# U.P. TECHNICAL UNIVERSITY, LUCKNOW



# Syllabus

# [Subjects related to Manufacturing Technology]

3<sup>rd</sup> & 4<sup>th</sup> Year

[Effective from session 2010-11]

# **B. TECH. MANUFACTURING TECHNOLOGY**

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#### U.P. TECHNICAL UNIVERSITY, LUCKNOW Study and Evaluation Scheme B. Tech. Manufacturing Technology [Effective from Session 2010-11] YEAR III, SEMESTER-V

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S.	Course	SUBJECT	PE	RIO	05	SESS	SESSIONAL EXAM.			Subject	
NO.	Code		L	Т	Р	СТ	TA	Total	ESE	Total	Š
		THEORY									
1.	EHU-501	Engineering and Managerial Economics	3	1	0	30	20	50	100	150	3
2.	EMT-501	Design of Machine Elements	3	1	0	30	20	50	100	150	4
3	EMT-502	Work study & Ergonomics	2	1	0	15	10	25	50	75	3
4	EMT-503	Plant Layout & design	2	1	0	15	10	25	50	75	3
5.	EME-502	Theory of Machines-I	3	1	0	30	20	50	100	150	4
6.	EME-503	Manufacturing Science-II	3	1	0	30	20	50	100	150	4
7	EHU-111	*Human values & Professional Ethics	2	0	0	15	10	25	50	75	-
		PRACTICAL/TRAINING/PR	ROJE	СТ	•	•	•		•		
8	EMT-551	Design of Machine Elements Lab	0	0	2	10	10	20	30	50	1
9	EMT-552	Work study & Ergonomics lab	0	0	2	10	10	20	30	50	1
10.	EMT- 553	SEMINAR	0	0	3	-	50	50	-	50	1
11.	EME- 553	Manufacturing Science-II Lab	0	0	3	10	10	20	30	50	1
12.	GP 501	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	16	7	9	-	-	-	-	1000	26

NOTE : The Syllabus of Subjects with EME code are common to B.Tech. Mechanical Engg. course

#### U.P. TECHNICAL UNIVERSITY, LUCKNOW Study and Evaluation Scheme B. Tech. Manufacturing Technology [Effective from Session 2010-11] YEAR III, SEMESTER-VI

			1		E	valua	tion Sch				
S. No.	Course Code	SUBJECT	PE	RIOD	DDS SESSIONAL EXAM.		NAL M.	ESE	Subject	edits	
			L	Т	Ρ	СТ	ТА	Total		Iotal	Cre
	l	THEORY					•			l	
1.	EHU-601	Industrial Management	3	0	0	30	20	50	100	150	3
2.	-	Departmental Elective-I	3	1	0	30	20	50	100	150	4
3.	-	Departmental Elective-II	2	1	0	15	10	25	50	75	3
4.	EMT-601	Pneumatics & Hydraulics	3	1	0	30	20	50	100	150	4
5	EMT-602	Production Planning & Control	3	1	0	30	20	50	100	150	4
6.	EME-603	Theory of Machines- II	2	1	0	15	10	25	50	75	3
7	EHU-111	*Human values & Professional Ethics	2	0	0	15	10	25	50	75	-
		PRACTICAL/TRAINING/PRC	JECT								
8.	EMT-651	Pneumatics & Hydraulics Lab	0	0	3	-	50	-	-	50	1
9.	EME-653	Theory of Machines Lab	0	0	2	10	10	20	30	50	1
10.	EMT-652	Computer Assisted Manufacturing Lab	0	0	2	10	10	20	30	50	1
11.	EMT-654	Welding Technology Lab	0	0	2	10	10	20	30	50	1
12.	GP-601	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	16	6	9	-	-	-	-	1000	26
		Industrial Training-II of 4 – 6 weeks after VI semester will be evaluated in VII semester									

Note- 4 to 6 Weeks Industrial Training-II after VI semester also to be evaluated in VII semester Departmental Electives:

