

**Faculty of Engineering & Technology**

**NORTH MAHARASHTRA UNIVERSITY,  
JALGAON (M.S.)**

**THIRD YEAR ENGINEERING  
(T.E.)**

**(PRODUCTION ENGINEERING)  
TERM-I & II**

**W.E.F.: 2007-08**

**NORTH MAHARASHTRA UNIVERSITY, JALGAON**  
**T.E. (PRODUCTION)**  
**W.E.F.: 2007-08**  
**TERM-I**

**Advanced Manufacturing & Forming processes**

Teaching Scheme  
Lectures: 4 Hrs/ week.  
Practical: 2Hrs/week.

Examination Scheme  
Paper: 3 Hours  
Paper: 100 Marks  
Oral: 25 Marks  
Term Work: 25 Marks

**Unit-I (10 Hours)**

Thread Manufacturing Processes:- Different method of thread manufacturing like thread milling, thread grinding, thread whirling, thread rolling. Use of the chasers & dies etc for thread manufacturing.

Super Finishing Processes: - Working, Scope, Importance- Lapping, Honing, Burnishing, Buffing, Polishing & allied processes.

Non-Conventional Processes: - Importance & Scope of the various non-conventional machining processes like Electro-chemical Machining (ECM), Electric Discharge Machining (EDM), Abrasive Jet Machining (AJM), Laser Beam Machining (LBM), and Ultrasonic Machining. **(20 Marks)**

**Unit-II (10 Hours)**

Gear Manufacturing: - Different method of gear manufacturing (for spur, helical, bevel gear), Casting, Rolling, Extrusion, Stamping, Power metallurgy of gear, Machining of gear (Forming, template, Generating), Gear finishing by Shaving, Lapping, Grinding, Burnishing, etc. **(20 Marks)**

**Unit-III (10 Hours)**

Automats – Construction, Working, & application of Single Spindle automat  
Introduction to CNC Machines, DNC System, Transfer Lines – Types & working principles & applications. Comparison of the rigid & flexible manufacturing. **(20 Marks)**

**Unit-IV (10 Hours)**

**FORMING PROCESSES**

Classification of Forming Processes, Theory of Plasticity: - Flow curve, Concept of True Stress & Strain, Stress tensor & Strain tensor, Yield Criteria & their comparison, Plastic Stress Strain relationship.( Only Theoretical treatment)

Rolling: - Application & Classification of Rolling Processes. Rolling Mill Types, Deformation of metal in rolling, roll bite, elongation, reduction, defects, rolling of sheets, plates, bars, sections & tubes. **(20 Marks)**

## **Unit-V**

**(10 Hours)**

Forging: - Basic Operation, Types of Forging & applications, Forging hammers/presses, Forging Stresses & forces calculation, Die Design considerations, Forging Defects.

Extrusion & Drawing: Equipment & principles of processes, Types of Extrusion, Forward, Backward, Impact, Hydrostatic, and Tube Extrusion, Metal flow in Extrusion, Defects. Factor affecting extrusion load,

Types of Drawing, Rod/Wire Drawing, Equipment & principles of processes, Defects, Tube Drawing, Seamless Pipe Manufacturing.

Advanced Metal Forming Processes: - Explosive Forming, Electro-hydraulic forming, Electromagnetic forming, Magnetic pulse forming.

**(20 Marks)**

## **TERM WORK**

- 1) Study, Process, Demonstration/Simulation for following processes.
  - a) Thread Manufacturing.
  - b) Non-Conventional Machining.
  - c) Study of Automats.
- 2) Die design for a simple forged component. (Calculations & Drawing)
- 3) Exercise on roll pass design. (Calculations & Drawing)
- 4) Demonstration of Gear Manufacturing (Gear Cutting on Milling/ Shaping/Hobbing)
- 5) At least one industrial visit to study industrial practices related to the subjects & Submission of the visit report.

## **Recommended Books :**

- 1) HMT "Production Technology" Tata McGraw Hill New Delhi.
- 2) Begman, "Manufacturing Processes", John Wiley
- 3) W.A. Chapman, "Workshop Technology" ELBS
- 4) B.S. Raghuwanshi, "Workshop Technology", (Vol. II) Dhanpat Rai & Company.
- 5) Dieter, "Mechanical Metallurgy" (S.I. Units), McGraw Hill New Delhi.
- 6) Rowe, "Principles of Industrial Metal Working Processes", ASM handbook on forming.
- 7) P.N.Rao, "Manufacturing Technology" (Metal Cutting & Machine Tools), Tata McGraw Hill New Delhi.
- 8) Sharan, Prasad, Saxena "Forging & Forging Die Design".
- 9) Ivankove & Chaturvedi "Rolling of Metals" Yantrik Publication Bombay.
- 10) Extrusion – Pearson McGraw Hill New Delhi.
- 11) Pandey, Singh, "Modern Manufacturing Processes" Tata McGraw Hill New Delhi.
- 12) Manufacturing Technology by Adinath & A.B. Gupta New Age International.
- 13) Manufacturing Technology: - Foundry, Forming & Welding by P.N.Rao Tata McGraw Hill New Delhi.

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**NORTH MAHARASHTRA UNIVERSITY, JALGAON**  
**T.E. (PRODUCTION)**  
**W.E.F.: 2007-08**  
**TERM-I**  
**Machine Design**

Teaching Scheme  
Lectures: 4 Hrs/ week.  
Practical: 2Hrs/week.

