

**Uttarakhand Technical University**

**Program: B.Tech**

**Year: 3 Industrial Production/ Production Engineering**

**Session: 2011-2012**

**Scheme and Evaluation Pattern**

S.No	Course NO.	Subject	Periods			Evaluation				Total Marks
			L	T	P	Sessional			External Exam	
						CT	T A	Total		
<b>Semester: V</b>										
<b>Theory</b>										
1	TIP-501	Quality Control	3	1	0	30	20	50	100	150
2	TME-502	Machine Design I	3	1	0	30	20	50	100	150
3	TIP-503	Industrial Ergonomics	3	1	0	30	20	50	100	150
4	TIP-504	Theory of Production Process	3	1	0	30	20	50	100	150
5	TME-505	Heat and Mass Transfer	3	1	0	30	20	50	100	150
6	TCS 507	Concepts of Programming and OOPS	2	1	0	15	10	25	50	75
<b>Practical</b>										
1	PME-552	Machine Design I Lab	0	0	2	0	0	25	25	50
2	PME 555	Heat and Mass Transfer Lab	0	0	2	0	0	25	25	50
	PCS 557	Concepts of programming and OOPS							25	25
3		Discipline								50
<b>Total</b>										<b>1000</b>

L- Lecture, T- Tutorial, P- Practical, CT- Class Test comprising of two testes in a semester each of 15 Marks, TA- Teacher Assessment comprising of Attendance and Home Assignments & Tutorial tests in a semester each 10 marks

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S.No	Course NO.	Subject	Periods			Evaluation				Total Marks
			L	T	P	Sessional			External Exam	
						CT	T A	Total		
<b>Semester: VI</b>										
<b>Theory</b>										
1	TME-601	Operation Research	3	1	0	30	20	50	100	150
2	TME-602	IC Engine	3	1	0	30	20	50	100	150
3	TME-603	Machine Design II	3	1	0	30	20	50	100	150
4	TIP-604	Advanced Welding	3	1	0	30	20	50	100	150
5	TIP-605	Maintenance & Safety Engg.	3	1	0	30	20	50	100	150
6	THU-608	Principles of Management	2	1	0	15	10	25	50	75
<b>Practical</b>										
1	PME-652	IC Engine LAB	0	0	2	0	0		25	25
2	PME-653	Machine Design II Lab	0	0	2	0	0	25	25	50
	PIP-654	Advanced Welding LAB						25	25	50
3		Seminar								50
<b>Total</b>										<b>1000</b>

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L T P

**(TIP-501) QUALITY CONTROL**

3 1 0

**Unit-I**

**Introduction:** Concept and evaluation of quality control. Measurement & Metrology, precision vs accuracy. Process capability, standardisation & Interchangeability. **3**

**Inspection and Gauges:** Inspection methods. Types of Gauges. Limits Fits and Tolerances. Non-Destructive Testings & Evaluation. **5**

**Unit-II**

Control Charts for SQC: Statistical Quality Control (SQC). Control charts for variables such as X, R charts and control charts for attributes such as p-chart, c-chart. Construction & use of the control charts. Process capability. **8**

**Unit-III**

Acceptance Sampling for SQC : Principle of acceptance sampling. Producer's and consumer's risk. Sampling plans –single, double & sequential. Sampling by attributes and variables. **7**

**Unit-IV**

**Reliability:** Introduction to reliability, bath-tub curve. Life expectancy. Reliability based design. Series & Parallel System. **3**

**Defect Diagnosis and prevention:** Basic causes of failure, curve/control of failure. MTBF.

Maintainability, Condition monitoring and diagnostic techniques. **4**

**Value Engineering :** Elements of value analysis, Techniques. **2**

**Unit-V:**

TQM: Inspection, Quality control, Quality Assurance and Quality Management and Total Quality Management. Implementation of TQM . ISO 9000 and its series, Zero defect. Quality circle. Taguchi method. Six sigma concept. **5**

**Other Factors in Quality:** Human Factors such as attitude and errors. Material-Quality. Machine Capability and Manufacturing process limitations. Quality in sales & service. Methods for improving accuracy & quality. Quality Circle. **3**

**References:**

1. Quality control, Kulkarni, Willey, New Delhi
2. Statistical Quality Control by Grant and Leavarworth, McGraw Hill
3. Maintenance for Reliability by Rao.
4. Quality: A critical Introductio, Bckford John BSPT & F, Hyderabad

## TME-502 MACHINE DESIGN -I

L T P  
3 1 0

### UNIT-I

**Introduction**, Definition, Methods, standards in design & selection of preferred size. 3

**Selection of materials** for static & fatigue loads, Materials for components subjected to creep, BIS system of designation of steels, steels, plastics & rubbers. AISI (American Iron & Steel Institution), ASTM rubber testing methods. 4

### UNIT-II

#### **Design against static load.**

Modes of failure, Factor of safety, stress-strain relationship, principal stresses, theories of failure 4

**Design against fluctuating load** stress concentration, stress concentration factors, Fluctuating/alterting stresses, fatigue failure, endurance limit, design for finite & infinite life, Soderberg & Goodman criteria. 4

### UNIT-III

#### **Joints**

Welded joint, screwed joints, ecentric loading of above joints, design for fatigue loading. 3

#### **Shaft, keys & coupling.**

Design against static and fatigue loads, strength & rigidity design, Selection of square & flat keys & splines, rigid & flexible couplings. 4

### UNIT-IV

#### **Mechanical springs**

Design of Helical and leaf springs, against static & fatigue loading. 4

#### **Design analysis of Power Screws**

Form of threads, square threads, trapezoidal threads, stresses in screw, design of screw jack. 4

### UNIT-V

#### **Introduction to Product Development & Design Process**

Definition of Design, Design Process, Need Analysis, Need based developments, Design By Evolution, Technology based developments, Examples. Case Studies. Brain-storming. 8

#### **Books**

1. Design of M/c Elements : Bhandari, TMH
2. Machine design : Sharma & Agarwal, Kataria
3. M/C Design : Maleev & Hartman,

## TIP 503 INDUSTRIAL ERGONOMICS

L T P  
3 1 0

### Unit-I

**Introduction:** Importance applications and principles of occupational ergonomics. 2

**Physiological Principles:** Muscular work, Nervous control of movements, Improving working efficiency. Optimal use of muscle strength. /Guidelines for work layout. 4

**Skilled work:** Acquiring skill, control of skilled movements. Design of tools and equipments for skilled work. 3

### Unit-II

**Heavy work:** Energy consumption, Efficiency, Heart rate as a measure of workload. 2

**Work-station Design:** Anthropometric data, Reach and clearance dimensions. Percentiles to be accommodated. 5

### Unit-III

**Working Heights:** Comfortable working postures. Room to grasp or move things, and operate controls. Sedentary work. Its advantages, disadvantages and limitation. Sedentary workplace design. Design of VDT workstations, Design of Key board. 5

**Handling Lads:** The Human spine, back troubles associated with industrial work, Intervertebral disc pressure, slip of disc, Bio-mechanical models of lower back. Recommendations for handling loads. 3

**Man-Machine System:** Display equipment, Controls, Relation between control and display instruments, Mental activity, Fatigue, Occupational stress, Job design in monotonous task. 3

### Unit-IV

**Human Visual System:** Accommodation, Aperture of the pupil, Adaptation of reline, eye movements Visual capacity, Visual strain, Physiology of reading. 3

**Ergonomic Principles of Lighting:** Light sources, measurement, physiological requirements of artificial lighting, arrangement of light. Light for fine work and for VDT offices. 3

### Unit-V

**Noise and Violation:** Sound perception, Noise load, damage to hearing, physiological and psychological effects of noise. Protection against noise, Vibrations and their effect on performance. 3

**Working Environment:** Thermo-regulation in human body, comfort indoors, Air quality and its dryness, Air pollution and ventilation. Heat in industry Recommendations for comfort indoors. Daylight, colours and music for pleasant work environment. 4

### Books

1. Fitting the task to the Man, E. Gandjean, Taylor and Francis.
2. A guide to Ergonomics of Manufacturing, Helander, M., East-West Press.
3. Human Factor in Engineering and Design, Sanders, M.S., and Mc Cormik, E.J., Mc Graw.Hill

## TIP- 504 THEORY OF PRODUCTION PROCESS

L	T	P
3	1	0

### Unit I

**Theory of Casting:** Cooling and solidification of castings, cooling curves, nucleation and dendrite formation, various casting defects and their remedies, design of gating and risering system in ferrous and nonferrous foundry practice, production of gray, malleable, and spheroidal graphite iron castings, mechanization in foundry equipments.