Department Elective - I

1.	EMT-011	Simulation & Modeling				
2.	EMT-012	Advanced Casting Process				
3.	EME-013	Product Development & Design				
4.	EME-014	Reliability Engineering				
5.	* EME604	Refrigeration & Air conditioning				
6.	EPI-601	Principles of Machines tool Design				
Department Elective - II						
1.	EMT-021	Tool Engineering				

2. EME-021 Non-Conventional Energy Resources & Utilization

- 3. EME-022 Advanced Welding Technology
- 4. EME-023 Optimization Techniques in Engineering
- 5. EME-024 Mechanical Vibrations
- Core in Mechanical Engineering

#### U.P. TECHNICAL UNIVERSITY, LUCKNOW Study and Evaluation Scheme [Effective form session 2011-12] B. Tech. Manufacturing Technology YEAR IV, SEMESTER-VII

						Evaluation Scheme			s		
S. No.	Course Code	SUBJECT	PE	Erio	DS	SESSIONAL EXAM.			ESE	Subject	redit
			L	Т	Ρ	СТ	TA	Total		Total	0
		THEORY									
1.	EOE071– EOE074	Open Elective-I**	3	1	0	30	20	50	100	150	4
2.	-	Departmental Elective-III	3	1	0	30	20	50	100	150	4
3.	-	Departmental Elective-IV	3	1	0	30	20	50	100	150	4
4.	EME-031	Computer Aided manufacturing	3	1	0	30	20	50	100	150	4
5.	EMT-701	Modern Manufacturing methods	3	1	0	30	20	50	100	150	4
6	EHU-111	*Human values & professional Ethics	2	0	0	15	10	25	50	75	
		PRACTICAL/TRAINING/PROJEC	T								
7.	EME-751	CAD/CAM Lab	0	1	2	10	10	20	30	50	1
8.	EMT-752	CNC Lab	0	0	2	10	10	20	30	50	1
9	EMT-753	Project	0	0	3	-	50	50	-	50	2
10	EMT-754	Industrial Training I & II Evaluation and viva-voce***	0	0	2		50	50	-	50	1
11.	GP 701	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	15	6	9	-	-	-	-	1000	26

**Note-**\*\*\*Practical Training-1 & 2 (4-weeks each) done after 4<sup>th</sup> & 6<sup>th</sup> Semesters would be evaluated in 7<sup>th</sup> semester through Report and viva voice etc.

\* Project should be initiated in  $7^{th}$  semester beginning, and should be completer by the end of  $8^{th}$  semester with good Report and power-point Presentation etc.

\*\* Open Electives - I 1. EOE-071 : Entrepreneurship Development

- 2. EOE-072 : Quality Management
- 3. EOE-073 : Operations Research
- 4. EOE-074 : Introduction to Biotechnology

Department Elective - III :

- 1. EME-701 Computer Aided Design
- 2. \*EME-702 Automobile Engg
- 3. EME-032 Project Management
- 4. EME-036 Management Information System
- 5. EMT-031 Production of gears & Screws

6. EMT-032 Advanced Metrology & Measurement

<u>Department Elective – IV:</u>

- 1. EME-041 Total Quality Management
- 2. EME-044 Tribology
- 3. EME-046 Concurrent Engineering
- 4. EMT-041 Artificial Intelligence in Manufacturing
- 5. EMT-042 Applied Electronics & Microprocessor
- 6. EMT-043 Logistics & Supply Chain management
  - \*Core in Mechanical Engineering

#### U.P. TECHNICAL UNIVERSITY, LUCKNOW Study and Evaluation Scheme [Effective form session 2011-12] B. Tech. Manufacturing Technology YEAR IV, SEMESTER-VIII

e						Evaluation Schen		ne		
No	Course Code	SUBJECT	PE	PERIODS		SESSIONAL EXAM.			ESE	Subject Total
-			L	Т	Р	СТ	TA	Total		iotai
		THEORY								
1.	EOE081- EOE-084	Open Elective-II**	3	1	0	30	20	50	100	150
2.	-	Departmental Elective - V	3	1	0	30	20	50	100	150
3.	-	Departmental Elective – VI	3	1	0	30	20	50	100	150
4.	EMT-801	Advanced Manufacturing Systems	3	1	0	30	20	50	100	150
7	EHU-111	*Human values & professional Ethics	2	0	0	15	10	25	50	75
PRACTICAL/TRAINING/PROJECT										
6.	EMT-851	Project	0	0	12	-	100	100	250	350
10	GP-801	General Proficiency	-	-	-	-	-	50	-	50
		Total	12	3	12	-	-	-	-	1000

