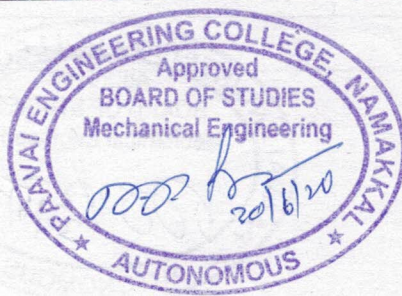


**SEMESTER III**

S. No	Category	Course Code	Course Title	L	T	P	C
<b>Theory</b>							
1	HS	GE20301	தமிழரும் தொழில்நுட்பமும் / Tamil and Technology	1	0	0	1
2	BS	MA20301	Transforms and Boundary Value Problems	3	1	0	4
3	PC	ME20301	Thermodynamics	3	1	0	4
4	PC	ME20302	Manufacturing Processes	3	0	0	3
5	PC	ME20303	Engineering Materials and Metallurgy	3	0	0	3
6	PC	ME20304	Fluid Mechanics and Hydraulic Machines	3	0	0	3
7	MC	MC20301	Value Education	2	0	0	0
<b>Practical</b>							
8	PC	ME20305	Manufacturing Processes Laboratory	0	0	2	1
9	PC	ME20306	Fluid Mechanics and Machinery Laboratory	0	0	2	1
10	EE	EN20301	English Proficiency Course Laboratory	0	0	2	1
<b>Total</b>				<b>18</b>	<b>2</b>	<b>6</b>	<b>21</b>

**SEMESTER IV**

S. No	Category	Course Code	Course Title	L	T	P	C
<b>Theory</b>							
1	BS	MA20404	Numerical Methods	3	1	0	4
2	PC	ME20401	Applied Thermodynamics	3	0	0	3
3	PC	ME20402	Mechanics of Materials	3	0	0	3
4	PC	ME20403	Kinematics of Machinery	3	0	0	3
5	PC	ME20404	Metal Cutting Processes	3	0	0	3
6	PC	ME20405	Hydraulics and Pneumatics	3	0	0	3
<b>Practical</b>							
7	PC	ME20406	Thermal Laboratory	0	0	2	1
8	PC	ME20407	Strength of Materials Laboratory	0	0	2	1
9	PC	ME20408	Metal Cutting Processes Laboratory	0	0	2	1
<b>Total</b>				<b>18</b>	<b>1</b>	<b>6</b>	<b>22</b>



அலகு I நெசவு மற்றும் பானைத் தொழில்நுட்பம் 3

சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்.

அலகு II வடுவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் 3

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை வடிவமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரம் சிற்பங்களும் கோவில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டி நாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக்கலை

அலகு III உற்பத்தி தொழில் நுட்பம் 3

கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பு உருக்குதல், எஃகு - வரலாற்றுச் சின்னங்களாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத் துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு IV வேளாண்மை மற்றும் நீர்பாசனத் தொழில்நுட்பம் 3

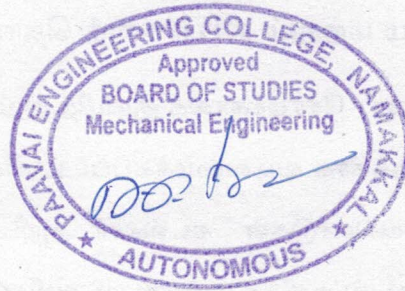
அணை - ஏரிகுளங்கள், மதகு - சோழர்காலக் குமிழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்

அலகு V அறிவியல் தமிழ் மற்றும் கணித்தமிழ் 3

அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் சொற்குவைத் திட்டம்

## TEXT CUM REFERENCE BOOKS:

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே.பிள்ளை. (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம் ( விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு).
4. பொருளை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A Joint publication of TNTB & ESC and RMRL – (in print).
6. Social Life of the Tamils – The Classical Period (Dr.S.Singaravelu) (Published by International institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subramanian, Dr.K.D.Thirunavukkarasu)
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by International institute of Tamil Studies)
9. Keeladi – ‘Sangam City Civilization on the banks of river vaigai’ (Jointly Published by Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by the author)
11. Porunai Civilization (Jointly Published by Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamilnadu).
12. Journey of Civilization Indus to vaigai (R.Balakrishnan) (Published by RMRL) – Reference Book



GE20301

TAMILS AND TECHNOLOGY

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**UNIT I WEAVING AND CERAMIC TECHNOLOGY**

3

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

**UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY**

3

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

**UNIT III MANUFACTURING TECHNOLOGY**

3

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel - Copper and gold Coins as source of history - Minting of Coins – Beads making - industries Stone beads - Glass beads - Terracotta beads - Shell beads/ bone beads - Archeological evidences - Gem stone types described in Silappathikaram.

**UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY**

3

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

**UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING**

3

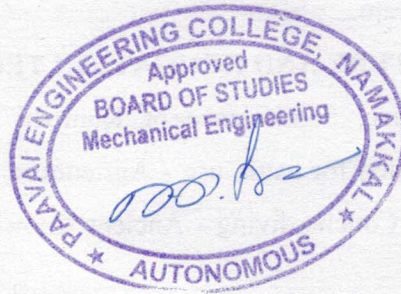
Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project

**TOTAL PERIODS: 15**

**TEXT CUM REFERENCE BOOKS:**

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே.பிள்ளை. (வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
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3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு).
4. பொருளை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு).

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12. Journey of Civilization Indus to vaigai (R.Balakrishnan) (Published by RMRL) – Reference Book





- 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

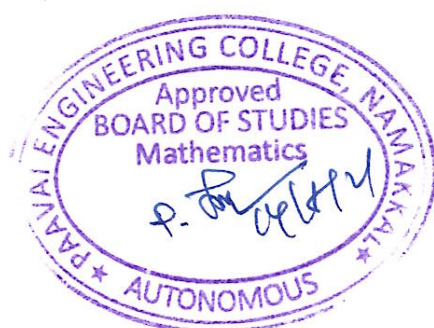
1. Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
2. Grewal. B.S, "Higher Engineering Mathematics", 41<sup>st</sup> Edition, Khanna Publications, Delhi,(2011).

#### 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 Engineers", 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", 3<sup>rd</sup> 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



**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

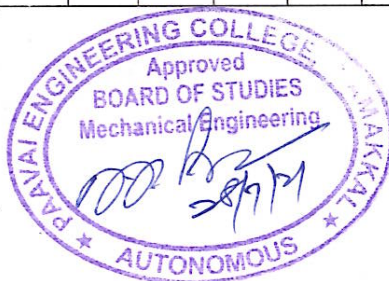
1. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi, 2017.
2. YunusA.Cengel, "Thermodynamics – An Engineering Approach" , Tata McGraw Hill, New Delhi, 2019.

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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



**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<sub>2</sub> 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, Percussion 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

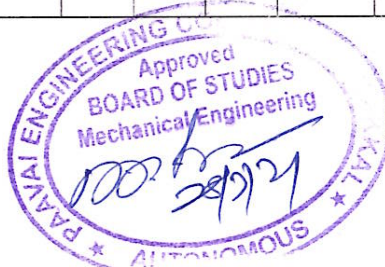
1. HajraChoudhury, "Elements of Workshop Technology, Vol.I and II", Media Promotors Pvt Ltd., Mumbai, 2001
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1. B.S. MagendranParashar& R.K. Mittal, "Elements of Manufacturing Processes", Prentice Hall of India, 2003.
2. P.N. Rao, "Manufacturing Technology", Tata McGraw-Hill Publishing Limited, II Edition, 2013.
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4. Begman, „Manufacturing Process", John Wiley& 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



**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, aluminium, 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 peritectoid 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 - Jominyend 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 Al<sub>2</sub>O<sub>3</sub>, SiC, Si<sub>3</sub>N<sub>4</sub>, 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**

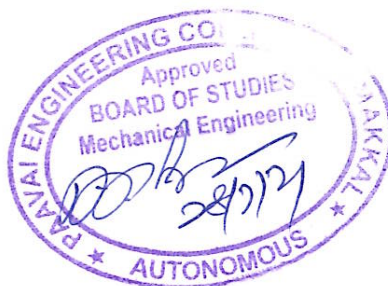
1. Kenneth G.Budinski and Michael K.Budinski “Engineering Materials” Prentice-Hall of India Private Limited, 4th Indian Reprint 2010.
2. O.P. Khanna, A text book of Materials Science and Metallurgy, Khanna Publishers, 2014.

