# UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

## Course Description

**Title of Course: IC Engine & Gas Turbine**
**Course Code: ME601**
**L-T Scheme: 3-0** **Course Credits: 3**

**Introduction:**

Fluid power has the highest power density of all conventional power-transmission technologies. Learn the benefits and limitations of fluid power, how to analyze fluid power components and circuits, and how to design and simulate fluid power circuits for applications.

**Objectives:**

1. To understand the underlying principles of operation of different IC Engines and components.
2. To provide knowledge on pollutant formation, control, alternate fuel etc.

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**Learning Outcomes:**
Completion of this course, the student should be able to:

Upon completion of this course, the students can able to compare the operations of different IC Engine and components and can evaluate the pollutant formation, control, alternate fuel

**Course Contents:**

**Module- 1:** Classification and working of basic engine types: 2-stroke, 4- stroke, C.I., S.I., etc. [3]
**Module- 2:** Analysis of air standard cycles: fuel- air cycles and actual cycles. [3]
**Module- 3:** Fuels: classification and desirable characteristics of I.C. engine fuels, Rating of S.I. and C.I. engine fuels, Alternative fuels (liquid, gaseous, etc.), Analysis of combustion product, HCV and LCV of the fuels.
[4]
**Module- 4:** Combustion of fuels in I.C. engines, Combustion in S.I and C.I engines, Parameter influencing combustion, Detonation and knocking in S.I. and C.I. engines and their preventions, Combustion chamber types, Basic principles of combustion chamber in I.C. engines.
[4]
**Module- 5:** Fuel- air mixing in S.I. engines, Working principle of a carburetor, Analysis of simple carburetor, Mechanical and electronic fuel injection system and their control in S.I. engines. Basic principles of MPFI in SI engines. [4]
**Module- 6:** Fuel-oil injection in C.I. engines, Fuel injection systems, Working principles, Injection pumps and nozzles. [4]
**Module- 7:** Ignition: ignition systems in I.C. engines (Battery, magneto and electronic), ignition timing and spark advance. [3]
**Module- 8:** Supercharging and scavenging of I.C. engines, supercharging limits, Turbo charging, Scavenging - ideal and actual, scavenging parameters, and scavenging pumps. [3]
**Module- 9:** Principles of lubrication in I.C. engines, Properties of lubricating oil. [2]
**Module- 10:** Air and liquid cooling of I.C. engines, Principles and systems. [2]

# UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

## Course Description

**TEXT BOOKS:**

1. Ramalingam. K.K., “Internal Combustion Engine Fundamentals”, Scitech Publications, 2002. 2. Ganesan, “Internal Combustion Engines”, II Edition, TMH, 2002.

**REFERENCES:**

1. Mathur. R.B. and R.P. Sharma, “Internal Combustion Engines”., Dhanpat Rai & Sons 2007. 2. Duffy Smith, “Auto Fuel Systems”, The Good Heart Willcox Company, Inc., 1987. 3. Eric Chowenitz, “Automobile Electronics”, SAE Publications, 1995.

# UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

## Course Description

**Title of Course: Machining Principles & Machine Tools**
**Course Code: ME602**
**L-T Scheme: 3-0** **Course Credits: 3**

**Course Objectives:**

- To introduce the students to the basic concept of manufacturing process with examples, recapitulation of classifications of the manufacturing processes with examples.
- To familiarize the students with the Machining processes Basic principle, purpose, definition, requirements, its merits & limitations.
- To enable the students to visualize (Tool geometry) that is different angles of single point cutting tool , its significance and to designate cutting tool geometry in ASA, ORS and NRS reference system.
- To familiarize the students with various types of chips and mechanism of chip formations in machining.
- To enable the students to indentify various Cutting force components in ORS system and to illustrate Merchant's circle analysis.
- To familiarize the students with the effects of cutting temperature on cutting tool and work -piece and to introduce about methods of controlling cutting temperature, Using cutting fluids.
- To introduce the students with desirable properties of cutting tool materials, use tool life equation in the measurement tool life.
- To illustrate the students with surface finishing technique, grinding processes, gridinding machine and broaching machine and its uses.
- To illustrate the students how machinability is governed or influenced by several factors and methods of improvement of machinability .
- To Show the students configuration of basic machine tools and state their uses. Machine tools - specification and classifications and to familiarise with the concept of Generatrix and Directrix and tool – work motions in different operations.
- To introduce about General constructions and function of various machine tools with applications.
- To introduce the students with automation technique applied to machine tools & its merits
- To show the students basic configuration & Kinematic structure of centre lathe ,shaping, planning and slotting machine, milling machine, capstan lathe ,turret lathe.
- To enable the students to determine time required for various operations like turning , drilling , shaping , milling.
- To illustrate the students with the basic feature of Computer numerical controlled machine tools.

# UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

## Course Description

**Course Outcomes:**

**At the end of this lesson, the student would be able to :**

- Identify the necessity of "manufacturing" and State with examples the main requirements for "machining".
- Understand Basic geometry of single point cutting tool, importance of different angles of single point cutting tool in Metal cutting process and designate cutting tool geometry in ASA, ORS and NRS,State the purposes of conversion of tool angles.
- Describe with illustration the mechanism of chip formation in machining ductile materials and brittle materials. Visualize and assess geometrical characteristics of ductile chips :chip reduction coefficient & cutting ratio ,shear angle and cutting strain. Identify and state the causes, characteristics and effects of (BUE) formation. Classify chips and identify the condition for different chip forms.
- Ascertain the benefits and state the purposes of determining cutting forces. Identify the cutting force components and conceive their importance. Develop Merchant's Circle Diagram and show the forces and their relations. Recognize advantageous use of Merchant's Circle Diagram. show the general principle of measurement of cutting force using tool dynamometer.
- Identify the causes of development of heat and temperature in machining. State the effects of cutting temperature on cutting tool and job. Determine the value of cutting temperature using Analytical methods Experimental methods .Point out the general methods of controlling cutting temperature. Applications of cutting fluids.
- State how the cutting tools fail. Define and assess tool life. Develop and use Taylor tool life equation.
- Describe Grinding machines and its applications. Describe the Working principles of Broaching machine its use.
- Conceptualize machinability and state its Definition, Criteria of judgment.

- Describe the basic functional principles of machine tools. Identify the concept of Generatrix and Directrix .Demonstrate Tool – work motions
- Differentiate between Machine and Mchine tool. Describe various types of mahine tools with its applications.
- Describe the advantages of automation and how its affects production rate.

- Draw & explain Kinematic structure of centre lathe ,shaping, planning and slotting machine, milling machine, capstan lathe ,turret lathe.
- Evaluate time required for various operations like turning , drilling , shaping , milling.

- Describe Basic features and characteristics of CNC , lathes , milling machines etc, machining centres and FMS .

# UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

## Course Description

**Course Contents:**

**Module 1:**

**Introduction:** Machining: Basic principle, purpose, definition and requirements

**Module 2:**

**Geometry of cutting tools:** Geometry of single point turning(shaping, planning and boring) tools in ASA, ORS and NRS systems, Conversion of tool angles from one system to another by graphical and vector methods, Geometry of drills and milling cutters.

**Module 3:**

**Mechanism of machining:** Chip formation mechanism, yielding and brittle fracture, chip reduction coefficient, cutting ratio, shear angle and cutting strain, Built-up edge formation, cause, type and effects, orthogonal cutting and oblique cutting, Machining chips: types and conditions, chip formation in drilling and milling.

