PAAVAI ENGINEERING COLLEGE, NAMAKKAL
B.E. MECHANICAL ENGINEERING
REGULATIONS 2023
(CHOICE BASED CREDIT SYSTEM)
CURRICULUM
SEMESTER – III

S.No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	BS	MA23301	Transform Techniques and Partial Differential Equations	3	1	0	4
2	PC	ME23301	Engineering Thermodynamics	3	1	0	4
3	PC	ME23302	Manufacturing Processes	3	0	0	3
4	PC	ME23303	Fluid Mechanics and Hydraulic Machines	3	0	0	3
5	MC	MC23302	Human Values and Gender Equality	2	0	0	0
Theory with Practical							
6	ES	EE23306	Electrical Machines and Drives	3	0	2	4
Practical							
7	PC	ME23304	Fluid Mechanics and Hydraulic Machines Laboratory	0	0	2	1
8	PC	ME23305	Manufacturing Processes Laboratory	0	0	2	1
9	EE	GE23301	Professional Development I	0	0	2	1
TOTAL				**17**	**2**	**8**	**21**

SEMESTER – IV

S.No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	BS	MA23401	Statistics and Numerical Methods	3	1	0	4
2	PC	ME23401	Kinematics of Machines	3	1	0	4
3	PC	ME23402	Applied Thermodynamics	3	0	0	3
4	PC	ME23403	Mechanics of Materials	3	1	0	4
5	MC	MC23401	Environmental Sciences and Sustainability	2	0	0	0
Theory with Practical							
6	PC	ME23404	Metal Cutting and Machine Tools	3	0	2	4
Practical							
7	PC	ME23405	Strength of Materials Laboratory	0	0	2	1
8	PC	ME23406	Thermal Engineering Laboratory	0	0	2	1
9	EE	GE23401	Professional Development II	0	0	2	1
TOTAL				**17**	**3**	**8**	**22**

PAAVAI ENGINEERING COLLEGE, NAMAKKAL
Approved
BOARD OF STUDIES
Mechanical Engineering
17/5/24
AUTONOMOUS

MA23301	TRANSFORM TECHNIQUES AND PARTIAL DIFFERENTIAL EQUATIONS	3	1	0	4

(Common to Aero, Agri, BME, Biotech, Civil, Chemical, EEE, Food, Pharma, Mech, MCT, R&A)

COURSE OBJECTIVES

To enable the students to

1.	develop the knowledge of periodic and non-periodic functions and their representations using fourier series.
2.	acquaint the student with Fourier transform techniques used in wide variety of situations.
3.	introduce the basic concepts of PDE for solving standard partial differential equations.
4.	acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
5.	develop Z transform techniques for discrete time systems.

UNIT I	FOURIER SERIES	12

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

UNIT II	FOURIER TRANSFORMS	12

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

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; Method of partial fraction ; Residue method; Convolution theorem; Solution of difference equations by Z-transform.

	TOTAL PERIODS	60

	COURSE OUTCOMES At the end of this course, the students will be able to	**BT MAPPED** (Highest Level)
CO1	classify the properties of periodic and non-periodic vibrations with the help of Fourier series.	Applying (K3)

CO2	apply the Fourier transform to convert the function from frequency domain to time domain.	Applying (K3)
CO3	demonstrate partial differential equations that occur in many engineering applications.	Applying (K3)
CO4	apply Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.	Applying (K3)
CO5	apply knowledge of Z transform to analyse linear time invariant systems.	Applying (K3)

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", 44th Edition, Khanna Publications, New Delhi, (2018).

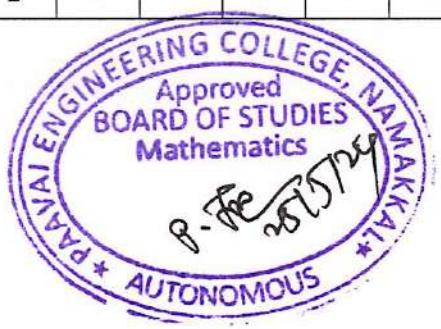
REFERENCES

1. Erwin Kreyszig , "Advanced Engineering Mathematics ", 10th Edition, Wiley Publications, New Delhi, India, 2016.
2. Ramana. B.V., "Higher Engineering Mathematics", Tata Mc-Graw Hill Publishing Company limited, New Delhi (2010).
3. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education (2007).
4. Wylie. R.C. and Barrett. L.C., "Advanced Engineering Mathematics", Tata Mc-Graw Hill Publishing Company limited, 6th Edition, New Delhi, 2012.

CO PO MAPPING

Mapping of Course Outcomes with Programme Outcomes
(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	3	3	2	2	-	-	-	-	-	-	-	3	1	3
CO2	2	3	3	2	-	-	-	-	-	-	-	3	2	3
CO3	3	3	3	2	-	-	-	-	-	-	-	2	2	3
CO4	3	3	3	2	-	-	-	-	-	-	-	2	1	2
CO5	2	3	2	2	-	-	-	-	-	-	-	2	2	2



ME23301	ENGINEERING THERMODYNAMICS	3	1	0	4

COURSE OBJECTIVES

To enable the students to

1	acquire knowledge on the basic thermodynamic concepts like processes, zeroth law, first law and application of thermodynamic system.
2	comprehend about the second law, Carnot cycle and the concept of entropy.
3	analyze the properties of pure substance and operations of steam power cycle.
4	distinguish between ideal and real gases and their thermodynamics relations.
5	understand the concepts of psychometry 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; steady flow process with reference to various thermal equipment's.

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; concept of entropy- entropy of ideal gas, principle of increase of entropy.

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.

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, compressibility factor, compressibility chart; Dalton's law of partial pressure - exact differential; T-D relations, Maxwell's relations, Joule –Thomson coefficient.