\*\* Open Electives - II

- 1. EOE-081 : Non Conventional Energy Resources
- 2. EOE-082 : Nonlinear Dynamic Systems
- 3. EOE-083 : Product Development
- 4. EOE-084 : Automation and Robotics

Departmental Electives:

Department Elective-V

- 1. EME-051 Operations Research
- 2. EME-052 Maintenance Engineering & Management
- 3. EME-055 Six Sigma Methods & Applications
- 4. EMT-051 Mechatronics
- 5. EMT-052 Statistical Quality Control
- 6. EMT-053 Heat Treatment of Metals

#### **Department Elective-VI**

- 1. EME-061 Finite Element Method
- 2. EME-062 Non-Destructive Testing
- 5. EME-065 6. EMT-061
  - 65 Energy Management 61 JIT Manufacturing
- EME-063 Advanced Materials Technology 6.
  EME-064 Production & Operations Management
- Note: (1) The students who had taken Open elective EME-073 Operations Research in VII Sem. can not take the course EME-051 Operations Research as a Departmental Elective in VIII Sem.
  - (2) The students who had taken departmental elective EME 021 Non Conventional Energy Resources & Utilization in VI Sem. can not take the open elective course EOE-081 Non Conventional Energy Resources in VIII Semester.

# FUNDAMENTALS OF DESIGN:

Design Process - Computer aided design - Optimum design - Mechanical properties of materials - BIS system of designations of steel, plastics &rubbers. Types of loads - Stresses -Static, varying, thermal, impact and residue - Factor of safety -

DESIGN OF MACHINE ELEMENTS

Design against static load, modes of failure theories, Stress concentration factors -Preferred numbers.

Design against fluctuating load, Stress concentration, Stress concentration factors, fluctuating stress, fatique failure, Endurance limit, design for finite & infinite life, soberer & Goodman criteria.

#### UNIT II **DESIGN OF GEARS**

Design of gears – Spur, Helical, Bevel and Worm gears – Design of multistage speed reducers.

# UNIT III

# DESIGN OF BASIC MACHINE ELEMENTS AND JOINTS

Design of shafts, keys, couplings, journal bearings - Selection of rolling element bearings -Design of pin, riveted and welded joints - Screw fasteners - Power screws

#### UNIT IV **DESIGN OF ENGINE PARTS**

Design of piston - Connecting rod - Crankshafts - Flywheels

# UNIT V **DESIGN OF SPRINGS**

Design of Helical springs –Compression and tension – Leaf springs

#### References

- 1. V.B.Bhandari, "Design of Machine Elements", Tata McGraw-Hill Publishing Company Ltd, 1998.
- 2. R.S.Khurmi & J.K.Gupta, "A Text book of Machine Design" S.Chand & Company (Ltd), New Delhi, 2004.
- 3. Bernard J.Harmrock, B O Jacobson, "Fundamentals of Machine Elements", McGraw-Hill, 1999
- 4. Sharma C.S., Kamlesh Purohit, "Design of Machine Elements", PHI 2003
- 5. T.J.Prabhu, "Design of Transmission Elements", Mani Offset Printers, Chennai 2004.
- 6. Design of machines Eliments-Dr.Sharma & agarwal-Kataria
- 7. Machine design-Dr.R.karwa
- 8. Machine design-Dr. Shadu Singh
- 9. Machine design-shigley, TMH
- 10. Design of machines Elements-M.F.Sports
- 11. Machine design-Malvee&hortman

