## Vision of the Institution

To ignite the minds of the students through academic excellence so as to bring about social transformation and prosperity.

## Mission of the Institution

- To expand the frontiers of knowledge through Quality Education.
- To provide valued added Research and Development.
- To embody a spirit of excellence in Teaching, Creativity, Scholarship and Outreach.
- To provide a platform for synergy of Academy, Industry and Community.
- To inculcate high standards of Ethical and Professional Behavior.

## Vision of Mechanical Engineering Department

To foster prosperity through technological development by means of education, innovation and collaborative research.

## Mission of Mechanical Engineering Department

- To produce effective and responsible graduate and post-graduate engineers for global requirements by imparting quality education.
- To improve the Department's infrastructure to facilitate research productivity and success.
- To integrate teaching and research for preservation and effective application of knowledge and skills.
- To strengthen and expand collaboration and partnerships with industry and other organizations.
- To provide consultancy to the neighborhood and inculcate a spirit of entrepreneurship.
- To serve society through innovation and excellence in teaching and research.

## Program Educational Objectives(PEOs)

**PEO1**: Graduates apply a deep working knowledge of technical fundamentals in areas such as Design, Thermal, Production, Industrial and related fields to address needs of the customer and society.

**PEO2**: Graduates pursue advanced education, Research and Development in Engineering, Technology and other professional careers.

**PEO3**: Perform themselves in a responsible, professional and ethical manner.

**PEO4**: Graduates participate as leaders in their fields of specialization and in activities that contribute to service and overall economic development of society.

## Program Outcomes(POs) of Mechanical Engineering Department

**Engineering Graduates will be able to:**

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## **Program Specific Outcomes (PSO's):**

**PSO1**: Able to apply the knowledge learned as a part of the curriculum to provide solutions for problems related to Mechanical Engineering.

PS**O**2: Think innovatively, design and develop products with modern CAD/CAM tools and with optimized manufacturing processes.

**III Year - I Semester**

## DESIGN OF MACHINE MEMBERS– II

| L | T | P | C |
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**Course Objectives:**

- This course gives the insight of slider and roller bearings and the lifeprediction.
- Learn to design I.C engineparts
- Design the mechanical systems for power transmission elements such as gears,belts,ropes,chains, keys andlevers

**UNIT – I**

**BEARINGS:** Classification of bearings- applications, types of journal bearings – lubrication – bearing modulus – full and partial bearings – clearance ratio – heat dissipation of bearings, bearing materials – journal bearing design – ball and roller bearings – static loading of ball & roller bearings, bearinglife.

**UNIT – II**

**ENGINE PARTS:** Connecting Rod: Thrust in connecting rod – stress due to whipping action on connecting rod ends – cranks and crank shafts, strength and proportions of over hung and center cranks – crank pins, crank shafts.

Pistons, forces acting on piston – construction design and proportions of piston, cylinder, cylinder liners,

**UNIT – III**

Design of curved beams: introduction, stresses in curved beams, expression for radius of neutral axis for rectangular, circular, trapezoidal and t-section, design of crane hooks, c – clamps**.**

**UNIT – IV**

**POWER TRANSMISSIONS SYSTEMS, PULLEYS**: Transmission of power by belt and rope drives , transmission efficiencies, belts – flat and v types – ropes - pulleys for belt and rope drives, materials, chain drives

**DESIGN OF POWER SCREWS:** Design of screw, square ACME, buttress screws, design of nut, compound screw, differential screw, ball screw- possible failures.

**UNIT – V**

**SPUR & HELICAL GEAR DRIVES:** Spur gears- helical gears – load concentration factor – dynamic load factor, surface compressive strength – bending strength – design analysis of spur gears – estimation of centre distance, module and face width, check for plastic deformation, check for dynamic and wear considerations.

**UNIT – VI**

**MACHINE TOOL ELEMENTS:** Levers and brackets: design of levers – hand levers-foot lever – cranked lever

– lever of a lever loaded safety valve- rocker arm straight – angular- design of a crank pin – brackets- hangers- wall boxes.