UNIT V	PSYCHROMETRY	12

Psychometry 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		BT MAPPED (Highest level)
CO1	understand the basic thermodynamic concepts like process, zeroth law, first law, thermodynamic systems.	Understanding (K2)

CO2	demonstrate the real time applications of second law, Carnot cycle and the concept of entropy.	Understanding (K2)
CO3	differentiate the properties of pure substances and steam power cycle.	Analysing (K4)
CO4	utilize the properties of ideal and real gas in thermodynamic relation.	Applying (K3)
CO5	apply the psychrometric concepts in various processes.	Applying (K3)

TEXT BOOKS

1. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi, 2017.
2. Yunus A.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, 2010.
3. Holman.J.P., "Thermodynamics", 3rd Ed. McGraw-Hill, Reprint 2012.
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	2	1	-	-	-	-	-	-	-	2	-	-
CO2	3	3	2	1	-	-	-	-	-	-	-	2	-	-
CO3	3	3	2	1	-	-	-	-	1	-	-	2	3	2
CO4	3	3	2	1	-	1	-	-	2	-	-	2	3	2
CO5	3	3	2	1	-	1	3	-	2	-	-	2	3	-

ME23302	MANUFACTURING PROCESSES	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	analyze the limitations and scope of manufacturing processes to perform variety of operations.
2	compare the different working principles of arc welding, TIG welding and special welding processes.
3	enhance the fundamental knowledge in hot and cold working processes with their typical applications.
4	understand the sheet metal characteristics, operations, and special forming processes.
5	learn the various types of powder metallurgy and plastic processing.

UNIT I METAL CASTING PROCESSES 9

Casting terminology, hand moulding, Type of patterns: Single piece, split, gated, Pattern materials, Pattern allowances, Moulding sand Properties; Cores – Types and Applications; Moulding machines – Types Melting furnaces - Cupola and Induction furnaces; principle of special casting processes – Shell, investment, Ceramic mould, Pressure die casting - Centrifugal casting, Stir casting - CO_2 casting; Sand Casting defects.

UNIT II JOINING PROCESSES 9

Gas welding – flame types, equipment, Electric Arc welding (EAW), Metal inert-Gas (MIG) welding, Tungsten inert-Gas (TIG) welding; types of electrodes, flux material, resistance welding: principle, spot, seam, lap welding, Modern welding processes: Friction Stir welding, Weld defects; Adhesive bonding.

UNIT III BULK DEFORMATION PROCESSES 9

Hot working and cold working of metals; Forging processes – Open, impression and closed die forging, 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, Hot and Cold extrusion.

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 POWDER METALLURGY AND PLASTIC PROCESSING 9

Production of metal powder: Atomization, crushing; Blending; Compacting: Die pressing, iso-static pressing; Sintering: Principle, continuous sintering process; Plastic processing: Injection, blow moulding and rotational moulding.

TOTAL PERIODS:45

COURSE OUTCOMES		**BT MAPPED** (Highest level)
At the end of the course, the students will be able to		
CO1	identify the types of casting and molding processes and melting furnaces.	Applying (K3)
CO2	interpret the various types of welding methods and their applications.	Understanding (K2)

CO3	analyze the various types of forging processes, types of rolling and extrusion processes.	Analysing (K4)
CO4	comprehend sheet metal characteristics and typical shearing operations.	Understanding (K2)
CO5	review different types of plastics and working of Injection molding machines.	Analysing (K4)

TEXT BOOKS

1. Rao P N "Manufacturing Technology", Tata McGraw Hill Education Private Limited., New Delhi, 2013
2. Serope Kalpakjian and Stephen Schmid "Manufacturing, Engineering and Technology", Pearson Education., 2018.

REFERENCES

1. Mikell P Groover "Fundamentals of Modern Manufacturing: Materials, Processes, and Systems", Wiley., 2015.
2. P.N. Rao, "Manufacturing Technology", Tata McGraw-Hill Publishing Limited, II Edition, 2013.
3. Arora R P "Manufacturing Technology", Macmillan India Limited., New Delhi, 2011
4. P.C. Sharma, "A text book of Production Technology", S. Chand and Company, VII Edition, 2006.

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	1	3	2	-	-	-	-	-	-	-	2	3	3
CO2	3	1	3	1	-	2	-	1	-	-	-	2	3	3
CO3	3	1	3	-	-	-	-	-	-	-	-	2	3	3
CO4	3	1	3	-	-	-	2	-	-	-	-	2	3	3
CO5	3	1	3	2	2	-	-	-	-	-	-	2	3	3

ME23303	FLUID MECHANICS AND HYDRAULIC MACHINES	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	gain knowledge of fluid, its properties and behaviour under various conditions.
2	apply Bernoulli's equation to various flow measuring devices.
3	evaluate the fluid velocity considering major and minor losses.
4	emphasize the boundary layer concepts and importance of dimensional analysis.
5	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; 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, Orifice meter and Pitot tube – Navier's stoke statement.

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.

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;

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 and derivation of discharge, work done and power required to drive a double acting pump) ; 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 the course, the students will be able to		BT MAPPED (Highest level)
CO1	apply the knowledge of various fluid properties at rest and in transit.	Applying (K3)
CO2	utilize the Bernoulli's equation to various fluid flow to kinematics and dynamics of fluid flow.	Applying (K3)
CO3	analyze the friction losses of fluid while flowing through a pipe to pipeline network.	Analyzing (K4)
CO4	illustrate the boundary layer concepts and dimensional analysis.	Understanding (K2)

CO5	analyze the performance aspects of fluid machinery for centrifugal pump and turbines.	Analyzing (K4)

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.
3. Som S.K., BiswasG.,"Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill,2012.
4. Subramanya K, "Fluid Mechanics and Hydraulic Machines-Problems and Solutions", Tata McGraw Hill

