

# **UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR**

## **Course Description**

**Title of Course:** Advance Manufacturing Technology

**Course Code:** ME 701

**L-T Scheme:** 3-1

**Course Credits:** 4

### **Introduction:**

Advanced manufacturing technologies are key enablers in modern manufacturing and play a significant role in increasing the efficiency, competitiveness and profitability of modern manufacturing industry.

The course is designed to expand the knowledge of new manufacturing technologies and their application in modern manufacturing

This course will provide you with an understanding of specific advanced and emerging manufacturing technologies and skills relating to the implementation of these technologies in modern industry within both global and local contexts. The focus is on additive technologies both metal and polymer based such as Selective Laser Melting, Direct Laser Metal Deposition, Electron Beam Melting and Fused Deposition Modelling.

### **Objectives:**

This course contributes to the following program learning outcomes:

#### **1. Needs, Context and Systems**

- Describe, investigate and analyse complex engineering systems and associated issues (using systems thinking and modelling techniques)

#### **2. Analysis**

- Comprehend and apply advanced theory-based understanding of engineering fundamentals and specialist bodies of knowledge in the selected discipline area to predict the effect of engineering activities

### **Learning Outcomes:**

After successfully completing this course, you should be able to demonstrate:

1. an appropriate degree of competency in the evaluation of various additive and rapid manufacturing technologies and their application in modern manufacturing processes.
2. appropriate levels of understanding of the principles of additive manufacturing from CAD design to part manufacture, particularly in-so-far as how that understanding is used in practical applications.
3. competency in specification and use of materials, both metal and polymer, in additive manufacturing processes.

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## **Course Description**

### **Course Contents:**

#### **UNIT I**

**Introduction to and scope of the subject of Advanced Manufacturing Technology**

#### **UNIT II**

##### **Manufacturing Systems and Automation :**

Job shop, Flowlines, Transfer lines, Project shop, Continuous processes, Cellular manufacturing system, Flexible Manufacturing System:

##### **Automation:**

- (i) degree of automation and their justified application in different levels of production
- (ii) benefits and draw backs of employing automation
- (iii) examples of conventional non-automatic, semi-automatic and automatic machine tools.
- (iv) extent of automation in transfer machines

##### **Integrated Manufacturing Production System:**

Steps involved in implementation, forming the linked-cell factory.

#### **UNIT III        CNC machine tools and systems**

- (i) types of automation ; fixed (or hard), programmable and flexible
- (ii) need and advantages of flexible automation
- (iii) basic principles of NC system

Components and their functions in NC machines

- (i) Control ; MCU, DPU and CLU
- (ii) feed drives ; special motors and screw-nut system
- (iii) advantages of CNC over NC machines

Basic systems of NC and CNC machines

- (i) coordinate system
- (ii) control – open loop and closed loop
- (iii) dimensioning – absolute and incremental

CNC machine tools ;

- (i) structure and working principle
- (ii) examples and use of CNC machines
- (iii) machining centre (MC) – characteristics and applications.

Control of tool – work travel ;

- (i) point – to – point and contouring
- (ii) interpolation – linear and circular

##### **Part programming for NC, CNC and MC systems**

Manual part programming

- (i) definition and codes used
- (ii) sequential steps
- (iii) examples ; part programming for machining in CNC lathes, drilling machines and milling.

Computer aided part programming

- (i) definition and advantages
- (ii) programming languages

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(iii) statements in APT

(iv) examples of CA part programming in APT

### **UNIT IV                      An overview of Non Traditional Manufacturing -**

Advantages over traditional, classification, characteristics of all processes:

#### **Abrasive Jet Machining (AJM)**

Working principle with help of layout, Applications, Effect of pressure, stand-off distance, grain size, abrasive flow rate on material removal rate (mrr) Mechanism of material removal. Advantages and limitations.

**Water Jet Machining:** Introduction, Machining System, Basic principle, Process parameters, Applications, Advantages and Disadvantages.

#### **Ultrasonic Machining (USM)**

Schematic Diagram of USM- Working principle, Functions of each equipment used in the set up, Material removal process. Influence of Process parameters on (i) machining rate (ii) Surface finish and accuracy and repeatability, Applications.

#### **Plasma Arc Machining**

Basic principle, applications

**UNIT V                      Chemical Machining-** Introduction, Blanking, Chemical Machining to multiple depths, Design factors, advantages and disadvantages.

**Electro-Chemical Machining-** Process principle, Equipment, Applications.

**Electron Beam Machining** Set up, Basic Principle, Applications.

**Electrical Discharge Machining (EDM)** Diesinking- Basic principle, Schematic diagram of EDM setup, Dielectric fluid, Electrode materials. System for maintaining the spark gap constant, Effect of cutting parameters pulse- on-time, pulse off time, peak current setting, no load voltage, servo reference voltage, Applications.

#### **Wire-cut EDM:**

Schematic diagram, working principle Dielectric fluid, use. Advantages & Disadvantages of EDM, Applications.

### **UNIT-VI**

#### **Laser Beam Machining (LBM)**

Characteristics of Laser light, Basic mechanism of Ruby laser, Energy level diagram of Ruby laser. Carbon Dioxide laser, Energy level diagram. Commercial lasers available for machining, welding Heat treating, cladding.