**Module 4:**

**Mechanics of machining:** Purposes of determination of cutting forces and basic two approaches, cutting force components in

ORS and Merchant's circle diagram, Determination of cutting forces, analytical methods, measurement, Dynamometers construction and working principles of strain gauge type and piezoelectric crystals type turning drilling, milling and grinding dynamometers.

**Module 5:**

**Cutting temperature:** Heat generators and cutting zone temperature, sources, courses and effects on job and cutting tools, role of variation of the machining parameters on cutting temperature, Determination of cutting temperature by analytical and experimental methods ,Control of cutting temperature and application of cutting fluids(purpose, essential properties, selection and methods of application)

**Module 6:**

**Cutting tools-failure, life and materials:** Methods of failure of cutting tools mechanisms, geometry and assessment of tool wear, Tool life, definition, assessment and measurement, Taylor's tool life equation and it's use, Cutting tool materials, essential properties, characteristics and applications of HSS, carbide(uncoated/coated), ceramic, diamond and CBN tools

# UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

## Course Description

**Module 7:**

**Broaching and grinding:** Modes and mechanisms of chip formation, selection and application ,Grinding forces, surface roughness and wheel life.

**Module 8:**

**Machinability and machining economics:** Machinability(and grindability), definition, assessment, improvement and evaluation of optimum cutting velocity and tool life.

**Module 9:**

**Machine tools – Introduction :** Purpose of use , definition and general features of machine tools, Generatrix and Directrix and tool – work motions in different operations of conventional machine tools.

**Module 10:**

**General constructions function of machine tools :**Major components and their functions in lathes ; shaping , planning and slotting machines ; drilling machines and melting machines, Machining operations and application of the common machine tools and their way of specification.

**Module 11: Automation and classification :** Purposes, degree, type and economy of machine tool automation ; broad classification of machine tools.

**Module 12:**

**Kinematic structure of machine tools :** Kinematic structure of centre lathe ,shaping, planning and slotting machine, Kinematic structure of drilling ( column /radial) and milling machines, capstan lathe, turret lathes, Kinematic structure of single spindle automatic lathe, by hydraulically driven machine tools , hobbling machine and gear shaping machine

**Module 13:**

**Control of speed and feed machine tools :** Need of wide ranges of speeds and feeds , and machine tool drive, Design of speed, gear box, speed layout, gear layout, ray diagrams , gears and spindle ,Control (selection and change ) of feed in centre lathes and by hydraulically driven machine tools.

**Module 14:**

**Machining time :** Estimation of time required for various operations like turning , drilling , shaping , milling and gear teeth generation.

# UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

## Course Description

**Module 15:**

**Computer numerical controlled machine tools :** NC and CNC system ; purpose, principle , advantages , limitations and application in machine tools, Basic features and characteristics of CNC , lathes , milling machines etc, machining centers and FMS
with reference to construction, advantages and applications.

**Text Books:**

1.Production technology by PC SHARMA

2. Manufacturing Technology: Metal Cutting and Machine Tools, 3e

**References:**


1. Manufacturing Engineering and Technology by Kalpakjian
2. Stephenson & Agapion, Metal Cutting Theory and Practice, Taylor and Francis, NY.
3. M.C. Shaw, Metal Cutting Principles and Practices, Oxford University Press.
4. G.C. Sen and A. Bhattacharyya, Principles of Machine Tools,
5. Acharkan, Machine Tool Design, Vol. I, II, III and IV, Mir Publication, Moscow.
6. A.B. Chattopadhyay, Machining and Machine Tools, Wiley India

# UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

## Course Description

Subject Name: Machine Design-II Subject Code-ME603
Year: 3rd Year Semester: Sixth

**L-T Scheme: 3-0** **Course Credits: 3**

### Introduction:

Machine Design is the creation of new and better machines and improving the existing ones. A new or better machine is one which is more economical in the overall cost of *production and operation*. The process of design is a long and time consuming one. From the study of existing ideas, a new idea has to be conceived. The idea is then studied keeping in mind its commercial success and given shape and form in the form of drawings.

In the preparation of these drawings, care must be taken of the availability of resources in *money*, in *men* and in *materials* required for the successful completion of the new idea into an actual reality. In designing a machine component, it is necessary to have a good knowledge of many subjects such as Mathematics, Engineering Mechanics, Strength of Materials, Theory of Machines, Workshop Processes and Engineering Drawing.

The topics to be covered (tentatively) include:

- Clutches
- Brakes
- Gears
- Worm-worm Wheel
- Pressure Vessels
- Flywheel
- Sliding contact Bearings
- Rolling contact Bearings

## Objectives:

**Objective 1**: To teach students how to apply the concepts of stress analysis, theories of Failure and material science to analyze, design and/or select commonly used machine Components.
**Objective 2**: To illustrate to students the variety of mechanical components available and Emphasize the need to continue learning.
**Objective 3**: To teach students how to apply mechanical engineering design theory to Identify and quantify machine elements in the design of commonly used mechanical Systems.
**Objective 4**: To teach students how to apply computer based techniques in the analysis, Design and/or selection of machine components.

## Learning Outcomes:

**Objective 1**
The students will demonstrate the ability to apply the fundamentals of stress analysis, theories of failure and material science in the design of machine components. The students will demonstrate the ability to make proper assumptions, perform correct

# UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

## Course Description

Subject Name: Machine Design-II Subject Code-ME603
Year: 3rd Year Semester: Sixth

**L-T Scheme: 3-0** **Course Credits: 3**

analysis while drawing upon various mechanical engineering subject areas.
- The design, analysis and sizing of shafts
- The selection, sizing and analysis of springs
- The selection of bearing types, and sizing and analysis of rolling element bearings
- The selection of gear types, sizing, analysis and material selection of gear systems
- The selection, sizing, design , and analysis of other mechanical components/systems

**Objective 2:**
Students will demonstrate the ability to seek and learn new material in addition to the Class topics through the completion of an open-ended project. The amount as well as the Depth of new material identified and used by the students are measurable indicators of the students' performance.

**Objective 3**
Students will demonstrate the ability to take technical, safety, legislative and other Issues such as environmental into account when selecting and/or designing mechanical Systems, in particular with respect to those components and systems defined in the topical Areas and performance criteria 1.3. The breadth and depth of the issues taken into account by students are measurable indicators of their performance.

**Objective 4**
Students will demonstrate their ability to use existing as well as develop new Computer-based techniques and algorithms for the analysis, selection, and synthesis of Mechanical components, in particular with respect to those components and systems Defined in the topical areas and performance criteria 1.3. The breadth and depth of the Issues taken into account by students are measurable indicators of their performance.

## Course Contents:

**Unit 1: Clutches:** Function, types; Friction clutches – torque capacity based on uniform pressure and uniform wear theory for disc and cone clutch; Centrifugal clutch; Friction materials; Considerations for heat dissipation.

**Unit 2: Brakes:** Function, types; pivoted block brake (single and double block brakes), internal expanding shoe brake, self energizing and self locking; Pivoted block brake; Band brake-simple and differential; Energy equation for braking time calculation; Magnetic and hydraulic thruster operated fail-safe brakes; Brake lining materials; Thermal considerations during braking.