Wire Ropes: Construction, Designation, Stresses in wire ropes, rope sheaves and drums.

**Note: Design data book is permitted for examination**

**Course outcomes:**

1. To select the suitable bearing based on the application of the loads and predict the lifeofthe bearing
2. Design of internal combustion engine parts for safe and continuous operation
3. Apply the basic principles to find position of neutral axis and stress variation across thecross section in curved beams
4. To select and/or design of belt drives, chain drives and power screws based on givenconditions
5. Design spur and helical gears based on strength and wear consideration
6. Design of levers, brackets and wire ropes for safe operation

**Text Books:**


1. Machine Design/V.Bandari/TMHPublishers
2. Machine Design/ NC Pandya& CS Shaw/ Charotarpublishers
3. Design databook.


**References:**


1. Machine Design: An integrated Approach / R.L. Norton / PearsonEducation
2. Mech. Engg. Design / JE Shigley/Tata McGraw Hilleducation
3. Design of machine elements- spots/PearsonPublications
4. Machine Design-Norton/PearsonPublications

III Year - I Semester

DYNAMICS OF MACHINERY

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Course Objectives:

- To equip the student with fundamental knowledge of dynamics of machines so that student can appreciate problems of dynamic force balance, transmissibility of forces, isolation of systems, vibrations.
- Develop knowledge of analytical and graphical methods for calculating balancing of rotary and reciprocating masses.
- Develop understanding of vibrations and its significance on engineering design
- Develop understanding of dynamic balancing, flywheel analysis, gyroscopic forces and moments

**UNIT – I**

PRECESSION: Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships, static and dynamic force analysis of planar mechanisms, (Demonstration of models in video show).

**UNIT – II**

FRICTION: Inclined plane, friction of screw and nuts, pivot and collar, uniform pressure, uniform wear, friction circle and friction axis: lubricated surfaces, boundary friction, film lubrication.

CLUTCHES: Friction clutches- single disc or plate clutch, multiple disc clutch, cone clutch, centrifugal clutch.

BRAKES AND DYNAMOMETERS: Simple block brakes, internal expanding brake, band brake of vehicle. General description and operation of dynamometers: Prony, Rope brake, Epicyclic, Bevis Gibson and belt transmission,

**UNIT – III**

TURNING MOMENT DIAGRAMS: Dynamic force analysis of slider crank mechanism, inertia torque, angular velocity and acceleration of connecting rod, crank effort and turning moment diagrams – fluctuation of energy – fly wheels and their design.

**UNIT-IV**

GOVERNERS: Watt, porter and proell governors, spring loaded governors – Hartnell and Hartung with auxiliary springs. sensitiveness, isochronism and hunting.

**UNIT – V**

BALANCING: Balancing of rotating masses single and multiple – single and different planes, use analytical and graphical methods. Primary, secondary, and higher balancing of reciprocating masses. analytical and graphical methods, unbalanced forces and couples – examination of “V” multi cylinder in line and radial engines for primary and secondary balancing, locomotive balancing, hammer blow, swaying couple, variation of tractive effort.

**UNIT – VI**

VIBRATIONS: Free Vibration of spring mass system –Natural frequency-types of damping – damped free vibration, Simple problems on forced damped vibration, vibration isolation and transmissibility transverse loads, vibrations of beams with concentrated and distributed loads. Dunkerly's methods, Raleigh's method, whirling of shafts, critical speeds, torsional vibrations, two and three rotor systems.

**Course Outcomes**

1. Analyze stabilization of sea vehicles, aircrafts and automobile vehicles
2. Compute frictional losses, torque transmission of mechanical systems
3. Analyzedynamicforceanalysisofslidercrankmechanism,Turningmomentdiagramsfor different engines and design of flywheel
4. Analyze the different types of governors
5. Understanding of vibrations and its significance on engineering design
6. Understand balancing of reciprocating and rotary masses

**Text Books :**

1. Theory of Machines / S.S Rattan/ Mc. Graw Hill
2. Mechanism and machine theory /Ashok G. Ambedkar/PHI Publications.

**References :**

1. Mechanism and Machine Theory / JS Rao and RV Dukkipati / New Age
2. Theory of Machines / Shigley / MGH
3. Theory of Machines / Thomas Bevan / CBS Publishers
4. Theory of machines / Khurmi/S.Chand.