12

### Unit II

**Theory of Welding:** Thermal effects in welding, structure in weld and heat affected zones, distortion and residual stresses, weldability or joinability, weld quality, welding of cast iron, stainless steel and aluminum, hard facing, brazing, soldering, and adhesive bonding.

10

### Unit III

**Theory of Forming:** Mechanics of materials: Elastic and plastic behavior, concept of stress and strain and their types, Mohr's stress and strain circle in 2D and 3D, stress and strain tensor, hydrostatic and deviatoric components, elastic stress-strain relations, strain energy, anisotropy of elastic behavior; Theory of Plasticity: True stress and strain, flow curve, concept of anelastic, hysteresis, and viscoelastic behavior, Bauschinger effect, Tresca and von Mises yield criteria, anisotropy in yielding, octahedral normal and shear stresses and strains, invariants of stress and strains, flow rules or plastic stress-strain relations.

10

### Unit IV

**Analysis of Forming Processes:** Introduction of forming process analysis methods (slab method, uniform deformation energy method, limit analysis) analysis of drawing, extrusion, rolling, forging, deep drawing, and bending, forming defects, formability and workability, temperature and lubrication aspects in forming.

8

### Unit V

**Powder Metallurgy:** Theory of powder metallurgy, manufacture of metal powders, sintering, secondary operations, properties of finished parts, design considerations and applications.

6

### Books :

1. DeGarmo, E.P., Black, J.T., and Kohser, R.A., "Materials and Processes in Manufacturing", Prentice-Hall of India 1997
2. Heine, R.W., Loper, C.R., and Rosenthal, P.C., "Principles of Metal Casting", 21st reprint, Tata McGraw-Hill 1997
3. Kuo, S., "Welding Metallurgy", John Wiley & Sons 2003
4. Dieter, G.E., "Mechanical Metallurgy", McGraw-Hill 1988
5. Ghosh, A., and Mallik, A.K., "Manufacturing Science", Affiliated



## TCS-507 CONCEPTS OF PROGRAMMING AND OOPS

L T P  
2 1 0

### UNIT 1

**UTILIZATION:** Developer fundamentals such as editor, integrated programming environment, UNIX shell, modules, libraries. 3

**PROGRAMMING FEATURES:** Machine representation, primitive types, arrays and records, objects, expressions, control statements, iteration, procedures, functions, and basic I/O. 4

**APPLICATIONS:** Sample problems in engineering, science, text processing, and numerical methods. 4

### UNIT 2

**PROBLEM SOLVING WITH ALGORITHMS-** Programming styles – Coding Standards and Best practices - Introduction to C Programming, Testing and Debugging. Code reviews, System Development Methodologies – Software development Models, User interface Design – introduction – The process – Elements of UI design & reports. 8

### UNIT 3

**OBJECTED ORIENTED CONCEPTS** – object oriented programming, UML Class Diagrams– relationship – Inheritance – Abstract classes – polymorphism, Object Oriented Design methodology - Common Base class, Alice Tool – Application of OOC using Alice tool. 5

### UNIT 4

**RDBMS- DATA PROCESSING** – the database technology – data models, ER modeling concept –notations – Extended ER features, Logical database design – normalization, SQL – DDL statements – DML statements – DCL statements, Writing Simple queries – SQL Tuning techniques – Embedded SQL – OLTP 8

## REFERENCES

C++ Program Design: An introduction to Programming and Object-Oriented Design, 3rd Edition, by Cohoon and Davidson, Tata McGraw Hill. 2003.

Polya, G., How to Solve \_It (2nd ed.), Doubleday and co. (1957).

Let Us C. Yashwant Kanetkar. Allied Publishers, 1998.

The Java Tutorial, Sun Microsystems. Addison-Wesley, 1999.



## TME-505 HEAT & MASS TRANSFER

L T P  
3 1 0

### UNIT-1

**Introduction to Heat Transfer:** Concepts of the mechanisms of heat flows: conduction, convection and radiation; effect Of temperature on thermal conductivity of materials; introduction to combined heat transfer mechanism. 2

**Conduction :** One-dimensional general differential heat conduction equation in the rectangular, initial and boundary conditions. 3

#### **Steady State one-dimensional Heat conduction :**

Composite Systems in rectangular, cylindrical and spherical coordinates with and without Energy generation; thermal resistance concept; Analogy between heat and electricity flow; thermal contact resistance; critical thickness of insulation. 3

### UNIT-2

Fins of uniform cross-sectional area; errors of measurement of temperature in thermometer wells. 2

**Transient Conduction:** Transient heat conduction Lumped capacitance method, Unsteady state heat conduction in one dimension only, Heisler charts. 4

### UNIT-3

**Forced Convection:** Basic concepts; hydrodynamic boundary layer; thermal boundary layer, flow over a flat plate; flow across a single cylinder and a sphere; flow inside ducts; empirical heat transfer relations; Relation between fluid friction and heat transfer; liquid metal heat transfer. 4

**Natural Convection :**Physical mechanism of natural convection; buoyant force; empirical heat transfer relations for natural convection over vertical planes and cylinders, horizontal plates and cylinders, and sphere. 3

### UNIT-4

**Thermal Radiation :** Basic radiation concepts; radiation properties of surfaces; black body radiation laws; shape factor; black-body radiation exchange; Radiation exchange between non blackbodies in an enclosure; Infinite parallel plates, radiation shields. 7

### UNIT-5

**Heat Exchanger :** Types of heat exchangers; fouling factors; overall heat transfer coefficient; logarithmic Mean temperature difference (LMTD) method; effectiveness-NTU method; compact heat exchangers. 5

**Condensation And Boiling :** Introduction to condensation phenomena; heat transfer relations for laminar film condensation on vertical surfaces and on a horizontal tube; Boiling modes pool boiling, curve, forced convective boiling. 3

**Introduction To Mass Transfer :** Introduction; Flick's law of diffusion; steady state equimolar counter diffusion; steady state diffusion through a stagnant gas film. 2

## REFERENCES

1. Elements of Heat transfer by Bayazitouglu & Ozisik, McGraw-Hill Book Company.
2. Fundamentals of Momentum, Heat and Mass Transfer by James R. Welty; John Wiley & Sons (Pvt). Ltd.
3. Heat Transfer, by Y.V.C. Rao, University Press.
4. Fundamentals of Heat and Mass Transfer, M Thirumaleshwar, Pearson.

**TME-553****HEAT & MASS TRANSFER - LAB**

(min 8 experiment of the following or such experiment)

1. Conduction - Composite wall experiment
2. Conduction - Composite cylinder experiment
3. Convection - Pool Boiling experiment
4. Convection - Experiment on heat transfer from tube-natural convection.
5. Convection - Heat Pipe experiment.
6. Convection - Heat transfer through fin-natural convection .
7. Convection - Heat transfer through tube/fin-forced convection.
8. Any experiment - Such as on Stefan's Law, on radiation determination of emissivity, etc.
9. Any experiment - Such as on solar collector, etc. on radiation
10. Heat exchanger - Parallel flow experiment
11. Heat exchanger - Counter flow experiment
12. Any other suitable exp such as on critical insulation thickness.
13. Conduction - Determination of thermal conductivity of fluids.
14. Conduction - Thermal Contact Resistance Effect.