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	1	2	2	1	2	1	1	2	2	2
CO2	3	3	3	2	1	2	2	1	2	1	1	2	2	2
CO3	3	3	3	3	1	2	2	1	2	1	1	2	2	2
CO4	3	3	3	3	1	2	2	1	2	1	1	2	2	2
CO5	3	3	3	3	1	2	2	1	2	1	1	2	2	2

MC23302	HUMAN VALUES AND GENDER EQUALITY	2	0	0	0

COURSE OBJECTIVES

To enable the students to

1.	define different types of human values and their impact on individual behaviour and societal norms.
2.	apply principles of personal development such as self-confidence, self-discipline, and resilience to navigate modern challenges effectively.
3.	evaluate the role of values in shaping professional ethics, civic sense and global citizenship.
4.	examine the socio-economic factors influencing gender inequality and explore avenues for empowerment and advocacy.
5.	critically analyze prevalent issues and challenges faced by women, including gender-based violence, discrimination, and cultural biases, and propose measures for their eradication.

UNIT I	HUMAN VALUES	6

Value Education - Definition, Types of values; Human values - Acceptance, Consideration. Appreciation, Listening. Empathy, Sympathy, Honesty, Integrity, Wisdom, Decision making, Self- actualization, Character formation towards positive personality, Contentment; - Religious Values - Humility, Compassion, Gratitude. Peace, Justice, Freedom, Equality.

UNIT II	PERSONALITY DEVELOPMENT	6

Personal Development - Introspection, Self-confidence, Self-discipline; Flexibility -Peer pressure - Sensitization towards Gender Equality; Reliability; Unity; Modern Challenges of Adolescent Emotions and behavior - Comparison and Competition, Positive and Negative attitudes; Family values; Self- improvement - Physical exercises, Meditation ,Yoga.

UNIT III	VALUE EDUCATION TOWARDS NATIONAL AND GLOBAL DEVELOPMENT	6

Professional Values -. Integrity, Responsibility, Punctuality, Dedication - Perseverance - Competence; Civic sense and Responsibility; Global Values - Computer Ethics, Moral Leadership, Code of Conduct; Corporate Social Responsibility; Aesthetic values; National Integration and International understanding of Religious Values – Spirituality, thought process.

UNIT IV	GENDER EQUALITY	6

Gender Equality - Definition, Empowerment, Economic Equality; Condition of Women in India- Education, Healthcare, Political Representation, Gender-based Violence; Challenging Stereotypes: Parental and Caregiving Responsibilities; Legal and Policy Reform; Cultural Shifts; Global Perspective; Male Chauvinism; Sustainable Development..

UNIT V	WOMEN ISSUES AND CHALLENGES	6

Women Issues and Challenges - female feticide, violence against women; Domestic violence- dowry related abuse and deaths, Physical violence, Emotional abuse; Sexual assault; Honour killing; Eve-teasing- Stalking, e-stalking (cyber-crime).

	TOTAL PERIODS:	30

COURSE OUTCOMES At the end of this course, the students will be able to		BT MAPPED (Highest Level)
CO1	discuss the concept of human values and their significance in personal and societal development.	Understanding (K2)
CO2	demonstrate introspective skills to enhance personal growth and self-awareness.	Applying (K3)
CO3	recognize the importance of gender equality in promoting a just and equitable society.	Understanding (K2)
CO4	cultivate a sense of social responsibility and ethical conduct towards achieving national and global development.	Analyzing (K4)
CO5	analyse the challenges faced by women in various spheres and identify strategies for addressing them.	Analyzing (K4)

TEXT BOOKS

1. A Foundation Course in Human Values and Professional Ethics: Presenting a Universal Approach to Value Education - Through Self-exploration. New Delhi, 2016.
2. Aurther, John. Personality Development. Lotus Press, 2018.

REFERENCES

1. Joshi, Dhananjay. Value Education in Global Perspective. Lotus Press, 2014.
2. Mahrotra, Mamta. Gender Inequality in India: Challenging Social Norms. Prabhat Books, 2015.

CO PO MAPPING

*CO-PO & PSO Matrix Correlation :: Put if, Strong :3, Moderate : 2, Weak : 1, Nil : -

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

EE23306	ELECTRICAL MACHINES AND DRIVES	3	0	2	4

COURSE OBJECTIVES

To enable the students to

1. understand the fundamentals of electrical drive motor characteristics.
2. recognize the characterization and utilization of different types of starters.
3. outline the representation of electrical drives.
4. acquire knowledge on the operation of solid state speed control of DC drives.
5. identify the voltage and frequency control of AC drives.

UNIT I	ELECTRICAL MACHINES	9

Mechanical characteristics - Speed-torque characteristics; Three-phase induction motor - Construction, types, principle of operation, torque-slip characteristics, applications.

UNIT II	STARTING METHODS	9

Necessity of starter; Types of D.C motor starters - Two point starter, three point starter, four point starter; Types of AC starter - Direct online starter, Y-Δ starter, rotor resistance starter.

UNIT III	FUNDAMENTALS OF ELECTRIC DRIVES	9

Basic elements; Types of electric drives; Factors influencing the choice of electrical drives; Heating and cooling curves; Loading conditions and classes of duty; Selection power rating of drive motors; Load equalization.

UNIT IV	CONVENTIONAL AND SOLID STATE SPEED CONTROL OF DC DRIVES	9

Speed control of DC series and shunt motors - Armature and field control; Ward-Leonard control system; Single phase half wave controlled rectifiers; Single phase fully controlled rectifier; Four quadrant chopper; Applications.

UNIT V	CONVENTIONAL AND SOLID STATE SPEED CONTROL OF AC DRIVES	9

Speed control of three phase induction motor - Voltage / frequency control, cascade control; Types of slip power recovery scheme; Voltage source inverters fed AC drive; AC voltage controller; Applications.