**Unit 3: Gears:** Design objectives, types, terminologies, conjugate action and involutes tooth profile, tooth systems, standard modules; Gear materials.
*Spur Gear* : Strength design, static and dynamic considerations in strength design, Lewis formula, Lewis form factor, beam strength, Buckingham equation for dynamic tooth load; Endurance strength and wear strength; Designing a pinion based on above considerations;
*Helical Gear*: Helix angle, minimum face width, virtual number of teeth; Strength design, Buckingham

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## Course Description

Subject Name: Machine Design-II Subject Code-ME603
Year: 3rd Year Semester: Sixth

**L-T Scheme: 3-0** **Course Credits: 3**

Formulae for checking dynamic load and wear load.

**Unit 4: Bevel Gear:** Terminologies, formative number of teeth; Lewis equation, dynamic load, endurance strength and wear strength checking.
**Worm- worm wheel:** Terminologies and their inter-relation; Preferred combination of various parameters; Efficiency; Materials.

**Unit 5: Pressure vessels–** thin cylinder, thick cylinder, Lame's equation, Clavarino's equation, Birnie's equation, Autofrettage– compound cylinders, End Covers, Opening in pressure vessel – area compensation method, Fired and unfired vessels – category, Industrial Code.

**Unit 6: Flywheel** design for application to: (i) Punching press; (ii) 2-stroke engine; (iii) 4-stroke engine, Torque analysis, Solid disc and rimmed flywheel.

**Unit 7: Sliding contact bearings:** Bearing types and materials; Stribeck Curve, Petroff equation, Hydrodynamic lubrication theory - pressure development; Tower experiment, Reynolds equation, Finite bearings – Raimondi-Boyd charts, Design factors/variables, Heat generation & dissipation; Hydrostatic bearing; Plummer block.

**Unit 8: Rolling contact bearings:** Bearing types, nature of load; Static and dynamic load capacity, Stribeck equation, Load - Life relation; Bearing selection from manufacturers' catalogues; Methods of lubrication; Bearing mounting on journal and bearing block.

## Text Book:

1. V. B. Bhandari, Design of Machine Elements, TMH.

**Reference Books:**

2. Shigley and Mischke, Mechanical Engineering Design, TMH.

3. V.B. Bhandari, Machine Design Data Book TMH

# UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

## Course Description

**Title of Course: Production & Operation Management**
**Course Code: ME 604**
**L-T Scheme: 3-0** **Course Credits: 3**

**Introduction:**

Operations Management is the systematic approach and control of the processes that transform inputs (e.g. human resources, facilities, materials, Information systems etc.) into finished goods and services. The operations function consists of the core wealth creation processes of a business and helps an organization to efficiently achieve its mission while constantly increasing productivity and quality. This course focuses on the role of operations management as a strategic element of the total organization. We will cover classic and up-to-date tools and concepts used to support operational managerial decisions.

**Objectives:**

**Upon course completion, the participants will be able to:**
1) To gain an understanding and appreciation of the principles and applications relevant to the planning, design, and operations of manufacturing/service firms.
2) To develop skills necessary to effectively analyze and synthesize the many inter-relationships inherent in complex socio-economic productive systems.
3) To reinforce analytical skills already learned, and build on these skills to further increase your "portfolio" of useful analytical tools for operations tasks.
4) To gain some ability to recognize situations in a production system environment that suggests the use of certain quantitative methods to assist in decision making on operations management and strategy.
5) To understand how Enterprise Resource Planning and MRPII systems are used in managing operations
6) To increase the knowledge, and broaden the perspective of the world in which you will contribute your talents and leadership in business operations.
7) To understand the managerial responsibility for Operations, even when production is outsourced, or performed in regions far from corporate headquarters

**Learning Outcomes:**

**Knowledge and Comprehension:**
- Understand the core features of the operations and production management function at the operational and strategic levels, specifically the relationships between people,process, technology, productivity and quality and how it contributes to the competitiveness of firms.
- Explain the various parts of the operations and production management processes and their interaction with other business functions (strategy, engineering, finance, marketing, HRM, project management and innovation)

**Application:**

# UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

## Course Description

1. Develop the ability to identify operational methodologies to assess and improve an organizations performance
2. Assess the OPM function performance and capabilities in various organizations
3. To communicate effectively through discussion in seminars, teamwork and writing in discussion board, critiques and a project report
4. To gather, organize and deploy evidence, data and information to make decisions.
5. To plan and carry out work independently and to be self-disciplined and self-directed.
6. To develop the skills of insight and critical evaluation

### Course Contents:

**Unit 1:**

**Operations Management:** An Overview - Systems concepts in Operations Management, Objectives in Operations Management, Operations management Decisions, Productivity concepts and measurement, Types of Production Systems. Aggregate planning and master scheduling Objectives of Aggregate planning Methods, Master Scheduling, Objectives, Master Scheduling Methods.

**Unit 2**:

**Forecasting Demand:** Forecasting Objectives and uses, Qualities & Quantities methods of Forecasting, Opinion and Judgmental Methods Time Series Methods, Exponential Smoothing, Regression and Correlation Methods, Time Series Analysis, Application and Control of Forecasts. Capacity Planning: Capacity Strategy, aspects of Capacity Planning, Determination of Capacity Requirement, Types of capacity, Evaluation of Alternative plant size, Traditional Economic Analysis, Cost-Volume Profit Analysis.

**Unit 3:**

Materials Management: Scope of Materials Management, Purchase system and procedure, purpose of Inventories, Classification of inventory, factors effecting inventory, inventory models, probabilistic models, inventory systems classification, selective inventory control, stores management, standardization codification and variety reduction. Material and Capacity Requirements Planning Overview, MRP and CRP, MRP Underlying concepts, system parameters, MRP Logic, CRP Activities.

**Unit 4**:

Scheduling and controlling Production Activities: Introduction, PAC Objectives and Date Requirements. Scheduling Strategy and Guidelines., Scheduling Methodology, Priority Control, Capacity Control.

**Unit 5:**

Just in Time (JIT) in manufacturing planning & control. Major-elements, Characteristics of Just in Time System pre-requisite for JIT manufacturing, Elements of Manufacturing, Eliminating Waste, Enforced, Problem Solving and Continuous Improvements, Benefits of JIT Purchasing, The Kanban System JIT implementation in Industries. Bottleneck scheduling and theory of constraints. Issues in choosing manufacturing technologies and strategies: product life cycle, standardization, simplification, diversification, value analysis.

**Text Book:**


1. Production and Operations Management, Adam Everett E.& Elbert Ronald J., PHI
2. production & Operation Management; S.N.Charry, TMH
3. Operations Management: Theory and Problems Monk J.G.
4. Manufacturing planning and control systems; Berry W.L.Whybark D.C. Vollman T.E.galgotia Publication Pvt. Ltd


**References**


1. Production and Operations Management, Adam Everett E.& Elbert Ronald J., PHI

**2.** production & Operation Management; S.N.Charry, TMH

# UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

## Course Description

**Title of Course: Air Conditioning & Refrigeration**
**Course Code: ME 605A**
**L-T Scheme: 3-0** **Course Credits: 3**

**Introduction:**

The course is designed to cover the following subjects: Refrigerants , Air Refrigerants, Vapour Compression System, Absorption, Psychometric chart, Human Comfort , Vapour Compression Refrigeration System ,Gas cycle Refrigeration ,Vapour Absorption System ,**Other Refrigeration System,** Cooling load calculations ,**Distribution and Duct systems.**

**Objectives:**

This course deals with the design and implementation of refrigeration and air conditioning systems and building services. The objectives of the course is to enable the student;

- To understand the principles of refrigeration and air conditioning.
- To calculate the cooling load for different applications.
- To select the right equipment for a particular application.
- To design and implement refrigeration and air conditioning systems using standards.
- Energy Conservation and Management.

