-	2	3	3
CO3	3	3	3	3	-	-	-	-	-	-	-	2	3	2
CO4	3	3	3	3	-	-	-	-	-	-	-	2	3	2
CO5	3	3	3	3	-	-	3	-	-	-	-	2	3	3

ME19302 **MANUFACTURING PROCESSES** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- analyze the limitations and scope of manufacturing processes to perform variety of operations.
- compare the different working principles of arc welding, gas welding and special welding processes.
- enhance the fundamental knowledge in hot and cold working processes with their typical applications.
- understand the sheet metal characteristics, operations, and special forming processes.
- learn the various types of plastic injection molding processes and typical applications.

UNIT I METAL CASTING PROCESSES **9**

Sand casting - Sand moulds, Type of patterns, Pattern materials, Pattern allowances, Types of Moulding sand Properties; Core – Types and Applications; Methods of Sand testing; Moulding machines – Types of moulding machines; Melting furnaces - Cupola and Induction furnaces; Working principle of Special casting processes – Shell, investment casting, Ceramic mould, Pressure die casting, Centrifugal casting, Stir casting, CO_2 process; Sand Casting defects – Secondary finishing process - Inspection methods.

UNIT II INTRODUCTION TO JOINING PROCESSES **9**

Fusion welding processes; Types of Gas welding – Equipments used, Flame characteristics, Filler and Flux slag materials; Arc welding equipments – Electrodes, Edge preparation, Coating and specifications; Principles of Resistance welding – Spot/butt, seam welding, Percusion welding; Gas metal arc welding – Flux cored; Submerged arc welding, Electro welding, TIG welding; Principle and application of special welding processes - Plasma arc welding, Thermit welding, Electron beam welding, Friction welding, Friction Stir welding, Diffusion welding; Weld defects; Brazing and soldering process – Methods and process capabilities; Types and applications of Adhesive bonding.

UNIT III BULK DEFORMATION PROCESSES **9**

Hot working and cold working of metals; Forging processes – Open, impression and closed die forging, Rolling; Characteristics of the processes; Typical forging operations – Rolling of metals, Types of Rolling mills, Flat strip Shape rolling operations; Defects in rolled parts - Principle of rod and wire drawing, Tube drawing; Principles of Extrusion – Types of Extrusion, Direct and Indirect extrusion, Hot and Cold extrusion; Equipments used.

Case Study: Manufacturing solid rocket-motor case segment for the space shuttle.

UNIT IV SHEET METAL PROCESSES **9**

Sheet metal characteristics; Typical shearing operations, stamping, blanking, piercing, bending and drawing operations; Stretch forming operations– Formability of sheet metal; Test methods; Working principle and application of special forming processes - Hydro forming, Rubber pad forming, Metal spinning,

Introduction to Explosive forming, Magnetic pulse forming, Peen forming, Super plastic forming, Micro forming, Incremental forming.

UNIT V MANUFACTURING OF PLASTIC COMPONENTS 9

Types and Characteristics of plastics; Moulding of Thermoplastics; Working principles and typical applications of Injection moulding – Plunger and screw machines; Compression moulding, Transfer moulding – Typical industrial applications; Introduction to Blow moulding, Rotational moulding, Film blowing, Extrusion, Thermoforming, Bonding of Thermoplastics.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, students will be able to

- identify the types of casting and molding processes and melting furnaces.
- interpret the various types of welding methods and their applications.
- analyze the various types of forging processes, types of rolling and extrusion processes.
- comprehend Sheet metal characteristics and typical shearing operations.
- review different types of plastics and working of Injection molding machines.

TEXT BOOKS

1. Hajra Choudhury, "Elements of Workshop Technology, Vol.I and II", Media Promotors Pvt Ltd., Mumbai, 2001
2. S.Gowri, P.Hariharan, and A.SureshBabu, "Manufacturing Technology 1", Pearson Education,2008.

REFERENCES

1. B.S. Magendran Parashar & R.K. Mittal, "Elements of Manufacturing Processes", Prentice Hall of India, 2003.
2. P.N. Rao, "Manufacturing Technology", Tata McGraw-Hill Publishing Limited, II Edition,2013.
3. P.C. Sharma, "A text book of Production Technology", S. Chand and Company, VII Edition,2006.
4. Begman, Manufacturing Process", John Wilely& Sons, VIII Edition,2005.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	2	2	1	-	-	-	2	2	3	3
CO2	3	2	2	-	2	2	1	-	-	-	2	2	3	3
CO3	3	2	2	-	2	2	1	-	-	-	2	2	3	3
CO4	3	2	2	-	2	2	1	-	-	-	2	2	3	3
CO5	3	2	2	-	2	2	1	-	-	-	2	2	3	3

ME19303 ENGINEERING MATERIALS AND METALLURGY 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- gain in depth knowledge about the micro-structure of materials, phase diagrams for different binary alloys.
- understand the different types heat treatments.
- enhance the fundamental knowledge of mechanical properties of materials through different types of tests and their significance.
- acquire knowledge on different types of alloy steels with their applications, non-ferrous alloys with particular reference to copper, aluminum, magnesium, zinc, nickel, titanium, lead and tin alloys.
- familiarize the knowledge of types, structure, properties and applications of polymers, ceramics and composites.

Review (Not for Exam)

Crystal structure – BCC, FCC and HCP structure – unit cell – crystallographic planes and directions, miller indices – crystal imperfections, point, line, planar and volume defects – Grain size, ASTM grain size number.

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 9

Classification of Engineering materials ; Constitution of alloys – Solid solutions, substitutional and interstitial ; Phase diagrams, Isomorphous, eutectoid, eutectic, peritectic and peritectroid reactions; Iron – Iron carbide equilibrium diagram.

UNIT II HEAT TREATMENT 9

Definition – Full annealing, stress relief, recrystallisation and spheroidizing; Normalising; hardening and tempering of steel; Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram, CCR; Hardenability-Jominy end quench test ; Austempering, martempering – case hardening - carburising, nitriding, cyaniding, carbonitriding.

UNIT III MECHANICAL PROPERTIES AND TESTING 9

Properties of engineering materials ; Mechanism of plastic deformation-slip and twinning ; Types of fracture – Testing of materials under tension, compression and shear loads; Hardness tests (Brinell, Vickers and Rockwell); Impact test - Izod and Charpy; Fracture and toughness tests..