**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														
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CO3	2	-	1	-	-	-	-	-	-	-	-	-	-	1
CO4	3	3	1	2	-	2	-	-	-	-	-	1	-	1
CO5	2	-	-	-	2	-	-	-	-	-	-	-	-	1



**ME20304                      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  $\pi$  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., 9<sup>th</sup> Edition, New Delhi, 2017.
2. Rajput R.K., "A text book of Fluid Mechanics and Hydraulic Machines" S.Chand& Company Ltd. 6<sup>th</sup> Edition , New Delhi. 2019.

### REFERENCES

1. Kumar. K.L., Engineering Fluid Mechanics Eurasia Publishing House (P) Ltd., 8<sup>th</sup> Edition, New Delhi, 2016.
2. Rathakrishnan. E., Fluid Mechanics:An Introduction, Prentice Hall of India Pvt. Ltd, 3<sup>rd</sup> Edition, 2012.
3. Som S.K., BiswasG., "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill Education Pvt. Ltd, 4<sup>th</sup> Edition New Delhi, 2019.

### CO - PO Mapping

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



MC20301

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 SOCIAL VALUES**

6

Social Values - Pity and probity - Self control - Respect to - Age, Experience, Maturity, Family members, Neighbours- Universal Brotherhood - Flexibility -Peer pressure - Sensitization towards Gender Equality, Physically challenged, Intellectually challenged - Reliability - Unity - Modern Challenges of Adolescent Emotions and behaviour - 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, the 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. Little William, An Introduction of Ethics. Allied Publisher, Indian Reprint 1955.
2. Sharma S.P. Moral and value education; Principles and practices, Kanishka publishers, 2013.

## REFERENCES

1. "Values (Collection of Essays)". Sri Ramakrishna Math. Chennai. 1996.

## CO - PO Mapping

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



**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**

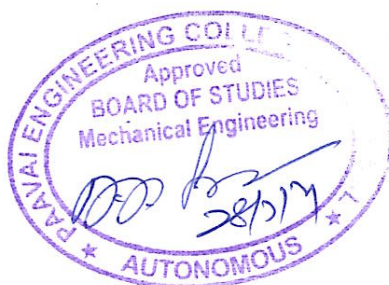
**COURSE OUTCOMES**

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

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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



**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**

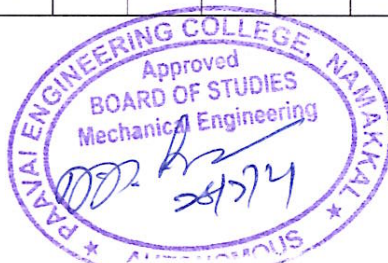
**COURSE OUTCOMES**

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





**COURSE OBJECTIVES**

To enable the students to

- familiarize with the reading skills such as skimming and scanning.
- practise 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.

**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
  - c. Identifying information
5. Reading Exercises from BEC Vantage & BEC Higher
  - a. Error identification
  - b. Gap filling
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 topic and appear with confidence for on-line tests.

## TEXT BOOKS

1. Cambridge IELTS 12 Academic Student's Book with Answers: Authentic Examination Papers (IELTS... by Cambridge University Press . New Delhi.2016
2. TOEFL iBT Prep Plus 2018-2019 4 Practice Tests) Kaplan Publishing. Newyork.2017.

## REFERENCES

1. Cambridge University Press India Pvt. Ltd, New Delhi.2016.
2. PTE Academic Test builder. Macmillan Education. London. 2012.

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



**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 conventional analytical 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 - Jordan method – Iterative method – Gauss-Seidel method – Inverse of a matrix by Gauss Jordan 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

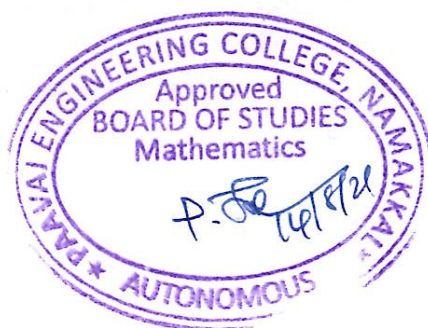
1. Erwin Kreyszig., "Advanced Engineering Mathematics" 10<sup>th</sup> edition, Wiley Publications, 2010.
2. T. Veerarajan. and T .Ramachandran, "Numerical Methods with programming in C", 2<sup>nd</sup> Ed., Tata McGraw-Hill, 2006.
3. SankarRao K " Numerical Methods ForScientisits And Engineers –3<sup>rd</sup> 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. Iyengar , 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.

