

## SEM 7 ME

### Syllabus

**Course Name: Metrology & Measurements**

**[1:0:2=2]**

#### Course Content:

Systems of limits and fits: Introduction, nominal size, tolerance, limits, deviations, fits, Unilateral and bilateral tolerance system, hole and shaft basis systems- interchangeability, deterministic & statistical tolerance, selective assembly. International standard system of tolerances, selection of limits and tolerances for correct functioning.

Linear measurement: Length standards, end standards, slip gauges & their calibration, dial indicators & micrometers; Interferometry: Interference of light, Michelson's interferometer, NPL flatness interferometer, and NPL gauge interferometer Comparators: mechanical, optical, electrical and electronic, pneumatic comparators and their uses; Limit gauges: Taylor's principle – design of go and no-go gauges; plug, ring, snap, gap, taper, profile and position gauges; Optical measuring instruments: Tools maker's microscope, Vision Measuring System;

Measurement of angles and tapers: Different methods – bevel protractor, angle slip gauges-angle Dekker- spirit levels- sine bar- sine table, rollers and spheres used to measure angles and tapers.

Surface roughness measurement: Differences between surface roughness and surface waviness – Numerical assessment of surface finish, Method of measurement of surface finish – Surface Profiles, Talysurf, ISI symbols for indication of surface finish

Flatness measurement: Measurement of flatness of surfaces- instruments used- straight edges- surface plates – auto collimator.

Machine tool alignment tests: Principles of machine tool alignment testing on lathe, drilling and milling machines.

#### List of Experiments:

- Demonstration of various gauges for linear, angular, thread measurements.
- Demonstration of various gauges for circular, taper etc. measurements.
- Go and No-Go gauges
- Tool Makers Microscope.
- Surface roughness measurement.
- Vision Measuring System.
- Coordinate measuring machine.

#### Course Outcomes:

**CO1:** Understand the fundamentals of measurements and measuring devices.

**CO2:** Analyse the principle of metrology and measurements in manufacturing.

**CO3:** Develop the competence in industrial applications of metrology and instrumentation.

**Textbook:**

1. N.V. Raghavendra, L. Krishnamurthy, *Engineering Metrology and Measurements*, India: Oxford University Press 2013, ISBN-13: 978-0-19-808549-2

**Reference Book:**

**Course Name: Industrial Engineering**

**[3:0:0=3]**

**Course Content:**

- **Introduction to Industrial Engineering and Production Systems**, Facility Location and Systematic Layout Planning.
- **Manufacturing Systems:** Introduction, Flexible Manufacturing System, CAM, Lean Manufacturing & Agile Manufacturing.
- **Techniques of Industrial Engineering** – Method Study, Time Study, Motion Economy, Value Analysis, Material Handling, Inventory Control, Job Evaluation, Ergonomics, System Analysis, Operations Research Techniques, Production, Planning and Control, Financial and Non-Financial Incentives,
- **Work study methods:** Operation process charts, Flow process charts, Two hand process chart, Multiple activity chart, Travel chart, Therblig gilbert chart, Flow diagrams, String diagrams, Cycle graphs, Chrono cycle graph & SIMO chart
- **Work measurement methods:** Direct time study, Predetermined time standards & Work sampling
- **Production Planning and Control:** Introduction to production planning and control, Forecasting, Sales & Operation Planning, Master Scheduling, Inventory Management, Material Requirement Planning, Capacity Management, Production Activity & Control, PPC in Lean & JIT and Fundamentals of Constraints

**Course Outcomes:**

**CO1:** Apply science, maths, and computer knowledge to solve industrial engineering problems.

**CO2:** Analyse the industrial engineering problems.

**CO3:** Develop a production plan for a production system operating in MTS/ MTO/ ATO/ ETO environment.

**Textbook:**

- 1) O. P. Khanna, *Industrial Engineering and Management*. Dhanpat Rai Publications.
- 2) Telsang Martand, *Industrial Engineering and Production Management*. S.Chand Publishing.
- 3) Pravin Kumar, *Industrial Engineering and Management*. Pearson.

- 4) Ravi Shankar, *Industrial Engineering and Management*. Galgotia Publications Pvt Ltd.
- 5) Stephen N. Chapman, *The Fundamentals of Production Planning and Control*, ISBN no-978-81-317-1739-4.

**Reference Books:**

- 1) Kjell B. Zandin, *Maynard's Industrial Engineering Handbook*. McGraw-Hill Companies, Inc. ISBN: 9780070411029.
- 2) Ralph M. Barnes, *Motion and Time Study: Design and Measurement of Work*. Wiley. ISBN-13: 978-0471059059
- 3) Fred E. Meyers, *Motion and Time Study: For Lean Manufacturing*. Pearson. ISBN-13: 978-0138974558
- 4) James A. Tompkins, John A. White, Yavuz A. Bozer & J. M. A. Tanchoco, *Facilities Planning*. Wiley, ISBN: 9780470444047
- 5) Richard Muther, *Systematic Layout Planning*. MIRP publication
- 6) Moran, Sean, *Process Plant Layout*. Oxford, UK: Butterworth-Heinemann, 2016.
- 7) R. L. Francis, and J. A. White, *Facility Layout and Location: An Analytical Approach*. Prentice Hall, 1993.
- 8) James Mendon Moore, *Plant layout and design*. Prentice Hall, 1962.
- 9) Reed Ruddell. *Plant layout: Factors, principles, and techniques*. RD Irwin, 1961.
- 10) Diego Marin, *Production Planning and Control*, Rmerrill Books Inc. Columbus.
- 11) Samuel Eilon, *Elements of Production Planning and Control*, Universal Publishing Corp.