UNIT IV FERROUS AND NON-FERROUS METALS 9

Effect of alloying additions on steel (Mn, Si, Cr, Mo, V, Ti& W) ; Steel Classifications - stainless and tool steels , HSLA , maraging steels; Cast Irons - Grey, White malleable, spheroidal ,Graphite, Alloy cast irons; Copper and Copper alloys- Brass, Bronze and Cupronickel: Aluminum and Al-Cu alloy.

UNIT V NON-METALLIC MATERIALS 9

Polymers – types of polymer, commodity and engineering polymers, Properties and applications of PE, PP, PS, PVC, PMMA, PET, PA, ABS, PI, PEEK Polymers; Thermoset polymers – Engineering Ceramics – Properties and applications of Al2O3, SiC, Si3N4, PSZ - Composites Classifications; Metal Matrix and FRP – Applications of Composites - Introduction to semiconductors.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, students will be able to

- demonstrate knowledge on micro-structure of materials, iron-carbon and other phase diagrams.
- identify isothermal transformation and various types of heat treatments in different metals.
- apply the concept of properties and plastic deformation and fracture of metals in real time situation.
- analyze of different type alloying steels and apply in relevant engineering field.
- evaluate the different types of polymers, composites materials for suitable applications in real time situation.

TEXT BOOKS

1. Kenneth G.Budinski and Michael K.Budinski "Engineering Materials" Prentice-Hall of India Private Limited, 4th Indian Reprint 2010.
2. O.P. Khanna, A text book of Materials Science and Metallurgy, Khanna Publishers, 2014.

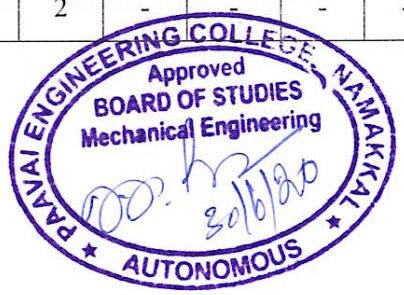
REFERENCES

1. William D Callister "Material Science and Engineering", John Wiley and Sons 2007.
2. Raghavan.V "Materials Science and Engineering", Prentice Hall of India Pvt., Ltd., 2007.
3. Sydney H.Avner "Introduction to Physical Metallurgy" McGraw Hill Book Company, 2007.
4. Dieter G. E., Mechanical Metallurgy, McGraw Hill Book Company, 1988.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	-	-	-	-	-	-	-	-	-	1
CO2	3	3	-	1	2	-	-	-	-	-	-	-	-	2
CO3	2	-	1	-	-	-	-	-	-	-	-	-	-	1
CO4	3	3	1	2	-	2	-	-	-	-	-	1	-	1
CO5	2	-	-	-	2	-	-	-	-	-	-	-	-	1



ME19304 FLUID MECHANICS AND HYDRAULIC MACHINES 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- gain knowledge of fluid, its properties and behavior under various conditions.
- apply Bernoulli's equation to various flow measuring devices.
- evaluate the fluid velocity considering major and minor losses.
- emphasize the boundary layer concepts and importance of dimensional analysis.
- comprehend the functioning and characteristic curves of pumps and turbines.

UNIT I FLUID PROPERTIES AND FLUID STATICS 9

Fluid definition and Classification; Properties of fluids - Density, Specific volume, Specific gravity, Specific weight, Viscosity, Compressibility, Bulk modulus, Capillarity and Surface tension; Forces on immersed surfaces; Introduction about center of pressure and buoyancy; Pressure Measurement - Piezometer, U-tube and Differential Manometers.

UNIT II KINEMATICS AND DYNAMICS OF FLUID FLOW 9

Kinematics of flow - Types of fluid flow, Continuity equation in two and three dimensions; Velocity and acceleration of fluid particle; Velocity potential function and Stream function; Dynamics of flow - Euler's equation of motion, Bernoulli's equation, Applications, Venturimeter, Orificemeter and Pitot tube.

UNIT III FLOW THROUGH PIPES 9

Reynold's experiment; Laminar flow through circular pipe (Hagen Poiseulle's equation); Flow through pipes - Loss of head due to friction, Minor head losses, Flow through pipes in series and in parallel, Hydraulic gradient and Total energy lines.

UNIT IV FLUID FLOW OVER BODIES AND DIMENSIONAL ANALYSIS 9

Boundary layer concepts - Types of boundary layer, Boundary layer thickness; Need for dimensional analysis - Methods of dimensional analysis using Buckingham's π theorem; Similitude - Types of similitude.

UNIT V HYDRAULIC PUMPS AND HYDRAULIC TURBINES 9

Centrifugal pumps - Classifications, Working principle, Velocity triangles, Work done by the impeller; Reciprocating pumps - Classifications, Working Principle (Theory only); Turbines - Classification of turbines, Pelton wheel, Francis turbine, Working principles, Velocity triangles , Work done by water on the runner.

TOTAL PERIODS 45

COURSE OUTCOMES

At the end of this course, students will be able to

- apply the knowledge of various fluid properties at rest and in transit.
- utilize the Bernoulli's equation to various fluid flow to kinematics and dynamics of fluid flow.
- analyze the friction losses of fluid while flowing through a pipe to pipeline network.
- illustrate the boundary layer concepts and dimensional analysis.
- evaluate the performance aspects of fluid machinery for centrifugal pump and turbines.

TEXT BOOKS

1. Bansal, R.K., Fluid Mechanics and Hydraulics Machines, Laxmi Publications (P) Ltd., 9th Edition. New Delhi, 2017.
2. Rajput R.K., "A text book of Fluid Mechanics and Hydraulic Machines" S.Chand& Company Ltd. 6th Edition , New Delhi. 2019.