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



**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 charge 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; speedregulations – 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 aircompressor.

**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

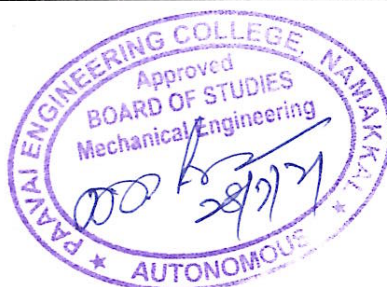
1. Rajput. R. K., "Thermal Engineering" Laxmi publications, 2018.
2. Kothandaraman.C.P., Domkundwar.S and Domkundwar. A.V., "A Course in Thermal Engineering," DhanpatRai& Sons, Fifth edition,2004.

## 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



**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; Lamé'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

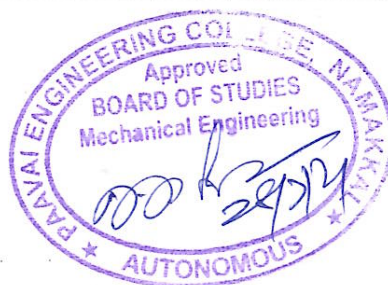
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2. Beer F. P. and Johnston R, "Mechanics of Materials", McGraw-Hill Book Co, Sixth Edition, 2011.

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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.
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## CO - PO Mapping

Mapping of Course Outcomes with Programme Outcomes (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
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CO3	3	3	3	-	-	-	-	-	-	-	-	2	3	2
CO4	3	2	3	-	-	-	-	-	-	-	-	2	3	2
CO5	3	2	2	-	-	-	-	-	-	-	-	2	3	2



**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      9**

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), Hook's joint, Toggle mechanism.

**UNIT II      KINEMATIC ANALYSIS      9**

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

**UNIT III      KINEMATICS OF CAMS      9**

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

**UNIT IV      GEARS      9**

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.

**UNIT V      FRICTION      9**

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

**TOTAL PERIODS :    45**

## 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

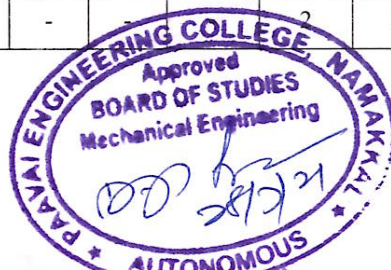
1. R.S.Khurmi&J.K.Gupta, "Theory of Machines", 14<sup>th</sup> Edition, Eurasia Publishing House, Delhi,2005.
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## REFERENCES

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", 15<sup>th</sup> 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														
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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



ME20404

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, planing, 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

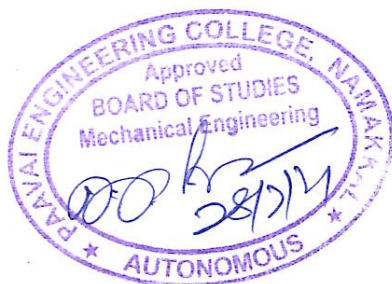
1. HajraChoudry, "Elements of Work Shop Technology – Vol. II", Media Promoters. 2002
2. HMT – "Production Technology", Tata McGraw-Hill, 1998.

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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“, 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
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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



**ME20405**

**HYDRAULICS AND PNEUMATICS**

**3 0 0 3**

**COURSE OBJECTIVES**

To enable the students to

- study about fluid power systems and fundamentals of hydraulics and pneumatics.
- learn about hydraulic System and components.
- understand the construction of control valves, accumulators and its operations in hydraulic system
- acquire the knowledge of pneumatic system components, pneumatic actuators, Sequential circuit design for simple applications using cascade method.
- know the design of pneumatic circuits and PLC applications in fluid power control circuits.

**UNIT I FLUID POWER SYSTEMS AND FUNDAMENTALS 9**

Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems, Properties of hydraulic fluids – General types of fluids – Fluid power symbols. Basics of Hydraulics - Applications of Pascals Law - Laminar and Turbulent flow – Reynold's number.