**Hybrid Machining-** Introduction, Methodology for Hybrid Machining thermal interaction, chemical and electrochemical interaction, mechanical interaction, Electromechanical Discharge Machining (ECDM/ECAM), Electrical Discharge Machining with Ultrasonic Assistance (EDMUS).

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## **Course Description**

### **UNIT VII**

**Rapid Prototyping-** Overview of Rapid Prototyping, Basic Process- CAD Model Creation, Conversion to STL format, Slice the STL File, Layer by layer construction, Clean and finish.

**Principles, systems, relative advantages and applications of the common RP methods ;**

- (i) stereo lithography (SLG)
- (ii) selective laser sintering (SLS)
- (iii) fused deposition modelling (FDM)
- (iv) laminated objects manufacturing (LOM)
- (v) 3-D Inkjet Printing

### **TEXT BOOKS:**

1. *Fundamentals of Modern Manufacturing* by Mikeel P. Grover– 3E Wiley
2. *Automation, Production systems and CIM* – M.P. Groover , Prentice Hall
3. *Non conventional machining* – P.K. Mishra, Narosa

### **REFERENCES:**

4. *Manufacturing science* – Ghosh & Mullick, EWP
5. *Rapid prototyping* – A. Ghosh, EW Press
6. *Non traditional Manufacturing Processes* by Gary F. Benedict– Marcel Dekker
7. *Micromaching of Engineering Material* by Mc Geongh, J.A. – Marcel Dekker
8. *Advanced Machining Process, Nontraditional and Hybrid Machining Processes* by Hassan Abdel- Gawad El-Hofy – McGraw Hill, Mechanical Engineering Science

# **UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR**

## **Course Description**

**Title of Course: Power Plant Engineering**

**Course Code: ME 702**

**L-T Scheme: 4-0**

**Course Credits: 4**

### **Introduction:**

Power Plant Engineering congaing all the topics related to the power plant. Weather it is boiler, compressor, turbine, site selection of plant, economics of plant. Lay out of plant etc.

### **Objectives:**

1. Basic knowledge of Different types of Power Plants, site selection criteria of each one of them.
2. Understanding of Thermal Power Plant Operation, turbine governing, different types of high pressure boilers including supercritical and supercharged boilers, Fluidized bed combustion systems.
3. Design of chimney in thermal power plants, knowledge of cooling tower operation, numerical on surface condenser design.
4. Basic knowledge of Different types of Nuclear power plants including Pressurized water reactor, Boiling water reactor, gas cooled reactor, liquid metal fast breeder reactor.
5. Understanding of Power Plant Economics, Energy Storage including compressed air energy and pumped hydro etc.
6. Discussing environmental and safety aspects of power plant operation.

### **Learning Outcomes:**

After taking this course the students should be able to

1. Select the suitability of site for a power plant.
2. Calculate performance of thermal power plant.
3. Propose ash handling, coal handling method in a thermal power plant.
4. Explain working principle of different types of nuclear power plant.
5. Calculate load factor, capacity factor, average load and peak load on a power plant.
6. Indicate safety aspects of power plants

### **Course Contents:**

#### **UNIT I**

Power plant cycles, reheat, regenerative and binary vapor and co-generation cycles

#### **UNIT II**

Boilers: Definition, classification, fire tube and water tube boilers, mountings and accessories. Draft in boilers, performance of boiler - boilers efficiency, equivalent evaporation, Losses in boilers. Coal and combustion: Properties of coal, ultimate analysis and proximate analysis, combination calculation..

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## **Course Description**

### **UNIT III**

Fuel bed firing, PF firing and Fluidized bed boilers. Introduction to boiling and circulation in boilers. Power station boilers - Benson, Lamont. Supercritical boiler

### **UNIT IV**

Boilers accessories: Super heater, economizer and air-pre heater. Handling of coal and ash.

### **UNIT V**

Steam turbine- i) parts and classification, ii) nozzles types, flow through nozzles and nozzle efficiency.

Impulse turbine - velocity diagram, work done and blade efficiency.

### **UNIT-VI**

Pressure compounding and velocity compounding of steam turbine.

### **UNIT VII**

Impulse reaction turbine - Velocity diagram, degree of reaction and Parsons turbine

### **UNIT VIII**

Governing in Steam turbine. Condensers – Basic ideas.

### **UNIT IX**

Power plant economics: load curve and various factors, cost of power generation. Introduction to Hydel, Nuclear and Renewable power plants

### **TEXT BOOK:**

1. Nag. P.K., “Power Plant Engineering”, Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008.

### **REFERENCES:**

1. El-Wakil. M.M., “Power Plant Technology”, Tata McGraw – Hill Publishing Company Ltd., 2010.
2. Black & Veatch, Springer, “Power Plant Engineering”, 1996.
3. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, “Power Plant Engineering”, Second Edition, Standard Handbook of McGraw – Hill, 1998.
4. Godfrey Boyle, “Renewable energy”, Open University, Oxford University Press in association with the Open University, 2004.

# **UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR**

## **Course Description**

**Title of Course: Maintenance Engineering**

**Course Code: ME 703A**

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

**Course Credits: 3**

### **Introduction:**

A course that will develop the student's knowledge and abilities in the subject of and enable them to more about **MAINTENANCE ENGINEERING and** know about basics concepts of **MAINTENANCE ENGINEERING** as well as technical aspects related to **MAINTENANCE and Engineering**. Topics covered are Objectives and Functions; Maintenance Organization, Predictive maintenance. Equipment wear records, standards., Reliability: Definition, failure data analysis, Mean failure rate, mean time to failure (MTTF,), System reliability: Series, parallel and mixed configuration, Spare Parts Management

### **Objectives:**

1. To enable the student to understand the principles, functions and practices adapted in industry for the successful management of maintenance activities.
2. To explain the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements.
3. To illustrate some of the simple instruments used for condition monitoring in industry.