LIST OF EXPERIMENTS

1. Load test on DC shunt motor.
2. Load test on DC series motor.
3. Open circuit characteristics and load characteristics of self-excited DC generator.
4. Open circuit characteristics and load characteristics of separately-excited DC generator.
5. Speed Control of DC shunt motor (Armature and Field control).
6. Load test on three phase squirrel cage induction motor.

	TOTAL PERIODS	75

COURSE OUTCOMES		
At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	describe the characteristics of DC motors under different load conditions.	Understanding (K2)
CO2	classify the type of starter for various applications.	Applying (K3)
CO3	infer the operations of electric drives.	Understanding (K2)
CO4	explain the speed control of DC motor drives.	Understanding (K2)
CO5	interpret the speed control of AC motor drives.	Understanding (K2)

TEXT BOOKS

1. Nagrath .I.J. & Kothari .D.P, "Electrical Machines", Tata McGraw-Hill, Fourth Edition, Reprint 2019.
2. Vedam Subrahmaniam, "Electric Drives (concepts and applications)", Tata McGraw- Hill, 2016.

REFERENCES

1. Theraja B.L and Theraja A.K., "A Text book of Electrical Technology", Volume – II, S,Chand Co.,2016.
2. M.D.Singh, K.B.Khanchandani, "Power Electronics", Tata McGraw-Hill, 2014.
3. Bimal K Bose, "Modern Power Electronics and AC Drives", Prentice-Hall of India Pvt. Ltd., 2013.
4. Muhammad H. Rashid, "Power Electronics: Circuits, Devices and Applications", Pearson Education, 2014.

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

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

ME23304	FLUID MECHANICS AND HYDRAULIC MACHINES LABORATORY	0	0	2	1

COURSE OBJECTIVES

To enable the students to

1	compute Coefficient of discharge of given Orifice meter.
2	calculate the rate of flow using Rotameter and friction factor for a given set of pipes.
3	find out efficiency of reciprocating and gear pump.
4	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 Venturimeter.
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 the course, the students will be able to		**BT MAPPED** (Highest level)
CO1	determine the coefficient of discharge of given orifice meter.	Analyzing (K4)
CO2	analyse the rate of flow using rotameter and friction factor for a given set of pipes.	Analyzing (K4)
CO3	choose an appropriate pump for a specific application.	Applying (K3)
CO4	test the performance of turbines.	Analyzing (K4)

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	2	2	-	-	-	-	-	-	-	2	2	2
CO2	3	3	2	2	-	-	-	-	-	-	-	2	2	2
CO3	3	3	2	2	-	-	-	-	-	-	-	2	2	2
CO4	3	3	2	2	-	-	-	-	-	-	-	2	2	2

ME23305	MANUFACTURING PROCESSES LABORATORY	0	0	2	1

COURSE OBJECTIVES

To enable the students to

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

LIST OF EXPERIMENTS

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		**BT MAPPED** (Highest level)
CO1	apply operating practice to perform various lathe operations	Applying (K3)
CO2	fabricate different type of metal joints using welding and brazing processes.	Applying (K3)
CO3	perform various sheet metal operations.	Applying (K3)
CO4	prepare sand moulding using different patterns.	Applying (K3)

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	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

GE23301	PROFESSIONAL DEVELOPMENT I	0	0	2	1

COURSE OBJECTIVES

To enable the students to

1.	enhance and evaluate the student's potential strength, personality skills and reduce weakness to survive. in corporate world.
2.	enhance and develop the students behavioral, speaking and listening skills to face the interview.
3.	solve the quantitative aptitude problems and improve their problem-solving skills.
4.	improve their reasoning skills to get placed in reputed companies.

UNIT I	SELF - UNDERSTANDING AND PERSONALITY ENHANCEMENT SKILLS	7

Introduction: Self Exploration, SWOT Analysis - Types and Barriers - Effective Communication in Workplace - Leadership Skills - Decision Making - Problem Solving - Goal Setting - Critical, Strategic and Lateral Thinking, JAM Level - 1, Basic Resume Building Level – 1.

UNIT II	BEHAVIOURAL SKILLS, LISTENING AND SPEAKING SKILLS	7

Behavioral Skills : Time Management - Emotional Intelligence - Analytical Thinking; Listening - Listening and Hearing - Self Introduction - Group Discussion: Types and Importance - Evaluation Criteria - Do's and Don'ts of GD - GD Level-1.

UNIT III	QUANTITATIVE APTITUDE	8

Number System - LCM and HCF - Simple Interest and Compound Interest - Average - Pipes and Cisterns - Area - Profit and Loss.

UNIT IV	LOGICAL REASONING	8

Logical Sequence - Analogy - Classification - Causes and Effect - Making Judgment – Directions.

	TOTAL PERIODS:	30

COURSE OUTCOMES At the end of this course, the students will be able to		BT MAPPED (Highest Level)
CO1	define and analyze soft skills to improve the leadership skills.	Analyzing (K4)
CO2	demonstrate the behavioral skills through various activities.	Applying (K3)
CO3	develop the problem solving skills through quantitative aptitude.	Applying (K3)
CO4	illustrate the logical reasoning Skills to solve real world problems.	Analyzing (K4)

TEXT BOOKS

1. Agarwal, R.S. "Objective General English", S.Chand&Co.2021.
2. Agarwal, R.S. "Quantitative Aptitude", S.Chand&Co.2021.

REFERENCES

1. Abhijit Guha, "Quantitative Aptitude ", Tata-Mcgraw Hill.2023.
2. Agarwal, R.S." A Modern approach to Verbal & Non Verbal Reasoning", S.Chand & Co Ltd, newdelhi.2021
3. Word Power Made Easy By Norman Lewis, Wr.Goyal Publications.2021.