**Learning Outcomes:**

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

1. Introduce students to HVAC technology, engineering, research, systems, system designs, energy impacts, and overall goals.
2. Develop understanding of the principles and practice of thermal comfort
3. Develop understanding of the principles and practice and requirements of ventilation
4. Develop generalized psychrometrics of moist air and apply to HVAC processes.

S Review heat transfer and solar energy engineering and develop techniques for the analysis of building envelope loads

6. Review thermodynamics and thermal systems engineering and develop understanding of vapor compression and possibly heat-driven refrigeration systems and evaporative cooling systems.
7. Review fluid mechanics and engineering and develop techniques for the analysis of duct and piping systems and room air distribution systems and review associated turbomachines and control systems.
8. Present overview of methods to predict seasonal and annual energy consumption and overview design guidelines and standards for energy efficient buildings and building energy systems.

Application:

a) Comfort Air Conditioning

- Residential air conditioning
- Commercial air conditioning
- Industrial air conditioning

b) Industrial Refrigeration
- Chemical and process industries
- Dairy plants
- Petroleum refineries

c) Food processing and food chain

d) Miscellanous

Using enthalpy of mixing (mixing of salt with water)
- Expansion in a turbine
- Throttling
- Thermoelectric effects
- Adiabatic demagnetization

**Course Contents:**

Unit 1:

Introduction - Refrigeration and second law of Thermodynamics, Refrigeration effect and unit of Refrigeration, Heat pump, reversed Carnot cycle. Vapour Compression Refrigeration System - Analysis of simple vapour compression Refrigeration cycle by p-h and T-S diagram. Effect of operating conditions, liquid vapour heat exchangers, actual refrigeration cycle. Multiple Evaporator and compressor system - Application, air compressor system, Individual compressor, compound compression, cascade system. Application, air compressor systems, individual compressor, compound compression, cascade system.

Unit 2:

Gas cycle Refrigeration - Limitation of Carnot cycle with gas, reversed Brayton cycle, Brayton cycle with regenerative heat exchanger. Air cycle for air craft - Necessity of cooling of air craft, Basic cycle, boot strap, regenerative type air craft refrigeration cycle..

Unit 3:

Vapour Absorption System - Simple Vapour absorption system, Electrolux Refrigerator, Analysis of Ammonia absorption refrigeration system, Lithium Bromide Absorption Refrigeration System. Refrigerants - Classification, Nomenclature, selection of Refrigerants, global warming potential of CFC Refrigerants. Refrigeration Equipments - Compressor, condenser, evaporator, expansion devices – types & working.

Unit 4:

**Other Refrigeration System:** Principle and applications of steam jet refrigeration system, Performance; vortex tube refrigeration, thermoelectric refrigeration systems. Psychrometry- Psychrometric properties, psychometric relations, pyschrormetric charts, psychrometric processes, cooling coils, By-pass factor and air washers. Human Comfort - Mechanism of body heat losses, factors affecting human comfort, effective temperature, comfort chart.

# UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

## Course Description

Unit 5:

Cooling load calculations - Internal heat gain, system heat gain, RSHF, ERSHF, GSHF, cooling load estimation, heating load estimation, psychometric calculation for cooling, selection of air conditioning, apparatus for cooling and dehumidification, Air conditioning system. **Distribution and Duct systems:** Distribution of air in conditioned space et location, return and exhaust grills. Duct materials and sizing, design of Supply and return air ducts.

**Text Book:**

i. Refrigeration and Air Conditioning by P. L. Ballaney
ii. Refrigeration and Air Conditioning by Jones ,TP 492.S8 1982
iii. A textbook of Refrigeration and Air Conditioning by Khurmi & Gupta, TH 7687.K49 2001

**References**

i. Refrigeration and Air Conditioning by Jordan and Priester, TH 7687. J6 1985
ii. Heating, Ventilating and Air Conditioning – Analysis and Design by McQuister & Parker, TH 7222.M38 1994
iii. Faber and Kell's Heating and Air Conditioning of Buildings by Martin and Oughton, TH 7222.M35 1995
iv. Heating and Cooling of Buildings – Design for Efficiency by Kreider and Rabl, TH 7345.K74 1994
v. Air Handling System Design by Tseng Yao Sun, TH 7345.S83 1994

# UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

## Course Description

**Title of Course: Mechatronics**
**Course Code: ME 605B**
**L-T Scheme: 3-0** **Course Credits: 3**

**Introduction:**

The course is designed to cover the following subjects: Introduction about Mechatronics ,Hydraulic And Pneumatic Actuation Systems, Electrical Actuation Systems, Sensors and transducers and application, Interfacing controllers, Data Acquisition and Control System , Design of Mechatronic systems.

**Objectives:**

To provide an adequate technical skill to understand the basic principles that govern the dynamics of particles and rigid bodies; as well as an ability to use that understanding in the solution of engineering problems.

1. Understand the scalar and vector analytical techniques for analysing forces in statically determinate structures.
2. Ability to apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems.
3. To prepare the students for higher level courses such as courses in Mechanics of Solids, Mechanical Design and Structural Analysis.
4. The mechatronic system design and their structure, mechanism, ergonomic and safety.
5. Theoretical and practical aspects of computer interfacing and real time data acquisition and control
6. Motion control of driver and motion converter

**Learning Outcomes:**

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

1. The students will be able to design systems in mechatronics approach using modern software packages.
2. The students will be able to design any inter discipline project with proper knowledge of electronic and mechanical.
3. Know the difference between traditional and mechatronics system.
4. Get knowledge in real time interfacing.
5. Solve case studies on data acquisition and control.
6. Gain the knowledge on advanced applications in mechatronics.

Application:

Toexpose the students to an integrated approach to the design of complex engineering systems involving Electrical, Mechanical and Computer Engineering

**Course Contents:**

**Unit 1:**

Introduction about Mechatronics, scope of Mechatronics, application, process control automation and N/c Machines.
Hydraulic And Pneumatic Actuation Systems: Overview: Pressure Control Valves, Cylinders, Direction Control Valves, Rotary Actuators, Accumulators, Amplifiers, and Pneumatic Sequencing Problems.

**Unit 2**:

# UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

## Course Description

Electrical Actuation Systems: Switching Devices, Mechanical Switches – SPST, SPDT, DPDT, Debouncing keypads; Relays, Solid State Switches, Diodes, Thyristors, Transistors, Solenoid, Types Devices: Solenoid Operated Hydraulic and Pneumatic Vlaves, Electro-Pneumatic equencing Problems. Control of DC Motors, Permanent Magnet DC Motors, Control of DCMotors, Bush less Permanent Magnet DC Motors, AC Motors, Stepper Motors, Stepper Motor Controls, Servo Motors.

**Unit 3:**

Sensors and transducers and application: Performance Terminology, Static and Dynamic Characteristics, Displacement, Position and Proximity Sensors, Potentiometer Sensors, Strain Gauge Element, LVDT, Optical Encoders, Pneumatic Sensors, Hall Effect Sensors,Tachogenerators, Strain Gauge Load Cell, Thermostats, Photo Darlington. Interfacing Sensors in Mechantronic System as – Temperature Switch Circuit, Float Systems

**Unit 4**:

Interfacing controllers: Interfacing, Buffers, Darlington Pair, I/O Ports, Interface Requirements, Handshaking, Serial and Parallel Port Interfacing, Peripheral Interface, Adapters.
Data Acquisition and Control System - Introduction, Quantitizing theory, Analog to Digital Conversion, Digital to Analog (D/A) conversation, transfer function, transient response & frequency response & frequency response, stability criteria.