### **Learning Outcomes:**

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

1. Upon completion of the programme, the students can able to implement the maintenance function and different practices in industries for the successful management of maintenance activities
2. To identify the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements.

### **Application:**

- (A) An ability to apply knowledge of mathematics, science, and engineering
- (B) An ability to design and conduct experiments, as well as to analyze and interpret data
- (C) An ability to design a system, component, or process to meet desired needs
- (D) An ability to function on multi-disciplinary teams
- (E) An ability to identify, formulate, and solve engineering problem

# **UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR**

## **Course Description**

### **Course Contents:**

#### **UNIT I PRINCIPLES AND PRACTICES OF MAINTENANCE PLANNING**

Basic Principles of maintenance planning – Objectives and principles of planned maintenance activity – Importance and benefits of sound Maintenance systems – Reliability and machine availability – MTBF, MTTR and MWT – Factors of availability – Maintenance organization – Maintenance economics.

#### **UNIT II MAINTENANCE POLICIES – PREVENTIVE MAINTENANCE**

Maintenance categories – Comparative merits of each category – Preventive maintenance, maintenance schedules, repair cycle – Principles and methods of lubrication – TPM.

#### **UNIT III CONDITION MONITORING**

Condition Monitoring – Cost comparison with and without CM – On-load testing and offload testing – Methods and instruments for CM – Temperature sensitive tapes – Pistol thermometers – wear-debris analysis

#### **UNIT IV REPAIR METHODS FOR BASIC MACHINE ELEMENTS**

Repair methods for beds, slide ways, spindles, gears, lead screws and bearings – Failure analysis – Failures and their development – Logical fault location methods – Sequential fault location.

#### **UNIT V REPAIR METHODS FOR MATERIAL HANDLING EQUIPMENT**

Repair methods for Material handling equipment – Equipment records –Job order systems -Use of computers in maintenance.

#### **TEXT BOOKS:**

1. Srivastava S.K., “Industrial Maintenance Management”, S. Chand and Co., 1981
2. Venkataraman .K “Maintenance Engineering and Management”, PHI Learning, Pvt. Ltd., 2007

#### **REFERENCES:**

1. Bhattacharya S.N., “Installation, Servicing and Maintenance”, S. Chand and Co., 1995
2. White E.N., “Maintenance Planning”, I Documentation, Gower Press, 1979.
3. Garg M.R., “Industrial Maintenance”, S. Chand & Co., 1986.
- 4 Higgins L.R., “Maintenance Engineering Hand book”, 5th Edition, McGraw Hill, 1988.5. Armstrong, “Condition Monitoring”, BSIRSA, 1988.
5. Davies, “Handbook of Condition Monitoring”, Chapman & Hall, 1996.
6. “Advances in Plant Engineering and Management”, Seminar Proceedings – IIPE, 1996. EE6007

# **UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR**

## **Course Description**

**Title of Course: Tribology**

**Course Code: ME 703C**

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

**Course Credits: 3**

### **Introduction:**

The study of friction, wear, and lubrication is of enormous practical importance, because the functioning of many mechanical, electromechanical, and biological systems depends on the appropriate friction and wear values. In recent decades, this field, termed tribology, has received increasing attention as it has become evident that the wastage of resources resulting from high friction and wear is greater than 6% of the Gross National Product. The potential savings offered by improved tribological knowledge are immense.

### **Objectives:**

Design of surfaces in contact is a critical problem for mechanical engineering. Tribology & lubrication is an interdisciplinary course which deals with fundamentals of surface contact, friction, wear and lubrication. Topics in Subjects include description and modeling of engineering surfaces, popular surface contact theories, major modes of friction, wear, lubrication and adhesion. The tribology challenges in micro system will be discussed as well

### **Learning Outcomes:**

The focus of Tribology & Lubrication is the fundamentals of interfacial contact, adhesion, friction, wear and lubrication. By the end of the course student should:

- (A) Have a knowledge of surface topography and know how to model a rough engineering surface;
- (B) Have a clear overall picture about the basics of tribology and related sciences, theoretical background about processes in tribological system, mechanisms and forms of interaction of friction surfaces;
- (C) Understand Hertz contact and rough surface contact;
- (D) Be familiar with adhesion theories and the effect of adhesion on friction and wear;
- (E) Have a mastery of the friction/lubrication mechanisms and know how to apply them to the practical engineering problem;
- (F) Know the methods to reduce the friction for engineering surface

### **Course Contents:**

#### **UNIT I**

**Introduction:** History, Industrial Importance.

**Engineering Surfaces:** Properties and Measurement: Measurement Methods, Surface Profilometry, Statistical Description of Roughness.

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## **Course Description**

### **UNIT II**

**Surface Contact:** Hertz contact theory, Greenwood-Williamson model, Elastic-plastic Contact

**Adhesion:** Basic Models, Factors influencing Adhesion

### **UNIT III**

**Friction:** Measurement Methods, Origin of Friction, Friction Theories – adhesion and ploughing, Mechanisms, Friction of Metals, Non-metallic Materials.