CO PO MAPPING														
Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) (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	1	1
CO2	-	-	-	-	-	-	2	3	2	3	-	3	1	1
CO3	3	2	2	2	-	-	1	-	-	-	-	-	2	2
CO4	2	3	3	2	-	3	3	1	-	1	2	-	2	2

MA23401	STATISTICS AND NUMERICAL METHODS	3	1	0	4

(Common to Civil, Chemical, Mech, MCT, R&A)

COURSE OBJECTIVES

To enable the students to

1.	determine the concepts of hypotheses testing, its need and applications.
2.	equip with statistical techniques for designing experiments, analyzing, interpreting and presenting research data.
3.	apply various numerical techniques for solving algebraic/transcendental equations and system of linear equations.
4.	develop the knowledge of numerical differentiation and numerical integration techniques.
5.	acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I	TESTING OF HYPOTHESIS	12

Sampling theory; Large sample - Tests for single mean, proportion and difference of means; Small sample - Test for single mean and difference of means; Test equality of variances; Chi square test - Goodness of fit, Independence of attributes.

UNIT II	DESIGN OF EXPERIMENTS	12

Completely randomized design; Randomized block design; One way and two way classifications- Latin square design - 2^2 factorial design.

UNIT III	SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS	12

Solution of algebraic and transcendental equations; Fixed point iteration method; Newton Raphson method; Solution of linear system of equations; Gauss elimination method – Pivoting; Gauss Jordan method; Iterative methods of Gauss Jacobi and Gauss Seidel; Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

UNIT IV	INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION	12

Interpolations - Newton's forward and backward difference interpolation; Approximation of interpolation polynomials; Divided differences; Lagrangian methods for equal and unequal intervals; Numerical differentiation and integration by trapezoidal and Simpson's 1/3 rules.

UNIT V	NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS	12

Single step methods: Taylor's series method; Euler's method, Modified Euler's method; Fourth order Runge-Kutta method for solving first order differential equations; Multi step methods: Milne's and Adams - Bash forth predictor corrector methods for solving first order differential equations.

	TOTAL PERIODS	60

COURSE OUTCOMES At the end of this course, the students will be able to		BT MAPPED (Highest Level)
CO1	apply the concept of testing of hypothesis for small and large samples in real life problems	Applying (K3)
CO2	analyse the principles to be adopted for designing the experiments.	Analysing(K4)
CO3	apply various numerical techniques to solve algebraic and transcendental equations.	Applying(K3)
CO4	derive the concepts of numerical differentiation and integration.	Applying (K3)
CO5	compute the solution of first order ordinary differential equations by numerical techniques..	Applying (K3)

TEXT BOOKS

1. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4thEdition, 2007.
2. Sankar Rao K " Numerical Methods for Scientists and Engineers –3rd Edition Princtice Hall of India Private, New Delhi, 2007.

REFERENCES

1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 7th Edition, 2007.
3. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics", Tata McGraw Hill Edition, 4th Edition, 2012.
4. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.

CO PO MAPPING:

Mapping of Course Outcomes with Programme Outcomes
(1/2/3 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	3	3	2	3	-	-	-	-	-	-	-	3	1	3
CO2	3	3	2	3	-	-	-	-	-	-	-	3	2	3
CO3	3	3	2	3	-	-	-	-	-	-	-	2	2	3
CO4	2	2	2	2	-	-	-	-	-	-	-	2	1	2
CO5	2	2	2	2	-	-	-	-	-	-	-	2	1	2

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Approved
BOARD OF STUDIES
Mathematics

25/5/24

ME23401	KINEMATICS OF MACHINES	3	1	0	4

COURSE OBJECTIVES

To enable the students to

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

UNIT I **BASICS OF MECHANISMS** **12**

Definitions – Link, Kinematic pair, Kinematic chain, Mechanism, and Machine. –Degree of Freedom – Mobility - Kutzbach criterion (Gruebler"s equation) -Grashoff's law - Kinematic Inversions of four-bar chain and slider crank chain - indices of merit - Mechanical Advantage-Transmission angle. Description of common Mechanisms - Offset slider mechanism as quick return mechanisms, Pantograph.

UNIT II **KINEMATIC ANALYSIS** **12**

Analysis of simple mechanisms (Single slider crank mechanism and four bar mechanism) - Graphical Methods for displacement, velocity and acceleration - Coincident points – Coriolis acceleration.

UNIT III **KINEMATICS OF CAMS** **12**

Fundamentals of cam - Classifications - Displacement diagrams - derivatives of uniform velocity, simple harmonic motion, cycloidal, uniform acceleration and retardation motion – Graphical angle construction of displacement diagrams and layout of plate cam profiles.

UNIT IV **GEARS AND GEAR TRAINS** **12**

Gear: Terminology and definitions - Classification of gears – 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.

UNIT V **FRICTION** **12**

Concept of friction – Friction in screw jack – Pivot and collar friction – Clutch, Functions and its types – Single Plate and Multi plate clutches - Block brakes, band brakes.

TOTAL PERIODS:60

COURSE OUTCOMES At the end of the course, the students will be able to		**BT MAPPED** (Highest level)
CO1	comprehend the types of motion, joints and degree of freedom.	Understanding (K2)
CO2	demonstrate the knowledge on displacement, velocity and acceleration for planer mechanism graphically.	Understanding (K2)
CO3	construct cam profile for different types of motions.	Applying (K3)
CO4	choose a gear and gear train depending on the application.	Applying (K3)
CO5	apply the friction concepts to belt drives and brakes.	Applying (K3)

TEXT BOOKS

1. R.S.Khurmi & J.K.Gupta, "Theory of Machines", 14th Edition, Eurasia Publishing House, Delhi, 2020.
2. Uicker J.J.,Pennock G.R., Shigley J.E., "Theory of Machines and Mechanisms"(Indian Edition),

REFERENCES

1. Rattan S S , "Theory of Machines", 4 th Edition, Tata McGraw Hill Publishers, New Delhi, 2017.
2. P.L.Ballaney, "Theory of Machines: A textbook for Engg students", 15th edition, Khanna, Delhi. Reprint, 2011.
3. Ambekar A. G., Mechanism and Machine Theory, Prentice Hall of India, New Delhi, 2009.
4. Ghosh, A, and Malick, A. K., "Theory of Mechanisms and Machines" 3rd Edition, East West Press Pvt Ltd., 2012.