## TME 601 OPERATIONS RESEARCH

L	T	P
3	1	0

### Unit 1: Introduction:

Linear programming, Definition, scope of Operations Research (O.R) approach and limitations of OR Models, Characteristics and phases of OR Mathematical formulation of L.P. Problems. Graphical solution methods. 6

### Linear Programming Problems:

The simplex method - slack, surplus and artificial variables. Concept of duality, two phase method, dual simplex method, degeneracy, and procedure for resolving degenerate cases. 7

### Unit 2: Transportation Problem:

Formulation of transportation model, Basic feasible solution using different methods, Optimality Methods, Unbalanced transportation problem, Degeneracy in transportation problems, Applications of Transportation problems. 7

Assignment Problem: Formulation, unbalanced assignment problem, traveling problem. 6

### Unit 3: Game Theory:

Formulation of games, two person-Zero sum game, games with and without saddle point, Graphical solution ( $2 \times n$ ,  $m \times 2$  game), dominance property. 6

### Unit 4: Queuing Theory:

Queuing system and their characteristics. The M/M/1 Queuing system, Steady state performance analyzing of M/M/1 and M/M/C queuing model. 6

### Unit 5: PERT-CPM Techniques:

Network construction, determining critical path, floats, scheduling by network, project duration, variance under probabilistic models, prediction of date of completion, crashing of simple networks. 8

### Reference :

1. Introductory operation research theory and applications, Kasana and Kumar, BSP, Hyderabad
2. Operations Research: Principles and practice: Ravindran, Phillips & Solberg, Wiley India ltd, 2nd Edition 2007.
3. AM Natarajan, P.Balasubramani , ATamilaravari "Operation research" Pearson 2005

## TME 602 I C ENGINES

L T P  
3 1 0

### Unit-1

#### Introduction to I.C Engines:

Engine classification, Air standard cycles, Otto, Diesel, Stirling, Ericsson cycles, Actual Cycle analysis, Two and four stroke engines, SI and CI engines, Valve timing diagram, Rotary engines, stratified charge engine. 5

#### Fuels:

Fuels for SI and CI engine , important qualities of SI engine fuels, Rating of SI engine fuels, Important qualities of CI engine fuels, Dopes, Additives, Gaseous fuels, LPG, CNG, Biogas, Producer gas, Alternative fuels for IC engines. 3

### Unit-2

#### SI Engines:

Carburetion, Mixture requirements, Carburetor types Theory of carburetor, MPFI. 3

Combustion in SI engine, Flame speed, Ignition delay, Abnormal combustion and it's control, combustion chamber design for SI engines. 2

Ignition system requirements, Magneto and battery ignition systems, ignition timing and spark plug, Electronic ignition. 2

### Unit-3

#### CI Engine:

Fuel injection in CI engines, Requirements, Types of injection systems, Fuel pumps, Fuel injectors, Injection timings. 4

Combustion in CI engines, Ignition delay, Knock and it's control, Combustion chamber design of CI engines. 2

Scavenging in 2 Stroke engines, pollution and it's control. 2

### Unit-4

**Engine Cooling:** Different cooling systems, Radiators and cooling fans . 2

**Lubrication:** Engine friction, Lubrication principal, Type of lubrication ,Lubrication oils, Crankcase ventilation. 2

**Supercharging:** Effect of altitude on power output, Types of supercharging. 2

**Testing and Performance:** Performance parameters, Basic measurements, Blow by measurement, Testing of SI and CI engines. 4

### Unit-5

#### Compressors:

Classification, Reciprocating compressors, Single and multi stage, Intercooling, volumetric efficiency. 3

Rotary compressors, Classification, Centrifugal compressor, Elementary theory ,Vector diagram efficiencies, Elementary analysis of axial compressors. 4

## REFERENCES

1. Fundamentals of Internal Combustion Engine by Gill, Smith,Ziurs, Oxford & IBH
2. Publishing COIC
3. Engines, by Rogowsky, international Book Co.
4. Reciprocating and Rotary Compressors, by Chlumsky, SNTI PublicationsCzechoslovakia .
5. I.C Engine Analysis & Practice by E.F Obert.
6. I.C Engine, by Ganeshan, Tata Mc Graw Hill Publishers.

**UNIT I**

**Spur Gears** Tooth forms, System of gear teeth, contact ratio, Standard proportions of gear systems, Interference in involute gears, Backlash, Selection of gear materials, Gear manufacturing methods, Design considerations, Beam strength of gear tooth, Dynamic tooth load, Wear strength of gear tooth, Failure of gear tooth, Design of spur gears, AGMA and Indian standards. **5**

**Helical Gears** Terminology, Proportions for helical gears, Beam strength and wear strength of helical gears, herringbone gears, crossed helical gears, Design of helical gears. **3**

**Worm Gears** Types of worms, Terminology, Gear tooth proportions, Efficiency of worm gears, Heat dissipation in worm gearing, Strength and wear tooth load for worm gears, Design of worm gearing **3**

**UNIT II**

**Sliding Contact Bearing** Types, Selection of bearing, Plain journal bearing, Hydrodynamic lubrication, Properties and materials, Lubricants and lubrication, Hydrodynamic journal bearing, Heat generation, Design of journal bearing, Thrust bearing-pivot and collar bearing, Hydrodynamic thrust bearing, **5**

**Rolling Contact Bearing** Advantages and disadvantages, Types of ball bearing, Thrust ball bearing, Types of roller bearing, Selection of radial ball bearing, Bearing life, Selection of roller bearings, Dynamic equivalent load for roller contact bearing under constant and variable loading, Reliability of Bearing, Selection of rolling contact bearing, Lubrication of ball and roller bearing, Mounting of bearing **6**

**UNIT III****IC ENGINE PARTS**

Selection of type of IC engine, General design considerations, Design of Cylinder and cylinder head; Design of piston, piston ring and gudgeon pin; Design of connecting rod; Design of centre crankshaft **6**

**References:**

- 1. Mechanical Engineering Design – Joseph E. Shigely, McGraw Hill Publications**
- 2. Machine design-M.F. Spott, Prentice Hall India**
- 3. Machine Design-Maleev and Hartman, CBS**
- 4. Machine Design-Sharma and Agrawal, S.K. Katara & Sons**
- 5. Mechanical Design Theory and Methodology, Waldron, Springer BSP**

**(TIP-604) ADVANCED WELDING TECHNOLOGY**

**L T P**  
**3 1 0**

**Unit-I**

**Introduction:** Importance and application of welding, classification of welding process. Selection of welding process. 2

**Review of conventional welding process:** Gas welding, Arc welding, MIG, TIG welding. Resistance welding. Electro slag welding, Friction welding etc. Welding of MS, CI, Al, Stainless steel, Soldering & Brazing. 8

**Unit-II**

Advanced welding Techniques- Principle and working and application of advanced welding techniques such as Plasma Arc welding, Laser beam welding, Electron beam welding, Ultrasonic welding etc. 8

**Unit-III**

**Advanced welding Techniques (continued):** Principle and working and application of advanced welding techniques such as explosive welding/ cladding, Underwater welding, Spray-welding / Metallizing, Hard facing. 8

**Unit-IV**

**Weld Design:** Welding machines/equipments and its characteristics. Weld defects and distortion and its remedies, Inspection/testing of welds, Macrostructure & microstructure of welds, HAZ, Weld Design, Welding of pipe-lines and pressure vessels. Life prediction. 7

**Unit-V**

**Thermal and Metallurgical consideration:** Thermal considerations for welding, temperature distribution, Analytical analysis, heating & cooling curves. Metallurgical consideration of weld, HAZ and Parent metal, micro & macro structure. Solidification of weld and properties. 7

**REFERENCES**

1. Welding Hand Book

## TIP 605 MAINTENANCE& SAFETY ENGINEERING

L T P  
3 1 0

### Unit-I

Introduction, operating life cycle, reliability, Failure data analysis, failure rate curve, hazard models. maintainability, availability, reliability 2

### Unit-II

Maintenance Strategies: Break down maintenance, planned maintenance, strategies, preventive maintenance, design out maintenance, planned lubrication, total productive maintenance, zero break down, preventive inspection of equipment used in emergency. 2

### Unit-III

Replacement planning maintain or replace decision, replacement of items that deteriorate identical equipment, replacement of items that fail without deterioration individual, group replacement, replacement in anticipation of failure. Break down maintenance planning. 8

### Unit-IV

**SAFETY IN ENGINEERING INDUSTRY:**Introduction - definitions - classification of engineering industry - different process in engineering industry. Safety in welding, cutting, finishing, Safety in heat treatments - safety in handling and storage,. 3

**Disposal of effluents** - health precautions, elimination and prevention of long time exposure to the hazardous fumes, source of fumes, ventilation and fume protection. Care and maintenance of common elements used in material handling equipments like rope chains slings, hooks , clamps .general safety consideration in material handling - manual and mechanical handling . 3

**Handling assessments** - handling techniques – lifting, carrying, pulling, pushing, palletizing and stocking. Occupational diseases due to physical and chemical agents. 2

### Unit-V

Maintenance Management, production maintenance system, objectives and functions, forms, policy, planning, organization, economics of maintenance, manpower planning, materials planning, spare parts planning and control, evaluation of maintenance management. 6

## REFERENCES

- 1) Industrial Safety Handbook : William Handley
- 2) Introduction to Safety Engineering : David S Gloss & Miriam GayleWardle
- 3) Industrial Safety : Roland P Blake
- 4) Industrial Hazard & Safety Handbook : Ralph King & John Magid