#### **EMT 501**

UNIT I

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#### WORK STUDY & ERGONOMICS

#### EMT-502

#### L T P: 3 1 0

#### <u>UNIT-I</u>

# Introduction

Introduction to industrial Engineering, productivity, measurement of productivity

#### UNITII

Introduction to work-study. The basic procedure of work-study. Work study for establishing the standard time for a given activity. Method study, procedure for Method study, Principles of motion economy, Filming techniques and micro motion analysis, recording technique. Construction of process chart, Gantt chart, SIMO chart, string chart, Travel chart, Multiple activity chart, Sampling process, Critical examination analysis. Primary, secondary and tertiary stages. Search for alternatives. Steps involved in evaluation of alternatives 8

#### UNIT III

Introduction to work measurement, objectives of work measurement, Techniques of work measurement. Basic procedure in time study. Advantages and limitations of time study. Time recording techniques in time study. Performance rating standard allowances, personal allowance, fatigue allowance, production delay allowance. Factors affecting the rating. Synthetic rating method.

# UNIT-IV

Work sampling, process of work sampling, predetermined motion time systems, standard data system, job evaluation and merit rating. work factor method. method time measurement system, basic, motion time study system Wages and incentive plans. relationship between wages productivity and cost. Case studies 8

## UNIT-V

Introduction to Ergonomics-Concept and scope of Ergonomics. Contribution of Ergonomics in System design and Management, Anthropometric principles in work space and Equipment design work space design for standing and seated workers. Assessment of human capabilities and limitations. Human physiological work capacity. Control And Displays psycho Physiological aspects of design.

#### **REFERENCE:**

1	А	ILO International labor organization	Introduction to work study	TATA McGraw Hill
2	В	M.E.Mundel	Motion and Time study	
3	С	R.M.Barynes	Motion and Time study	
4	D	E.S.Buffa	Modern production management	TATA McGraw Hill
5	E	Dr.A.K.Singh	Time and motion study	Jaico publishing houses
6	F	Dalela	Work study & Ergonomics	ТМН
7	G	Mc.Wick	Human factors in Engineering	

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# EMT503

# Plant Layout and Design

#### UNIT-I

1. **Introduction** : Meaning of plant layout, design-importance and scope. Planning for plant design. 03hrs

2. **Plant Location** : Levels of location problems, factors influencing location of a plant, theories of plant location. 03Hrs

#### UNIT\_II

3. **Industrial Buildings** : Relationship between building and the layout, building design and construction, ground and exterior facility. Building fundamentals. 04 Hrs

4. **Plant Layout and Planning** : Purpose and classes of plant layout problems. Classical types of layout, objectives of a good layout, data collection, material and processes, equipment requirement product flow, determining and diagramming the flow, space requirements, building data. 06 Hrs

# UNIT-III

5. **Developing and Presenting Layout**: Plot plans, detailed layouts, and visualizing layout. Evaluation of layout, cost comparison, pilot plant, productivity, space sequence demand, factor analysis, ranking pros. And cons. Optimising evaluation and line balancing. Checking, presenting and installing layout. 8 Hrs

#### UNIT-IV

6. **Materials Handling** : Principles, Classification of Material handling systems, product flow, and material handling equipments. Characteristics of different types of handling - conveyor's, cranes, trolleys and forklifts. 06 Hrs

#### UNIT-V

**7Employee Facilities** : Services, working conditions, influence of organisation and incentives. 06 Hrs

8. **Plant Services and Industrial Layout** : Electrical, water, sewage, compressed air and gases, steam and heating, and communication facilities. Hazards and prevention - prevention against noise, air and water pollution. Environment management plan. 06 Hrs

#### **REFERENCE** :

- 1. James Moore, "Plant Layout and Design", Macmillan Co.
- 2. Apple, "Plant Layout and Materials Handling"
- 3. Richard Muther "Practical Plant Layout", McGraw Hill
- 4. Richard Muther "Plant Engineering Handbook" McGraw Hill
- 5. Shubin and Madeheim, "Plant Layout" Prentice