REFERENCES

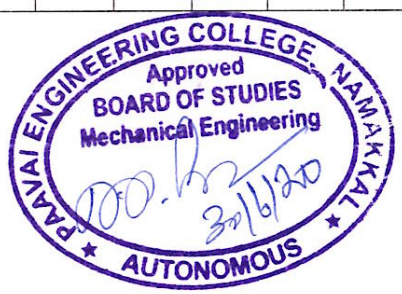
1. Kumar. K.L., Engineering Fluid Mechanics Eurasia Publishing House (P) Ltd., 8th Edition, New Delhi, 2016.
2. Rathakrishnan. E., Fluid Mechanics:An Introduction, Prentice Hall of India Pvt. Ltd, 3rd Edition. 2012.
3. Som S.K., Biswas G.,"Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill Education Pvt. Ltd, 4th Edition New Delhi, 2019.
4. P.N. Modi and S.M. Seth "Hydraulics and Fluid Mechanics", Rajsons Publications Pvt.Ltd, 22nd Edition Delhi, 2019.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	2	2	2
CO2	3	2	3	2	-	-	-	-	-	-	-	2	2	2
CO3	3	3	3	2	-	-	-	-	-	-	-	2	2	2
CO4	3	3	3	2	-	-	-	-	-	-	-	2	2	2
CO5	3	3	3	2	-	-	-	-	-	-	-	2	2	2



MC19301 **VALUE EDUCATION** **2 0 0 0**

COURSE OBJECTIVES

To enable the students to

- develop the individual multi-dimensionally in physical, intellectual, emotional and spiritual dimensions.
- facilitate individuals think about and reflect on different values.
- understand their responsibility in making choices and the practical implications of expressing them.
- instigate to choose their personal, social, moral and spiritual values.
- design and chisel the overall personality of an individual.

UNIT I PERSONAL VALUES **6**

Value Education – Definition, Types of values; Human values - Respect, Acceptance, Consideration, Appreciation, Listening, Openness, Affection, Patience, Honesty, Forgiveness, Sacrifice, Authenticity, Self Control, Altruism, Tolerance and Understanding, Wisdom, Decision making, Self –actualization, Character formation towards positive Personality, Contentment; Religious Values -Humility, Sympathy and Compassion, Gratitude. Peace, Justice, Freedom, Equality.

UNIT II COMMUNAL VALUES **6**

Social Values - Pity and probity - Self control - Respect to - Age, Experience, Maturity, Family members, Neighbors - Universal Brotherhood - Flexibility -Peer pressure - Sensitization towards Gender Equality, Physically challenged, Intellectually challenged - Reliability - Unity - Modern Challenges of Adolescent Emotions and behavior - Comparison and Competition- Positive and Negative thoughts- Arrogance, Anger and Selfishness.

UNIT III ENGINEERING ETHICS **6**

Professional Values -Knowledge thirst - Sincerity in profession- Regularity, Responsibility, Punctuality and Faith - Perseverance - Courage - Competence - Co-operation- Curbing unethical practices - Integrity, Social Consciousness and Responsibility. Global Values - Computer Ethics – Moral Leadership - Code of Conduct - Corporate Social Responsibility.

UNIT IV SPIRITUAL VALUES **6**

Developing Spirituality - Thinking process, Moralization of Desires - Health benefits- Physical exercises- Mental peace - Meditation - Objectives, Types, Effects on body, mind and soul- Yoga - Objectives, Types, Asanas. Family values -family's structure, function, roles, beliefs, attitudes and ideals, Family Work Ethic, Family Time, Family Traditions.

UNIT V HUMAN RIGHTS **6**

Classification of Human Rights - Right to Life, Liberty and Dignity- Right to Equality - Right against Exploitation - Cultural and Educational Rights- Physical assault and Sexual harassment - Domestic violence.

TOTAL PERIODS: 30

COURSE OUTCOMES

At the end of this course, students will be able to

- cultivate the values needed for peaceful living in the existing society.
- comprehend humanistic values to develop peace in the world.
- foster ethics in profession and usage of Technology.
- orient with the importance of value education towards personal, group and spiritual attributes.
- nurture physical, mental, spiritual growth to face the competitive world.

TEXT BOOKS

1. Sharma, S.P. Moral and Value Education; Principles and Practices, Kanishka publishers, 2013.

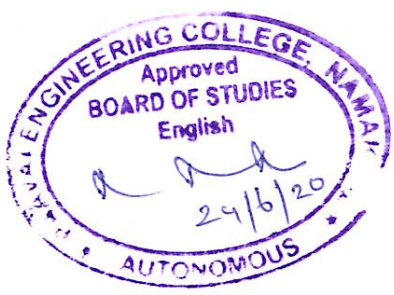
REFERENCES

1. Little, William, An introduction of Ethics. Allied publisher, Indian Reprint 1955.
2. "Values (Collection of Essays)". Sri Ramakrishna Math. Chennai. 1996.

CO-PO MAPPING

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	-	-	-	-	-	-	2	2	-	-	2	-	2
CO2	-	-	-	2	-	2	-	1	3	2	1	3	-	2
CO3	-	-	3	2	2	3	2	3	3	1	3	3	2	3
CO4	-	-	3	1	-	2	-	-	1	-	-	3	2	-
CO5	-	-	-	-	-	1	-	-	-	-	-	3	-	-



ME19305 MANUFACTURING PROCESSES LABORATORY 0 0 2 1

COURSE OBJECTIVES

To enable the students to

- give hands- on experience on working of general purpose machine tools and various manufacturing processes.
- enhance real-time knowledge on metal joining processes
- provide hands on experience of different cutting tools used for sheet metal works.
- learn essential concepts of moulding processes.

Lathe

- Facing, plain turning and step turning
- Taper turning using compound rest, Tailstock set over, etc.
- Single start V thread (LH & RH), Knurling (Diamond & Single Start)
- Internal thread cutting (Metric &BSW)

Welding exercises

- Horizontal, Vertical and overhead welding.
- Gas Cutting, Gas Welding
- Brazing - for demonstration purpose

Sheet metal work

- Fabrication of sheet metal tray
- Fabrication of a funnel

Metal Casting – Demo

- Cube (or) Gear Blank - for demonstration purpose

TOTAL PERIODS 30

COURSE OUTCOMES

At the end of the course, the students will be able to

- apply operating practice to perform various lathe operations
- fabricate different type of metal joints using welding and brazing processes.
- perform various sheet metal operations.
- prepare sand moulding using different patterns.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes **(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak**														
COs	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	1	-	-	-	-	-	-	2	1	2	2	3	2
CO2	3	1	-	-	-	-	-	-	2	1	2	2	3	2
CO3	3	1	-	-	-	-	-	-	2	1	2	2	3	2
CO4	3	1	-	-	-	-	-	-	2	1	2	2	3	2

PAVAI ENGINEERING COLLEGE, NAMAKKAL
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Mechanical Engineering
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ME19306 FLUID MECHANICS AND MACHINERY LABORATORY 0 0 2 1