### **UNIT IV**

**Wear:** Types: Adhesive, Abrasive, Corrosive, Fatigue, Minor Forms: Fretting, Erosion, Percussion, Delamination Theory, Wear Debris Analysis, Wear Testing Methods, Wear of Metals, Ceramics, Polymers.

### **UNIT V**

**Surface Engineering:** Surface Treatments: Microstructural and Thermochemical Treatments, Surface Coatings: Hard Facing, Vapour Deposition Processes: PVD, CVD, PECVD etc.

### **UNIT- VI**

**Lubrication:** Basic Equations for Fluid Film Lubrication. Hydrodynamic lubrication -Thrust and Journal bearings, Squeeze Film Bearings, Hydrostatic lubrication, Gas-Lubrication. Lubrication of rolling element bearings. Boundary lubrication – metal working lubrication, solid film lubrication. Hygiene of Lubricants

### **UNIT VII**

**Nanotribology:** Measurement Tools: Surface Force Apparatus, Scanning Tunnelling Microscope, Atomic / Friction Force Microscope.

### **TEXT BOOKS:**

Principles of Tribology (Third Edition), by Wen Shizhu and Huang Ping

### **REFERENCES:**

1. Tribology, Principles and Design Applications, by Arnell et al.
2. Principles and Applications of Tribology, by B. Bhushan
3. Fluid Film Lubrication, By B. Hamrock
4. Tribology, by I.M. Hutchings
5. Engineering Tribology, by G. Stachowiak and A.W. Batchelor

# **UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR**

## **Course Description**

**Title of Course:** Renewable Energy System

**Course Code:** ME703B

**L-T Scheme:** 3L

**Course Credits:** 3

### **Introduction:**

Renewable energy resources provide an introduction to energy systems and renewable energy resources, with a scientific examination of the energy field and an emphasis on alternate energy sources and their technology and application. The Course will explore society's present needs and future energy demands, examine conventional energy sources and systems, including fossil fuels and then focus on alternate, renewable energy sources such as solar, biomass (conversions), wind power and geothermal.

### **Objectives:**

To study various types of conventional and non-conventional energy resources including solid, liquid and Gaseous fuels. To understand processing and limitations of fossil fuels (coal, petroleum and natural gas) and necessity of harnessing alternate energy resources such as solar, wind, nuclear, geothermal, tidal and biomass..

### **Learning Outcomes:**

**At the successful completion of course, the student is able to:**

1. List and generally explain the main sources of energy and their primary applications in the India and the world.
2. Describe the challenges and problems associated with the use of various energy sources, Including fossil fuels, with regard to future supply and the environment.
3. List and describe the primary renewable energy resources and technologies.
4. Convert units of energy—to quantify energy demands and make comparisons among energy uses, resources, and technologies.
5. Collect and organize information on renewable energy technologies as a basis for further analysis and evaluation.

### **Course Contents:**

**Unit 1:** Introduction: Principles of Renewable Energy, history of energy scene, energy future: energy and sustainable, Development and role of renewable energy [4]

**Unit 2: Solar Energy:** Definition, Energy available from Sun, Sun-Earth geometry, Solar radiation, Solar Radiation Measurement, solar energy conversion into heat, Flat plate and Concentrating collectors, Principle of natural and forced convection, . Solar cells, Application and Systems, solar Grid. [7]

**Unit 3: Solar Thermal Applications:** solar water heating system, Air heaters, Water Desalination, Space Cooling, Solar Concentrators, Solar ponds. [6]

**Unit 4: Wind Energy:** Energy available from wind, Lift and drag, Basis of Wind energy conversion, Effect of density, Horizontal axis and Vertical axis windmill, wind power, Mechanical & Electrical Power from Wind Turbines, working principle of wind power plant. [7]

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## **Course Description**

**Unit 5:** Principles of **Bio-Conversion**, Anaerobic/aerobic digestion, types of Bio-gas digesters, combustion characteristics of bio-gas, utilization for cooking and other applications. [6]

**Unit 6: Geothermal Sources:** Definition and Utilization for electricity generation and direct heating, potential in India. [4]

**Unit 7:**

**OCEAN ENERGY**, OTEC, Principles utilization, Setup of OTEC plants. Tidal and wave energy: Potential and conversion techniques. [4]

**Unit 8:** Energy Storage. [2]

### **Text Books**

1. Non Conventional Energy Sources- G.D. Rai, Khanna Publishers.
2. Non Conventional Energy Resources- B.H. Khan, M H.

### **References**

1. Renewable Energy – G. Boyle, 2<sup>nd</sup> edition, OUP, 2010.
2. Renewable Energy Resources- Twidell, J & Weir, T, 2<sup>nd</sup> edition, Taylor & Francis, 2006.

# **UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR**

## **Course Description**

**Title of Course: Quantity Production Method**

**Course Code: ME 704A**

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

**Course Credits: 3**

### **Introduction:**

The course is designed to cover the following subjects: Objectives and benefits of planning and control- Functions of production control, Method study, Product planning-Extending the original product information, Master Scheduling, Production Control Systems, Inventory control-Purpose of holding stock-Effect of demand on inventories

### **Objectives:**

1. To understand the various components and functions of production planning and control such as work study, product planning, process planning, production scheduling, Inventory Control.
2. To know the recent trends like manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

### **Learning Outcomes:**

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

1. Upon completion of this course, the students can able to prepare production planning and control activities such as work study, product planning, production scheduling, Inventory Control.
2. They can plan manufacturing requirements manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

Application

### **Course Contents:**

#### **UNIT I INTRODUCTION**

Objectives and benefits of planning and control-Functions of production control ,Method study, Product planning-Extending the original product information, Master Scheduling, Production Control Systems, Inventory control-Purpose of holding stock-Effect of demand on inventories, Break even analysis-Economics of a new design.