**UNIT II HYDRAULIC SYSTEM AND COMPONENTS 9**

Sources of Hydraulic Power: Pumping theory – Pump classification – Gear pump, Vane Pump, piston pump, construction and working of pumps – pump performance – Variable displacement pumps. Fluid Power Actuators: Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, double acting special cylinders like tandem, Rodless, Telescopic, Cushioning mechanism, Construction of double acting cylinder, Rotary actuators – Fluid motors, Gear, Vane and Piston motors.

**UNIT III DESIGN OF HYDRAULIC CIRCUITS 9**

Construction of Control Components: Directional control valve – 3/2way valve – 4/2way valve – Shuttle valve – check valve – pressure control valve – pressure reducing valve, sequence valve, Flow control valve – Fixed and adjustable, electrical control solenoid valves, Relays, ladder diagram. Accumulators and Intensifiers: Types of accumulators – Accumulators circuits, sizing of accumulators, intensifier – Applications of Intensifier – Intensifier circuit.

**UNIT IV PNEUMATIC SYSTEMS AND COMPONENTS 9**

Pneumatic Components: Properties of air – Compressors – Filter, Regulator, Lubricator Unit – Air control valves, Quick exhaust valves, pneumatic actuators, mufflers. Fluid Power Circuit Design, Speed control circuits, synchronizing circuit, Pneumo - hydraulic circuit, Sequential circuit design for simple applications using Cascade Method- Trouble Shooting and Remedies in Hydraulic systems.

**UNIT V DESIGN OF PNEUMATIC CIRCUITS 9**

Servo systems – Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves. Fluidics – Introduction to fluidic devices, simple circuits, Introduction to Electro Hydraulic Pneumatic logic; circuits, ladder diagrams, PLC applications in fluid power control. Low cost

automation Fluid power circuits failure and troubleshooting. Pneumatic circuits for industrial applications in the field of Machine tools, material handling, hydraulic presses, clamping and indexing devices. Trouble Shooting and Remedies in Pneumatic systems.

**TOTAL PERIODS : 45**

### COURSE OUTCOMES

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

- analyze properties of hydraulic fluids, laminar flow and turbulent flow
- demonstrate pump performance and working process of gear pump, vane pump and piston pump
- gain knowledge on 3/2way valve, 4/2way valve, Shuttle valve, check valve and pressure control valve
- have good grounding on properties of air, compressors, filter, regulator and lubricator unit
- have an in-depth knowledge of Hydro Mechanical servo systems, Electro hydraulic servo systems and Proportional valves and use of PLC in fluid power systems

### TEXT BOOKS

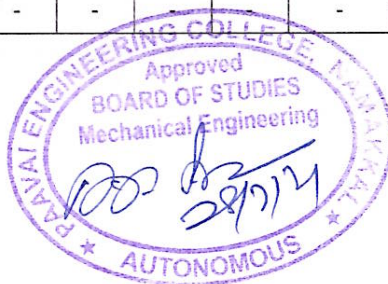
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2. Majumdar S.R., “Oil Hydraulics Systems- Principles and Maintenance”, Tata McGraw-Hill, 2004.

### REFERENCES

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3. Majumdar S.R., “Pneumatic systems – Principles and Maintenance”, Tata McGraw Hill, 2008.
4. W.Bolten, “Pneumatic and Hydraulic Systems”, Butterworth-Heinemann Ltd ,1997.

### 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
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CO3	3	3	3	2	-	-	-	-	-	-	-	2	2	2
CO4	3	3	3	2	-	-	-	-	-	-	-	2	2	2
CO5	3	3	3	2	-	-	-	-	-	-	-	2	2	2



**ME20406**

**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**

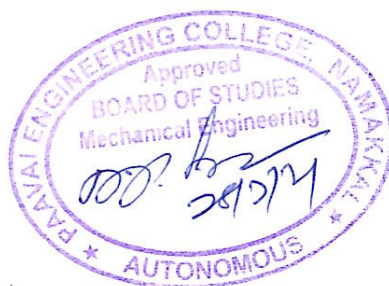
**COURSE OUTCOMES**

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														
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CO4	3	3	1	2	2	2	2	-	-	2	2	2	3	3



ME20407

**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. Test on Cement

**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**

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



ME20408

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

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