**THU-608 PRINCIPLES OF MANAGEMENT**

**L T P**  
**2 1 0**

**UNIT 1**

**INTRODUCTION TO MANAGEMENT:** Theories of management: Traditional behavioral, contingency and systems approach. Organization as a system. 3

**UNIT 2**

**MANAGEMENT INFORMATION:** Interaction with external environment. Managerial decision making and MIS. 4

**UNIT 3**

**PLANNING APPROACH TO ORGANIZATIONAL ANALYSIS:** design of organization structure; job design and enrichment; job evaluation and merit rating. 4

**UNIT 4**

**MOTIVATION AND PRODUCTIVITY:** Theories of motivation, leadership styles and managerial grid. Co-ordination, monitoring and control in organizations. Techniques of control. Japanese management techniques. Case studies. 5

**REFERENCES**

1. Peter Drucker, Harper and Row: The Practice of Management.
2. Koontz: Essentials of Management, PHI Learning.
3. Joel Dean: Managerial Economics, PHI learning.
4. V. L. Mote, Samuel Paul and G.S. Gupta: Managerial Economics Concepts & Cases, TMH
5. Fundamentals of Management, Stephen P Robbins and Nanda Agrwal, pearson



**PI P 6 5 3 MACHINE DESIGN -II LAB**

**L T P**

**0 0 2**

**Minimum five experiments are to be performed from the following list.**

1. Design & drawing of Riveted joints for given operating conditions.
2. Design of an eccentrically loaded welded, riveted or bolted joint.
3. Design of bolted joint for fluctuating loads.
4. Design a wall bracket, which is being used in real life by actual measurement of load  
a) Welded joints b) Riveted and bolted joints And justify your findings
5. Design a shaft used in some practical application, by actual working and loading conditions
6. Justify the design of single plate clutch of a engine assembly
7. Design a software in some high level language or excel sheets for design of a component

**PIP-654 ADVANCED WELDING TECHNOLOGY LAB**

**L T P**

**0 0 2**

**Minimum 7 experiments are to be performed out of following**

- 1 Gas welding experiment
2. Arc welding experiment
3. Resistance welding experiment.
4. Soldering & Brazing experiment.
5. Experiment on unconventional welding.
6. Experiment on TIG/MIG Welding.
- 7 macro and microstructure of welding joints , HAZ
- 8 study of advanced welding techniques such cladding, Spray-welding / Meetalising, Hard facing.

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			L	T	P	Sessional			External Exam	
						CT	T A	Total		
<b>Semester: VII</b>										
<b>Theory</b>										
1	TME-701	CAD/CAM	3	1	0	30	20	50	100	150
2	TIP-702	MECHANICAL SYSTEM DESIGN	3	1	0	30	20	50	100	150
3	TIP-703	Advance production engineering	3	1	0	30	20	50	100	150
4	TIP- XXX	Elective I	3	1	0	30	20	50	100	150
5		Open Elective I	2	1	0	15	10	25	50	75
<b>Practical</b>										
1	PIP-752	CAD/CAM Lab	0	0	2	0	0	25	25	50
2	PIP-754	Industrial Training	0	0	2	0	0	25	25	50
	PIP-755	Project								100
	PIP-756	Seminar								50
<b>Total</b>										<b>1000</b>

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						CT	T A	Total		
<b>Semester: VIII</b>										
<b>Theory</b>										
1	TIP-801	UNCONVENTIONAL MANUFACTURING PROCESSES	3	1	0	30	20	50	100	150
2	TIP-802	AUTOMOBILE ENGINEERING	3	1	0	30	20	50	100	150
3	TIP- XXX	Elective II	3	1	0	30	20	50	100	150
4	TIP- XXX	Elective III	3	1	0	30	20	50	100	150
<b>Practical</b>										
1	PME-852	AUTOMOBILE ENGINEERING Lab	0	0	2	0	0	25	25	50
2	PIP-853	Project	0	0	2	0	0	100	200	300
	PIP-854	Discipline						50		50
<b>Total</b>										<b>1000</b>

L- Lecture, T- Tutorial, P- Practical, CT- Class Test comprising of two testes in a semester each of 15 Marks, TA- Teacher Assessment comprising of Attendance and Home Assignments & Tutorial tests in a semester each 10 marks

**UNIT I :**

**CAD TOOLS:** Definition of CAD Tools, Types of system, CAD/CAM system evaluation criteria, input and output devices. Graphics standard, functional areas of CAD, Modeling and viewing, Review of C, C++, statements such as if else for while & switch, functions, pointer notations, structure & class, concept of OOP. **4**

**GEOMETRICMODELLING:** Output primitives- Bresenham's line drawing and Mid-point circle algorithms. Types of mathematical representation of curves, wire frame models wire frame entities parametric representation of synthetic curves her mite cubic splines Bezier curves B-splines rational curves **3**

**UNIT II:**

**SURFACE MODELING :**Mathematical representation surfaces, Surface model, Surface entities surface representation, Parametric representation of surfaces, plane surface, rule surface, surface of revolution, Tabulated Cylinder. **3**

**PARAMETRIC REPRESENTATION OF SYNTHETIC SURFACES** – Hermite Bicubic surface, Bezier surface, B- Spline surface, COONs surface, Blending surface , Sculptured surface, Surface manipulation – Displaying, Segmentation, Trimming, Intersection, Transformations (both 2D and 3D). **4**

**GEOMETRICMODELLING-3D :** Solid modeling, Solid Representation, Boundary Representation (B-rep), Constructive Solid Geometry (CSG). **3**

**UNIT III :**

CAD/CAM Exchange : Evaluation of data – exchange format, IGES data representations and structure, STEP Architecture, implementation, ACIS & DXF. **4**

**Design Applications :** Mechanical tolerances, Mass property calculations, Finite Element Modeling and Analysis and Mechanical Assembly. **3**

**Collaborative Engineering:** Collaborative Design, Principles, Approaches, Tools, Design Systems. Introduction to CAD/CAE, Element of CAD, Concepts of integrated CAD/CAM, CAD Engineering applications, its importance & necessity. Finite Element Methods: Introduction and Application of FEM, Stiffness Matrix/ Displacement Matrix, One/Two Dimensional bar & beam element (as spring system) analysis. **7**

**UNIT – IV**

Features of NC MachinesDifference between ordinary and NC machine tools. Methods for improving Accuracy and Productivity. **4**

**NC Part Programming-**

Manual (word address format) programming. Examples Drilling and Milling. **5**

**UNIT – V**

System Devices- Introduction to DC motors, stepping motors, feed back devices such as encoder, counting devices, digital to analog converter and vice versa.

4

**Interpolators-** Principle, Digital Differential Analysers. Linear interpolator, circulator Interpolator and its software interpolator. Control of NC Systems- Open and closed loops. Automatic control of closed loops with encoder & tachometers. Speed variation of DC motor. Adaptive control

8

### **References**

- 1.. CAD/CAM Theory and Practice – Ibrahim Zeid (Mc Graw Hill International)
2. Computer Aided Analysis & Design of Machine Elements (Rao & Dukkupati)
3. Computer Graphics –Theory & Practice- Foley, Van Dam, Feiner, (Pearson Education)
4. C AD/CAM – Groover & Zimmers (Prentice Hall of India Pvt Ltd)

**TIP-702 : MECHANICAL SYSTEM DESIGN**

**L T P**  
**3 1 0**

**UNIT-I**

Engineering process and System Approach Basic concepts of systems, Attributes characterizing a system, system types, Application of system concepts in Engineering, Advantages of system approach, Problems concerning systems, Concurrent engineering, A case study-Viscous lubrication system in wire drawing. Problem Formulation Nature of engineering problems, Need statement, hierarchical nature of systems, hierarchical nature of problem environment, problem scope and constraint, 4

**A case study:** heating duct insulation system, high speed belt drive system. 3

**UNIT-II**

**System Theories :** System Analysis, Black box approach, state theory approach, component integration approach, Decision process approach, A case study- automobile instrumentation panel system. System modeling Need of modeling, Model types and purpose, linear systems, mathematical modeling, concepts, A case study compound bar system. 8

**UNIT-III**

**Graph Modeling and Analysis :** Graph Modeling and analysis process, path problem, Network flow problem, 2

**A case study:** Material handling system. Optimization Concepts Optimization processes, Selection of goals and objectives-criteria, methods of optimization, analytical, combinatorial, subjective. A case study: aluminium extrusion system. 4