#### **UNIT II QUANTITY PRODUCTION METHODS - CONCEPT**

Broad classification of engineering production methods

Major sequential steps in industrial production ; preforming, semi finishing, heat treatment, finishing, assembly and inspection

Quantity production (methods) of common items ; (i) shafts and spindles (1) (ii) automobile parts ; engine block, piston, connecting rods and crank shaft (1) (iii) metallic wires, rods, tubes, bars, plates and sheets (iv) various types of gears and bearings (2) Methods of quantity production of cutting tools, tool inserts and tool holders

Smallsize products ; pins, clips, needles, metallic caps, washers, utensils, chains springs, paste tubes and coins

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## **Course Description**

Large scale production of bolts and nuts Quantity production by spinning, bulging, magneto forming, hydro forming and explosive forming Production by powder metallurgical process.

### **UNIT III                      PRODUCT PLANNING**

Process planning and scheduling for quantity production using ;

(i) semi-automatic and automatic lathes (2)

(ii) transfer machines (1)

(iii) CNC machining systems ( including machining centres FMS) (2)

Design and use of jigs and fixtures for batch production in machine shops

### **UNIT IV                      PRODUCTIVITY AND QUALITY ENHANCEMENT IN QUANTITY PRODUCTION**

Group technology ; concept and application in large scale production Inspection and quality control in quantity production Computerisation and robotization in quantity production

### **UNIT V                      NON-CONVENTIONAL MANUFACTURING OF PRODUCTS IN QUANTITY**

Quantity production by non-traditional processes ; Examples – EDM, ECM, AJM, USM, ChM and EBM Regenerative manufacturing ; rapid prototyping and rapid tooling Quantity production of ceramic and polymer products.

#### **TEXT BOOKS:**

1. Martand Telsang, “Industrial Engineering and Production Management”, First edition, S. Chand and Company, 2000.
2. James.B.Dilworth,”Operations management – Design, Planning and Control for manufacturing and services” Mcgraw Hill International edition 1992.

#### **REFERENCES:**

1. Samson Eilon, “Elements of Production Planning and Control”, Universal Book Corpn.1984
2. Elwood S.Buffa, and Rakesh K.Sarin, “Modern Production / Operations Management”, 8th Edition, John Wiley and Sons, 2000.
3. Kanishka Bedi, “ Production and Operations management”, 2nd Edition, Oxford university press, 2007.
4. Melynck, Denzler, “ Operations management – A value driven approach” Irwin Mcgraw hill.
5. Norman Gaither, G. Frazier, “Operations Management”, 9th edition, Thomson learning IE, 2007
6. Jain. K.C & L.N. Aggarwal, “Production Planning Control and Industrial Management”, Khanna Publishers, 1990.
7. Chary. S.N. “Theory and Problems in Production & Operations Management”, Tata McGraw Hill, 1995.
8. Upendra Kachru, “Production and Operations Management – Text and cases”, 1st Edition, Excel books 2007.

# **UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR**

## **Course Description**

**Title of Course:** Advanced Welding Technology

**Course Code:** ME 704B

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

**Course Credits:** 3

### **Introduction:**

Materials (mild steel, stainless steel, aluminum, cast iron, etc.) and their behavior during welding. Welding (different types for different welding processes, materials) Metrology, standards and documentation..

### **Objectives:**

1. Evaluate potential hazards and apply procedures to maintain workplace safety; demonstrate appropriate safe work habits when operating ox fuel, plasma and electric welding equipment and function safely in a welding environment.
2. Select and operate tools and equipment to support welding and related activities.
3. Read and interpret basic blueprints and welding symbols to fabricate components.
4. Perform Shielded Metal Arc Welding to industry standards and pass the AWS D1.1 Structural Unlimited Certifications.
5. Perform Gas Metal Arc Welding to industry standards.
6. Perform Flux Core Welding to industry standards and pass the AWS D1.1 Structural Unlimited Certifications.

### **Learning Outcomes:**

After successfully completing this course, you should be able to demonstrate:

- deeper knowledge of materials technology of welding
- deeper knowledge of different metals and their properties in welded constructions
- knowledge of quality techniques at production by welding
- knowledge of current computer systems and cost for welding operations
- knowledge of applications of strength of materials on welded constructions
- knowledge of applications of fracture mechanics on welded constructions, pressure vessels etc.
- ability to perform design calculations on a welded component
- ability to analyse defect tolerance of a casualty critical construction

### **Course Contents:**

#### **UNIT I**

Review of welding processes, joint design

#### **UNIT II**

Process descriptions of and parametric influences on fusion welding; arc welding- SMAW,

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stud arc welding, GMAW, GTAW and FCAW, solid state welding processes- pressure welding, friction welding, diffusion welding; resistance welding processes..

### **UNIT III**

Arc welding- different types of equipment, power sources, arc characteristics, electrode selection.