**III Year - I Semester**

## METAL CUTTING & MACHINE TOOLS

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**Course objectives:**

1. The course provides students with fundamental knowledge and principles in material removalprocesses.

2.In this course, the students apply the fundamentals and principles of metal cutting to practical applications through multiple labs using lathes, milling machines, grinding machines, and drill presses, Computer Numerical Controletc

3. To demonstrate the fundamentals of machining processes and machinetools.

4. To develop knowledge and importance of metal cuttingparameters.

5. To develop fundamental knowledge on tool materials, cutting fluids and tool wearmechanisms.

6. To apply knowledge of basic mathematics to calculate the machining parameters for different machining processes.

**UNIT – I**

**FUNDAMENTAL OF MACHINING:**

Elementary treatment of metal cutting theory – element of cutting process – geometry of single point cutting tool, tool angles, chip formation and types of chips – built up edge and its effects, chip breakers, mechanics of orthogonal cutting –Merchant's force diagram, cutting forces, cutting speeds, feed, depth of cut, tool life, tool wear, machinability, economics of machining, coolants, tool materials and properties.

**UNIT – II**

**LATHE MACHINES:**

Engine lathe – principle of working, specification of lathe – types of lathe – work holders tool holders – box tools taper turning, thread turning – for lathes and attachments, constructional features of speed gear box and feed gear box. Turret and capstan lathes – collet chucks – other work holders – tool holding devices – box and tool layout. Principal features of automatic lathes – classification – single spindle and multi-spindle automatic lathes – tool layout and cam design for automats.

**UNIT – III**

**SHAPING, SLOTTING AND PLANNING MACHINES:** Principles of working – principal parts – specifications, operations performed, machining time calculations.

**DRILLING & BORING MACHINES:** Principles of working, specifications, types, operations performed – tool holding devices – twist drill – Boring Machines – fine Boring Machines – jig boring machine, deep hole DrillingMachine.

**UNIT – IV**

**MILLING MACHINES:** Principles of working – specifications – classification of Milling Machines – principal features of horizontal, vertical and universal Milling Machine, machining operations, types of cutters, geometry of milling cutters – methods of indexing, accessories to millingmachines.

**UNIT –V**

**FINISHING PROCESSES:** Theory of grinding – classification of grinding machines, cylindrical and surface grinding machines, tool and cutter grinding machines, different types of abrasives, bonds, specification and selection of a grinding wheel. Lapping, Honing & Broaching operations, comparison to grinding.

**UNIT - VI**

**JIGS & FIXTURES**: Principles of design of jigs and fixtures and uses, classification of jigs & fixtures, principles of location and clamping, types of clamping & work holding devices, typical examples of jigs and fixtures.

**CNC MACHINE TOOLS:** CNC Machines, working principle, classification, constructional features of CNC machines, CNC controller, types of motion controls in CNC machines, applications of CNC machines.

**Course Outcomes:**

1. Operate lathe, milling machines, drill press, grinding machines etc.
2. Select cutting tool materials and tool geometries for different metals
3. Select appropriate machining processes and conditions for different metals
4. Apply cutting mechanics to metal machining based on cutting force and power consumption
5. Learn machine tool structures and machining economics
6. Write simple CNC programs and conduct CNC machining

**Text Books:**

1. Manufacturing Processes / JP Kaushish/ PHI Publishers-2nd Edition

2. Manufacturing Technology Vol-II/P.N Rao/Tata McGrawHill

**References:**

1. Metal cutting and machine tools /Geoffrey Boothroyd, Winston A.Knight/ Taylor &Francis

2. Production Technology / H.M.T. Hand Book (Hindustan MachineTools).

3. Production Engineering/K.C Jain & A.K Chitaley/PHIPublishers

4. Technology of machine tools/S.F.Krar, A.R. Gill, Peter SMID/TMH

5. Manufacturing Processes for Engineering Materials-Kalpakjian S & Steven R Schmid/Pearson Publications 5th Edition

**III Year - I Semester**

## OPERATIONS RESEARCH

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**Course Objectives:**

To learn the importance of Operations Research in the design, planning, scheduling, manufacturing and business applications and to use the various techniques of Operations Research in solving such problems.