Examination Scheme  
Paper: 3 Hours  
Paper: 100 Marks  
Oral: 25 Marks  
Term Work:25 Marks

**Unit-I Fundamental of Design: (10 Hours)**

Mechanical Engineering design, Aesthetic considerations in design, Ergonomic consideration in design, Man/Machine closed loop system, Standardizations, selection of material, mechanical properties of material, Limits, fits, tolerance, factor of safety, theories of failure. Design of simple machine parts-Cotter joint, Knuckle joint and Stresses in curved beams (for circular cross-section only). (20 Marks)

**Unit-II Design against fluctuating load (10 Hours)**

Fluctuating stresses, S-N diagram for fatigue loading, endurance limit, endurance strength  
Modifying factors, stress concentration, causes and remedies, notch sensitivity, design of finite and infinite life under reverse stresses, cumulative damage in fatigue failure, Soderberg & Goodman diagram, Modified Goodman diagram, fatigue design for component such as shaft, bolted joints & springs under combined stresses. (20 Marks)

**Unit-III Design of shaft keys and coupling (10 Hours)**

shafts: Introduction, types of shafts, design of shafts subjected to twisting moments, bending moments, combined twisting and bending moments  
Keys :Types of keys, design of keys,  
Coupling : Design of rigid coupling & design of flexible coupling. (20 Marks)

**Unit-IV (10 Hours)**

a) Spur gear: Design of spur gear and helical gear, laws of gearing, terminology of spur Gear, force, analysis, face width, no. of teeth, beam strength and wear strength of gear, tooth, gear tooth failure  
b) Helical gear: Terminology of helical gear, virtual no. of teeth, tooth properties, force analysis, beam strength and wear strength  
c) Design of bevel: Terminology, force analysis, beam strength and wear strength. (20 Marks)

## **Unit-V**

**(10 Hours)**

### Miscellaneous design

Design of power screw Self locking of power screws, recirculating ball screw

Design of springs : Types application, materials of springs-stress deflection equation of helical springs, Wahl's factor, Leaf Spring.

c) Design of Brakes.

**(20 Marks)**

### **Term work:**

1. Design project report of screw jack
2. Design project report of knuckle joint
3. Assignment on design of spring
4. Assignment on design of spur gear and helical gear
5. Assignment on shafts, keys, and coupling
6. Assignment on c programming of helical compression spring
7. Assignment on c programming of coupling
8. Auto lisp programme on knuckle joint

### **Recommended Books :**

- 1) Shigley J.E. and Mischke C.R., "Mechanical Engineering Design", McGraw Hill Publication Co. Ltd.
- 2) Spotts M.F. and Shoup T.E. , "Design of Machine Elements" , Prentice Hall International.
- 3) Bhandari V.B., "Design of Machine Elements", Tata McGraw Hill Publication Co. Ltd.
- 4) Black P.H. and O. Eugene Adams, "Machine Design" , McGraw Hill Book Co. Inc.
- 5) Willium C. Orthwein, "Machine Components Design", West Publishing Co. and Jaico Publications House.
- 6) Design Data", P.S.G. College of Technology, Coimbatore.
- 7) Juvinal R.C., "Fundamentals of Machine Components Design", John Wiley and Sons.
- 8) Hall A.S., Holowenko A.R. and Laughlin H.G., "Theory and Problems of Machine Design", Schaum's Outline Series.

**NORTH MAHARASHTRA UNIVERSITY, JALGAON**  
**T.E. (PRODUCTION)**  
**W.E.F.: 2007-08**  
**TERM-I**  
**TOOL ENGINEERING –I**

Teaching Scheme  
Lectures: 4 Hrs/ week.  
Practical: 2Hrs/week.

Examination Scheme  
Paper: 3 Hours  
Paper: 100 Marks  
Oral: 25 Marks  
Term Work:25 Marks

**Unit-I** **(10 Hours)**

Theory of Metal Cutting:

General Principals: Wedge action of cutting, concept of speed, feed and depth of cut, Orthogonal and oblique cutting.

Mechanics of Metal cutting: Chip Formation and types of chips, shear plane angle, cutting ratio and force relationships – velocity relationships, Merchant theory, its assumptions and limitations, modifications.

Tool dynamometry –

Requirements, Types and Applications

**(20 Marks)**

**Unit-II** **(10 Hours)**

Machinability of Metals – Cutting force, surface finishes and tool life and measures of Machinability.

Cutting force- effect of speed, feed and depth of cut, tool materials, angles and work material on – tangential cutting force, gross and net power requirements – concept of specific cutting force, specific power consumption.

Tool Life – flank and crater wear – preliminary and ultimate failure – mechanism of wear – effect of variables such as speed, feed, depth of cut and material on tool life, Taylor's equations.

Surface finish: Preliminary factors affecting surface finish like speed and depth of cut, angles, materials etc. feed ridges and built up edges, chatter and its elimination.

Coolants: Heat generation in machining, functions of coolants and its effect of cutting force, tool life and surface finish, types of coolants and choice.

**(20 Marks)**

**Unit-III** **(10 Hours)**

Tool Sharpening – of single and multi point cutting tools.

Economics of machining –Analysis of Machining cost, tool cost, non – productive costs

Etc. tool life and cutting speed for minimum production cost and maximum production rate.

Tool materials : types, properties, applications, limitations. Advanced tool materials.

**(20 Marks)**

**Unit-IV****(10 Hours)**

Design of Cutting tools:

Single point tools – Definition of angles as per ASA system and ORS system, Tool Signature, Effect of tool geometry on tool life, cutting force, surface finish etc.,

Design of single point H.S.S. turning tool. Constructional features of carbide tipped tools – brazed and throwaway tips, coated tips, chip breakers, ISO classification of carbide tipped tools,

Form tools : Flat, tangential and circular form tools, Constructional features-Design of flat and circular form tool.

Boring tools : Solid, tool bits, Micro boring tools, Design of boring bar.

Drills : Geometry and nomenclature, Types of drills, Selection of drills.

Reamers : Geometry and nomenclature, Types, Selection of reamer.

**(20 Marks)****Unit-V****(10 Hours)**

Milling cutter : Geometry and nomenclature Types, Design and selection criteria.

Broach : Types, Nomenclature – Design of broach, Thread cutting tools –Geometry, Types and selection criteria, Gear Cutting tools –Geometry, types &amp; selection criteria.

Advances in cutting tools – tool materials, tools for CNC machines and machining centers, High speed machining etc.

**(20 Marks)****Term Work**

- 1) Tool Geometry, drawing and description of minimum two tools.
- 2) Study and measurements of cutting force with tool dynamometer.
- 3) Design and drawing of minimum two tools not covered in (2)
- 4) Study of universal tool and cutter grinder
- 5) Case study for selection of tools from standard commercial tool catalogue (for term work only).