# EMT551

#### **Design of Machine Elements Lab**

List of experiments

- 1. Design of coupling Rigid & flexible type
- 2. Design of riveted joints (under axial & eccentric loading)
- 3. Design of Welded joints (under axial & eccentric loading)
- 4. Design of cotter & knuckle joint
- 5.Design & Analysis of leaf & Helical springs under various loading
- 6. Design of Piston
- 7. Design of Connected rod/crankshaft,
- 8. Design of Spur gear under various loading
- 9. Design of Helical & bevel gear under various loading
- 10. Design of Screw Jack under various loading

11.Best practices in computer aided design of some of the above mentioned design using 3D Software.

# EMT 552

Work Study	& Ergonomics lab	L	ΓP
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# List of Experiments:

- 1. Method Study on Peg Board Assembly
- 2. Method Study on Bolt, Washer and Nut Assembly
- 3. Flow Process Chart [Man Type/Material Type]
- 4. Man-Machine Chart
- 5. Performance rating on walking using walking simulator
- 6. Performance rating on dealing cards
- 7. Estimation of standard time for peg board assembly
- 8. Work measurement experiment using MTM Tables
- 9. Time study on 5 amp plug assembly
- 10. Plant layout

EMT-601 : Pneumatics & Hydraulics	

#### UNIT 1 (Introduction to Fluid Power And Drives)

Fluid Power Systems – Application of fluid power – Properties of hydraulics fluids –

Hydraulics pumps – Characteristics – Pump Selection -, Hydraulics Actuators – Linear, Rotary – Selection – Characteristics – Cylinder Mountings, cushioning, pipe fittings.

# **UNIT 2 (Fluid Power Elements)**

Pressure control valves, flow control valves, directional control valves – working principle and construction, special type valves, servo valves, Cartridge valves Actuation methods, Shock absorbers – Accumulator – Symbol for fluid power elements.

## UNITIII

(Hydraulics Circuits) 8

Hydraulics circuits – automatic reciprocating circuit – speed control circuit - Meter in - Meter out – Sequencing Circuits – Synchronizing circuits

Accumulator circuit – Safety circuits – Hydraulic Motor braking System. Design of Hydraulic circuits.

# **UNIT IV (Pneumatic Systems)**

Pneumatic fundamentals Filter, regulator, lubricator, air motors, air cylinders, pneumatic valves, Basic Pneumatic circuits – Hydro Pneumatic Systems – air- oil cylinder, air – oil reservoir, air – oil intensifier and simple circuits.

# UNIT V (Fluid Logic Control)

Principle of fluid Logic control, Basic fluidic devices - Fluid sensors Fluidic circuits – sequencing control, continuous reciprocation, Electrical controls – electrical components – simple electro hydraulic/ pneumatic circuits. PLC application in fluid power control.

#### **References:**

1. 2. 3. 4. 5.	A B. C. D. E.	Fluid Power with applications Pneumatic Systems – Principles and Maintenance Oil Hydraulics Systems – Principles and Maintenance Industrial Hydraulics Fluid Power	Antony Esposito Mazumdar S. R Mazumdar S. R John Pipenger & Tyler Hicks Chandashekhara P. K.					
6.	F.	Automobile Engineering Vol. I	Kripal Singh					
EN	IT 60	PRODUCTION PLANNING & CONTR	<b>ROL LTP</b> 310					
Un	it-l	9						
Int of Pla	Introduction: Types and characteristics of production systems Objective and functions of Production, Planning & Control,							
Pr	Preplanning: Forecasting & Market Analysis. Factory Location & Layout,							

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Equipment policy and replacement. Preplanning production, capacity planning.

#### Unit-II

**Production Planning:** Material Resource Planning, Selection of material methods, machines & manpower. Routing, Scheduling and Dispatching. Types of charts and form used. Computer Aided Process Planning.

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#### Unit-III

**Production and Inventory Control:** Progress control through records and charts. Types of inventories, ABC analysis

Inventory Classification. Economic lot (batch) size. Trends in purchasing and store keeping.