**UNIT – I**

Development – definition– characteristics and phases – types of operation research models – applications.

**ALLOCATION:** Linear programming problem formulation – graphical solution – simplex method – artificial variables techniques -two–phase method, big-M method – duality principle.

**UNIT – II**

**TRANSPORTATION PROBLEM:** Formulation – optimal solution, unbalanced transportation problem – degeneracy, assignment problem – formulation – optimal solution - variants of assignment problem- traveling salesman problem.

**SEQUENCING** – Introduction – flow **–**shop sequencing – *n* jobs through two machines – *n* jobs through three machines – job shop sequencing – two jobs through 'm' machines.

**UNIT – III**

**REPLACEMENT:** Introduction – replacement of items that deteriorate with time – when money value is not counted and counted – replacement of items that fail completely, group replacement.

**UNIT – IV**

**THEORY OF GAMES:** Introduction – mini. max (max. mini) – criterion and optimal strategy – solution of games with saddle points – rectangular games without saddle points – 2 x 2 games – dominance principle – m x 2 & 2 x n games -graphical method.

**WAITING LINES:** Introduction – single channel – poison arrivals – exponential service times – with infinite population and finite population models– multichannel – poison arrivals – exponential service times with infinite population single channel poison arrivals.

**UNIT – V**

**INVENTORY :** Introduction – single item – deterministic models – purchase inventory models with one price break and multiple price breaks – shortages are not allowed – stochastic models – demand may be discrete variable or continuous variable –

instantaneous production. Instantaneous demand and continuous demand and no set up cost. ABC & VED Analysis.

**UNIT – VI**

**DYNAMIC PROGRAMMING:** Introduction – Bellman's principle of optimality – applications of dynamic programming- capital budgeting problem – shortest path problem – linear programming problem.

**SIMULATION:** Definition – types of simulation models – phases of simulation– applications of simulation – inventory and queuing problems – advantages and disadvantages – simulation languages.

**Course Outcomes:**

1. Identify and formulate LP problems using various methods for maximization and minimization problems.
2. Apply mathematical techniques in different application areas of operations research like transportation, assignment and sequencing models.
3. Students are able to proficient to use mathematical models to solve the Replacement problems.
4. Apply the principles of Game theory and waiting lines to real world Competitive situations.
5. Formulate mathematical models for quantitative analysis of Inventory control practicein industry.
6. Apply mathematical techniques to solve decision models using LP Problems and dynamic programming method.

**TEXT BOOKS:**


1. Operations Research-An Introduction/Hamdy A Taha/Pearsonpublishers
2. Operations Research –Theory & publications / S.D.Sharma-Kedarnath/McMillan publishers IndiaLtd


**REFERENCES:**


1. Introduction to O.R/Hiller &Libermann/TMH
2. Operations Research /A.M.Natarajan,P.Balasubramani,A. Tamilarasi/PearsonEducation.
3. Operations Research: Methods & Problems / Maurice Saseini, ArhurYaspan& Lawrence Friedman/Wiley
4. Operations Research / R.Pannerselvam/ PHIPublications.
5. Operations Research / Wagner/ PHIPublications.
6. Operation Research /J.K.Sharma/MacMilanPubl.
7. Operations Research/ Pai/ OxfordPublications
8. Operations Research/S Kalavathy / VikasPublishers
9. Operations Research / DS Cheema/University SciencePress
10. Operations Research / Ravindran, Philips, Solberg / Wileypublishers

**III Year - I Semester**

## THERMAL ENGINEERING – II

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**(Use of steam tables and**

**Mollier chart is allowed)**

**Course objectives:**

This course is intended to provide basic knowledge of components being used in steam and gas power plant cycles and to analyse the energy transfers and transformations in these components including individual performance evaluation.