### **UNIT IV**

Critical and precision welding processes like: PAW, LBW, EBW, USW, friction stir welding, under-water welding. Welding of plastics, ceramics and composites

### **UNIT V**

Welding metallurgy, HAZ, effects of different process parameters on the characteristics of weldment. Welding fixtures, welding automation and robotic applications

### **UNIT-VI**

Weldability of plain carbon steels, stainless steel, cast iron, aluminium and its alloys.

### **UNIT VII**

Welding defects- types, causes, inspection and remedial measures; testing of welded joints by visual inspection, dye-penetration (DP) test, ultrasonics and radiography. Safe Practices in Welding

### **TEXT BOOKS:**

1. O.P. Khanna, A Text Book of Welding Technology, Dhanpat Rai & Sons.
2. R.S. Parmar, Welding Engineering and Technology, Khanna Publishers.
3. M. Bhattacharyya, Weldment Design, The Association of Engineers, India Publication, Kolkata.

### **REFERENCES:**

4. J.C. Lippold and D.J. Kotecki, Welding Metallurgy and Weldability of Stainless Steels, Wiley-India (P) Ltd., New Delhi.
5. Udin, Funk and Wulf, Welding for Engineers, John Wiley and Sons.
6. J.L. Morris, Welding Process and Procedures.
- 7.. S.V. Nadkarni, Modern Arc Welding Technology, Oxford & IBH Publishing Co. Pvt. Ltd./ Advani-Oerlikon Ltd.

# **UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR**

## **Course Description**

**Title of Course:** Software Engineering

**Course Code:** ME705A

**L-T Scheme:** 3-1

**Course Credits:** 3

**Pre-requisite:** Good Knowledge of Computer Programming

**Post Course:** Object Oriented Software Engineering, Software Quality Management

**Objective:** To engineer good quality software from its specification.

### **Learning Outcomes**

1. Familiar with processes of Software Engineering
2. Awareness about handling the complexities that may arise in various stages of SDLC
3. Generating test cases for software testing
4. Computer Aided Software Engineering
5. Aspect of Quality in Software Development
6. The Rational method

### **Course Contents:**

**Unit I-** Interactive Systems, Usability, Introduction to software engineering, Software process models, PSP, TSP, Requirement Engineering: Requirement Elicitation, Analysis, Specification, SRS, Formal system development techniques.

**Unit II-** Analysis and Modeling: Data modeling, Functional modeling Software Architecture and Design: Data design, Architectural Design Process, SADT, OOAD, function-oriented design, Design Patterns: Structural Patterns, Behavioral Patterns, and Creational Patterns.

**Unit III-** UML: Use case diagram, State diagram, Activity Diagram, Class Diagram, Sequence diagram, Collaboration diagram, Deployment Diagram, Event trace diagram.

**Unit IV-** Software Estimation: Estimating Size, Effort and Cost: Metric for Analysis, Metric for Design, COCOMO model, Putnam Model etc., Implementation and Integration: Coding standard and practices.

**Unit V-** Software Testing: Top-Down and Bottom-up Approach, Verification and Validation, Structural testing, functional Testing, Testing Strategies, Test Case design.

**Unit VI-** Software Maintenance: Types, Cost of Software, maintenance, Software Maintenance Models, CASE Tool Taxonomy: Business Process Engineering tool, Process modeling and management tool, project planning tool, requirement tracking tool, Metric and management tool, documentation tool, system software tool etc. Introduction to software engineering for web and mobile applications.

### **Text Books**

1. Software Engineering: A practitioner's approach: Roger S. Pressman, McGraw- Hill Publications (Sixth Edition).
2. Fundamentals of Software Engineering: Mall, Rajib, Prentice Hall of India, New Delhi (2nd Edition).

### **References**

1. Software Testing Techniques, B. Beizer.
2. Structured Systems Analysis: Tools and Techniques, Gane and Sarson.
3. Software Engineering, Sommerville, Addison Wesley.
4. Modern Structured Analysis, E.Yourdon.
5. An Integrated approach to Software Engineering: Pankaj Jalote, Narosa Publishing House.

# **UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR**

## **Course Description**

**Title of Course: Operation Research**

**Course Code: ME705C**

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

**Course Credits: 3**

### **Introduction:**

The goal of this course is to provide a very common simple intuition enables one to make right decisions and especially show how mathematics is applied to solve fundamental engineering problems. The Topics to be covered (tentatively) include:

Linear programming problems

Transportation and Assignments problems

Inventory Controls

Game Theory

Network Analysis

Queue Theory

### **Course Objectives:**

It lays the required foundation and skills that can be repeatedly employed in subsequent courses at higher levels. Students will acquire the skills and techniques of:

1. Discuss about algebraic solution of the linear problem with certain constraints.
2. Obtain the optimal solution of Transportation and Assignment problems.
3. Discuss about Network Analysis problems.
4. Discuss about six main factor of waiting line.
5. Solve the Nonlinear Programming problems.

### **Learning Outcomes:**

#### **Knowledge:**

1. Student completing the first unit of this course would be expected to find the solution of linear programming problems using Graphical method and simplex method.
2. At the end of second unit student will be able to assign different jobs to the different person to have the optimum efficiency of working and similar in transportation problems.
3. After the completion of the third unit, student will be able to calculate the shortest path of the graph by several methods and Algorithms.
4. At the end of fourth unit student will be able to find the optimal no. of servers such that the sum of cost of service and waiting is minimized.
5. At Student completing the fifth unit of this course would be expected to find the solution of Nonlinear programming problems using several methods.