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	3	3
CO2	3	2	2	-	2	-	-	-	-	-	2	2	3	3
CO3	3	2	2	-	2	-	-	-	-	-	2	2	3	3
CO4	3	2	2	-	2	-	-	-	-	-	2	2	3	3
CO5	3	2	2	-	2	-	-	-	-	-	2	2	3	3

PAVAI ENGINEERING COLLEGE, NAMAKKAL
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BOARD OF STUDIES
Mechanical Engineering
17/5/24
AUTONOMOUS

ME23402	APPLIED THERMODYNAMICS	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	acquire knowledge on the basic thermodynamic cycles used in various thermal devices and their related calculations.
2	understand the fundamentals of operation of internal combustion engines, the factors affecting their performance, operation, fuel requirements and environmental impact.
3	analyze the various cycles used for power generation, combustion and kinetics involved in turbines.
4	comprehend design and working principles of air compressors.
5	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, Rankine, 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 its types -Splash and full pressure lubrication system ; Cooling systems; CRDI; Homogeneous change compression ignition engines.

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 the course, the students will be able to		**BT MAPPED** (Highest level
CO1	analyze the different gas power cycles for various requirements.	Analysing (K4)

CO2	apply the knowledge of the working of internal combustion engine in automobile industry.	Applying (K3)
CO3	implement the concepts of steam nozzles and turbines in real time application.	Applying (K3)
CO4	make use of the knowledge on working and performance of air compressor.	Applying (K3)
CO5	solve problems on refrigeration and air-conditioning systems by understanding the various thermodynamic properties.	Applying (K3)

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

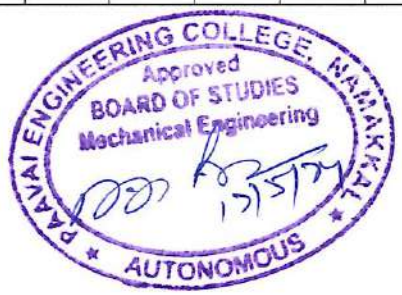
1. Sarkar, B.K,"Thermal Engineering" Tata McGraw-Hill Publishers, 2017.
2. Arora.C.P,"Refrigeration and Air Conditioning," Tata McGraw-Hill Publishers, 2017.
3. Ganesan V." Internal Combustion Engines", Third Edition, Tata McGraw-Hill, 2015.
4. Rudramoorthy, R, "Thermal Engineering ", Tata McGraw-Hill, 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	2	1	-	-	-	-	-	-	-	1	2	1
CO2	3	2	2	1	-	-	-	-	-	-	-	1	2	1
CO3	3	3	2	1	-	-	-	-	-	-	-	1	2	1
CO4	3	3	2	1	-	-	-	-	-	-	-	1	2	1
CO5	3	3	2	1	-	-	-	-	-	-	-	1	2	1



ME23403	MECHANICS OF MATERIALS	3	1	0	4

COURSE OBJECTIVES

To enable the students to

1	understand the concepts of stress, strain, principal stresses and principal planes.
2	know the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses.
3	determine stresses and deformation in circular shafts and helical spring due to torsion.
4	compute slopes and deflections in determinate beams by various methods.
5	understand the stresses and deformations induced in thin shells.

UNIT I	STRESS, STRAIN AND DEFORMATION OF SOLIDS	12

Mechanical Properties of Materials, Stress strain curve, Rigid and Deformable bodies – Strength, Stiffness and Stability; Stresses - Tensile, Compressive and Shear; Generalized Hook's law Deformation of simple and compound bars under axial load; Thermal stress Relationship between Elastic constants –Volumetric strains; Stresses on inclined plane – Principal planes and stresses – Mohr's circle of stresses.

UNIT II	SHEAR FORCE & BENDING MOMENT	12

Definition of beam & 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; Point of contra flexure.

UNIT III	TORSION OF SHAFTS AND SPRINGS	12

Theory of torsion, Bars of Solid and hollow circular section; Power transmitted by a Shaft -Torsion stiffness; Stresses in helical springs – Deflection of open & closed coil helical springs under axial loads.

UNIT IV	DEFLECTION OF BEAMS	12

Slope & Deflection of a Cantilever & Simply supported beams by Double Integration Method, Macaulay Method for computation of slopes and deflections in beams; Concept of Conjugate beam method (Theory only).

UNIT V	THIN SHELLS	12

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

TOTAL PERIODS:60

COURSE OUTCOMES At the end of the course, the students will be able to		BT MAPPED (Highest level
CO1	apply the concepts of strength of materials to obtain solutions to real time Engineering problems.	Applying (K3)
CO2	analyze the deformation behavior of simple structures subjected to different loads.	Analysing (K4)
CO3	solve torsion of circular bars and stresses in helical springs.	Applying (K3)
CO4	interpret the deflection and slope of beams using different methods under various loading conditions.	Understanding (K2)
CO5	experiment with the stresses in thin cylindrical and spherical shells.	Applying (K3)

TEXT BOOKS

1. Bansal R.K, "Strength of Materials", Laxmi Publications Ltd., Fifth Edition, 2012.
2. Russell C. Hibbeler, Mechanics of Materials in SI Units, 9th Edition; 2018, Pearson Education, India.