**Unit 5:**

Design of Mechatronic systems - Introduction, Automatic front and book and cutting in steel rolling mill, lift control system, CNC lathe, temperature control of a heat treatment furnace, EOT crane control panel, Grey grain separators, electrode arm control in electric arc furnace.

**Text Book:**


1. Bolton,W, “Mechatronics” , Pearson education, second edition, fifth Indian Reprint, 2003
2. Smaili.A and Mrad.F , "Mechatronics integrated technologies for intelligent machines", Oxforduniversity press, 2008


**References**


1. Mechatronics Engineering, Tomkinson, D. and Horne, J., McGraw Hill, 1996
2. Mechatronics, Bolton, W., Longman, 1995
3. Mechatronics, HMT Hand Book, 1998
4. Understanding Electro-Mechanical Engineering, Kamm, L.J., IEEE Press, New York, 2000
5. NitaigourPremchandMahalik, Mechatronics, Tata Mcgraw-Hill
6. J.P. Holman, Mechanical Measurements,McGraw-Hill
7. T.K.Kundra, P.N.Rao And N.K.Tewari,Numerical Control and Computer AidManufacturing,Tata McGraw-Hill,
8.

# UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

## Course Description

**Title of Course: Fluid Power Control**
**Course Code: ME605C**
**L-T Scheme: 3-0** **Course Credits: 3**

**Introduction:**

Fluid power has the highest power density of all conventional power-transmission technologies. Learn the benefits and limitations of fluid power, how to analyze fluid power components and circuits, and how to design and simulate fluid power circuits for applications.

**Objectives:**

In this course, you will be introduced to the fundamental principles and analytical modeling of fluid power components, circuits, and systems. You will learn the benefits and limitations of fluid power compared with other power transmission technologies; the operation, use, and symbols of common hydraulic components; how to formulate and analyze models of hydraulic components and circuits; and how to design and predict the performance of fluid power circuits.

**Learning Outcomes:**
Completion of this course, the student should be able to:

1. Explain the meaning of fluid power.
2. Differentiate between fluid power and transport systems.
3. Explain the industrial applications of fluid power.
4. Differentiate between electrical, pneumatic and fluid power systems.
5. Appreciate the future of fluid power in India.

**Application:**
Fluid power plays an important role in industry. Uses of fluid power include machine tools, off-road vehicles, material testing systems etc.

**Course Contents:**

**Unit 1: Fluid power systems and fundamentals**

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 – Darcy's equation – Losses in pipe, valves and fittings. [10]

**Unit 2: Hydraulic system & components.**

Sources of Hydraulic Power: Pumping theory – Pump classification – Gear pump, Vane Pump, piston pump, construction and working of pumps, Variable displacement pumps.

Fluid Power Actuators: Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, Double acting, Construction of double acting cylinder, force, velocity and power from a cylinder, Fluid motors-Gear, Vane and Piston motors. [8]

**Unit 3: Design of hydraulic circuits**

Construction of Control Components : Director control valve – 3/2 way valve – 4/2 way valve – Shuttle valve – check valve – pressure control valve – pressure reducing valve, sequence valve, Flow control valve – Fixed and adjustable, electrical control solenoid valves. Operation and graphical symbols of check valves, pressure relief valve pressure reducing valve and flow control valve. [7]

**Unit 4:** ANSI symbols for different hydraulic components. Analysis of hydraulic circuits for :

i) single acting cylinder control,
ii) double acting cylinder control,
iii) regenerative circuit,
iv) pump unloading circuit
v) double pump hydraulic system,
vi) cylinder synchronization circuit
vii) circuit to lift and hold heavy load. [7]

**Unit 5:** Advantages & disadvantages of pneumatic system compared to hydraulic system; constructional details and operation of a reciprocating compressor; working principle and use of filter, pressure regulator, lubricator and silencer; symbols of different pneumatic components; compressed air distribution system in a plant; drawing pneumatic circuits for different operations. [6]

**Unit 6:** Use of electrical devices for controlling fluid circuits; function of electrical devices like push-button switches, limit switches, pressure switches, solenoids, relays and timers and their symbols.
Study of following circuits using electrical control devices:

i) Control of a solenoid actuated cylinder using one limit switch;
ii) Reciprocation of a cylinder using pressure or limit switches,
iii) Two cylinder sequencing circuit using two limit switches. [4]

**Text Books**

1. Ilango and Soundararajan, Introduction to Hydraulics and Pneumatics, PHI.
2. S.R. Majumdar, Pneumatic Systems: Principles and Maintenance, Tata McGraw Hill.

**References**

1. A. Esposito, Fluid Power with Applications, Pearson.
2. E.C. Fitch Jr., Fluid Power and Control Systems, McGraw Hill Book Co.

# UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

## Course Description

**Title of Course: Material Handling**
**Course Code: ME605A**
**L-T Scheme: 2-0** **Course Credits: 2**

**Introduction:**

Following Topics we will cover in this subject:-
1.Definition of Materials Handling 2. Objectives of Materials Handling 3. Functions 4. Costs Included 5. Systems Concept 6. Steps in Analysing Materials Handling Problems 7. Activity Areas 8. Relationship with Other Departments 9. Basic Materials Handling Systems 10. Principles 11. Limitations.

**Objectives:**

1. As we know that with the rise of factory system, men continued to develop handling equipment to perform jobs where human or animal muscles were insufficient in either capacity or speed. Later on it becomes important to reduce materials handling labour in order to reduce production cost.

2. Therefore main objective of materials handling engineer is to reduce product cost the one overall goal. Materials handling equipment is not production machinery, but is auxiliary equipment that improves the flow of material which in turn reduces stoppages in production machines and thus increases their production.

**Learning Outcomes:**
**Knowledge:**

1. . Increase the production effectiveness by having right quantity of material, at right places at the right time, by avoiding delays and following the orderly flow of material or item. This helps in improving the productivity.

2. 2. Minimise unnecessary labour and make the enterprise more profitable.

3. 3. Reduce damage due to materials handling and thus saves expenditure due to scrap and rework. This can be achieved only if we have sufficient data related to the damages e.g., identification of product or item, whether in transportation, storing, picking or setting down, packaging material or method, type of container etc.

4. 4. Reduce accident rates.

5. 5. Effective utilisation of space by proper layout planning.

# UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

## Course Description

**Course Contents:**

**Introduction :** Definition, importance and scope of materials handling (MH); classification of materials; codification of bulk materials ; utility of following principles of MH – (i) materials flow, (ii) simplification, (iii) gravity, (iv) space utilization, (v) unit size, (vi) safety, (vii) standardization, (viii) dead-weight, (ix) idle time, (x) motion.

**Unit load :** Definition; advantages & disadvantages of unitization; unitization by use of platform, container, rack, sheet, bag and self contained unit load; descriptive specification and use of pallets, skids, containers, boxes, crates and cartons; shrink and stretch wrapping.

**Classification of MH Equipment :** Types of equipment –
(i) industrial trucks & vehicles, (ii) conveyors, (iii) hoisting equipment, (iv) robotic handling system and (v) auxiliary equipment; Independent equipment wise sub classification of each of above type of equipment.

**Industrial trucks & vehicles :** Constructional features and use of the following equipment – (i) wheeled hand truck, (ii) hand pallet truck, (iii) fork lift truck; Major specifications, capacity rating and attachments of fork lift truck.