#### Unit-IV

# **PRODUCT STANDARDIZATION &VALUE ENGINEERING**

Production standardization variety reduction. Use of Preferred numbers in standardization. Introduction &scope of value engineering. Evaluation of part function, cost and worth. Application of value engg methodology, simple value engineering case studies.

# UNIT-V

#### **PROJECT CONTROL**

Review of CPM&PERT, Concurrent engineering, Re-engineering, MRP and ERP.Introduction to manufacturing resource planning (MRP-II), Enterprise resource planning (ERP), case studies.

#### Books:

Elements of Production Planning & Control – Eilon Production Planning & Control – Jain and Agarwal Operations Management – Buffa. Production System – J.L. Riggs.

# PNEUMATICS & HYDRAULICS LAB

#### EMT 651

#### List of experiments

- 1. Study of the single acting & double acting hydraulic& pneumatic cylinders .
- 2. Study of symbols used in single and double acting hydraulic & pneumatic cylinders.
- 3. Study of constructional detail and performance characteristics of linear pumps.
- 4. Study of constructional detail and performance characteristics of rotary pumps.
- 5. Determination of viscosity index of hydraulic fluids by using redwood viscometer.
- 6. Study and operation of solenoid valves and relay timers.

7.To operate a single acting cylinder using 3/2 push button valves on a electro pneumatic kit

LTP 003

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8 To operate a single acting cylinder using 3/2 push button valves on a electro pneumatic kit

- 7. To operate a 5/2 pilot operated valve by using double acting cylinder on a electro pneumatic kit.
- 8. Design of Hydraulic/Pneumatic circuit of a single acting and double acting cylinders.

# COMPUTER ASSISTED MANUFACTURING LAB

# EMT 652

LTP 002

List of experiments

**1** Study & use of software for

Inventory control . Facility Design Process planning Production control.

2 Study of simulation software and applications in material flow.

- 3 Study of PDM software (SMART TEAM.PDM WEB) -Software Architecture -Check in/check out -Life Cycle -Work Flow -Material Data -Benefits
- 4 Study of Digital manufacturing Software(DELMIA) -Concept and Aim -Assembly -robotics -Plant Design -Ergonomics -NC Manufacturing

5 Creation & use a actual manufacturing database.

#### Suggested list of Softwares.

SIMPROCESS, GPSS, QUEST, SMARTEAM, DELIMIA, VMAP, MS-PROJECT, PROCOL, WINMAN, SEER etc.

#### EMT-654

# Welding Technology lab

LT P 002

- 1. Making of welded joints using conventional welding processes arc welding
- 2. Making of welded joints using conventional welding processes -gas welding.
- 3. Making of at least one joint using TIG welding techniques
- 4. Making of at least one joint using MIG welding techniques.
- 5. Testing of welded joints as per BIS
- 6. Microstructure study of welded joints
- 7. Inspection of welded joints by dye penetration ultrasonic method.
- 8. study of different techniques used for inspection of welds
- 9. study of HAZ of welded joint

# CNC Lab EMT752

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#### List of experiments –

- 1. Write and execution of manual programming using ISO codes for machining of simple machine parts.
- 2. Write and execution of part Programme using G codes & M codes for Turning & Taper turning.
- 3. Write and execution of part Programme using G codes & M codes for Thread cutting operation.
- 4. Part programming using canned cycle for various machining operations.
- 5. Writing a part programming (In word address & in APT) for a job for drilling operation (point to point) and running the on NC machine
- 6. Writing a part programming (In word address & in APT) for a job for milling operation (contouring) and running the on NC machine.
- 7. Simulation of various machining operations using CAM packages.
- 8. Experiment on study of system device such has motors feed back devices.
- 9. Experiment on Study of various sensors used in factory.
- 10. Study & Experiment on measuring capabilities of CMM.