**UNIT – I**

**BASIC CONCEPTS:** Rankine cycle - schematic layout, thermodynamic analysis, concept of mean temperature of heat addition, methods to improve cycle performance – regeneration & reheating. combustion: fuels and combustion, concepts of heat of reaction, adiabatic flame temperature, Stoichiometry, flue gas analysis.

**UNIT II**

**BOILERS :**Classification – working principles of L.P & H.P boilers with sketches – mountings and accessories

– working principles, boiler horse power, equivalent evaporation, efficiency and heat balance – draught, classification – height of chimney for given draught and discharge, condition for maximum discharge, efficiency of chimney – artificial draught, induced andforced.

**UNIT – III**

**STEAM NOZZLES:** Function of a nozzle – applications - types, flow through nozzles, thermodynamic analysis

– assumptions -velocity of fluid at nozzle exit-Ideal and actual expansion in a nozzle, velocity coefficient, condition for maximum discharge, critical pressure ratio, criteria to decide nozzle shape: Super saturated flow, its effects, degree of super saturation and degree of under cooling - Wilsonline.

**STEAM TURBINES:** Classification – impulse turbine; mechanical details – velocity diagram – effect of friction

– power developed, axial thrust, blade or diagram efficiency – condition for maximum efficiency. De-laval turbine - methods to reduce rotor speed-velocity compounding, pressure compounding and velocity & pressure compounding, velocity and pressure variation along the flow – combined velocity diagram for a velocity compounded impulse turbine, condition for maximumefficiency

**UNIT IV**

**REACTION TURBINE:** Mechanical details – principle of operation, thermodynamic analysis of a stage, degree of reaction –velocity diagram – Parson's reaction turbine – condition for maximum efficiency – calculation of blade height.

**STEAM CONDENSERS**: Requirements of steam condensing plant – classification of condensers – working principle of different types – vacuum efficiency and condenser efficiency – air leakage, sources and its affects, air pump- cooling water requirement.

**UNIT – V**

**GAS TURBINES:** Simple gas turbine plant – ideal cycle, essential components – parameters of performance – actual cycle – regeneration, inter cooling and reheating – closed and semi-closed cycles – merits and demerits, types of combustion chambers.

**UNIT – VI**

**JET PROPULSION :** Principle of operation –classification of jet propulsive engines – working principles with schematic diagrams and representation on t-s diagram - thrust, thrust power and propulsion efficiency – turbo jet engines – needs and demands met by turbo jet – schematic diagram, thermodynamic cycle, performance evaluation, thrust augmentation – methods.

**Rockets :** Application – working principle – classification – propellant type – thrust, propulsive efficiency – specific impulse – solid and liquid propellant rocket engines.

**Course outcomes:**

1. Student able to understand the concept of Rankinecycle ,stoichiometry ,flue gas analysis
2. Student able to understand the construction details of various boilers and boiler efficiency calculations
3. Student to acquire the design procedure for the steam nozzles and impulse steam turbine
4. Student able to understand the concept steam condensers and reaction turbine
5. Understand the design and constructional details of gas turbine
6. Student able to understand the concept of jet propulsions and rockets

**Text Books:**


1. Thermodynamics and Heat Engines/R.Yadav, Volume -II /Central PublishingHouse
2. Gas Turbines /V.Ganesan/TMH
3. Heat Engineering /V.P Vasandani and D.S Kumar/Metropolitan Book Company, NewDelhi


**References:**


1. Gas Turbines and Propulsive Systems /P.Khajuria&S.P.Dubey/Dhanpatrai
2. Gas Turbines / Cohen, Rogers and SaravanaMuttoo / Addison Wesley –Longman

3. Thermal Engineering-R.S Khurmi, &J SGupta/S.Chand.

4. Thermal Engineering-P.L.Bellaney/ Khanna publishers.

5. Thermal Engineering-M.L.Marthur& Mehta/Jain bros.Publishers

6. Thermal Engineering / RK Rajput/ LakshmiPublications

**III Year - I Semester**

## IPR & PATENTS

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**Objectives:**

- To know the importance of Intellectual property rights, which plays a vital role in advanced Technical and Scientificdisciplines.
- Imparting IPR protections and regulations for further advancement, so that the students can familiarize with the latest developments.