REFERENCES

1. Singh. D.K., "Strength of Materials", Ane Books Pvt Ltd., New Delhi, 2021.
2. Beer. F.P. & Johnston. E.R. "Mechanics of Materials", Tata McGraw Hill, 8th Edition, New Delhi 2019.
3. S. S. Bhavikatti, Strength of Materials, Vikas Publishing House, New Delhi, Fourth edition, 2013.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 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	3	3	2	3	1	3	2	3	1	3	1	2
CO2	3	3	3	3	2	3	1	3	2	3	1	3	3	2
CO3	3	3	3	3	2	3	1	3	2	3	1	3	3	2
CO4	3	3	3	3	2	3	1	3	2	3	1	3	3	2
CO5	3	3	3	3	2	3	1	3	2	3	1	3	3	2

MC23401	ENVIRONMENTAL SCIENCES AND SUSTAINABILITY	2	0	0	0

COURSE OBJECTIVES	
To enable the students to	
1	establish the knowledge of precious resources of the environment and their various impacts.
2	create awareness on ecosystem and biodiversity preserve.
3	learn scientific and technological solutions to current day pollution issues.
4	analyze climate changes, concept of carbon credit and the challenges of environmental management.
5	understand green materials, energy cycles and the role of sustainable urbanization.

UNIT I	ENVIRONMENT AND NATURAL RESOURCES	6

Definition, scope and importance of Environment. Forest resources: Use and over-exploitation, deforestation, - mining, dams and their effects on forests and tribal people. Water resources: Use and over- utilization of surface and ground water, dams-benefits and problems. Food resources: effects of modern agriculture, fertilizer-pesticide problems. Role of an individual in conservation of natural resources.

UNIT II	ECOSYSTEMS AND BIODIVERSITY	6

Concept of an ecosystem: Structure and function of an ecosystem - ecological succession - food chains and food webs. Ecosystems- Types of ecosystem: Introduction - forest ecosystem and lake ecosystems. Biodiversity: Introduction - definition (genetic - species - ecosystem). Diversity - Value of biodiversity - Hotspots of biodiversity - Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

UNIT III	ENVIRONMENTAL POLLUTION	6

Pollution: Définition - air pollution - water pollution - marine pollution - noise pollution. Solid waste management: Causes - effects - control measures of urban and industrial wastes. Role of an individual in prevention of pollution - Electronic waste -Sources-Causes and its effects- Pollution case studies-Field study of local polluted site – Industrial/Agricultural

UNIT IV	SUSTAINABILITY AND ENVIRONMENT	6

Sustainability - from unsustainability to sustainability-millennium development goals, and protocols. Sustainable development goals-targets, indicators and intervention areas. Climate change-– acid rain - ozone layer depletion. Regional and local environmental issues and possible solutions-case studies. Concept of carbon credit, carbon footprint. Environmental management in industry-A case study.

UNIT V	SUSTAINABILITY PRACTICES	6

Zero waste and R concept, Circular economy, ISO 14000 Series, Environmental Impact Assessment - Sustainable energy: Non-conventional Sources, Green materials, Energy Cycles - carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio economical and technological change.

	TOTAL PERIODS	30

COURSE OUTCOMES		
At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	find the method of conservation of natural resources	Understand(K2)
CO2	understand ecosystem and the conservation of biodiversity.	Understand(K2)
CO3	aware of environmental pollution and interpret its effects.	Understand(K2)
CO4	apply sustainable development for technological advancement and societal development.	Apply (K3)
CO5	measure the sustainability practices for green energy cycles.	Analyze (K4)

TEXT BOOKS

1. Benny Joseph, "Environmental Science and Engineering", Tata McGraw Hill, 1st edition, 2017.
2. Gilbert M. Masters, Wendell P. Ela "Introduction to Environmental Engineering and Science", 3rd edition, Pearson, 2022.

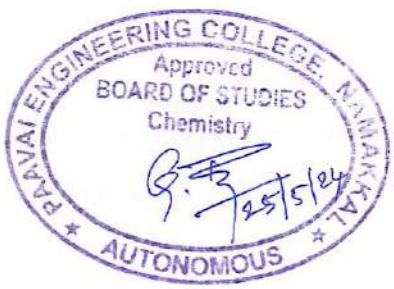
REFERENCES

1. William P. Cunningham and Mary Ann Cunningham, "Environmental Science: A Global Concern", McGraw Hill, 16th edition, 2023.
2. C. S. Rao, Environmental Pollution and Control engineering, New Age International (P) ltd Publication, New Delhi, 4th edition, 2021.
3. Erach Bharucha, "Textbook of Environmental Studies", Universities Press Pvt. Ltd., edition, 2020.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 4th Edition, 2015.

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

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



ME23404	METAL CUTTING AND MACHINE TOOLS	3	0	2	4

COURSE OBJECTIVES

To enable the students to

1	understand the basic principles of theory of metal cutting..
2	illustrate the construction, specifications and operations of conventional lathe and semi-automatic machines.
3	comprehend the operating mechanisms of machine tools like shaping, slotting, planning, milling, and drilling, grinding machines.
4	gain knowledge on intricate manufacturing operations for gears and surface finishing processes.
5	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.