**Recommended Books :**

- 1) P.H.Joshi, "Cutting tools" Tata McGraw Hill, New Delhi.
- 2) Production Technology HMT Handbook
- 3) Arshinov V. and Alekseev G., "Metal cutting theory and cutting tool design", Mir Publication.
- 4) A. Bhattacharya "Metal Cutting Theory and Practice", New Central Book Agency.
- 5) Metals Handbook, Vol 16 Machining, A.S.M., Metals Park, Ohio.
- 6) Dr. Ranganath, "Metal cutting and tool design", Vikas Publishing House
- 7) Shaw M.C, "Metal cutting Principals" Oxford Calrendon Press, 1984.
- 8) Sinha Prasad, "Theory of Metal Forming and Metal Cutting" Dhanpat Rai.
- 9) K.R. Nagpal, "Machine Tool Engineering", Khanna Publication.

**NORTH MAHARASHTRA UNIVERSITY, JALGAON**  
**T.E. (PRODUCTION)**  
**W.E.F.: 2007-08**  
**TERM-I**

**Personal Management and Industrial Relations**

Teaching Scheme  
Lectures: 4 Hrs/ week.

Examination Scheme  
Paper: 3 Hours  
Paper: 100 Marks  
Term Work: 25 Marks

**Unit-I The Personnel Function: (10 Hours)**

The Managerial perspective – the managers job's, administration verses management, the personnel department, the objective of the personnel departments.

2) The personnel specialist- the personnel department at government level, vide scope of personnel function, functions and objective of the personnel departments, manpower – an asset appreciating in use, Human Resources Developments (HRD), The HRD ministry, the corporative personnel, philosophy.

3) The Indian perspectives – the industrial relation situation in India, beyond selfish personal objectives. **(20 Marks)**

**Unit-II Position of the Personal Department (10 Hours)**

Line-staff relationship-authority, responsibility an accountability, line-staff relationship, line and staff structure, line authority, staff authority, line & staff departmentation, the personnel department and the line managers.

Organization of the personnel department- The chief of the personnel department, staff relationship, qualification of the personnel staff, professionalisation.

Changing concept of personnel management – The historical perspectives ,the modern context, Humanizations of work, personnel policies. The nature of the personnel policies. Personnel department in practice

**(20 Marks)**

**Unit-III Increasing Personnel Productivity (10 Hours)**

Personnel productivity through motivation – Labour productivity, the performance objective, the relivance of disincentivies theories of motivation.

Personnel supervision-leadership styles - Nature of leadership, leadership style and assumptions, the Indian setting and right style contribution of TA to understanding human behaviour.

Wage Administration and wages policies – Systems of wage payments, wages policies, shairing the gain.

Employee Fringe benefit and social securities. - payment without work, retirement benefit, safety and health provision. **(20 Marks)**



**Unit-IV Industrial relation****(10 Hours)**

Industrial relation - Objective of industrial relation, size of labour force, work force participation rate, features of industrial labors, role of labors in economics development, problems of labors management relation, union and their role, the trade union act, important trade union and weakness of unionism, Illustration of industrial relation.

**(20 Marks)****Unit-V Industrial disputes and the legislative framework****(10 Hours)**

Industrial disputes and the legislative framework, principal of industrial legislation, settlement of dispute, the industrial disputes act.

The employee communication - Communication structure , the communication problem, communication failure, achieving effective communication.

**(20 Marks)****TERM WORK**

**FIVE** assignments based on above syllabus ( One on each unit).

**Recommended Books :**

- 1) R.S. Davar, "Personnel management and Industrial relation", Vikas Publication. House Pvt. Ltd.
- 2) T.N. Chhabara and R.K. Suri, "Industrial Relation" Dhanpat Rai Company.

**NORTH MAHARASHTRA UNIVERSITY, JALGAON**  
**T.E. (PRODUCTION)**  
**W.E.F.: 2007-08**  
**TERM-I**  
**APPLIED THERMODYNAMICS**

Teaching Scheme  
Lectures: 4 Hrs/ week.  
Practical: 2Hrs/week.

Examination Scheme  
Paper: 3 Hours  
Paper: 100 Marks  
Term Work: 25 Marks

**Unit I (10 Hours)**  
Steam generators. Classification, constructional features of process and power boilers, Boiler mountings and accessories, Equivalent evaporation, boiler efficiency, energy balance, rankine cycle, work power out put, steam consumption, rankine efficiency, method to improve efficiency steam turbine classification, construction and necessity of compounding of steam turbine. **(20 Marks)**

**Unit II (10 Hours)**  
Internal combustion engine: classification Otto and diesel cycles, construction and working of 2 stroke and 4stroke engines, calculations of IP, BP, FP, BSFC, MEP and a efficiencies, heat balance sheet . Engine trial and performance. Study of fuel feeding ignition, starting, governing, cooling, lubrication, exhaust and power Take off. **(20 Marks)**

**Unit III (10 Hours)**  
Air compressor : uses of compressed air , classification, construction and working of air compressor, power input , concept of clearance volume , swept volume ,single and multi stage compression ,volumetric and isothermal efficiencies and factors affecting these efficiencies. Necessity of cooling of compressor and compressed air , FAD, air motor ,its use, construction and working. **(20 Marks )**

**Unit IV (10 Hours)**  
Introduction to heat transfer: various models of heat transfer, fundamental laws of conduction, convection and radiation. Concept of thermal conductivity , heat transfer coefficient and emmisivity, concept of black, gray , white body, use of fins on electrical appliances. **(20 Marks )**

**Unit V ( 10 Hours)**  
Refrigeration and air conditioning: Refrigeration effect and its uses. Vapour compression cycle, calculations of vapour compression, Refrigeration system, coefficient of performance, TR capacity. Common refrigerants and their desirable properties. air conditioner and its requirement. Properties of moist air psychometric chart and its use. Psychometric processes such as sensible heating and cooling,

humidification and dehumidification. Study of central air conditioning plant. Refrigeration controls and industrial air conditioning. Vapour absorption system.