**UNIT-IV**

**System Evaluation :** Feasibility assessment, planning horizon, time value of money, Financial analysis, 3

**A case study:** Manufacture of maize starch system. Calculus Method for Optimization Model with one decision variable, model with two decision variables, model with equality constraints, model with inequality constraints, A case study: Optimization of an insulation system. 7

**UNIT-V**

**Decision Analysis:** Elements of a decision problem, decision making, under certainty, uncertainty risk and conflict probability, density function, Expected monetary value, Utility value, Baye's theorem, A case study: Installation of machinery. 3

**System Simulation** : Simulation concepts, simulation models, computer application in simulation, spread sheet simulation, Simulation process, problem definition, input model construction and solution, limitation of simulation approach, A case study: Inventory control in production plant. 4

**TIP-703: Advance production engineering**

L	T	P
3	1	0

#### **Unit-I**

**Metal Forming Processes** : Elastic & plastic deformation, yield criteria. Hot working vs cold working. Analysis (equilibrium equation method) of Forging process for load estimation with sliding friction, sticking friction and mixed condition for slab and disc. Work required for forging, Hand, Power, Drop Forging. 8

#### **Unit-II**

**Metal Forming Processes (continued)**: Analysis of Wire/strip drawing and maximum-reduction, Tube drawing, Extrusion and its application. Condition for Rolling force and power in rolling. Rolling mills & rolled-sections. Design, lubrication and defects in metal forming processes 6

#### **Unit-III**

**Metal Cutting and Machine Tools** : Metal Cutting- Mechanics of metal cutting. Geometry of tool and nomenclature, ASA system Orthogonal vs. oblique cutting. Mechanics of chip formation, types of chips. Shear angle relationship. Merchant's force circle diagram. Cutting forces, power required. Cutting fluids/lubricants, Tool materials, Tool wear and tool life. Machinability. Dynamometer. Brief introduction to machine tool vibration and surface finish. Economics of metal cutting. 8

#### **Unit-IV**

**Unconventional Metal forming** : Unconventional metal forming processes such as explosive forming, electromagnetic, electro hydraulic forming. 8

#### **Unit- V**

**Unconventional Machining** : Principle and working and applications of unconventional machining process such as ElectroDischarge machining, Electrochemical machining, ultrasonic machining, Abrasive jet machining, laser beam machining, Electron beam machining. 8

### **ELECTIVE I**

**TIP 011 INDUSTRIAL AUTOMATION AND ROBOTICS**

**TIP 012 ENGINEERING ECONOMICS AND INDUSTRIAL DESIGN**

**TIP 013 NON CONVENTIONAL ENERGY SOURCES & TECHNOLOGIES**

**TIP 015 METALLURGY AND HEAT TREATMENT**

**TME 015 NON DESTRUCTIVE TESTING**

**ELECTIVE II**

**EAU 020 MAINTENANCE AND RELIABILITY ENGINEERING**

**EAU 021 PLANNING AND CONTROL OF MANUFACTURING SYSTEMS**

**EAU 022 PRODUCT DEVELOPMENT AND DESIGN**

**TME 024 SIX SIGMA AND APPLICATION**

**TME020 TOTAL QUALITY MANAGEMENT**

**ELECTIVE III**

**EAU 030 PRODUCTIVITY ENGINEERING AND TECHNOLOGY MANAGEMENT**

**EAU 031 MANAGEMENT INFORMATION SYSTEM**

**EAU 032 FACILITY PLANNING AND VALUE ENGINEERING**

**EAU033 MAINTENANCE AND SAFETY ENGINEERING**

**TME 032 ROBOTICS & AUTOMATION**

**L T P**  
**3 1 0**



## UNIT I:

**Hydraulics:** Hydraulic System Elements: Pumps, types, working, characteristics, 2

**applications:** Types of conductors, and connectors, their selection,: Seals and packing , types, materials, applications. Hydraulic Actuators: Linear and Rotary, types, working, cushioning effect, mounting, 4

**calculation of force and velocity of piston System components:** Accumulators, Intensifiers, their types, working, applications. 4

## UNIT II:

**Hydraulics(continued):** Control Elements: Pressure control Valves, direct acting type, pilot operated, sequence, counterbalancing, unloading, pressure reducing, 2

**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. 4

**Hydraulic Circuits and their Applications:** Speed control circuits, regenerative, sequencing, counterbalancing, synchronizing, interlocking, circuits with accumulator and intensifier. 4

**Introduction to Fluidics and study of simple logic gates:** Hydraulic clamping and braking systems. 2

## UNIT III:

**Pneumatics:** 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 consumption, Comparison of air, hydraulic and electric motor. 3

**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. 3

**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. Fluid power maintenance, troubleshooting and safety. 1

## UNIT IV:

**Robotics:** Definition-types & classification of Robot-need for Robot-Installation procedure area of applications-basics parts & function-specification. Mechanical, Electrical & fluid power-combination-

selection of system-simple problems based on load for linear & rotary travel-control system-servo control-interfacing methods-micro processor, PLC and PC based. Functions of sensors-types and selection of sensors-need for grippers-types and selection of grippers-common types of grippers used-end effectors. Types of programming-programming languages-sample program for different types of robots-vision system application of image processing. 6

**UNIT V:**

**Automation devices:** Feeders, orienters, catchment devices, PLC architecture and programming 4

**TIP-012: Engineering Economics and Industrial Design**

**L T P**  
**3 1 0**

**UNIT I:**

**Introduction:** Definitions, what is industrial design, assessing the need for ID, product and process cycles, ethics, societal and economic considerations in engineering, technological forecasting, technological innovation and design process. 3

**Design Process:** Importance of product design, considerations of a good design, detailed descriptions of design process, role of marketing, organization for design and role of computers in design. 3

#### UNIT II:

**Concept generation & concept selection:** Concept generation process, basic methods, information gathering and brain storming, conventional aids, brain ball, C-Sketch/6-3-5 method. 3

**advanced methods:** Direct search, systematic search with physical principles and classifying schemes: Morphological analysis, factors that determine effective decision making, Estimating technical feasibility, concept selection process- basic and advanced methods. 4

#### UNIT III:

**Product Modeling:** model preparation & selection method, construction of product models, physical models/ prototypes, types of prototypes, uses of prototypes, rapid prototyping techniques, dimensional analysis, similitude and scale models, geometrical modeling on the computer, computer visualization. 3

**Design for Robustness:** Quality design theory, general robust design model, robust design model construction, taguchi's method; noise variable matrix, design variable matrix, experimental matrix, signal to noise ratio, selection of target design, optimization methods, finite element analysis, evaluation considerations in optimization, design optimization. 4

#### UNIT IV:

**Design for manufacturing and assembly:** Estimation of manufacturing costs, reducing the cost of components and assemblies, design for assembly, design for piece part production, cost driver modeling and manufacturing cost analysis. 3

**Simulation:** concept of simulation, advantages and disadvantages of simulation, areas of application, systems and system environment, components of a system, discrete and continuous systems, model of a system, types of models, steps in a simulation study, simulation application examples 3

#### UNIT V:

**Economic decision-making:** Break-Even analysis, Applications of Break-Even Analysis, Investment Decisions, Payback Period, ARR, NPV and IRR methods, Depreciation, benefits - cost analysis. Cost

evaluation: categories of cost, method of developing cost estimates, cost indexes, cost capacity factors, estimation of plant cost, design cost, manufacturing costs, value analysis in costing, overhead costs, activity based costing, learning curve, cost models, life cycle costing. 7

**TIP-013: NON-CONVENTIONAL ENERGY RESOURCES AND UTILISATION**

**L T P**  
**3 1 0**

**UNIT-1**

**Energy resources and their utilization :** indian and global energy sources, Energy exploited, Energy planning, Energy parameters (energy intensity, energy-GDP elasticity), Introduction to various sources of energy, Solar thermal, Photovoltaic, Water power, Wind energy, Biomass, Ocean thermal, Tidal and wave energy, Geothermal energy, Hydrogen energy systems, Fuel cells, Decentralized and dispersed generation. 3

**Solar radiations:** Extra terrestrial radiation, Spectral distribution, Solar constant, Solar radiations on earth, Measurement of solar radiations, Solar radiation geometry, Flux on a plane surface, Latitude, Declination angle, Surface azimuth angle, Hour angle, Zenith angle, Solar altitude angle expression for angle between incident beam and the normal to a plane surface (no derivation), Local apparent time, Apparent motion of sun, Day length, Solar radiation data for India. 5