# UNIT-I PHYSICAL MODELING

Concept of system and environment, continuous and discrete system, linear and nonlinear system, stochastic activities, static and dynamic models, principles used in modeling, Basic simulation modeling, Role of simulation in model evaluation and studies, Advantages and Disadvantages of simulation. Modeling of systems, Iconic, analog & Mathematical Modeling. 8

# UNIT-II

# COMPUTER BASED SYSTM SIMULATION

Technique of simulation, Monte Carlo method, experimental nature of simulation, numerical computation techniques, calumnious system models, analog and hybrid simulation, feedback systems, Buildings simulation models of waiting line system, Job shop material handling and flexible manufacturing system. 8

# UNIT-III

# PROBABILITY CONCEPTS IN SIMULATION

Stochastic variables, discrete and continuous probability functions, random numbers, generation of random numbers, variance reduction techniques, Determination of the length of simulation runs, Output analysis. 8

# UNIT-IV

# SYSTEM DYNAMICS MODELING

Identification of problem situation, preparation of causal loop diagrams and flow diagrams, equation writing, level and rate relationship, Simulation of system dynamics model.

# **UNIT-V**

# VERIFICATION AND VALIDATION

Design of simulation experiments, validation of experimental models, testing and analysis. Simulation languages comparison and selection, study of SIMULA, DYNAMO, STELLA, POWERSIM. simulation software.

# Suggested Reading

- Gorden G., System simulation, Printice Hall.
- Payer T., Introduction to system simulation, McGraw Hill.

Advanced 14

- spuet, Computer Aided Modeling and Simulation, W.I.A.
- Sushil, System Dynamics, Wiley Eastern Ltd.
- Shannon R.E., System simulation, Prentice Hall.
- Allan Carrie, "Simulation and Modeling" McGraw Hill.

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**Casting Processes** 

# UNIT-I

1. **Production of Moulds and Cores** : Mould production - equipment for moulding, moulding technique - pattern utilisation, hand and machine compaction, machine moulding, mould drying and hardening. Cores and core making - core boxes, compaction, core hardening, closing of moulds. 06 Hrs UNIT-II

# 2. Melting and Pouring :

Melting Practice : Classification of melting furnaces, brief description of construction and operation of various furnaces - cupola and its design, electric arc furnaces, electric induction furnaces. Melting charge, melting conditions, melting losses, special melt treatment, melt quality control and recent development in metal melting.

Pouring : Metal temperature, pouring equipment and techniques. 8 Hrs UNIT-III 8 hrs

# 3. Details Study of Following Casting Techniques :

- i) Shell moulding Basic operation, production systems, characteristics of shell moulded casting and D-process.
- ii) Investment Casting expandable pattern process. Pattern production, investment, pattern removal and firing, casting. Factor influencing casting quality characteristics of precision investment casting. Investment casting from permanent casting.
- iii) Die-casting Gravity die-casting, pressure-die casting, die-casting machines, casting techniques, characteristics of die castings.
- iv) Centrifugal casting Fundamental principles, methods production techniques, characteristics of centrifugal casting.

#### UNIT-IV

4. **Solidification of Castings** : Crystallization and development of cast structure -Nucleation, Growth and dendrite growth, independent nucleation, eutectic freezing, paratactic relations, structure of castings - significance and practical control cast structure, grain shape and orientation, grain size, refinement and modification of cast structure. Concept of progressive and directional solidification, solidification time and derivation of Chvorinov's equation influence of mould characteristics and cast metal. Properties on solidification, process numerical methods for heat flow analysis. 10 Hrs UNIT-V

5. **Feeding of Castings** : Feeding characteristics of alloys, geometric influences on solidification. Methods of the feeding of castings - cost and concept of yield, orientations, gating technique, casting temperature and pouring speed, design and location of feeder heads. Aids to feeder head efficiency, junction of feeder head and casting, use of padding, chills and insulators. 10 Hrs

# **REFERENCE** :

- 1. Beeley P.R., "Foundry Technology" (Buttersworth)
- 2. Heine and Rosenthal, "Principles of Metal Cutting" (TMH)
- 3. "Metal Casting" ASME Handbook
- 4. P.C.Mukherji, "Metal Casting Technology" PRINCIPLES OF MACHINE TOOL 15