**(20 Marks )**

### **List of experiments**

#### **Group A**

- 1) Study of steam power plant.
- 2) Study of boiler mountings and accessories.
- 3) Study of fuel feeding system of an I.C. engine
- 4) Study of ignition system of an I.C. engine

#### **Group B**

- 1) Study and trial on petrol engine at one load.
- 2) Study and trial on reciprocating air compressor.
- 3) Study and trial on refrigeration system.
- 4) Study and visit of central air conditioning plant.
- 5) Determination of thermal conductivity of metal rod
- 6) Determination of Stefan Boltzmann's constant
- 7) Calculation of fin efficiency in natural and forced convection.
- 8) Study and trial on diesel engine at one load.

The term-work should include minimum eight experiments, two from group A and six from group B.

#### **Recommended Books :**

- 1) P.K.Nag, "Engineering Thermodynamics", Tata McGraw Hill, New Delhi
- 2) R.K.Rajput., "Thermal Engineering", Laxmi Publication Ltd. New Delhi.
- 3) R.K.Rajput., Heat and Mass Transfer, S. Chand and Company, New Delhi
- 4) V.Ganeshan, Internal Combustion Engine, Tata McGraw Hill, New Delhi
- 5) T.Roy chowdhary. Basic thermodynamics, Tata McGraw Hill, New Delhi
- 6) Domkundwar, "Thermal Engineering", Khanna Publications, Delhi
- 7) P.L.Ballany, "Thermal Engineering", Khanna Publications, Delhi
- 8) Domkundwar, "Refrigeration and Air Conditioning", Khanna Publications, Delhi

**NORTH MAHARASHTRA UNIVERSITY, JALGAON**  
**T.E. (PRODUCTION)**  
**W.E.F.: 2007-08**  
**TERM-I**  
**Workshop Practice-V**

Teaching Scheme  
Practical: 2Hrs/week.

Examination Scheme  
Term Work: 25 Marks

One composite job consisting of 4 to 8 parts requiring the machining processes like turning, Milling, grinding, drilling, gear cutting, etc.

**NOTE:-**

Every student should prepare a journal consisting of details of information about the different machines utilized for manufacturing the above selected job along with Work-Shop diary.

The candidates are required to finish the job to the following limits

- 1) CNC lathe and milling: +/- 0.05 mm.
- 2) Capstan and turret lathe: +/- 0.005mm
- 3) Planner: +/- 0.3mm

**NORTH MAHARASHTRA UNIVERSITY, JALGAON**  
**T.E. (PRODUCTION)**  
**W.E.F.: 2007-08**  
**TERM-I**

**Entrepreneurship Development Skill/ Human Research Training**  
**(Common with Automobile Engineering and Mechanical Engineering)**

Examination Scheme  
Term Work: 25 Marks

Study the following topic from Entrepreneurship Development from the literature/  
books and submit a report it.

**1) Introduction**

Entrepreneur  
Entrepreneur-ship.

**2) Information gathering for identification of opportunity.**

Entrepreneurial process.

**3) Information gathering techniques.**

**4) Product and Services**

Theory  
Product specifications.  
Market research, survey.  
Functions of marketing.  
Research and Development activity.

**5) Procedures for estimation of resources required for establishment  
enterprise or starting service business.**

5.1 Space.  
5.2 Human Resources.  
5.3 Equipments.  
5.4 Financial Resources

**6) Establishing and running enterprise**

Management of enterprise.  
Team spirit.  
Motivation.  
Communication

**7) Budgeting and accounting expenditures for running enterprises.**

7.1 Concept of budgeting.  
7.2 Budget preparation.  
7.3 Different type of budgets

**8) Procedure of accounting expenditures**

8.1 Preparation of P&L account and Balance sheet.

**9) Quality Control**

**10) Procedure of report writing for getting approval from financial agencies.**

10.1 Financial Resources.  
10.2 Financial Corporations

**OR**

Attend a course of Entrepreneurship Development conducted by college and submit a report on it.

**OR**

Attend a course of H. R. Training conducted by college and submit a report on it.

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**NORTH MAHARASHTRA UNIVERSITY, JALGAON**  
**T.E. (PRODUCTION)**  
**W.E.F.: 2007-08**  
**TERM-II**  
**ENGINEERING METALLURGY**  
**(Common with Automobile Engineering and Mechanical Engineering)**

Teaching Scheme  
Lectures: 4 hrs. /week  
Practical: 2 hrs. /week

Examination Scheme  
Paper: 3 Hours  
Paper: 100 marks.  
Term-work: 25 marks.

**UNIT I : (10 Hours)**

Metallography, Introduction, Microscopy and macroscopy, Sample preparation, sampling or sectioning, mounting, Grinding, Polishing Etching, Mechanism of Etching for single phase and multiphase alloys, Etching Reagents, Electrolytic polishing, Metallurgical microscope working principal Properties of lenses such as magnifying power, numerical aperture, Resolving power etc, Macroscopy, sulphur printing Flow line observations, Examination of fractures.

Steels: - Plain carbon steels, Iron – carbon Equilibrium Diagram, various phases in the diagram, various phase reactions identified in the diagram, solubility of carbon in iron, Allotropy, critical temperature, Microstructure of slowly cooled steels, estimation of carbon from microstructure, Non – Equilibrium cooling of steels. Specification of some commonly used steels for engineering applications.

**(20 Marks)**

**UNIT II: (10 Hours)**

Heat Treatment, Introduction, and Principles of heat treatment of steel, Transformation. Products of Austenite, Equilibrium diagrams as Aids, Heat Treatments for steel-principles & processes such as annealing, normalizing, Heat treatment used to increase strength of steel, Isothermal transformation Diagram, Tempering of martensite, other heat treatment methods such as austempering, patenting, isoforming, martemperig, Ausforming, etc., continuous cooling Transformation, Jominey Test for Hardenability, Hardenability considerations, Quenching media, Techniques to reduce the cracking,

**(20 Marks)**

**UNIT III: (10 Hours)**

Surface Hardening Treatments of steel : selective Heating Techniques, Flame Hardening, Induction and laser beam hardening, Electron beam hardening, Techniques Involving Altered surface chemistry, carburising, pack, Gas and liquid Carburizing, Nitriding,

Heat Treatment furnaces & Atmospheres : Furnace types, Furnace controls, Heat Treatment and energy, controlled atmosphere.