**Conveyors :** Use and characteristics of belt conveyor, constructional features of flat and troughed belt conveyor; Use and constructional features of Flg. types of chain conveyors – (i) apron, car and trolley type; Construction of link-plate chains; Dynamic phenomena in chain drive; Use and constructional features of roller conveyors; Gravity and powered roller conveyor; Pneumatic conveyor-use and advantages; Positive, negative and combination system of pneumatic conveyors; constructional feature, application and conveying capacity of screw conveyor.

**Hoisting Equipment :** Advantage of using steel wire rope over chain; constructional features of wire ropes; Rope drum design; Pulley system-simple vs. multiple pulley; Load handling attachments : hooks, grabs, tongs, grab bucket; Arrangement of hook suspension with cross piece and pulleys (sheaves); Use and constructional features of (i) hand operated trolley hoist , (ii) winch; (iii) bucket elevator, (iv) Jib crane, (v) overhead travelling crane and (vi) wharf crane; Level luffing system of a wharf crane; Utility of truck mounted and crawler crane.

**Robotic handling :** Materials handling at workplace; Major components of a robot; Applications of robotic handling.

**Auxiliary Equipment :** Descriptive specification and use of – (i) Slide and trough gates, (ii) belt, screw and vibratory feeders, (iii) Chutes, (iv) positioners like elevating platform, ramps, universal vise; (v) ball table.

**Text Books**

1. S. Ray, Introduction to Materials Handling, New Age Int. Pub.
2. T. K. Ray, Mechanical Handling of Materials, Asian Books Pvt. Ltd.

**References**

13. T.H. Allegri, Materials Handling: Principles and Practices, CBS Publishers and Distributors.
4. J.A. Apple, Material Handling System Design, John Wiley & Sons..

# UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

## Course Description

**Title of Course: Finite Element Method**
**Course Code: ME606B**
**L-T Scheme: 2-0** **Course Credits: 2**

**Course Objectives:**

1. To provide the fundamental concepts of the theory of the finite element method
2. To develop proficiency in the application of the finite element method (modeling, analysis,
   and interpretation of results) to realistic engineering problems through the use of a major commercial general-purpose finite element code.

**Outcomes:-**

1) to demonstrate the ability to create models for trusses, frames, plate structures, machine parts, and
components using ANSYS general-purpose software;
2) to model multi-dimensional heat transfer problems using ANSYS;
3) to demonstrate the ability to evaluate and interpret FEA analysis results for design and evaluation
purposes;
4) to develop a basic understanding of the limitations of the FE method and understand the possible
error sources in its use.

**Course Contents**

**UNIT I**

**Introduction**: Historical background, Relevance of FEM to design problems, Application to the continuum– Discretisation, Matrix approach, Matrix algebra– Gaussian elimination, Governing equations for continuum, Classical Techniques in FEM, Weighted residual method, Ritz method, Galerkin method

**UNIT II**

**One dimensional problems:** Finite element modeling– Coordinates and shape functions, Potential energy approach– Element matrices and vectors, Assembly for global equations, Boundary conditions, Higher order elements- Shapes functions, Applications to axial loadings of rods– Extension to plane trusses, Bending of beams– Finite element formulation of stiffness matrix and load vectors, Assembly to Global equations, boundary conditions, Solutions and Post processing, Example Problems.

**UNIT III**

**Two dimensional problems– scalar variable problems:** Finite element modeling– CST element, Element equations, Load vectors and boundary conditions, Assembly, Application to heat transfer, Examples

**UNIT IV**

**Two dimensional problems– vector variable problems:** Vector Variable problems, Elasticity equations– Plane Stress, Plane Strain and Axisy

**UNIT V**

**Isoparametric elements for two dimensional problems:** Natural coordinates, Iso parametric elements, Four node quadrilateral element, Shape functions, Element stiffness matrix and force vector, Numerical integration, Stiffness integration, Displacement and Stress calculations, Examples.

**UNIT VI**

**Computer implementation**: Pre-processor, Processor, Post-processor. Discussion about finite element packages.

**REFERENCES**: BOOK

1. R.D. Cook, D.S. Malkus and M.E. Plesha, Concepts and Applications of Finite Element Analysis, Prentice Hall-India, New Delhi.
2. T.R. Chandrupatla and A.D. Belegundu, Introduction to Finite Elements in Engineering, Prentice Hall of India.
3. C.S. Krishnamoorthy, Finite Element Analysis, TMH.
4. K-J. Bathe, Finite Element Procedures, Prentice Hall.
5. O.C. Zienkiewicz, R.L. Taylor, J.Z. Zhu, The Finite Element Method: Its Basis and Fundamentals, Elsevier.
6. J.N. Reddy, An Introduction to the Finite Element Method, McGraw-Hill.

# UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

## Course Description

**Title of Course: Turbo Machinery**
**Course Code: ME606C**
**L-T Scheme: 2-0** **Course Credits: 2**

**Course Objectives:**

1. The applications of the conservation laws to flow through pipes and hydraulic machines are studied
2. To understand the importance of dimensional analysis.
3. To understand the importance of various types of flow in pumps and turbines.

**Outcomes:-**

1. Upon completion of this course, the students can able to apply mathematical knowledge to predict the properties and characteristics of a fluid.
2. Can critically analyse the performance of pumps and turbines.

**Course Contents**

**UNIT I**

**Introduction:**
**Classification**: **Incompressible and compressible flow machines; Radial, axial and mixed flow machines;** Turbines vs pumps, fans and compressors.
**Applications**: Water supply, ventilation, power generation, propulsion.

**UNIT II**

**Incompressible- Flow Machines:**
**Hydraulic Turbines**: Headrace, penstock, nozzle, runner, draft tube and tail race; Gross head and net head; Velocity diagrams for impulse and reaction turbines; Discharge, head, power and efficiencies.
**Pumps**: Reservoir, foot valve, suction line, pump, delivery line and overhead tank; Static head and losses; Velocity diagrams; Discharge, head, power and efficiencies.

**UNIT III**

**Compressible-Flow Machines:**
Static and stagnation states; Isentropic and adiabatic expansion and compression processes; Nozzle, diffuser and rows of stationary and moving blades; Efficiencies.

**UNIT IV**

**Dimensional Analysis:**
**Similarity laws,** Volume-flow, mass-flow head and power coefficients, pressure ratio, enthalpy ratio, Reynolds number, Mach number; Specific speed and machine selection

**UNIT V**

**Testing and Performance Analysis:**

Measurement devices; affinity laws and unit quantities. Set up and operating characteristics of pumps, turbines; fans and turbo-compressors. Cavitation– **cause of cavitation and definition of Thoma's cavitation parameter,** surge and choking.

**TEXT BOOK:**

1. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2004.

**REFERENCES:**

1. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2010
2. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House(p) Ltd., New Delhi 2004
3. Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, "Fluid Mechanics and Machinery", 2011.
4. Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011

# UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

## Lab Manual

**Title of Course: IC Engine Lab**
**Course Code: ME691**
**L-T –P Scheme: 3P** **Course Credits: 2**

**Course Description & Objectives:**

The main objective of this lab is to develop an idea of fuel properties and their variation with temperature, determination of kinematic viscosity and calorific value of fuels, understanding of basic internal combustion engine performance, determination of friction power and volumetric efficiency of I.C. engines and the use of multi-stage compression.