COURSE OBJECTIVES

To enable the students to

- compute Coefficient of discharge of given Orifice meter.
- calculate the rate of flow using Rota meter and friction factor for a given set of pipes.
- find out efficiency of reciprocating and gear pump.
- select a suitable type of turbine for the given situation

LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submersible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

TOTAL PERIODS 30

COURSE OUTCOMES

At the end of this course, students will be able to

- determine the coefficient of discharge of given orifice meter.
- analyse the rate of flow using rota meter and friction factor for a given set of pipes
- choose an appropriate pump for a specific application.
- test the performance of turbines.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes: **(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak**														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	-	-	-	-	-	-	-	2	2	2
CO3	3	2	3	2	-	-	-	-	-	-	-	2	2	2
CO4	3	3	3	2	-	-	-	-	-	-	-	2	2	2

PAVAI ENGINEERING COLLEGE, NAMAKKAL
Approved
BOARD OF STUDIES
Mechanical Engineering
30/6/20
AUTONOMOUS

EN19301 **ENGLISH PROFICIENCY COURSE LABORATORY** **0 0 2 1**

COURSE OBJECTIVES

To enable students to

- familiarize with the reading skills such as skimming and scanning.
- practice writing tasks to the level expected.
- develop listening strategies such as listening for key words, making inferences and identifying main ideas.
- speak well without inhibition and to assist the students in improving their vocabulary, pronunciation and comprehension of grammar.
- enrich their LSRW skills so as to crack on-line proficiency tests and to bring their career aspirations true.

EXERCISES FOR PRACTICE

1. Listening Exercises from TOEFL
    a. Conversations, Lectures
2. Listening Exercises from IELTS
    a. Places and directions
    b. Actions and processes
3. Reading Exercises from PTE
    a. Re-order paragraphs
4. Reading Exercises from IELTS
    a. Opinions and attitudes
    b. Locating and matching information
5. Reading Exercises from BEC Vantage
    a. Single informational text with lexical gaps
    b. Error identification
6. Writing Exercises from PTE
    a. Summarize written text
7. Writing Exercises from IELTS
    a. Describing maps
    b. Describing diagrams
8. Speaking IELTS format
    a. Talking about familiar topics
    b. Giving a talk
    c. Discussion on a Topic

TOTAL PERIODS 30

COURSE OUTCOMES

At the end of this course, the students will be able to

- skim, scan and infer the given texts and attend the tasks successfully.
- write coherently using appropriate vocabulary and grammar.
- listen to speeches and conversations and answer the questions.
- communicate fluently and effectively on any given topics.
- appear with confidence for on-line tests.

CO/PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programmes Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	2	3	-	-	-	3	2	-	-	-	2
CO2	-	-	2	2	-	-	1	1	3	2	-	2	-	2
CO3	-	-	-	-	-	3	1	2	3	2	2	3	2	-
CO4	-	-	-	-	-	2	2	3	3	2	2	-	2	-
CO5	-	-	2	-	-	1	2	-	3	3	-	1	2	3

MA19404 **NUMERICAL METHODS** **3 1 0 4**

COURSE OBJECTIVES

To enable the students to

- apply various numerical techniques for solving algebraic/transcendental equations and system of linear equations.
- analyse the knowledge of interpolation using numerical data.
- develop the knowledge of numerical differentiation and numerical integration techniques.
- solve numerically non-linear differential equations that cannot be solved by conventionalanalytical methods.
- apply finite difference methods of solving boundary value problems .

UNIT I SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 12

Solution of equation –Iteration method : Newton Raphson method – Solution of linear system by Gaussian elimination and Gauss - Jordon method – Iterative method – Gauss-Seidel method – Inverse of a matrix by Gauss Jordon method – Eigenvalue of a matrix by power method.

UNIT II INTERPOLATION AND APPROXIMATION 12

Lagrangian Polynomials – Divided differences – Newton's Divided Difference, Hermite Interpolation Polynomial and Interpolating with a cubic spline – Newton's forward and backward difference formulas.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 12

Differentiation using interpolation formulae –Numerical integration by trapezoidal and Simpson's 1/3– Romberg's method – Two and Three point Gaussian quadrature formulas – Double integrals using trapezoidal and Simpsons rule.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 12

Single step methods: Taylor series method – Modified Euler method for first order equation – Fourth order Runge – Kutta method for solving first and second order equations – Multistep methods: Milne's and Adam's predictor and corrector methods.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 12

Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations.

TOTAL PERIODS: 60

COURSE OUTCOMES

At the end of the course, the students will be able to

- comprehend the basics of algebraic and transcendental equations and their numerical solutions.
- apply the interpolation methods for constructing approximate polynomials
- demonstrate the knowledge of numerical differentiation and integration in computational and simulation processes

- utilize the numerical methods of solving initial value problems occurring in various fields of science and engineering
- describe the computational methods of solving various boundary value problems

TEXT BOOKS

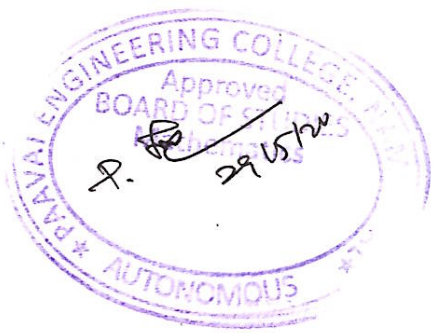
1. Erwin Kreyszig., "Advanced Engineering Mathematics" 10th edition, Wiley Publications, 2010.
2. T. Veerarajan. and T .Ramachandran, "Numerical Methods with programming in C", 2nd Ed., Tata McGraw-Hill, 2006.
3. SankarRao K " Numerical Methods ForScientisits And Engineers –3rd Edition Princtice Hall of India Private, New Delhi, 2007.