**(20 Marks)**

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**UNIT IV: (10 Hours)**

Engineering Alloy steels :- Effect of alloying elements, types of alloy steels, stain less steel, types, and Applications and method of selection. Sensitization and weld decay of stainless steel. Heat-treatment of high speed steels, classification and types tool steels, such as water hardening, shock resistance, cold work and Hot work tool steels and their heat treatment.

Cast irons: - classification, Effect of controlling eutectic reaction on microstructure and properties of cast iron, carbon Equivalent, white cast iron, malleable cast iron, gray cast iron, S.G. iron, chilled and alloy cast iron, Properties, specifications and applications in machine tools, Automobile and pump Industry. **(20 Marks)**

**UNIT V: (10 Hours)**

Engineering Non- Ferrous metals and Alloys : Introduction, Copper and its alloys, Brasses and Bronzes, Copper-Nickel alloys, Aluminum and its alloys, Bearing Materials, Lead, Tin and its alloys Heat Treatment of Non- Ferrous metals, Precipitation or Age Hardening.

Composite Materials: Classification, different types of composite material and its applications **(20 Marks)**

**List of Experiments:**

Note: Minimum **EIGHT** experiments must be performed out of following ten experiments.

- 1) Micro Specimen Preparation and use of metallurgical microscope, objective (a) To provide the practice in the techniques of micro specimen selection, grinding, polishing and etching; (b) To provide initial training in the use of metallurgical microscope
- 2) Study and drawing microstructure of low carbon, medium carbon, eutectoid steel, hypereutectoid steel in annealed condition.
- 3) Study and drawing microstructure of Gray, White, Malleable and Spheroidal Graphite Cast Iron.
- 4) Furnace operations and spark testing, objectives (a) to determine the natural (empty furnace) heating and cooling rates of an available laboratory furnace. (b) to draw the spark diagrams of low, medium, high carbon steel, cast iron, stainless steel
- 5) Sulphur print test on steel specimen or flow lines examination on forged components
- 6) Study of change in microstructure of annealed and normalized medium carbon steel, Objective (a) To anneal and normalized the sample of medium carbon steel in to the laboratory furnace and to find out hardness and microstructure of steel
- 7) Jomney Harden ability test, Objective (a) To conduct the Jomney harden ability test on two types of steel specimen.
- 8) To study the effect of carbon on hardness of harden and tempered steel
- 9) Study and drawing microstructure of alpha brass, alpha-beta brass, Aluminum Bronze and bearing metal
- 10) To study the effect of temperature on hardness of tempered steel



**Recommended books:**

- 1) E Paul Degarmo, J.T. Black, Ronald A. Koshner, "Material and Process in Manufacturing", 9<sup>th</sup> Edition, John Wiley Inc.
- 2) V.D.Kodgire, "Material Science and Metallurgy for Engineers", Everest Publishing House. Pune
- 3) B. K. Agrawal, "Introduction to Engineering Materials", Tata McGraw Hill, New Delhi.
- 4) S.H. Avner, "An Introduction to Physical Metallurgy", Tata McGraw Hill, New Delhi.
- 5) Raymond A.Higgins," Engineering Metallurgy (Part I&II )",ELBS publication,London
- 6) Clark D.S.," Physical Metallurgy for Engineers", Affiliated East-West Press pvt. Ltd., New Delhi
- 7) Rollason A.C.," Metallurgy for Engineers", ELBS Publication,London
- 8) W Calister, Material Science and Engineering, Wiley-Students edition.
- 9) A.S.T.M./A.S.M. Hand books on Metallography, Steels, Heat Treatment of Steels & Furnaces.
- 10) Kenneth G. Budinski and Michael K. Budinski, " Engineering Materials Properties and Selection", Pearson Education.

**NORTH MAHARASHTRA UNIVERSITY, JALGAON**  
**T.E. (PRODUCTION)**  
**W.E.F.: 2007-08**  
**TERM-II**  
**TOOL ENGINEERING-II**

Teaching Scheme  
Lectures: 4 hrs. /week  
Practical: 2 hrs. /week

Examination Scheme  
Paper: 3 Hours  
Paper: 100 marks.  
Term-work: 25 marks.  
Oral: 25 marks

**UNIT I: (10 Hours)**

1. Introduction to jigs and fixtures : necessity, application and types, basic concept of jigs and fixtures for different manufacturing process, selection of sequence of operation for machining of components, dependency of jigs and fixtures design on operation sequence,
2. Location and clamping system: principles, types, application, locating pins, pads, diamond pins, adjustable supports, vee and post locators, clamping system principle, types, screw clamp, multiple clamping, quick acting clamp, pneumatically operated clamps. **(20Marks)**

**UNIT II: (10 Hours)**

Design of jigs: principles of jigs design, types jigs –plate, template, box, cannel, sandwich, latch, tumble, turn-over, tumble jigs etc., types of bushes, selection of bushes and liner, construction of jigs and fixtures body, use of standard parts. **(20Marks)**

**UNIT III: (10 Hours)**

1.Design of fixture: principles of fixture design, types of fixtures- gang, straddle, vertical, slot, string milling fixture etc, selection of the suitable type, design of milling fixtures, use of setting block, tennons, t-bolts etc., design turning fixture for lathe  
Indexing system: Necessity of indexing, different indexing systems for jigs and fixtures **(20Marks)**

**UNIT IV: (10 Hours)**

1. Introduction to press tool: Dies, punches, types of presses, types of dies, simple, compound, combination, progressive dies, press tools for operation like blanking, piercing, drawing shaving trimming etc.  
2. Design of dies set for cutting operations: Theory of metal cutting, cutting force and blank folding force estimation, punch and die clearance, scrap strip layout, design of punches, design of dies, pilots, strippers, stock stops, fingers stops, auto stop, center of pressure, selection of die set. **(20Marks)**

**UNIT V:****(10 Hours)**

Design of drawing dies: blank size determination, numbers of draws, stage wise achievement of drawn component, stage wise components drawings, drawing radii and clearance, drawing forces, defects in drawing,

Miscellaneous dies like- cut of dies, trimming, shaving, bulging, rubber, lancing, slitting, horn type, side cam dies, bending, forming, curling dies etc.(theoretical treatment only)

**(20Marks)****TERM WORK**

- 1) Study of various elements of jigs and fixture.
- 2) Design and drawing tool drilling/reaming/tapping jigs. (Details of at least one sheet showing manufacturing drawing with fits etc.)
- 3) Design and drawing of tool milling fixture. (Details of at least one sheet showing manufacturing drawing with fits etc.)
- 4) Design and drawing of one progressive die.
- 5) Design and drawing of one drawing die.