**Course Outcomes:**
After the completion of this course, the student should be able to:
1. Understand the complete operation of 2 stroke and 4 stroke I.C engines which can be further confirmed through V.T.D and P.T.D
2. Find the performance of 2-S and 4-S engines and the variation of various performance parameters with load and speed.
3. Know how to balance the heat energy available in engine cylinder after the combustion process.
4. Understand the working and performance evaluation of mechanical power consuming devices like compressors.
5. Analyze the performance of the variable compression ratio engine with computerized set up which enables the understanding of pressure variation with crank angle during a cycle of operation.
6. Find the kinematic viscosity of fuels and its variation with temperature.

## Course Contents:

## Any 6 (six) of the following experiments to be conducted.

1) To study the constructional details & working principles of two-stroke petrol/ four-stroke petrol Engine.
2) To study the constructional details & working principles of two-stroke Diesel / four-stroke Diesel Engine.
3) Analysis of exhausts gases from single-cylinder/ multi-cylinder/ petrol engine by Orsat apparatus.
4) To prepare heat balance sheet on multi-cylinder diesel engine / petrol engine.
5) To find the indicated horse power (IHP) on multi-cylinder diesel engine / petrol engine by Morse test.
6) To prepare variable speed performance test of a multi-cylinder /single-cylinder petrol engine / diesel engine and prepare the curve (i) bhp, ihp, fhp Vs Speed (ii) Volumetric efficiency & indicated specific fuel consumption Vs Speed.

7) To find fhp of multi cylinder diesel engine / petrol engine by Willian's Line Method & Motoring Method.
8) To perform constant speed performance test on a single-cylinder/ multi-cylinder diesel engine & draw curves of (i) bhp Vs fuel rate, air rate and A/F and (ii) bhp Vs mep, mechanical efficiency & s.f.c.
9) To study and determine the effect of A/F ratio on the performance of the two stroke, single – cylinder petrol engine.
10) To study and draw the valve timing diagram four stroke, single – cylinder diesel engine.

**Text Books:**

1. Mathur. R.B. and R.P. Sharma, "Internal Combustion Engines"., Dhanpat Rai & Sons 2007. 2. Duffy Smith, "Auto Fuel Systems", The Good Heart Willcox Company, Inc., 1987. 3. Eric Chowenitz, "Automobile Electronics", SAE Publications, 1995.

# UNIVERSITY OF ENGINEERING AND MANAGEMENT, JAIPUR

## Course Description

**Title of Course: Machining & Machine Tools Lab**
**Course Code: ME692**
**L-T-P scheme: 0-0-3** **Course Credit: 2**
**Objectives:**

1. To learn and understand the working principle of various types of machine tools.
2. To provide an understanding of the different types of chip formation during the machining process.
3. To provide an efficient understanding of phenomena of heat generation and its effect.
4. To introduce the students with automation technique applied to machine tools & its merits
5. To show the students basic configuration & Kinematic structure of centre lathe ,shaping, planning and slotting machine, milling machine, capstan lathe ,turret lathe.
6. To enable the students to determine time required for various operations like turning , drilling , shaping , milling.
7. To illustrate the students with the basic feature of Computer numerical controlled machine tools.

**Learning Outcomes:**
**After the completion of this practical course, the student will be able to:**

- Know Desirable Properties of good cutting tools
- Know Types of cutting tools
- Know Basic geometry of single point cutting tool
- Know Different angles associated with single point cutting tool
- Know Importance of different angles of single point cutting tool in cutting process
- Describe the advantages of automation and how its affects production rate.
- Draw & explain Kinematic structure of centre lathe ,shaping, planning and slotting machine, milling machine, capstan lathe ,turret lathe.
- Evaluate time required for various operations like turning , drilling , shaping , milling.
- Describe Basic features and characteristics of CNC , lathes , milling machines etc, machining centres and FMS .

**Course Contents:**
**At list six Experiments that must be done in this course are listed below:**

1. Study of Measurement of cutting forces (Pz and Px or Py ) in straight turning at different feeds and velocities with dynamometer.
2. Study of Measurement of average cutting temperature in turning under different speed – feed combinations.
3. Measurement of surface roughness in turning under different conditions.
4. Study of chip formation ( type, color & thickness ) in turning mild steel and evaluation of role of variation of cutting velocity and feed on chip reduction coefficient /cutting ratio and shear angle.
5. Measurement of tool – wear and evaluation of tool life in turning mild steel by HSS or carbide tool
6. Geometrical and kinematic test of a centre lathe or a drilling machine
7. Producing a cast iron vee – block by machining
8. Production of a straight toothed spur gear from a cast or forged disc.
9. Study of Single Point and Multi Point Cutting Tool.
10. Study of Capstan & Turret Lathe.

**Text Books:**

1.Production technology by PC SHARMA & 2. Manufacturing Technology: Metal Cutting and Machine Tools, 3e

**References:** 1. Manufacturing Engineering and Technology by Kalpakjian

# UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

## Course Description

Subject Name: Design Practice - II Subject Code-ME693

Year: 3rd Year **L-T –P Scheme: 3P**

**OBJECTIVES:**

**a) An ability to apply knowledge of mathematics, science, and engineering:**

This course builds upon the foundations in mechanics of materials with application to mechanical design activities.

Knowledge in basic engineering science is applied to analysis and design of machine elements.

**b) An ability to design and conduct experiments, as well as analyze and interpret data.**

**c) An ability to design a system, component, or process to meet desired needs:**

Design projects and homework sets provide the students with experience in the design of systems and components.

**d) An ability to function on multi-disciplinary teams.**

**e) An ability to identify, formulates, and solve engineering problems:**

Through projects and homework, students identify engineering problems and formulate methods for their solution.

**f) An understanding of professional and ethical responsibility:**

This course includes a review of the canon of ethics for engineers, and a project involving safety and risk analysis.

**g) An ability to communicate effectively:**

This course requires students to make oral presentations as well as write reports for their projects. The oral and written performance accounts for approximately 10% of their final grade.

**h) The broad education necessary to understand the impact of engineering solutions in a global and societal context.**

**i) A recognition of the need for, and an ability to engage in life-long learning.**

**j) A knowledge of contemporary issues.**

**k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice**:

Students complete their projects using computational tools, such as spreadsheets and other appropriate software.

# UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

## Course Description

**LEARING OUTCOMES:**

1) Students will be able to identify the elements of the design process.

2) Students will be able to define strict liability, negligence and express and implied warrantee.

3) Students will be able to list the fundamental canons of engineering ethics.

4) Students will be able to identify or define the yield stress and the ultimate stress of a material.

5) Students will be able to calculate the endurance limit of a material with appropriate corrections.

6) Students will be able to identify the stresses acting on a surface and find principal stresses.

7) Students will be able to evaluate loading and stress results using principal shear stress criterion.

8) Students will be able to evaluate loading and stress results using maximum distortion energy criterion.

9) Students will be able to create a Soderberg endurance failure line.

10) Students will be able to calculate stresses and loads involved with fatigue effect.

11) Students will be able to devise a list of concepts for a design application using idea-generation techniques.

12) Students will be able to determine the speeds of gears in spur gear systems including planetary systems.

13) Students will be able to determine stresses in a gear using the Lewis equation or the AGMA equation.

14) Students will be able to calculate the life of ball or roller bearings.

15) Students will be able to determine shaft parameters so that design conditions for performance are met.

16) Students will be able to calculate bounds on parameters in design.