REFERENCES

1. P. Kandasamy, K. Thilagavathy and K. Gunavathy, "Numerical Methods", S.Chand Co. Ltd., New Delhi, 2003
2. Gerald C.F. and Wheatley, P.O., "Applied Numerical Analysis" 6th Edition, Pearson Education Asia, New Delhi, 2002.
3. M.K.Jain , S.R.K. Iyangar , R.K.Jain , "Numerical Methods For Scientific & Engineering Computation" New Age International (P) Ltd , New Delhi , 2005.
4. M.B.K. Moorthy and P.Geetha, "Numerical Methods" , Tata McGraw Hill Publications company, New Delhi, 2011.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes **(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak**														
COs	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	3	-	-	-	-	-	-	-	1	3	2
CO2	3	3	2	3	-	-	-	-	-	-	-	1	3	2
CO3	3	3	2	3	-	-	-	-	-	-	-	1	3	2
CO4	3	3	2	3	-	-	-	-	-	-	-	1	3	2
CO5	3	3	3	2	-	-	-	-	-	-	-	1	3	2



ME19401 **APPLIED THERMODYNAMICS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- acquire knowledge on the basic thermodynamic cycles used in various thermal devices and their related calculations.
- understand the fundamentals of operation of internal combustion engines, the factors affecting their performance, operation, fuel requirements and environmental impact.
- analyze the various cycles used for power generation, combustion and kinetics involved in turbines.
- comprehend design and working principles of air compressors.
- acquire the knowledge of designing concepts of refrigeration and its types and also air conditioning processes

UNIT I THERMODYNAMIC CYCLES **9**

Gas power cycles – Basics, types of gas power cycles, Otto, Diesel, Dual, Brayton cycles, Calculation of mean effective pressure, and air standard efficiency.

UNIT II INTERNAL COMBUSTION ENGINES **9**

Classification - Components and their function- Valve timing diagram and port timing diagram - Actual and theoretical p-V diagram of four stroke and two stroke engines; Governing of I.C. engines; Simple and complex Carburetor; MPFI; Diesel pump and injector system; Battery and Magneto Ignition System; Principles of Combustion and knocking in SI and CI Engines; Turbulence in S.I. engines; Lubrication and Cooling systems; CRDI; Homogeneous change compression ignition engines- Hybrid electric vehicles.

UNIT III STEAM NOZZLES AND TURBINES **9**

Flow of steam through nozzles; shapes of nozzles; effect of friction, critical pressure ratio, supersaturated flow- variation of mass flow rate with pressure ratio; Effect of friction. Metastable flow; Impulse and Reaction principles- compounding, velocity diagram for simple and multi-stage turbines; speed regulations – Governors.

UNIT IV AIR COMPRESSORS **9**

Classification and working principle of various types of compressors; work of compression with and without clearance; Volumetric efficiency; Isothermal efficiency and Isentropic efficiency of reciprocating compressors; Multistage air compressor and inter cooling – work of multistage air compressor.

UNIT V REFRIGERATION AND AIR CONDITIONING **9**

Refrigerants classification- properties and applications; Vapour compression refrigeration cycle- super heat, sub cooling , Performance calculations; working principle of vapour absorption system - Ammonia , Water,

Lithium bromide, water systems (Description only); Air conditioning system - Processes, Types and Working Principles ,Split AC, Window AC, Central AC and inventor AC.

TOTAL PERIODS : 45

COURSE OUTCOMES

At the end of this course, students will be able to

- analyze the different gas power cycles for various requirements.
- apply the knowledge of the working of internal combustion engine in automobile industry.
- implement the concepts of steam nozzles and turbines in real time application.
- acquire the knowledge on working and performance of air compressor.
- solve problems on refrigeration and air-conditioning systems by understanding the various thermodynamic properties.

TEXT BOOKS

1. Rajput. R. K., "Thermal Engineering" Laxmi publications, 2018.
2. Kothandaraman.C.P., Domkundwar.S and Domkundwar. A.V., "A Course in Thermal Engineering," Dhanpat Rai & Sons, Fifth edition,2004.

REFERENCES

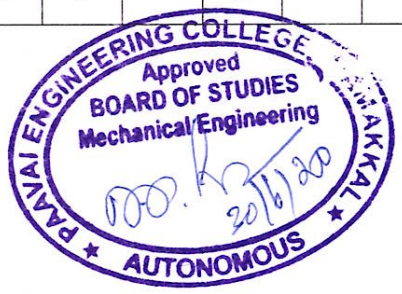
1. Sarkar, B.K,"Thermal Engineering" Tata McGraw-Hill Publishers,2017.
2. Arora.C.P,"Refrigeration and Air Conditioning," Tata McGraw-Hill Publishers,2017.
3. Ganesan V." Internal Combustion Engines", Third Edition, Tata McGraw-Hill,2017.
4. Rudramoorthy, R, "Thermal Engineering ", Tata McGraw-Hill, New Delhi,2017.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	-	-	3	-	-	-	-	2	3	2
CO2	3	2	2	2	2	-	3	-	-	-	-	2	3	3
CO3	3	3	3	2	2	-	3	-	-	-	-	2	3	2
CO4	3	3	3	2	2	-	3	-	-	-	-	2	3	3
CO5	3	3	3	2	2	-	3	-	-	-	-	2	3	3



ME19402 **MECHANICS OF MATERIALS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- familiarize the terminology like simple stresses, strains and deformation in components due to external loads.
- comprehend the stresses and deformations through mathematical models of beams, twisting bars or combinations of both.
- analyze torsion of circular bars and stresses in helical springs.
- understand about the deflection and slope of the beams under various loading conditions.
- determine the stresses in thin cylindrical and spherical shells.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS **9**

Rigid and Deformable bodies – Strength, Stiffness and Stability; Stresses - Tensile, Compressive and Shear; Deformation of simple and compound bars under axial load; Thermal stress; Shear stress and strain, Lateral strain and Poisson's ratio ; Relationship between Elastic constants ; Volumetric strains; Stresses on inclined plane – Principal planes and stresses – Mohr's circle of stresses.

UNIT II BEAMS – LOADS AND STRESSES **9**

Types of beams - Supports and Loads; Shear force and Bending Moment diagram in beams – Cantilever, simply supported and over hanging beams subjected to concentrated loads, uniformly distributed and uniformly varying loads; Theory of Simple Bending, Section Modulus; Bending stress distribution; Flitched beams.

UNIT III TORSION OF SHAFTS AND SPRINGS **9**

Analysis of torsion of circular bars – Bars of Solid and hollow circular section; Power transmitted by a Shaft ; Stepped shaft ;Torsion stiffness ; Compound Shafts ; Deflection of shafts fixed at both ends; Stresses in helical springs – Deflection of helical coil springs under axial loads.