**RECOMMENDED BOOKS :**

- 1) Donaldson, "Tool design", Tata Mc-Graw Hill, New Delhi.
- 2) Pollock, "Tool design", Reston Publication. Co.Inc.
- 3) Basu, Mukharjee, "Tool Design", Mishra
- 4) M.H.A Kempster, "An introduction to jig & Tool design", ELBS
- 5) Fundamental of Tool design, ASTME Tata Mc-Graw Hill, New Delhi.
- 6) Jigs and Fixture Design Manual, Henirkson
- 7) P.C. Sharma, "A Textbook of Prod. Engineering", S.Chand
- 8) J.R. Paquin, R.E. Crowley, "Die Design Fundamentals", Industrial press Inc.
- 9) P.H.Joshi, "Jigs and Fixture", Tata Mc-Graw Hill, New Delhi
- 10) Eary and Reed "Techniques of Press Working of Metal".

**NORTH MAHARASHTRA UNIVERSITY, JALGAON**  
**T.E. (PRODUCTION)**  
**W.E.F.: 2007-08**  
**TERM-II**  
**Industrial Hydraulics And Pneumatics**

Teaching Scheme  
Lectures: 4 hrs. /week  
Practical: 2 hrs. /week

Examination Scheme  
Paper: 3 Hours  
Paper: 100 marks.  
Term-work: 25 marks.

**UNIT I: (10 Hours)**

1. Fundamental Concepts: Classification, Properties of fluids, Derivation of Pascal's law, Continuity Equation and Bernoulli's Equation, their interpretation and applications.
2. Introduction to Fluid Power: Types, advantages and applications, hydraulic and pneumatic ISO symbols, hydraulic fluids: Functions, desirable properties for selection, Conditioning of fluids, study of reservoir, strainers, filters, heat exchangers.

**(20 Marks)**

**UNIT II: (10 Hours)**

1. Hydraulic System Elements: Pumps – types, working, characteristics, applications: Types of conductors, and connectors, their selections,: Seals and packing – types, materials, applications. Hydraulic Actuators – Linear and Rotary, types, working, cushioning effect, mounting, calculation of force and velocity of piston  
System components: Accumulators, Intensifiers, their types, working, applications.

2. Control Elements: Pressure control Valves – direct acting type, pilot operated, sequence, counterbalancing. Unloading, pressure reducing, construction and working: Direction control valves – types, construction and working, spool actuation methods, spool center positions,  
Flow control valves – compensated and non compensated types, construction and working.

**(20 Marks)**

**UNIT III: (10 Hours)**

1. Hydraulic Circuits and their Applications : Speed control circuits, regenerative, sequencing counterbalancing, synchronizing, interlocking, circuits with accumulator and intensifier. Introduction to Fluidics and study of simple logic gates. Hydraulic clamping and braking systems.

2. Introduction to Pneumatics: Basic principle, applications, comparison with hydraulic system.

**(20 Marks)**

**UNIT IV: (10 Hours)**

1. Pneumatic System Elements: Piping, materials and pressure ratings, piping layout, calculation of pressure drop in pneumatic line; Air compressors, types, working, selection criteria; FRL unit, construction and working; Pneumatic cylinders and air

motors, construction and working, types, calculation of force and air consumptions, Comparison of air, hydraulic and electric motor.

2. Pneumatic System Control Elements: Direction control valves, types, control methods for spool working; Flow control valves, working of variable flow control, quick exhaust, time delay and shuttle valve; Pressure control valves, types and working.

**(20 Marks)**

#### **UNIT V:**

**(10 Hours)**

1. Pneumatic Circuits: Basic circuit, impulse operation, speed control, sequencing, time delay circuits and their applications. Pneumatic clamping and braking systems, Pneumatic power tools.

2. Hydro pneumatic systems: concept, working and applications.

3. Fluid power maintenance, troubleshooting and safety.

**(20 Marks)**

#### **Term Work**

- 1) At least one industrial visit to study applications related to the subject and submission of the relevant report.
- 2) Verification of Bernoulli's Theorem
- 3) Speed control circuits on hydraulic trainer
- 4) Sequencing circuit on hydraulic trainer
- 5) Counterbalancing circuit on hydraulic trainer
- 6) Synchronizing circuit on hydraulic trainer
- 7) Design of any hydraulic circuit and selection of components
- 8) Manual and automatic forward and reverse with solenoid control / pilot control on pneumatic trainer
- 9) AND and OR logic circuits on pneumatic trainer

#### **Recommended Books**

- 1) J.J.Pipenger, "Industrial Hydraulics", Hicks McGraw hill, New Delhi.
- 2) H.L.Stewart, "Hydraulics And Pneumatic Power for Production", Industrial Press.
- 3) A. Esposito, "Fluid Power with Applications" Pearson
- 4) Dr. Jagdish.Lal, "Fluid Mechanics and Hydraulics" Metropolitan Book Company.
- 5) Modi, Seth, "Hydraulics and Fluid Mechanics" (Standard Book House)
- 6) Gadre, Mirajgaonkar, "Engineering Fluid Mechanics" Nem chand and Brothers
- 7) Shames, Irving H, "Mechanics of Fluids", McGraw hill, New Delhi.
- 8) S. R. Majumdar, "Oil Hydraulic Systems", Tata McGraw hill, New Delhi.
- 9) Industrial Hydraulics Manual by Vickers Sperry
- 10) S. R. Majumdar, "Pneumatic systems-principles and Maintenance", Tata McGraw hill, New Delhi.
- 11) H.L.Stewart and J.M.Storer, "abc's of hydraulic Circuits" Taraporwala
- 12) H.L.Stewart and J.Mstorer, "abc's of Pneumatic Circuits", Taraporwala.