**UNIT I: Introduction to Intellectual Property Rights (IPR)**

Concept of Property - Introduction to IPR – International Instruments and IPR - WIPO - TRIPS – WTO -Laws Relating to IPR - IPR Tool Kit - Protection and Regulation - Copyrights and Neighboring Rights – Industrial Property – Patents - Agencies for IPR Registration – Traditional Knowledge –Emerging Areas of IPR - Layout Designs and Integrated Circuits – Use and Misuse of Intellectual Property Rights.

**UNIT II: Copyrights and Neighbouring Rights**

Introduction to Copyrights – Principles of Copyright Protection – Law Relating to Copyrights - Subject Matters of Copyright – Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works –Rights of Distribution – Rights of Performers **–** Copyright Registration – Limitations – Infringement of Copyright – Relief and Remedy – Case Law - Semiconductor Chip ProtectionAct.

**UNIT III: Patents**

Introduction to Patents - Laws Relating to Patents in India – Patent Requirements – Product Patent and Process Patent - Patent Search - Patent Registration and Granting of Patent - Exclusive Rights – Limitations - Ownership and Transfer — Revocation of Patent – Patent Appellate Board - Infringement of Patent – CompulsoryLicensing

— Patent Cooperation Treaty – New developments in Patents – Software Protection and Computer related Innovations.

**UNIT IV: Trademarks**

Introduction to Trademarks – Laws Relating to Trademarks – Functions of Trademark – Distinction between Trademark and Property Mark – Marks Covered under Trademark Law - Trade Mark Registration – Trade Mark Maintenance – Transfer of rights - Deceptive Similarities - Likelihood of Confusion - Dilution of Ownership – Trademarks Claims and Infringement – Remedies – Passing Off Action.

**UNIT V: Trade Secrets**

Introduction to Trade Secrets – General Principles - Laws Relating to Trade Secrets - Maintaining Trade Secret – Physical Security – Employee Access Limitation – Employee Confidentiality Agreements – Breach of Contract – Law of Unfair Competition – Trade Secret Litigation – Applying State Law.

**UNIT VI: Cyber Law and Cyber Crime**

Introduction to Cyber Law – Information Technology Act 2000 - Protection of Online and Computer Transactions - E-commerce - Data Security – Authentication and Confidentiality - Privacy - Digital Signatures – Certifying Authorities - Cyber Crimes - Prevention and Punishment – Liability of NetworkProviders.

- Relevant Cases Shall be dealt where evernecessary.

**Course Outcome:**

- **IPR Laws and patents pave the way for innovative ideas which are instrumental for inventions to seek Patents.**
- ***Student get an insight on Copyrights, Patents and Software patents which are instrumental for further advancements.**

**References:**


1. Intellectual Property Rights (Patents & Cyber Law), Dr. A. Srinivas. Oxford University Press, NewDelhi.
2. Deborah E.Bouchoux: Intellectual Property, Cengage Learning, NewDelhi.
3. PrabhuddhaGanguli: Intellectual Property Rights, Tata Mc-Graw –Hill, NewDelhi
4. Richard Stim: Intellectual Property, Cengage Learning, NewDelhi.
5. KompalBansal&ParishitBansal Fundamentals of IPR for Engineers, B. S. Publications(Press).
6. Cyber Law - Texts & Cases, South-Western's Special TopicsCollections.
7. R.Radha Krishnan, S.Balasubramanian: Intellectual Property Rights, Excel Books. NewDelhi.
8. M.Ashok Kumar and MohdIqbal Ali: Intellectual Property Rights, SerialsPub.

III Year - I Semester

## MACHINE TOOLS LAB

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**Course objectives:**

The students are required to understand the parts of various machine tools and operate them. They are required to understand the different shapes of products that can be produced on these machine tools.