## **UNIT-2**

**Solar energy:** Solar thermal power and it's conversion, Solar collectors, Flat plate, Performance analysis of flat plate collector, Solar concentrating collectors, Types of concentrating collectors, Thermodynamic limits to concentration, Cylindrical collectors, Thermal analysis of solar collectors, Tracking CPC and solar swing. Solar thermal energy storage, Different systems, Solar pond, Applications, Water heating, Space heating & cooling, Solar distillation, solar pumping, solar cooking, Greenhouses, Solar power plants Solar photovoltaic system: Photovoltaic effect, Efficiency of solar cells, Semiconductor materials for solar cells, Solar photovoltaic system, Standards of solar photovoltaic system, Applications of PV system, PV hybrid system. 7

## **UNIT-3**

**Biogas:** Photosynthesis, Bio gas production Aerobic and anaerobic bio-conversion process, Raw materials, Properties of bio gas, Producer gas, Transportation of bio gas, bio gas plant technology & status, Community biogas plants, Problems involved in bio gas production, Bio gas applications, Biomass conversion techniques, Biomass gasification, Energy recovery from urban waste, Power generation from liquid waste, Biomass cogeneration, Energy plantation, Fuel properties, Biomass resource development in India. 5

**Wind energy:** Properties of wind, Availability of wind energy in India, wind velocity, Wind machine fundamentals, Types of wind machines and their characteristics, Horizontal and Vertical axis wind mills, Elementary design principles, Coefficient of performance of a wind mill rotor, Aerodynamic considerations in wind mill design, Selection of a wind mill, Wind energy farms, Economic issues, Recent development. 5

## **UNIT-4**

**Electrochemical effects and fuel cells:** Principle of operation of an acidic fuel cell, Reusable cells, Ideal fuel cells, Other types of fuel cells, Comparison between acidic and alkaline hydrogen-oxygen fuel cells, Efficiency and EMF of fuel cells, Operating characteristics of fuel cells, Advantages of fuel cell power plants, Future potential of fuel cells . 3

**Tidal power:** Tides and waves as sources of energy, Fundamentals of tidal power, Use of tidal energy Limitations of tidal energy conversion systems. **Hydrogen Energy:** Properties of hydrogen in respect of its use as source of renewable energy, Sources of hydrogen, Production of hydrogen, Storage and transportation, Problems with hydrogen as fuel, Development of hydrogen cartridge, Economics of hydrogen fuel and its use.. 4

## **UNIT-5**

**Thermoelectric systems:** Kelvin relations, power generation, Properties of thermoelectric materials, Fusion Plasma generators. 2

**Geothermal energy:** Structure of earth's interior, Geothermal sites, earthquakes & volcanoes, Geothermal resources, Hot springs, Steam ejection, Principal of working, Types of geothermal station with schematic representation, Site selection for geothermal power plants. Advanced concepts, Problems associated with geothermal conversion. 4

**Ocean energy;** Principle of ocean thermal energy conversion, Wave energy conversion machines, Power plants based on ocean energy, Problems associated with ocean thermal energy conversion systems, Thermoelectric OTEC, Developments of OTEC, Economics. Impact of renewable energy generation on environment, Kyoto Protocol, Cost of electricity production from different energy sources, Energy options for Indian economy. 4

**UNIT I:**

**Creep:** Introduction, time dependent mechanical behavior, creep curve, mechanism of creep, factors affecting creep, effect of alloys, creep under combined stresses, presentation of engineering creep data, fatigue creep interaction. 4

**Equilibrium Diagrams for non-ferrous alloys:** Review of cooling curves, phase rule, solid state transformation, phase diagram of non-ferrous alloys 3

**UNIT II:**

**Iron Carbon Diagram:** Allotropic forms of carbon, solid and liquid state reactions, types of steels, types of cast irons, microstructures at various carbon percentages, properties as a function of microstructures, significance of IC diagram. Cooling curves and equilibrium diagrams for brass and aluminum alloys. 4

**TTT Diagrams:** Time temperature transformations diagram, transformations as a function of cooling rate, mechanism of various transformations, significance of TTT diagram. 3

**UNIT III:**

**Heat Treatment Methods:** Mechanism of annealing and advantages, mechanism of normalizing and advantages, mechanisms of tempering and advantages, mechanism of hardening and advantages, mechanism of case hardening and advantages, mechanism of induction hardening and advantages. 8

**UNIT IV:**

**Chemical Heat Treatment Methods:** Introduction to chemical heat treatment, mechanism and methods of carburizing, nitriding, cyaniding, introduction to flame hardening. 7

**UNIT V:**

**Hardenability:** Meaning of Harden ability, tests of Harden ability, factors affecting Harden ability 4

**Effect Of Alloying Elements:** Effect on strength and hardness, effect on Harden ability, effect on transformation temperature 4

## **Unit-1**

### **INTRODUCTION:**

Scope and advantages of N.D.T. some common NDT methods used since ages – visual inspection, Ringing test, and chalk – test (oil-whiting test) their effectiveness in detecting surface cracks, bond strength and surface defects. 5

## **Unit-2**

Common NDT methods Dye – penetrant tests – principle, scope, equipment and techniques. Zyglo testing. Magnetic Particle Tests- Scope of test, Principle equipment and technique. DC And AC magnetization, use of dry and wet powders magnaglow testing. Interpretations of results. 6

## **Unit-3**

**RADIOGRAPHIC METHODS** X-ray radiography – principle, equipment and methodology. Interpretation of radiographs, Limitations Gamma ray radiography. Principle, equipment, source of radioactive material and technique. Precautions against radiation hazards, Advantage over x-ray radiography methods. 6

## **Unit-4**

**ULTRASONIC TESTING METHODS** Introduction Principle of Operation – piezoelectricity. Ultrasonic probes, cathode ray oscilloscope techniques and advantages limitation and typical applications. 4

## **Unit-5**

Testing of castings, forgings & weldments Application of NDT methods in inspection of castings, forgings and welded structures with illustrative examples. Case studies. Sample-testing in the lab. 6



**UNIT I:**

Objectives and policies of maintenance, organization and structure of maintenance systems, maintenance records, types of maintenance, breakdown, predictive, replacement, on-line, offline, preventive maintenance, reconditioning and correction maintenance. 7

**UNIT II:**

Preventive maintenances v/s. repair, development of preventive maintenance schedule, top down bottom up approach, production maintenance integration. Maintenance manpower planning, spare parts management, computerized maintenance system, condition based monitoring, on-line v/s off-line maintenance systems, maintenance devices, budgeting and cost control. 8

**UNIT III:**

Concept of reliability, objectives, applications, area of use, use of reliability in industry. Mean time to repair, mean time between failures, mean time to failure, types of failure, permanent failure, proneness to failure, bath tub curve. 8

**UNIT IV:**

Reliability functions, probability function, failure rate, failure density, hazard rate, uncertainty measures. Concept of redundancy, objectives, applications, redundant standby systems, Determination of reliability, Series and parallel-connected systems, confidence levels. 8

**UNIT V:**

Fault tree diagram, event tree, failure rate, beta, Gamma, Log-normal and Weibull distribution, Design & analysis of life tests. Introduction to failure mode and effect analysis, FMEA and FMECA, criticality analysis, severity, occurrence and detection of failure, case studies. 7

## TIP-021: Planning and Control of Manufacturing Systems

### UNIT I:

**Production Processes:** discrete and process types, mass, batch, unit flexible manufacturing types, manufacturing operations: selection of a process, difference between manufacturing and service operations, classification of manufacturing processes, 5 Ps in the organization. 4

**Process Design:** Systems approach to process planning and design, linkage between product planning and process planning, distinction between process planning and facilities planning, types of process design, product mix, process planning aids, process design procedure . 4

### UNIT II;

**Forecasting:** characteristics of demand over time, forecasting qualitative model: Delphi, naïve quantitative models: simple average, simple moving average, weighted moving average, exponential smoothing, smoothing coefficient selection, adaptive exponential smoothing, incorporating trend and seasonal components, linear regression, selection of forecasting models. 4

**Aggregate Planning:** Concept, strategies for aggregate planning: three pure planning strategies, graphical method for aggregate output planning, master production scheduling (MPS), procedure for developing MPS. 4

### UNIT III:

**Shop floor planning and control:** Nature, factors determining production planning, factors determining production control, phases in production planning and control, limitations of PPC, measuring effectiveness of PPC, production activity control, operations planning and scheduling, scheduling process-focused production systems, scheduling techniques for job shop, stages in scheduling, load charts and machine loading charts, dynamic sequencing rules, scheduling product –focused systems, scheduling for flexible manufacturing system. 8