### **Application:**

1. First unit of this course would be expected to formulate and solve the linear programming problems with the given constraints.

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## **Course Description**

2. Student will be able to assign different jobs to the different person to have the optimum efficiency of working and similar in transportation problems.
3. Third unit student will be able to calculate the shortest path of the graph by several methods and Algorithms.
4. Forth unit student will be able find the optimal no. of servers such that the sum of cost of service and waiting is minimized.

### **Course Contents:**

#### **Unit: 1 (Linear Programming Problems)**

Basic LPP and Applications, LP Problem Formulation, Simultaneous Equations and Graphical Method, Simplex Method, Big-M Method, Duality Theory, Transportation Problems and Assignment Problem

#### **Unit 2: (Network Analysis)**

Shortest Path; Floyd Algorithm, Maximal Flow Problem (Ford-Fulkerson); PERT-CPM (Cost Analysis, Crashing, Resource Allocation excluded).

#### **Unit 3: (Inventory Control):**

Introduction to EOQ Models of Deterministic and Probabilistic, Safety Stock; Buffer Stock.

#### **Unit 4: (Game Theory):**

Introduction; 2-Person Zero-sum Game; Saddle Point; Mini – Max and Maxi – Min Theorems (statement only) and problems; Games without Saddle Point; Graphical Method; Principle of Dominance.

#### **Unit 5: (Queuing Theory):**

Introduction, Axiomatic Derivation of the Arrival & Departure (Poisson Queue).Poisson Queue Models: (M/M/1:∞/FIFO) and (M/M/1:N/FIFO).

### **TextBooks:**

1. H.A.Taha,“Operations Research”, Pearson
2. P. M.Karak–“Linear Programming and Theory of Games”, ABS Publishing House
3. Ghosh and Chakraborty,“Linear Programming and Theory of Games”,Central Book Agency
4. Ravindran,Philips and Solberg- “Operations Research”,WILEYINDIA

### **References:**

1. Kanti Swaroop— “Operations Research”, Sultan Chand & Sons
2. Rathindra P.Sen—“Operations Research: Algorithms and Applications”, PHI
3. R.Panneerselvam- “Operations Research”,PHI
4. A.M.Natarajan,P.Balasubramani andA.Tamilarasi- “Operations Research”, Pearson
5. M.V.Durga Prasad–“Operations Research”,CENGAGE Learning
6. J. K.Sharma- “Operations Research”, Macmillan Publishing Company

# **UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR**

## **Course Description**

**Title of Course: Advance Manufacturing Technology lab**  
**L-T –P Scheme: 3P**

**Course Code: ME791**  
**Course Credits: 2**

### **Course Description & Objectives:**

To Study and acquire knowledge on various basic machining operations in special purpose machines and its applications in real life manufacture of components in the industry

### **Course Outcomes:**

- Ability to use different machine tools to manufacturing gears.
- Ability to use different machine tools for finishing operations
- Ability to manufacture tools using cutter grinder
- Develop CNC part programming.

### **Course Contents:**

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

- 1) Study of Abrasive Jet Machining**
- 2) Study of Ultrasonic Machining**
- 3) Parametric Study of Electro-Discharge Machining**
- 4) Study of Electro-Chemical Machining**
- 5) Study of geometry of robot manipulator, actuators and grippers**
- 6) Programming on CNC Turning**
- 7) Programming on CNC Milling Machine**
- 8) Robot Programming.**

### **TEXT BOOKS:**

1. *Fundamentals of Modern Manufacturing* by Mikeel P. Grover– 3E Wiley
2. *Automation, Production systems and CIM* – M.P. Groover , Prentice Hall
3. *Non conventional machining* – P.K. Mishra, Narosa

### **REFERENCES:**

4. *Manufacturing science* – Ghosh & Mullick, EWP
5. *Rapid prototyping* – A. Ghosh, EW Press
6. *Non traditional Manufacturing Processes* by Gary F. Benedict– Marcel Dekker
7. *Micromaching of Engineering Material* by Mc Geongh, J.A. – Marcel Dekker
8. *Advanced Machining Process, Nontraditional and Hybrid Machining Processes* by Hassan Abdel- Gawad El-Hofy – McGraw Hill, Mechanical Engineering Science

# **UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR**

## **Course Description**

**Title of Course: Group Discussion**

**Course Code: ME792**

**L-T –P Scheme: 3P**

**Course Credits: 2**

A group discussion aims at a structured but informal exchange of knowledge, ideas, and perceptions among the participants on any issue, topic or sub-topic. Contributions are pooled together and examined in terms of their relevance and validity to the discussion objectives. If planned and organized in a structured way and certain essential conditions are met, it can provide a highly enriching and stimulating experience to the participants. Lets us see, the objectives, different steps involved in it and its limitations.