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**NORTH MAHARASHTRA UNIVERSITY, JALGAON**  
**T.E. (PRODUCTION)**  
**W.E.F.: 2007-08**  
**TERM-II**  
**MECHANICAL MEASUREMENT AND METROLOGY**  
**(Common with Automobile Engineering and Mechanical Engineering)**

Teaching Scheme  
Lectures: 4 Hrs/ week.  
Practical:-2Hrs/week.

Examination Scheme  
Paper: 3 Hours  
Paper: 100 Marks  
Oral: 25 Marks  
Term Work: 25 Marks

**Unit-I (10 Hours)**

Fundamental of instrumentation, Block diagram of measuring instruments, Static and dynamic characteristics, Errors and source of error, Sensors and Transducers.  
Signal transmission and processing: Intermediate Modifying devices-Mechanical, electrical & electronics, Terminating devices- Meter indicators, Mechanical Counters, CRO, XY plotters, oscillograph,  
Data acquisition system: Introduction, Digital recording system, microprocessor based system  
**(20 Marks)**

**Unit-II (10 Hours)**

Measurement of force and torque: Introduction, Different type of load cells, dynamometers- Mechanical, electrical, hydraulic.  
Pressure and flow measurement: Bourdon tube, diaphragm and bellows, vacuum measurement – McLeod gauge, thermal, conductivity gauge, Dead weight gauge tester, Electromagnetic flow meter, Ultrasonic flow meter, rotameter  
Strain measurement: Types of strain gauge & their working, strain gauge circuits, Temperature compensation, Strain rosettes, Temperature measurement by electrical effects, RTD, Pyrometer.  
**(20 Marks)**

**Unit-III (10 Hours)**

Metrology  
Introduction: Definition and concept of metrology, standards of measurements. Classification of methods of measurement, precision and accuracy  
Linear Measurement: Line standard and end standard, Wavelength standard, Slip gauges,  
Measurement of geometric features, Machine tool metrology, Design and manufacture of gauges.  
Comparators: Types, construction and working of different Mechanical, Optical, Electrical, Pneumatic comparators, Interferometry: Basic principles, Source of light, Optical flats, Fringe pattern and their interpolation.  
**(20 Marks)**

**Unit-IV****(10 Hours)**

Angular Measurement Angle standard, Sine bars, Sine centers, Angle gauges, autocollimator, angle Dekker, optical square, taper measurement, Universal bevel protractor,

Measurement of surface finish Surface texture, assessment of surface roughness as per IS, Tomlinson surface meter, and other surface measuring devices

Screw thread measurement: Terminology, errors in thread, Measurement of elements of external & internal threads,

Gear metrology: Gear terminology, measurement of element of gears

Toolmakers microscope, Profile projector.

**(20 Marks)****Unit-V****(10 Hours)**

Measuring Machines

UMM, CMM, Numerically controlled CMM, Fluidic system NC system, Recent trends in Engineering Metrology, Development in optical measurement, Precision instruments based on laser, Probes, telemetric system, Isometric viewing of surface defects, Nano technology

Quality control:

Introduction, Inspection, Sampling plans, Control charts. (X, R, C,P), Problems based on control charts, Recent trends in quality control (TQM,TQC,Six Sigma, Zero defect)

**(20 Marks)**

Any **Eight** Experiments based on the following list:

- 1) Determination of linear and angular dimension.
- 2) M/c tool alignment tests on any M/c tool like Lathe, Drilling m/c, Milling m/c
- 3) Measurement of surface finish and testing of surface flatness by optical flat
- 4) Study and measurement of parameter using tool makers microscope  
Use of comparator.
- 5) Measurement of screw parameter using floating carriage micrometer
- 6) Measurement by gear parameter- Gear tooth thickness, constant chord, pitch circle diameter
- 7) Measurement of temperature using thermocouple and pyrometer
- 8) Calibration of strain gauge meter
- 9) LVDT for displacement measurement
- 10) Flow measurement-using rotameter.

**Recommended Books :**

- 1) Beckwin Marrongoni and Lienhard , "Mechanical Measurement", Pearson Educations
- 2) I.C.Gupta, "Engineering Metrology" , Dhanpat Rai & Sons
- 3) M.S.Mahajan, "Engineering Metrology", Dhanpat Rai & Sons.

- 4) R.K.Jain, "Engineering Metrology", Khanna Publications
- 5) Doeblin, "Measurement System Application & Design", McGraw Hill  
New Delhi.
- 6) D.S.Kumar, "Mechanical Measurement",
- 7) A.K.Sawhney, " Mechanical Measurement and Instruments",  
Dhanpat Rai and Sons
- 8) H.S.Kalsi, " Electronic Instrumentation", TMH
- 9) K.L.Narayanan, "Engineering Metrology", SciTech Publication
- 10) R.S.Sirohi, H.S.Radhakrishnan, "Mechanical Measurement", New  
Age International



**NORTH MAHARASHTRA UNIVERSITY, JALGAON**  
**T.E. (PRODUCTION)**  
**W.E.F.: 2007-08**  
**TERM-II**  
**Machine Tools and Product Design**

Teaching Scheme  
Lectures: 4 Hrs/ week.  
Practical: 2Hrs/week.

Examination Scheme  
Paper: 3 Hours  
Paper: 100 Marks  
Oral: 25 Marks  
Term Work: 50 Marks

**Unit-I** **(10 Hours)**

Introduction to Machine & Machine Tool :

Types , Capabilities , features of construction like Working and Auxiliary Motion in Machine Tools, Parameters Defining the Working Motion of a Machine Tool, Machine Tool Drives ,General Requirements of Machine Tool Design , Engineering design Process Applied to Machine Tools.

The influence of various parameters of tool ,Work Material and Machine Tool on the geometrical accuracy and surface finish of the product .

Principal of Machine Tool Design from Strength, Rigidity , Production , Assembly, Servicing , Ergonomics ,Aesthetics, maintenance and Changeability point of view, Effect of the above parameters on the accuracy and economics of Machine Tools .