LIST OF EXPERIMENTS

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

TOTAL PERIODS: 75

COURSE OUTCOMES		
At the end of this course, students will be able to		**BT MAPPED** (Highest level)
CO1	apply the concepts of theory of metal cutting in real time machining.	Applying (K3)
CO2	explain different machining operations which are performed in lathe machines.	Understanding (K2)
CO3	identify machine tools and apply operating knowledge on the working of tools like shaper, drilling, milling and all allied machines.	Applying (K3)
CO4	apply knowledge of gear cutting and different surface finishing process like grinding and gear finishing.	Applying (K3)
CO5	make use of CNC operating codes for designing different machine components.	Applying (K3)

TEXT BOOKS

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

REFERENCES

1. SeropeKalpakjian, 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". Dhanpat Rai&Co., 2010.

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	1	-	-	-	-	-	2	3	3
CO2	3	3	2	1	2	1	-	-	-	-	-	2	3	3
CO3	3	2	3	2	2	1	-	-	-	-	-	2	3	3
CO4	3	2	2	2	2	1	-	-	-	-	-	2	3	3
CO5	3	3	2	2	2	1	-	-	-	-	-	2	3	3

ME23405	STRENGTH OF MATERIALS LABORATORY	0	0	2	1

COURSE OBJECTIVES

To enable the students to

1	impart knowledge on mechanical properties of materials subject to different types of loading on wood and steel.
2	apply the knowledge of testing steel rod subjected to tension and torsion.
3	gain practical knowledge on double shear test and impact test on metal.
4	gain practical knowledge on compression and tension test on springs.

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.

TOTAL PERIODS : 30

COURSE OUTCOMES

At the end of the course, the students will be able to		**BT MAPPED** (Highest level)
CO1	test the wood and steel for various loadings.	Analyzing (K4)
CO2	analyze the tension, torsion on steel rod.	Analyzing (K4)
CO3	experiment with the double shear and impact strength on metal.	Applying (K3)
CO4	determine the compression and tension test on spring.	Analyzing (K4)

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	3	-	-	3	2	-	3	3	3
CO2	3	3	-	3	3	3	-	-	3	2	-	3	3	3
CO3	3	3	-	3	3	3	-	-	3	2	-	3	3	3
CO4	3	3	-	3	3	3	-	-	3	2	-	3	3	3

ME23406	THERMAL ENGINEERING LABORATORY	0	0	2	1

COURSE OBJECTIVES

To enable the students to

1	comprehend the thermodynamic concepts used in various thermal applications like IC engines, steam generator, turbine and other thermal devices.
2	demonstrate and interpret the procedure for valve timing and port timing diagrams.
3	analyze the performance characteristics of IC Engines.
4	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 by using Mechanical Loading.
3. Performance Test on 4-stroke Diesel Engine by using Hydraulic Loading.
4. Performance Test on 4-stroke Diesel Engine by using Electrical Loading.
5. Performance Test on 4-stroke Petrol Engine by using Mechanical Loading.
6. Heat Balance Test on 4-stroke Diesel Engine.
7. Morse Test on Multi cylinder Petrol Engine.
8. Retardation Test to find Frictional Power of a Diesel Engine.
9. Determination of Viscosity – Red Wood Viscometer.
10. Determination of Flash Point and Fire Point.

STEAM LABORATORY

1. Study of steam generators.
2. Study of steam turbines.
3. Study of Air compressor.

TOTAL PERIODS :30

COURSE OUTCOMES

At the end of this course, the students will be able to		**BT MAPPED** (Highest level)
CO1	interpret the concepts of thermal applications.	Understanding(K2)
CO2	construct the valve timing and port timing diagrams involved in the operation of engines.	Applying (K3)
CO3	demonstrate the performance characteristics of internal combustion engines.	Understanding(K2)
CO4	test for the find out the property of fuels and lubricants oils.	Analyzing (K4)

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	-	-	-	-	-	1	-	2	-	-	1	1	2
CO2	3	-	-	-	-	-	1	-	2	-	-	1	1	2
CO3	3	-	-	-	-	-	1	-	2	-	-	1	1	2
CO4	3	-	-	-	-	-	1	-	2	-	-	1	1	2

GE23401	PROFESSIONAL DEVELOPMENT II	0	0	2	1

COURSE OBJECTIVES

To enable students to

1	enhance their own behavioral skills to survive in corporate world.
2	evaluate their listening and speaking skills to face the interviews in a successful way.
3	solve the quantitative aptitude problems and improve their problem-solving skills.
4	improve their reasoning skills to get placed in reputed companies

UNIT I	WRITING SKILLS	7

Email Writing - fixing and cancelling appointments, paper submission for seminars and conferences - Business communication, Stress Management - Body Language - Dress Code - Self Introduction II - Update Resume Building II - JAM Level - 3.

UNIT II	PRESENTATION SKILLS	7

Presentation Skills: Types and Methods of Delivering Presentation - Ways and Methods to improve Presentation Skills; Mini Presentation in smaller groups - Situational Role Play; Face to Face interview, Group Discussion Level II - JAM Level - 4.

UNIT III	QUANTITATIVE APTITUDE	8

Simplification - Time, Speed and Distance - Trains - Boats and Streams - Ratio and Proportion - Partnership - Percentage.

UNIT IV	LOGICAL REASONING	8

Seating Arrangement - Arithmetic Reasoning - Character Puzzle - Syllogisms - Matching - Definitions - Statements and Arguments.

TOTAL PERIODS	30

COURSE OUTCOMES At the end of this course, the students will be able to		BT MAPPED (Highest Level)
CO1	interpret the personality development through various activities.	Understanding (K2)
CO2	examine speaking and Listening Skills to excel in their jobs.	Analyzing (K4)
CO3	develop the quantitative skills and analytical skills to face the interview	Applying (K3)
CO4	extend the reasoning abilities by scoring exceeded percentage to get placed in reputed companies	Understanding (K2)

TEXTBOOKS

1. Agarwal, R.S. "Objective General English", S.Chand&Co., 2021.
2. Agarwal, R.S. "Quantitative Aptitude", S.Chand&Co., 2021.

REFERENCES

1. Abhijit Guha, "Quantitative Aptitude ", Tata-Mcgraw Hill., 2023.
2. Agarwal, R.S." A Modern approach to Verbal & Non Verbal Reasoning", S.Chand & Co Ltd, newdelhi., 2021.
3. Word Power Made Easy By Norman Lewis, Wr.Goyal Publications., 2021.

CO/PO MAPPING:

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

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