### **Objectives of a Group Discussion**

- Produce a range of options or solutions, addressing a particular problem or an issue.
- Generate a pile of ideas by examining issues in greater depth, looking at different dimensions of these issues.
- Broaden the outlook of the participants through cross-fertilization and exposure to new and different experiences and ideas and enrich their understanding of the issues under discussion.
- Develop their skills in interpersonal communication and in expressing their views in a clear and succinct manner.
- Effective means of changing attitudes through the influence of peers in the group
- Valuable means of obtaining feedback for the training team on verbal skills, motivation level and personal traits of the participants and characteristics of the group

### **Steps in organizing a Group Discussion**

- Setting up the Groups
- Planning a Group Discussion
- Preparation of Group Reports
- Presentation and Consolidation of Group Reports

### **Limitations**

- If the group is large, not all the members may get the opportunity to participate and contribute to the discussion.
- If the task is not clearly defined, the discussion may lack focus and, as a result, it may be unproductive.
- Difficulties can arise if the leader is unskilled in guiding the discussion and/or not familiar with the topic or the issues.
- Some members may dominate and, in a way, hijack the discussion.

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## **Course Description**

- As this is a group task, some members may take it easy and not feel constrained to participate.

### Learning outcomes

After studying this course, you should be able to:

- understand the key skills and behaviours required to facilitate a group discussion
- prepare effectively before facilitating a meeting
- consider some of the difficult behaviours that can occur in meetings
- think of some possible strategies for dealing with these.

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## **Course Description**

**Title of Course: Seminar on Industrial Training**

**Course Code: ME781**

**L-T –P Scheme:0-0-3**

**Course Credits: 2**

### **Course Description & Objectives:**

1. **Understand** the history of medical research and bioethics related to the HeLa cells. Understand the diverse social and economic, racial and gender contexts within which Henrietta Lacks lived and died. Understand the themes of this seminar. Appreciate the legacy and implications of these medical, ethical and social understandings on today's society.
2. **Identify**, understand and discuss current, real-world issues.
3. **Distinguish** and **integrate** differing forms of knowledge and academic disciplinary approaches (e.g., humanities and sciences) with that of the student's own academic discipline (e.g., in agriculture, architecture, art, business, economics, education, engineering, natural resources, etc.). And apply a **multidisciplinary strategy** to address current, real-world **issues**.
4. Improve oral and written **communication** skills.
5. Explore an appreciation of the **self** in relation to its larger diverse social and academic contexts.
6. Apply principles of **ethics** and **respect** in interaction with others.

### **Course Outcomes:**

After the completion of this course, the student should be able to:

1. **Learn and integrate.** *Through independent learning and collaborative study, attain, use, and develop knowledge in the arts, humanities, sciences, and social sciences, with disciplinary specialization and the ability to integrate information across disciplines.*
2. *Use multiple thinking strategies to examine real-world issues, explore creative avenues of expression, solve problems, and make consequential decisions*
3. **Learn and integrate.** Communicate. *Acquire, articulate, create and convey intended meaning using verbal and non-verbal method of communication that demonstrates respect and understanding in a complex society.*
4. *Use multiple thinking strategies to examine real-world issues, explore creative avenues of expression, solve problems, and make consequential decisions.*

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## **Course Description**

5. **Clarify purpose and perspective.** *Explore one's life purpose and meaning through transformational experiences that foster an understanding of self, relationships, and diverse global perspectives.*
6. **Practice citizenship.** *Apply principles of ethical leadership, collaborative engagement, socially responsible behavior, respect for diversity in an interdependent world, and a service-oriented commitment to advance and sustain local and global communities.*

# **UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR**

## **Course Description**

**Title of Course: Project Part- I Lab**

**Course Code: ME782**

**L-T –P Scheme: 6P**

**Course Credits: 4**

Project: an activity where the participants have some degree of *choice* in the outcome. The result is complete and functional, that is, it has a beginning, middle and end. Usually, it spans multiple lab periods and requires work outside scheduled lab periods. Since there are choices in implementation, *design* is inherently a component of a project. A project is inherently different from an *analysis* or *exercise*, in which the solution has a predictable form. Projects span a wide variety of possibilities: design and build, identify a system, do a forensic analysis, evaluate a product or assess some environmental situation.

### **Program Objective 1**

Graduates shall make their way to the society with proper scientific and technical knowledge in mechanical engineering.

### **Program Objective 2**

Graduates shall work in design and analysis of mechanical systems with strong fundamentals and methods of synthesis.

### **Program Objective 3**

Graduates shall adapt to the rapidly changing environment in the areas of mechanical engineering and scale new heights in their profession through lifelong learning.

### **Program Objective 4**

Graduates shall excel in career by their ability to work and communicate effectively as a team member and/or leader to complete the task with minimal resources, meeting deadlines.

### **Program Outcomes:**

1. Ability to apply knowledge of mathematics, science and mechanical engineering fundamentals for solving problems.
2. Ability to Identify, formulate and analyze mechanical engineering problems arriving at meaningful conclusions involving mathematical inferences.
3. Ability to design and develop mechanical components and processes to meet desired needs considering public health, safety, cultural, social, and environmental aspects.
4. Ability to understand and investigate complex mechanical engineering problems experimentally.
5. Ability to apply modern engineering tools, techniques and resources to solve complex mechanical engineering activities with an understanding of the limitations.
6. Ability to understand the effect of mechanical engineering solutions on legal, cultural, social, public health and safety aspects./li>

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## **Course Description**

7. Ability to develop sustainable solutions and understand their impact on society and environment.
8. Ability to apply ethical principles to engineering practices and professional responsibilities.
9. Ability to function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.
10. Ability to comprehend, design documentation, write effective reports, make effective presentations to the engineering community and society at large.
11. Ability to apply knowledge of engineering and management principles to lead teams and manage projects in multidisciplinary environments.
12. Ability to engage in independent and life-long learning in the broad context of technological changes and advancements.