UNIT IV DEFLECTION OF BEAMS **9**

Evaluation of beam deflection and slope - Double Integration Method, Macaulay Method and Moment Area Method for computation of slopes and deflections in beams; Concept of Conjugate beam method (Theory only); Maxwell's reciprocal theorems.

UNIT V THIN SHELLS 9

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders; spherical shells subjected to internal pressure – Deformation in spherical shells; Lame's theorem.

TOTAL PERIODS : 45

COURSE OUTCOMES

At the end of the course, the students will be able to

- apply the concepts of strength of materials to obtain solutions to real time Engineering problems.
- analyze the deformation behavior of simple structures subjected to different loads.
- estimate torsion of circular bars and stresses in helical springs.
- interpret the deflection and slope of beams using different methods under various loading conditions.
- compute the stresses in thin cylindrical and spherical shells..

TEXT BOOKS

1. Bansal R.K, "Strength of Materials", Laxmi Publications Ltd., Fifth Edition, 2012.
2. Beer F. P. and Johnston R," Mechanics of Materials", McGraw-Hill Book Co, Sixth Edition, 2011.

REFERENCES

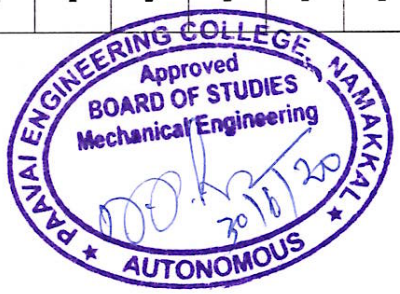
1. Popov E.P, "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi, 2015.
2. Rajput R. K, "Strength of Materials: Mechanics of Solids", S. Chand Limited, 2018.
3. Kazimi S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co., New Delhi, 2006.
4. Ryder G.H, "Strength of Materials, Macmillan India Ltd"., Third Edition, 2002.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	3	-	-	-	-	-	-	-	-	3	3	2
CO3	3	3	3	-	-	-	-	-	-	-	-	2	3	2
CO4	3	2	3	-	-	-	-	-	-	-	-	2	3	2
CO5	3	2	2	-	-	-	-	-	-	-	-	2	3	2



ME19403 **KINEMATICS OF MACHINERY** **3 1 0 4**

COURSE OBJECTIVES

To enable the students to

- understand the mechanisms, machines and related terminology for providing specific motions.
- analyze the parameters of displacement, velocity and acceleration for planer mechanism graphically.
- understand the importance of cam profiles for different types of motions.
- estimate the transmission of power by gear trains and its variation in speed through theoretical approach.
- evaluate the role of friction in belt drives and brakes.

UNIT I BASICS OF MECHANISMS **10**

Definitions – Link, Kinematic pair, Kinematic chain, Mechanism, and Machine; Degree of Freedom – Mobility, Kutzbach criterion (Grueble's equation); Grashoff's law; Kinematic Inversions of four-bar chain and slider crank chain; Mechanical Advantage, Transmission angle; Description of common Mechanisms - Offset slider mechanism as quick return mechanisms, Pantograph, Straight line generators (Peaucellier and Watt mechanisms), Hooke"s joint, Toggle mechanism.

UNIT II KINEMATIC ANALYSIS **13**

Analysis of simple mechanisms (Single slider crank mechanism and four bar mechanism) - Graphical Methods for displacement, velocity and acceleration; Shaping machine mechanism – Kinematic synthesis for simple mechanism; Coincident points – Corolis acceleration; Analytical method of analysis of slider crank mechanism and four bar mechanism.

UNIT III KINEMATICS OF CAMS **11**

Classifications; Displacement diagrams - Parabolic, Simple harmonic and Cycloidal motions; kinematic coefficients, Graphical angle; Construction of displacement diagrams and layout of plate cam profiles - circular arc and tangent cams; Pressure and undercutting.

UNIT IV GEARS **13**

Classification of gears; Gear tooth terminology - Fundamental Law of toothed gearing and involute gearing, Length of path of contact and contact ratio, Interference and undercutting; Gear trains – Simple, compound and Epicyclic gear trains, Differentials.

UNIT V FRICTION 13

Dry friction; Friction in screw jack – Pivot and collar friction; Plate clutches; Belt and rope drives; Block brakes, band brakes.

TOTAL PERIODS : 60

COURSE OUTCOMES

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

- comprehend the types of motion, joints and degree of freedom.
- demonstrate the knowledge on displacement, velocity and acceleration for planer mechanism graphically.
- design cam profile for different types of motions.
- choose a gear and gear train depending on the application.
- apply the friction concepts to belt drives and brakes.

TEXT BOOKS

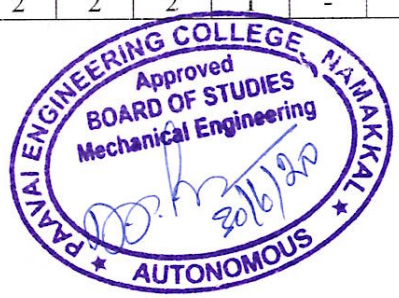
1. R.S.Khurmi & J.K.Gupta, "Theory of Machines", 14th Edition, Eurasia Publishing House, Delhi,2005.
2. UickerJ.J.,Pennock G.R., Shigley J.E., "Theory of Machines and Mechanisms"(Indian Edition), Oxford University Press, 2003.

REFERENCES

1. S.S.Rattan,"Theory of Machines", second edition, Tata Mc-Graw Hill, Delhi, 2008.
2. P.L.Ballaney, "Theory of Machines: A textbook for Engg students", 15th edition, Khanna, Delhi, 1987.
3. Ambekar A. G., Mechanism and Machine Theory, Prentice Hall of India, New Delhi,2007.
4. Ghosh, A, and Malick, A. K., "Theory of Mechanisms and Machines" 3rd Edition, East West Press Pvt Ltd., 2000

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes **(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak**														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	2	2	2	1	-	-	-	2	2	3	3
CO2	3	2	2	2	2	2	1	-	-	-	2	2	3	3
CO3	3	2	2	2	2	2	1	-	-	-	2	2	3	3
CO4	3	2	2	2	2	2	1	-	-	-	2	2	3	3
CO5	3	2	2	2	2	2	1	-	-	-	2	2	3	3



ME19404 **METAL CUTTING PROCESSES** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- understand the basic principles of theory of metal cutting.
- illustrate the construction, specifications and operations of conventional lathe and semi-automatic machines.
- comprehend the operating mechanisms of machine tools like shaping, slotting, planning, milling, and drilling, grinding machines.
- gain knowledge on intricate manufacturing operations for gears and surface finishing processes
- develop the knowledge on CNC programming and part programming

UNIT I THEORY OF METAL CUTTING **9**

Introduction - Material removal processes; Single point cutting tools-Types of chip formation, orthogonal cutting, tool nomenclature; machinability; cutting tool materials- tool wear, tool life , surface finish ,cutting fluids.