1. Introduction of general purpose machines -lathe, drilling machine, milling machine, shaper, planing machine, slotting machine, cylindrical grinder, surface grinder and tool and cuttergrinder.
2. Step turning and taper turning on lathemachine
3. Thread cutting and knurling on lathemachine.
4. Drilling andtapping
5. Shaping andplanning
6. Slotting
7. Milling
8. Cylindrical surface grinding
9. Grinding of toolangles.

**Course outcome:**

1. To impart practical exposure on various machine tools used in industry
2. Able to identify different types of cutting tools and the effect of cutting tool geometry on machining.
3. Able to perform various machining operations on lathe.
4. Capable of manufacturing components according to given drawings using various machine tools.
5. Exhibit the ability in developing sequence of machining operations required for industry.
6. Able to produce work pieces with good surface finish using machine tools

III Year - I Semester

## THEORY OF MACHINES LAB

| L | T | P | C |
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1. To determine whirling speed of shaft theoretically andexperimentally.
2. To determine the position of sleeve against controlling force and speed of a Hartnell governor and to plot the characteristic curve of radius ofrotation.
3. To analyse the motion of a motorized gyroscope when the couple is applied along its spinaxis
4. To determine the frequency of undamped free vibration of an equivalent spring masssystem.
5. To determine the frequency of damped force vibration of a spring masssystem
6. To study the static and dynamic balancing using rigidblocks.
7. To find the moment of inertia of aflywheel
8. To plot follower displacement vs cam rotation for various Cam Followersystems.
9. To plot slider displacement, velocity and acceleration against crank rotation for single slider crank mechanism/Four barmechanism
10. To find coefficient of friction between belt andpulley.
11. To study simple and compound screw jack and determine the mechanical advantage , velocity ratio andefficiency
12. To study various types of gears- Spur, Helical, Worm and BevelGears

**Course outcomes:**

| | |
|---|---|
| **1** | Experimental study of Undamped ,damped free and forced vibrations and determine the whirling speed of the shaft |
| **2** | Determine the controlling force of Hartnell Governor |
| **3** | Identify the significance of friction in belt &pulley and study the efficiency of simple and compound screw jacks |
| **4** | Know the application of Gyroscope and understand the concept of balancing of rotating masses by experiment |
| **5** | Study of different types of Gears and Four bar mechanism with the help of functional models |
| **6** | Practical determination of moment of inertia of the flywheel and know the relative motion between the cam & follower |

**III Year - I Semester**

## THERMAL ENGINEERING LAB

| L | T | P | C |
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**Course objective: To provide hands on experience in operating various types of internal combustion engines and understand their functioning and performance.**

2. I.C. Engines valve / port timingdiagrams.
3. Testing of Fuels – Viscosity, flash point/fire point, carbon residue, calorificvalue.
4. I.C. Engines performance test and Exhaust emission measurements (4 -stroke dieselengine)
5. I.C. Engines performance test and Exhaust emission measurements (2-stroke petrolengine)
6. Evaluation of engine friction by conducting Morse test on 4-stroke multi cylinder petrolengine.
7. Determination of FP by retardation and motoring test on ICengine.
8. I.C. Engines heat balance at different loads and show the heat distributioncurve.
9. Economical speed test of an ICengine.
10. Performance test on variable compression ratioengines.
11. Performance test on reciprocating air compressorunit.
12. Dis-assembly / assembly of different parts of two wheelers. 3 wheelers & 4 wheelers. Tractor & Heavy duty engines covering 2-stroke and 4 stroke, SI and CIengines.
13. Study of boilers, mountings andaccessories.

**Course outcome:**

1. Student able to understand the IC engine valve, port timing mechanism.
2. To study the performance characteristics of an internal combustion engines and conduct heat balance test on I.C.Engine
3. Understand the method of finding the Indicated power and Evaluate the engine friction by conducting mores test, retardation test and motoring test on IC engine.
4. Able to identify the various fuel characterizations through experimental testing
5. Able to conduct Performance test on reciprocating air compressor and calculations of various efficiencies.
6. To Study the principle of various parameters in different types of boilers and study the different parts by dis-assembly/ assembly of IC engines.