**(20 Marks)**

**Unit-II** **(10 Hours)**

Kinematics of Machine Tools:

Classification of various driving systems, basics consideration in the design of drives. Aims of speed & feed regulations, stepped regulations of speeds (design of speed box ) , laws of stepped regulation, selection of range ratio, G.P. ratio, break up of speed steps, structural diagram & speed chart, design of feed box, machine tool drives using multiple speed motors, general recommendations for developing gearing diagram, determining number of teeth of gears, steps less regulations of speed & feed rates.

**(20 Marks)**

**Unit-III** **(10 Hours)**

Design Considerations & Selection of Standard Components :

Such as pulleys, belts, ropes, chain, oil seals, gaskets and electric motors from manufacturers catalogues .

Design of Spindle & Spindle Supports: Functions of spindle unit & requirements, materials & construction, spindles ends, spindles support, design calculations, arrangements of bearings for rigidity of spindle, spindle bearing lubrication. Selection of Machine Tool Bearing : Journal, Rolling & hydrostatic Bearings: Basic Principles, assembly, mounting & maintenance. Selection procedure of bearings from manufacturers catalogue from load and life considerations.

**(20 Marks)**

**(24)**

**Unit-IV****(10 Hours)**

Design of Machine Tool Structures

Functions & their requirements, design criteria, materials, static & dynamic stiffness, profiles of machine tool structure, basic design procedure, design of beds, columns, housings, rams etc., Causes of vibration in machine tool & methods of elimination.

Design of Guide ways:

Functions & types of guide ways, wear accuracy and materials, design of slideways, design criteria & calculations for slideways, design of anti-friction guide ways, hydrostatics & hydrodynamics lubrication of guide ways.

**(20 Marks)****Unit-V****(10 Hours)**

Product Design &amp; Development:

Definition of product & product design; aesthetic, ergonomic & economic design considerations applied to m/c tool as a product.

Aesthetics: Aims, basic form elements, contribution of factors like structure, elegance, rhythm, proportions, harmony, use of curves, joints, materials, surface finish & Colour.

Ergonomics: Aims, man – machine relationship, use of anthropometrical data related with m/c tool & control elements; Design of controls & display.

Developments: Trends & developments in the field of m/c tools & controls.

**(20 Marks)****TERM WORK:**

- 1) Gear box design for speed & feed drive, Design of shafts & gears with assembly drawing.
- 2) Selection of bearings from manufacturer's catalogues.
- 3) Study of different machine tools from the types of machine parts point of view.
- 4) Design of machine tools from ergonomics aspects suitable in India.
- 5) One case study on Product design and development. (Report expected)
- 6) Two computer programs based on the above syllabus. (Compulsory)

**RECOMMENDED BOOKS :**

- 1) N.K.Mehta, "Machine Tool Design", Tata McGraw-Hill, New Delhi.
- 2) Machine Tool Design Handbook, C.M.T.I. Bangalore, (TMH)
- 3) Gopal Chandra Sen and Amitabha Bhattacharayya, "Principles of Machine Tools", (New Central Book Agency)
- 4) H.M.T. Production Technology Handbook.
- 5) Dobrovalsky , "Design of Machine elements",
- 6) Dr. S. K. Basu, "Design of Machine Tool", (Oxford IBH)
- 7) V.B.Bhandari, "Design of Machine Elements", Tata McGraw-Hill, New Delhi.
- 8) N.C. Pandya and C. S. Shaha, "Elements of Machine Design", Charotkar Publishing House
- 9) K. Mahadevan and K. Balweera Reddy, "Design Data HandBook", C.B.S. Publishers & Distributors
- 10) A.K. Chitale and R.C. Gupta, "Product Design and Manufacturing", Prentice-Hall of India Pvt. Ltd.

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**NORTH MAHARASHTRA UNIVERSITY, JALGAON**  
**T.E. (PRODUCTION)**  
**W.E.F.: 2007-08**  
**TERM-II**

**Practical Training/ Mini Project/ Special study**

Teaching Scheme  
Practical : 2Hrs/week.

Examination Scheme  
Term Work: 25 Marks

- Every student has to undergo industrial / practical training for a minimum period of two weeks during summer vacations between (S.E Second Term) fourth and (T.E First Term)fifth term or during winter vacation between fifth and sixth term(T.E. First Term and Second Term).
  - The industry in which practical training is taken should be a medium or large scale industry
  - The paper bound report on training must be submitted by every student in the beginning of (T.E. Second Term) sixth term along with a certificate from the company where the student took training .
  - The report on training should be a detailed one.
  - Maximum number of students allowed to take training in accompany should be five. Every student should write the report separately.
  - In case if a student is not able to undergo practical training , then such student should be asked to
    - Prepare special study report on a recent topic from reported literature.
    - or
    - A mini project related to production branch of engineering.
1. A student must design the model for mini project.
  2. The model should be simulated using any of the standard simulation software available.
  3. Result verification for paper design an simulation should be carried out and discrepancies should be discussed.
  4. Assemble the model. Prepare bill of materials.
  5. Project report should be detail of work , carried out by student ,including layouts , models, bill of materials and relevant details.

- The practical training /special study / mini project shall carry a team work of 25 marks. Every student shall be required to present a seminar in the respective class in the presence of two teachers. These teachers (appointed by head of department in consultation with the principal) shall award marks based on the following.

(a) Report	10 marks
(b) Seminar presentation	10 marks
(c) Viva – voca at the time of seminar presentation	05 marks
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Total	25 marks

(27)

## Engineering & Technology Faculty

### Equivalence Subject of TE Production Engineering

<b>Sr. No.</b>	<b>Old Subject</b>	<b>Sr. No</b>	<b>New Subject</b>
1	Engineering Metallurgy	1	Engineering Metallurgy
2	Work Study, Ergonomics and Safety	2	Same as TE (Production) Old
3	Principle of Management	3	Same as TE (Production) Old
4	Plant Layout and Material Handling.	4	Same as TE (Production) Old
5	Numerical Analysis and Computational method	5	Numerical Analysis and Computational Method
6	Metrology and Quality Control	6	Mechanical Measurement and Metrology
7	Design Analysis of Machine Elements	7	Machine Design
8	Machine Tool Design	8	Machine Tool & Product Design
9	Production Technology-II	9	Manufacturing Science–II of SE (Prod.) New
10	Operation Research	10	Same as TE (Production) Old

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