UNIT II LATHE AND SEMI AUTOMATIC MACHINES **9**

Centre lathe - construction, specification, and operation ; cutting tool geometry; various operations- taper turning and thread cutting; work holding devices; Capstan and turret lathes- Swiss type, multi spindle, Turret Indexing mechanism, Bar feed mechanism.

UNIT III SPECIAL MACHINES **9**

Reciprocating machine tools - shaper, planer, slotter; Milling - types, milling cutters, operations; hole making- drilling ,Quill mechanism, Reaming, Boring, Tapping; Sawing machine - band saw, circular saw; broaching machines - broach construction, push, pull, surface and continuous broaching machines.

UNIT IV ABRASIVE PROCESSES AND GEAR CUTTING **9**

Abrasive processes- grinding wheel, specifications and selection; types of grinding process- cylindrical grinding, surface grinding, Centre less grinding ; Gear cutting- forming, generation, shaping, hobbing; Gear Finishing Process-honing, lapping, super finishing, polishing and buffing, shot peening.

UNIT V CNC MACHINE TOOLS AND PART PROGRAMMING **9**

Numerical control (NC) machine tools ; CNC - types, constructional details, special features; Part programming fundamentals – manual part programming, computer assisted part programming

TOTAL PERIODS : 45

COURSE OUTCOMES

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

- apply the concepts of theory of metal cutting in real time machining.
- describe different machining operations which are performed in lathe machines.
- identify machine tools and apply operating knowledge on the working of tools like Shaper, Drilling, Milling and all allied machines.
- apply knowledge of gear cutting and different surface finishing process like grinding and gear finishing.
- write CNC operating codes for designing different machine components.

TEXT BOOKS

1. HajraChoudry, "Elements of Work Shop Technology – Vol. II", Media Promoters. 2002
2. HMT – "Production Technology", Tata McGraw-Hill, 1998.

REFERENCES

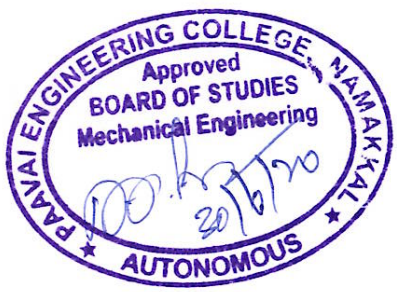
1. Serope Kalpakjian, Steven R. Schmid, —Manufacturing Process for Engineering Materials‖, 5th Edition, 14th Impression, Pearson Education, 2014.
2. Rao, P.N. "Manufacturing Technology", Metal Cutting and Machine Tools, Tata McGraw–Hill, New Delhi, 2013.
3. P.C. Sharma, "A Text Book of Production Engineering", S. Chand and Co. Ltd, IV edition, 2009.
4. Shrawat N.S. and Narang J.S, „CNC Machines", DhanpatRai&Co., 2002.

CO - PO Mapping

Mapping of Course Objectives with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	2	-	-	-	3	3	-	3	3	3
CO2	3	2	-	-	2	-	-	-	2	2	-	2	2	2
CO3	2	2	-	-	2	-	-	-	3	3	-	2	3	3
CO4	3	2	-	-	3	-	-	-	3	3	-	2	2	3
CO5	3	2	-	-	3	-	-	-	2	3	-	2	3	3



MC19401 **ENVIRONMENTAL SCIENCE AND ENGINEERING** 3 0 0 0

(Mandatory, Non credit Course)

COURSE OBJECTIVES

To enable the students to

- recognize the interdisciplinary and holistic nature of the environment.
- create awareness on ecosystem and biodiversity preserve.
- study about the integrated themes of pollution control and waste management.
- understand the significance of natural resources and environment to stimulate sustainable development.
- assess the socio-economic, political and ethical issues on population with environment.

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 9

Environment–Definition, scope, importance, need for public awareness; Forest resources–Use, over exploitation, deforestation, effects on forests and tribal people; Water resources – Use, over utilization of surface and ground water.; Mineral resources – Use, exploitation, environmental effects of extracting and using mineral resources; Food resources: Effects of modern agriculture – fertilizer, pesticide problems; Role of an individual in conservation of natural resources; Activity– Slogan making event on conserving natural resources or plantation of trees.

UNIT II ECOSYSTEMS AND BIODIVERSITY 9

Concept of an ecosystem–Structure and function of an ecosystem, producers, Consumers, decomposers, energy flow in the ecosystem; Ecological succession; Food chains - food webs and ecological pyramids; Ecosystems–Types of ecosystem, Introduction, forest ecosystem. aquatic ecosystems(lakes, rivers); Biodiversity– Introduction, definition (genetic - species –ecosystem); Diversity–Value of biodiversity, Consumptive use, productive use, social values, ethical values, aesthetic values; Hotspots of biodiversity; Conservation of biodiversity– In-situ and ex-situ; conservation of biodiversity.

UNIT III POLLUTION 9

Pollution–Définition, air pollution, water pollution, marine pollution, noise pollution, thermal pollution ; Solid waste management– Causes, effects, control measures of urban and industrial wastes; Role of an individual in prevention of pollution; Disaster management– Floods, earthquake, cyclone, landslides; Electronic waste –Sources, causes and its effects.

UNIT IV SOCIAL ISSUES AND ENVIRONMENT 9

Water conservation – rain water harvesting, watershed management; Environmental ethics– climate change, global warming and its effects on flora and fauna, acid rain, ozone layer depletion, nuclear accidents, nuclear holocaust; Environment protection act– Air (Prevention and Control of Pollution) Act, water (Prevention and control of Pollution) act.