### UNIT IV:

**Resource Requirements Planning:** Nature, resource requirement planning system, MRP-I, MRP-II, MRP Computational procedure, issues in MRP, implementation of MRP, evaluation of MRP, Introduction to ERP. 7

### UNIT V:

**Introduction to project planning and control:** Nature, project life cycle, project organization, role of project manager, project planning and control, techniques, project scheduling techniques, line of balance. 5

**Manufacturing planning & Control systems:** JIT, CIM and WCM 4

## TIP-022: PRODUCT DEVELOPMENT AND DESIGN

### Unit-I:

**Introduction to Product Design:** Introduction to PDD, Applications, Relevance, Product Definition, Scope, Terminology. Design definitions, the role and nature of design, old and new design methods, Design by evolution. Examples such evolution of bicycle, safety razor etc. Need based development, technology based developments. Physical reliability & Economic feasibility of design concepts. 8

### UNIT II:

#### **Morphology of Design :**

Divergent, transformation and convergent phases of product design. Identification of need, Analysis of need. Design for what? Design criteria, functional aspects. Aesthetics, ergonomics, form (structure). Shape, size, color. Mental blocks, Removal of blocks, Ideation Techniques. Creativity, Checklist. 7

### UNIT III:

**Transformations** :Brainstorming & Synectics. Morphological techniques. Utility concept, Utility value, Utility index. Decision making under multiple criteria. Economic aspects of design. Fixed and variable costs. Break-even analysis. 7

### UNIT IV:

**Reliability** :Reliability considerations, Bath tub curve, Reliability of systems in series and parallel. Failure rate, MTTF and MTBF. Optimum spares from reliability consideration. Design of displays and controls, Man-Machine interface, Compatibility of displays and controls. Ergonomic aspects. Anthropometric data and its importance in design. Applications of Computers in product design. 8

### UNIT V:

**Product Appraisal** :Information and literature search, patents, standards and codes. Environment and safety considerations. Existing techniques such as work-study, SQC etc. which could be used to improve method & quality of product. Innovation versus Invention. Technological Forecasting. 8

## Unit-I

**Quality Concepts** Evolution of Quality control, concept change, TQM Modern concept, Quality concept in design, Review off design, Evolution of proto type. Control on Purchased Product Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure. Manufacturing Quality Methods and Techniques for manufacture, Inspection and control of product, Quality in sales and services, Guarantee, analysis of claims. 5

## Unit-II

**Quality Management** Organization structure and design, Quality function, decentralization, Designing and fitting organization for different types products and company, Economics of quality value and contribution, Quality cost, optimizing quality cost, seduction programme. Human Factor in Quality Attitude of top management, co-operation, of groups, operators attitude, responsibility, causes of operators error and corrective methods. 6

## Unit-III

**Control Charts** Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts. Attributes of Control Charts Defects, construction and analysis off-chart, improvement by control chart, variable sample size, construction and analysis of C-chart. 7

## Unit-IV

Defects Diagnosis and Prevention Defect study, identification and analysis of defects, corrective measure, factors affecting reliability, MTTF, calculation of reliability, Building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle. 6

## Unit-V

ISO-9000 and its concept of Quality Management:

ISO 9000 series, Taguchi method, JIT in some details

5

### References:

1. Lt. Gen. H.Lal, "Total Quality management", Wiley Eastern Limited, 1990. .
2. Greg Bounds. "Beyond Total Quality Management". McGraw Hill, 1994.
3. Menon, H.G, "TQM in New Product manufacturing", McGraw Hill 1992.

**TME 023 SIX SIGMA METHODS & APPLICATION**

**L T P**

**Unit 1**

**3 1 0**

**Quality Perception** : Quality in Manufacturing, Quality in Service Sector; Differences between Conventional and Six Sigma concept of quality; Six Sigma success stories. Statistical foundation and methods of quality improvement.

**Descriptive statistics:** Data Type, Mean, Median, Mode, Range, Variation, Standard Deviation, Skewness, Kurtosis.

**Probability Distribution** : Normal, Binomial, Poisson Distribution Unit 2

**Basics of Six Sigma:** Concept of Six Sigma, Defects, DPMO, DPU, Attacks on X'S, Customer focus, Six Sigma for manufacturing, Six Sigma for service. Z score, Understanding Six Sigma organization, Leadership council, Project sponsors and champions, Master Black Belt, Black Belt, Green Belts.

### **Unit 3**

Methodology of Six Sigma, DMAIC, DFSS, Models of Implementation of Six Sigma, Selection of Six Sigma Projects.

### **Unit 4**

Six Sigma Tools: Project Charter, Process mapping, Measurement system analysis, Hypothesis Testing, Quality Function deployment, Failure mode effect analysis, Design of Experiments.

### **Unit 5**

Sustenance of Six Sigma, Communication plan, Company culture, Reinforcement and control, Introduction to softwares for Six Sigma, Understanding Minitab, Graphical analysis of Minitab plots.

### **References:**

1. Six Sigma: SPC and TQM in manufacturing and service, Geoff Tennant, Gower Publishing Co.
2. Six Sigma for managers, Greg Brue, TMH
3. What is Six Sigma, Pete Pande, TMH
4. The Six Sigma Way, Peter S. Pande, TMH Team Field book
5. The Six Sigma way, Peter S. Pande, TMH

## **PIP-751: CAD/CAM LAB**

### **A. CAD Experiments**

1. Line Drawing or Circle Drawing experiment: Writing and designing steps.
2. Design of machine component or other system experiment: Writing and designing steps.
3. Understanding and use of any 3-D Modeling Software commands.
4. Pro/E/Idea etc. Experiment: Solid modeling of a machine component.
5. Understanding the commands and specific usages in CAD.

### **B. CAM Experiments**

1. To study the characteristic features of CNC machine.
2. Experiment on Robot and programs.
3. Experiment on Transfer line/Material handling.
4. Experiment on difference between ordinary and NC machine, study on Mechatronics and controls.
5. Experiment on study of system devices such as motors and feed back devices.

## Unit-I

**Introduction:** Limitations of conventional manufacturing processes, need of unconventional manufacturing processes & its classification and its future possibilities. 2

## Unit-II

**Unconventional Machining Process:** Principle and working and applications of unconventional machining process such as Electro-Discharge machining, Electrochemical machining, ultrasonic machining, Abrasive jet machining etc. 3

## Unit-III

**Unconventional Machining Process (continued) :**Principle and working and application of unconventional machining processes such as Laser beam Machining, Electron beam machining, Ultrasonic machining etc 7

## Unit-IV

**Unconventional welding processes:** Explosive welding, Cladding etc. Under water welding, Metalizing, Plasma arc welding/cutting etc. 5

## Unit-V

**Unconventional Forming processes:** Principle, working and applications of High energy forming processes such as Explosive Forming, Electromagnetic forming, Electro-Discharge forming, water hammer forming, explosive compaction etc. Electronic-device Manufacturing: Brief description of Diffusion and Photo- Lithography process for electronic-device manufacturing. 7

## Unit-I

**Power Unit and Gear Box:** Principles of Design of main components. Valve mechanism. Power and Torque characteristics. Rolling, air and gradient resistance. Tractive effort. Gear Box. Gear ratio determination. Design of Gear box. 5

## Unit-II

**Transmission System:** Requirements. Clutches. Torque converters. Over Drive and free wheel, Universal joint. Differential Gear Mechanism of Rear Axle. Automatic transmission, Steering and Front Axle. Castor Angle, wheel camber & Toe-in, Toe-out etc.. Steering Geometry. Ackerman mechanism, Understeer and Oversteer . 7

## Unit-III

**Braking System:** General requirements, Road, tyre adhesion, Weight transfer, Braking ratio. Mechanical brakes, Hydraulic brakes. Vacuum and air brakes. Thermal aspects. Chassis and Suspension System: Loads on the frame. Strength and stiffness. Various suspension systems. 7

## Unit-IV

**Electrical System :** Types of starting motors, generator & regulators, lighting system, Ignition system, Horn, Battery etc. Fuel Supply System: Diesel & Petrol vehicle system such as Fuel Injection Pump, Injector & Fuel Pump, Carburetor etc. MPFI. 7

## Unit-V

**Automobile Air Conditioning:** Requirements, Cooling & heating systems.

Cooling & Lubrication System: Different type of cooling system and lubrication system. 3

Maintenance system: Preventive maintenance, break down maintenance and Over hauling. 3