**Course Name: Advanced Manufacturing Processes**

**[0:0:4=2]**

**Course Content:**

Introduction to advanced manufacturing processes, their importance in the modern manufacturing industry. Classification of advanced manufacturing processes; Mechanical Advanced Machining Processes: Abrasive jet machining, ultrasonic machining, abrasive finishing processes, water-jet machining and abrasive water jet machining. Thermoelectric Advanced Machining Processes: Electric Discharge machining, wire electric discharge machining, laser beam machining, plasma arc machining and electron beam machining. Electro Chemical and Chemical Advanced Machining Processes: Electro chemical machining, electro chemical grinding, electro-stream drilling, shape tube electrolytic machining, electrochemical deburring and chemical machining. Micro-Manufacturing: Challenges in Meso-, Micro-, Nano manufacturing, Micro-Turning, Micro-grinding, Bio-machining, Focused-Ion-Beam micro-manufacturing. Nano-finishing: Magnetorheological and allied finishing process, Magnetic abrasive finishing, abrasive flow finishing. Applications of non-conventional machining processes: Design and fabrication of the engineering components using Electro-Discharge Machining techniques (WEDM/ EDM); Introduction to modern manufacturing technology (Rapid prototyping) and additive manufacturing.

**Course Outcomes:**

**CO1:** Understanding the fundamentals of advanced manufacturing processes

**CO2:** Analysing various advanced manufacturing processes

**CO3:** Application of advanced machining processes for fabrication of engineering components

**Textbook:**

1. Vijay K. Jain, Advanced Machining Processes, Allied publisher Private Limited, 20112.
2. P.K. Mishra, "Nonconventional Machining" Publisher: Narosa Publishing House (19 July2007) ISBN-10: 8173191387; ISBN-13: 978-8173191381
3. Serope Kalpakjian, Steven R. Schmid, 2010, Manufacturing Engineering and Technology, Sixth Edition (or later), Prentice Hall International.

**Reference Book:**

1. Mikell P. Groover, Principles of Modern Manufacturing, Wiley, 20142.
2. Advanced Gear Manufacturing and Finishing - Classical and Modern Processes, 1st Edition, ISBN: 9780128044605, eBook ISBN: 97801280450603.
3. Amitabha Ghosh and Asok Kumar Mallik, "Manufacturing Science", East-West Press, 1985.

**Course Name: Refrigeration & Airconditioning**

**[2:1:0=3]**

**Course Content:****Air refrigeration system**

Introduction to refrigeration system, Methods of refrigeration, Carnot refrigeration cycle, Unit of refrigeration, Refrigeration effect & C.O.P. Air Refrigeration cycle: Open and closed air refrigeration cycles, Reversed Carnot cycle, Bell Coleman or Reversed Joule air refrigeration cycle, Aircraft refrigeration system, Classification of aircraft refrigeration system. Boot strap refrigeration, Regenerative, Reduced ambient.

**Vapour Compression System:**

Single stage system, Analysis of vapour compression cycle, Use of T-S and P-H charts, Effect of change in suction and discharge pressures on C.O.P, Effect of sub cooling of condensate & superheating of refrigerant vapour on C.O.P of the cycle, Actual vapour compression refrigeration cycle, Multistage vapour compression system requirement, Removal of flash gas, Intercooling, Different configuration of multistage system, Cascade system.

## **Vapour Absorption system**

Working Principal of vapour absorption refrigeration system, Comparison between absorption & compression systems, Elementary idea of refrigerant absorbent mixtures, Temperature – concentration diagram & Enthalpy – concentration diagram, Ammonia – Water vapour absorption system, Lithium- Bromide water vapour absorption system, Comparison.

### **Refrigerants:**

Classification of refrigerants, Nomenclature, Desirable properties of refrigerants, Common refrigerants, Secondary refrigerants and CFC free refrigerants. Ozone layer depletion and global warming considerations of refrigerants

### **Air Conditioning**

Introduction to air conditioning, Psychometric properties and their definitions, Psychometric chart, Different Psychometric processes, Thermal analysis of human body, Effective temperature and comfort chart, Cooling and heating load calculations, Sensible heat factor ( SHF ), By pass factor, Apparatus dew point (ADP).

### **Course Outcomes:**

**CO1:** To understand the methods of producing refrigeration using Gas cycle, Vapor Compression, and Vapor Absorption techniques.

**CO2:** To apply thermodynamic principles for studying single stage Vapor compression refrigeration system.

**CO3:** To apply thermodynamic principles for studying Aircraft refrigeration.

**CO4:** To apply psychrometric processes for air-conditioning analysis.

### **Textbooks**

1. R. C. Arora, Refrigeration and Air Conditioning, 2<sup>nd</sup> Edition, India, PHI Learning (P) Ltd. ISBN: 978-81-203-3915-6.

### **Reference books:**

1. CP Arora, Refrigeration and Air Conditioning, 3<sup>rd</sup> Edition, India, Tata McGraw Hill Publication.