**Course Contents:**

**Exercises that must be done in this course are listed below:**

- 2-D and 3-D modeling of mechanical components and systems using software packages like AUTOCAD, CATIA, PRO E or similar software.
- Design analysis of mechanical components using software packages like CATIA, PRO E or similar software.

- Design Practice using codes, e.g., Pressure vessel codes, Gear design codes etc.
- Selection of mechanical components from manufacturers' catalogue, e.g., chain drive, rolling element bearings etc.

**Text Book:**

1. Shigley and Mischke, Mechanical Engineering Design, TMH.
2. V.B. Bhandari, Machine Design Data Book TMH

**Recommended Systems/Software Requirements:**

**1.** Windows XP or Linux Operating System.

**2.** Auto-CAD, D2S SOLIDWORKS, CATIA, ANSYS, CREO Design Sofwares.

**3.** Intel based desktop PC or LAPTOP with minimum of 1.4 GHZ or faster processor with at least 2 GB RAM and 40 GB free disk space and AMD READON or NIVIDIA powered at least 1 GB GRAPHICS.

# UNIVERSITY OF ENGINEERING AND MANAGEMENT, JAIPUR

## Course Description

**Title of Course: Dynamics of Machines Lab**
**Course Code: ME694**
**L-T-P scheme: 0-0-3** **Course Credit: 2**
**Course Objectives**

- To impart students with the knowledge about motion, masses and forces in machines.
- To enable students to apply fundamental of mechanics to machines which include engines, linkages etc.,
- To give basic knowledge on kinematic and dynamic design of machinery.
- To facilitate students to understand the function of flywheels, the concept of balancing of rotating and reciprocating masses
- To give awareness to students on the phenomenon of vibration and its effects.
- To Introduce the approaches and mathematical models used in kinematic and dynamic analysis of machinery.

**Course Outcomes**

- The students will be able to determine velocities & accelerations of various planar
- mechanisms.
- Students will have an understanding of static force relationships and inertia forces and
- their effect that exist in machines
- Students will demonstrate the CAM profile and their motion
- Students will be able to perform balancing, vibration and critical speeds with respect to machine dynamics

**Course Contents:**

**At list five Experiments that must be done in this course are listed below:**

1. Watt Governor
2. Porter governor
3. Hartnell Governor
4. Cam Analysis – Cam Profile and Jump-speed Characteristics
5. Whirling of Shaft – Determination of Critical Speed
6. Balancing of Rotating Masses
7. Determination of Gyroscopic Couple

**Text Books:**

1. S.S. Rattan, Theory of Machines, Tata McGraw Hill.
2. R. S Kurmi, Theory of Machines, S. Chand Pub.

**References:**

1. W.T. Thomson, Theory of vibration with Applications, McGraw Hill.

# UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

## Course Description

**Title of Course:** MECHATRONICS Lab **Course Code: M695B**
**L-T –P Scheme: 3P** **Course Credits: 2**

**Objectives:**
1. To present architecture of the mechatronics system
2. Method of experimental identification of the control system
3. To study interfacing of the electromechanical devices.

**Outcome:** Learner will be able to…
1. Identify the suitable sensor and actuator for a control system
2. Indigenously design and develop a mechatronic system

**Course Contents:**

At least 6 (six) experiments of the following list of topics to be conducted.
Experiments on:
1. Open loop position control;
2. Closed loop position control using positional and velocity feedback;
3. Use of analog and digital servosystems,
4. Use of PID control;
5. Experiments on pneumatic drives and actuators;
6. Experiments on hydraulic drives and actuators;
7. Use of logic gates;
8. Programming on a 8085 Microprocessor training kit;
9. Programming on a PLC for simple control operations..

**Pre-requisites:**
1. MTC503: Sensors and Actuators
2. MTC504: Control Systems
3. MTC502: Machine Design
4. MTC505: Embedded Systems

# UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

## Course Description

**Title of Course: Air Conditioning & Refrigeration Lab** **Course Code: ME695 A**
**L-T –P Scheme: 3P** **Course Credits: 2**

**Objectives:**
This course deals with the design and implementation of refrigeration and air conditioning systems and building services. The objectives of the course is to enable the student;

- To understand the principles of refrigeration and air conditioning.
- To calculate the cooling load for different applications.
- To select the right equipment for a particular application.
- To design and implement refrigeration and air conditioning systems using standards.
- Energy Conservation and Management.

**Learning Outcomes:**

At the end of the course, the student will be able to
1. Introduce students to HVAC technology, engineering, research, systems, system designs, energy impacts, and overall goals.
2. Develop understanding of the principles and practice of thermal comfort
3. Develop understanding of the principles and practice and requirements of ventilation
4. Develop generalized psychrometrics of moist air and apply to HVAC processes.
S Review heat transfer and solar energy engineering and develop techniques for the analysis of building envelope loads
6. Review thermodynamics and thermal systems engineering and develop understanding of vapor compression and possibly heat-driven refrigeration systems and evaporative cooling systems.
7. Review fluid mechanics and engineering and develop techniques for the analysis of duct and piping systems and room air distribution systems and review associated turbomachines and control systems.
8. Present overview of methods to predict seasonal and annual energy consumption and overview design guidelines and standards for energy efficient buildings and building energy systems

**Course Contents:**
At least 4 (four experiments) to be conducted of which No. 4 is compulsory.
1. Study of a Domestic Refrigerator.
2. To determine the COP and tonnage capacity of the chilling plant.
3. To determine COP and tonnage capacity of a Air conditioning system.
4. To determine the COP and tonnage capacity of a Mechanical Heat Pump.
5. To determine the COP and tonnage capacity of an Ice plant.
6. To study the cut sectional model of reciprocating, rotary and centrifugal compressor.

7. To study various controls used in Refrigeration and Air-conditioning system.
8. To study different psychometric process & chart.

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**Text Books:**

i. Refrigeration and Air Conditioning by Jordan and Priester, TH 7687. J6 1985
ii. Heating, Ventilating and Air Conditioning – Analysis and Design by McQuister & Parker, TH 7222.M38 1994
iii. Faber and Kell's Heating and Air Conditioning of Buildings by Martin and Oughton, TH 7222.M35 1995

# UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

## Course Description

**Title of Course:** Fluid Power Control Lab **Course Code: M695C**
**L-T –P Scheme: 3P** **Course Credits: 2**

**Introduction:**
To expose the learner to the fundamentals of hydraulic and pneumatic power control and their circuits with industrial applications.

**Objectives:**
To acquaint the student with the basic principles of fluid power and their symbols.
To acquaint the student with the working of various components of hydraulic systems. To teach the students in designing the fluid power circuits, to teach the students, the fundamentals of pneumatic systems and their components.

**Learning Outcomes:**
**At the successful completion of course, the student is able to:**
The student will be able to design, application of fluid power components in Industries.

**Course Contents:**

**Exercises that must be done in this course are listed below:**

1. Study of a Hydraulic system, making a circuit diagram of the system and labeling all the components with their basic specifications.
2. Study of a Pneumatic system, making a labeled diagram of the system and labeling all the components with their basic specifications.
3. Operation and study of the function of a pressure reducing valve in a hydraulic circuit.
4. Design and prepare circuit for speed up the extending speed of a double-acting cylinder.
5. Prepare an AND logic circuit using pneumatic components.
6. Prepare an OR logic circuit using pneumatic components.

**Text Books:**


1. Ilango and Soundararajan, Introduction to Hydraulics and Pneumatics, PHI.
2. S.R. Majumdar, Pneumatic Systems: Principles and Maintenance, Tata McGraw Hill.