**UNIT I:**

Productivity concept and definition, productivity and economic development, impact of productivity in macro-economic context, productivity and production, productivity and profitability, productivity and quality, productivity and technology, external environment and productivity, total, partial and total factor productivity. 8

**UNIT II:**

**Measurement of productivity:** factors affecting the productivity of any nation, GDP and GNP, productivity at firm level, measurement approaches, total productivity model, product oriented model, computer algorithms for measuring total and partial productivity. Productivity measurement of services. 8

**UNIT III:**

**Productivity evaluation:** Productivity evaluation and planning, methodologies for evaluation, the productivity evaluation tree, short-term and long-term productivity planning. 8

**UNIT IV:**

**Technology management:** Need for managing the technology, importance of technology and its management, role of technology in economic development, technological change in modern society. Technology planning, technology forecasting, applications of technology forecasting and its impact on business, technology life cycle and its importance. 8

**UNIT V:**

**Technology transfer:** Technology transfer at macro and micro level, need for technology transfer, modes of technology transfer, technology adaptation, factors affecting technology adaptation, technology absorption, technology diffusion, technology transfer agreements, negotiations in technology transfer, cultural differences, introduction to re-engineering, characteristics of technology in developing countries, role of R & D department in technology adaptation & development, implementation of acquired technology. 8

Organisation & Types, Decision Making, Data & information, Characteristics & Classification of information, Cost & value of information, Various channels of information & MIS. 5

## **Unit-II**

Foundation of Information System : Introduction to Information System in Business Fundamentals of Information System, Solving Business Problems with Information System, Concept of Balanced MIS, Effectiveness & Efficiency Criteria. Tool and Techniques of MIS dataflow diagram, flow chart etc. 6

## **Unit-III**

Business application of information technology, electronic commerce, Internet, Intranet, Extranet & Enterprise Solutions, Information System for Business Operations, Information system for managerial Decision Support, Information System for Strategic Advantage. 5

## **Unit-IV**

Managing Information Technology, Enterprise & Global Management, Security & Ethical Challenges, Planning & Implementing Change. Reports: Various types of MIS reports, GUI & Other Presentation tools. 8

## **Unit-V**

Advanced concepts in information system: Enterprise Resource Planning: introduction, various modules like Human Resources, Finance, Accounting, Production & Logistics. Supply Chain Management, CRM, Procurement Management System Object Oriented modeling case studies. 8

## **REFERENCES:**

O.Brian, "Introduction to Information System", Mc-Graw Hill.

O.Brian, "Management Information System", TMH.

Alter, "Information Systems : A Management Perspective", Addison Wesley.

Arora & Bhatia, "Information Systems for Managers", Excel

Bansal, "Information System Analysis & Design", TMH.

Jawadegar, "Management Information System", TMH.

Murdick, "Information System for Modern Management", PHI.

Alexis Leon, "Enterprise Resource Planning", TMH

**UNIT I:**

**Introduction to facilities planning and design:** plant layout, material handling and their interrelationship, objectives of a good plant layout, principles of a good layout, classical types of layouts, special types and practical layouts. 3

**Factors affecting plant layout:** man, material, machine, movement, waiting, service, building and change, features and considerations of each factor, procedure of plant layout, data collection for layout design, layout visualization using templates and 3D models. 3

**UNIT II:**

**Site location:** various theories/models of site location like equal weights, variable weights, weight cum rating, composite model and Bridgemann's model, Weber index, and various subjective techniques, evaluation of layout, computerized layout, flowcharts of various Programmes like CRAFT, ALDEP AND CORELAP. 7

**UNIT III:**

**Material handling:** principles, factors affecting material handling, objectives, material handling equation, selection of material handling systems and equipments, cranes, conveyors, hoists and industrial trucks, installation of new facilities in the existing setup using median model and gravity model. 8

**UNIT IV:**

**Introduction to value engineering & value analysis:** methodology of value engineering, unnecessary costs, use and prestige value, estimation of product quality or performance. Types of functions functional cost and functional worth. Effect of value improvement on profitability, tests for poor value. 7

**UNIT V:**

Aims and objectives of value engineering, systematic approach. Value engineering, job plan- study of various phases of the job plan. Selection of projects for value analysis. Primary and secondary functions work and sell functions, determining and evaluating functions, assigning equivalence, function-cost matrix evaluation. Function (FAST).Reporting, implementation & follow up. 8

## **Unit-I**

Introduction, operating life cycle, reliability, Failure data analysis, failure rate curve, hazard models. maintainability, availability, reliability **4**

## **Unit-II**

Maintenance Strategies: Break down maintenance, planned maintenance, strategies, preventive maintenance, design out maintenance, planned lubrication, total productive maintenance, zero break down, preventive inspection of equipment used in emergency. **6**

## **Unit-III**

Replacement planning & maintain or replace decision, replacement of items that deteriorate with time identical equipment, replacement of items that fail without deterioration individual, group replacement, replacement in anticipation of failure. Break down maintenance planning **8**

## **Unit-IV**

### **SAFETY IN ENGINEERING INDUSTRY:**

Introduction - definitions - classification of engineering industry - different process in engineering industry. Safety in welding, cutting, finishing, Safety in heat treatments - safety in handling and storage, . disposal of effluents - health precautions, elimination and prevention of long time exposure to the hazardous fumes, source of fumes, ventilation and fume protection. **7**

Care and maintenance of common elements used in material handling equipments like rope chains slings, hooks , clamps .general safety consideration in material handling - manual and mechanical handling . Handling assessments - handling techniques – lifting, carrying, pulling, pushing, palletizing and stocking. Occupational diseases due to physical and chemical agents. **8**

## **Unit-V**

Maintenance Management, production maintenance system, objectives and functions, forms, policy, planning, organization, economics of maintenance, manpower planning, materials planning, spare parts planning and control, evaluation of maintenance management. **8**

## **References**

- 1) Industrial Safety Handbook : William Handley
- 2) Introduction to Safety Engineering : David S Gloss & Miriam GayleWardle
- 3) Industrial Safety : Roland P Blake
- 4) Industrial Hazard & Safety Handbook : Ralph King & John Magid
- 5) Occupational Safety Management & Engg. : Willi Hammer
- 6) Recognition of Health Hazards in Industry : William A Burgess
- 7) Hunters disease of occupation : Dr. Hunter
- 8) Health and Safety in Welding and allied process :N C Balchin,Jaico publishers
- 9.Management of systems – R.N. Nauhria & R. Prakash.

## Unit I

**Introduction** : Brief history, robot terminology, classification, characteristic, physical configuration, structure of industrial robot. Robot and Effectors: Types, mechanical grippers, other types of gripper, tools as end effectors, Robot/end effector interface, design consideration. 4

**Robot Motion Analysis & Control** : Introduction to manipulator kinematics, robot dynamics, manipulator dynamics, robot control, task planning. 5

## Unit II

**Sensors** : Transducers and sensors, sensors in robotics, tactile sensors, proximity and range sensors, miscellaneous sensors and sensor-based systems, use of sensors in robotics, touch sensors, force-torque sensors. 6

**Machine Vision**: Introduction, sensing and digitizing function in machine vision, image processing and analysis, vision system robotic applications. 3

## Unit III

**Programming** : Basics of robot programming, languages, commands, communications and data processing.

**Applications** : Welding, electro-plating, painting, spraying, assembling, material handling, inspection, Future applications. Introduction to design of robot in specific applications. 6

## Unit IV

Fundamentals of Manufacturing Automation: Basic Principles of automation, types of automated systems, degrees of automation, Automated flow lines. Automation for machining operations Design and fabrication considerations. Analysis of multi station assembly. 4

**Automated Material Handling**: components, operation, types, design of automated guided vehicles and applications. 2

**Automated storage / retrieval systems** - types, basic components and applications. 2

## Unit V

**Group Technology:** Part families, part classification and coding, machine Cell design, Benefits. Computer Aided Process Planning, benefits and limitations.

**Automated Inspection And Testing:** Automated inspection principles and methods sensors techniques for automated inspection-techniques for automated inspection-contact and noncontact inspection methods-in process gauging, CMM's, construction, types, inspection probes, types, and applications. Machine vision, LASER Micrometer and optical inspection methods.

6

**Reference Books:**

1. Industrial Robotics (Technology, Programming and applications) – Mc Graw Hill Editions
2. Robotics – An introduction - Douglas R. Malcolm. Jr -- Delmar Publisher Inc
3. Robot technology fundamentals - Saures G. Keramas - Delmar publishers
4. Fundamentals of robotics – analysis & control - Robert J. Schilling – (PHI) edition