UNIT V HUMAN POPULATION AND ENVIRONMENT 9

Human population– Population growth, variation among nations, population explosion; Family welfare programme; Environment and human health; Human rights; Value education; HIV/AIDS; Women and child welfare; Role of information technology in environment and human health.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- explain the importance of interdisciplinary nature of environment studies, uses and exploitation of natural resources.
- analyze the different types of ecosystem and biodiversity, its values and protecting the environment from degradation.
- investigate the existing environmental challenges related to pollution and its management.
- select suitable strategies for sustainable management of components of environment..
- correlate the impacts of population and human activities on environment

TEXT BOOKS

1. Raman Sivakumar, Introduction to Environmental Science and Engineering, 2nd Edn, Tata McGraw Hill Education Private Limited, New Delhi,(2010).
2. Benny Joseph, "Environmental Science and Engineering", Tata McGraw Hill, (2010).

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1. S. Divan, Environmental Law and Policy in India, Oxford University Press, New Delhi, 2001.
2. A.K.De, Environmental Chemistry, VI edition,2015 NewAge International (P) ltd Publication, NewDelhi.
3. C.S.Rao, Environmental Pollution and Control engineering, Vedition, NewAge International (P) ltd. Publication, NewDelhi 110002
4. Clair Nathan Sawyer, Perry L. McCarty, Gene F. Parkin, "Chemistry for Environmental Engineering.

CO - PO Mapping

Mapping of Course Objectives with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	1	3	3	-	2	-	3	1	-
CO2	-	-	-	-	-	1	2	3	-	2	-	3	1	-
CO3	1	-	2	-	1	1	2	3	-	2	-	3	1	2
CO4	-	-	2	-	2	1	3	3	-	2	-	2	1	1
CO5	-	1	-	-	-	1	3	3	-	2	-	2	1	-

ME19405 **THERMAL LABORATORY** **0 0 2 1**

COURSE OBJECTIVES

To enable the students to

- comprehend the thermodynamic concepts used in various thermal applications like IC engines, steam Generator, turbine and other thermal devices.
- demonstrate and interpret the procedure for valve timing and port timing diagrams.
- analyze the performance characteristics of IC Engines
- identify the characteristics of fuels/Lubricants used in IC Engines

LIST OF EXPERIMENTS

I.C Engine lab and Fuels lab

1. Valve Timing and Port Timing Diagrams.
2. Performance Test on 4-stroke Diesel Engine/Petrol Engine
3. Heat Balance Test on 4-stroke Diesel Engine
4. Morse Test on Multi cylinder Petrol Engine
5. Retardation Test to find Frictional Power of a Diesel Engine
6. Determination of Viscosity – Red Wood Viscometer
7. Determination of Flash Point and Fire Point

STEAM LABORATORY

1. Study of steam generators and turbines
2. Performance and energy balance test on a steam generator
3. Performance and energy balance test on steam turbine

TOTAL PERIODS 30

COURSE OUTCOMES

At the end of this course, the students will be able to

- interpret the concepts of thermal applications.
- draw the valve timing and port timing diagrams involved in the operation of engines.
- demonstrate the performance characteristics of internal combustion engines.
- compute the property of fuels and lubricants oils using suitable tests.

CO- PO Mapping

Mapping of Course Outcomes with Programme Outcomes: **(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak**														
COs	**Programme Outcomes(POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	1	2	2	2	2	-	-	2	2	2	3	3
CO2	3	3	1	2	2	2	2	-	-	2	2	2	3	3
CO3	3	3	1	2	2	2	2	-	-	2	2	2	3	3
CO4	3	3	1	2	2	2	2	-	-	2	2	2	3	3

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ME19406 **METAL CUTTING PROCESSES LABORATORY** **0 0 2 1**

COURSE OBJECTIVES

To enable the students to

- give hands-on training to students on various metal cutting operations
- provide hands on experience on the working of general purpose shaping machines.
- enhance real time knowledge on special machines like milling machines, gear cutting machines.
- understand knowledge on operational concepts of grinding machines.

LIST OF EXPERIMENTS

1. Measurement of Cutting Force using tool dynamometer
2. Single point tool profile
3. Dove Tail ,Surface Finishing, Spline
4. Generating of Contour Profile (Concave &Convex)
5. Keyway Machining (External &Internal)
6. Spur gear & Helical gear Machining
7. Cylindrical grinding & Surface Grinding operations

TOTAL PERIODS 30

COURSE OUTCOMES

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

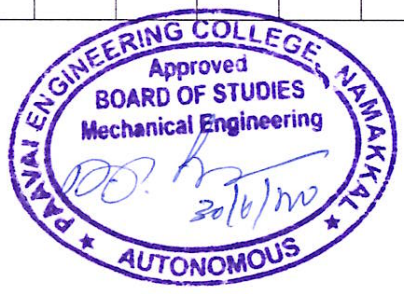
- use tool dynamometer to measure cutting force and perform lathe operations.
- perform various operations using shaping machines like dove-tail and spline cutting
- fabricate spur gear, helical gear, internal and external keyway using milling machine & gear cutting machine
- apply the principle of cylindrical grinding and surface grinding operations in real time situation.

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	2	1	2	2	3	2
CO2	3	1	-	-	-	-	-	-	2	1	2	2	3	2
CO3	3	1	-	-	-	-	-	-	2	1	2	2	3	2
CO4	3	1	-	-	-	-	-	-	2	1	2	2	3	2



ME19407 **STRENGTH OF MATERIALS LABORATORY** **0 0 2 1**

COURSE OBJECTIVES

To enable the students to

- conduct tension test on different metals.
- interpret compression tests on spring and concrete.
- carry out flexural and torsion tests to determine elastic constants.
- determine hardness of metals.

LIST OF EXPERIMENTS

1. Tension test on mild steel rod
2. Compression test on wood
3. Double shear test on metal
4. Torsion test on mild steel rod
5. Impact test on metal specimen (Izod and Charpy)
6. Hardness test on metals (Rockwell and Brinell Hardness Tests)
7. Deflection test on metal beam
8. Compression test on helical spring
9. Deflection test on carriage spring
10. Compression test on concrete cube

TOTAL PERIODS : 30

COURSE OUTCOMES

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

- determine stresses and strains from the member forces
- find out deflection, bending and torsion on mild steel specimen
- calculate elastic constants for different materials.
- compute hardness of different metals

CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes:
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

COs	Programme Outcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	-	-	-	-	-	-	-	2	2	2
CO3	3	2	3	2	-	-	-	-	-	-	-	2	2	2
CO4	3	3	3	2	-	-	-	-	-	-	-	2	2	2