DESIGN

L T P 3 1 0

#### EPI-601

Unit-I

**Introduction:** Developments is machine tools, types of machine tools surface, profits and paths produced by machine tools. Features of construction and operations of basic machine tools e.g. lathe, drill, milling shapes and planers, grinding machine etc. General requirement of machine tool design. Machine tool design process. Tool wear, force Analysis. 9

# Unit-II

Machine Tools Drives: Classification of machine tool drives, group Vs individual drives, Selection of electric motor, A brief review of the elements of mechanical transmission e.g. gear, belt and chain drives, slider-crank mechanism, cam mechanism, nut & Screw transmission, Devices for intermittent motion, reversing & differential mechanisms. Couplings and clutches Elements of hydraulic transmission system. e.g. pumps, cylinder, directional control valves, pressure valves etc. Fundamentals of Kinematics structure of machine tools. 8

#### Unit-III

**Regulation of Speed and Feed rates:** Laws of stepped regulation, selection of range ratio, standard progression ratio, selection of best possible structural diagram, speed chart, Design of feed box, Developing gearing diagrams. Stepless regulation of speed and feed in machine tool, speed and feed control.

# Unit-IV

**Design of Machine Tool Structure:** Requirements and design criteria for machine tool structures, selection of material Basic design procedure for machine tool structures, design of bed, column and housing, Model technique in design. 3

Design of guideways and power screws: Basic guideway profiles, Designing guideway for stiffness a wear resistance & hydrostatic and antifriction guideways. Design of sliding friction power Screws. Design of spindlier & spindle supports. 3 2

Layout of bearings, selection of bearings machine tools

#### Unit-V

Dynamics of machine tools: General procedure for assessing the dynamic stability of cutting process, closed loop system, chatter in machine tools. 5

**Control Systems:** Functions, requirements & types of machine tool controls, controls for speed & feed change. Automatic and manual Controls. Basics of numerical controls. Machine tool testing. 3

Books:

Machine Tools Design & Numerical Controls – N.K. Mehta, T.M.H. New Delhi. Design of Machine Tools – S.K. Basu Allied Publishers. Principles of Machine Tools, Bhattacharya A and Sen.G.C. New Central Book Agency.

# EMT021: Tool Engineering

Unit I

# General Considerations:

Tool classification, Tool materials, properties & applications, Tooling economicsGeneral design considerations, Safety aspects.6

Unit II

# **Design Of Metal Cutting Tools:**

Design of single point cutting tool for strength & rigidity. Design for optimum geometry. Design strategies for H. S. S, Carbide and Ceramics chip Breakers, Design of form tool.

**Multipoint cutting tool:** Design of drills, reamers, milling cutters, broach & gear cutting tools. 9

#### Unit III

# Design Of Metal Working Tools:

Design of press working tools, shearing, piercing, blanking, dies, compound die design, progressive dies, bending, forming drawing dies. Tooling for Forging-Design principles for forging dies, Drop forging, upset forging. Design principles and practice for rolling, Roll pass Design. 10

# Unit IV

**Design Of Jigs And Fixtures:** Principles of location and clamping, locating & clamping, materials for locating and clamping elements, Drilling bushes. Design of various **j**igs & fixtures. 7

#### Unit V

**Design Of Gauges And Inspection Features:** Design of gauges for tolerance for dimensions and form inspection.

**Dies And Mould Design For Plastics & Rubber Parts:** Compression moulding, transfer moulding, blow moulding. 8

#### Suggested Books:

- 1. Fundamentals of Tool Design Wilson ASTME
- 2. Tooling for production parron
- 3. Tool Design Donaldson T.M.H.
- 4. Die Design Handbook Paqwin J.R. The Industrial Press, NY
- 5. Die Design Hand Book by ASTME/ McGraw Hill
- 6. Metal cutting & Cutting Tool Design Archinov MIR Publishers Moscow Introduction to Jig and Tool Design M. H. A. Kempster FLBS

# EMT – 701 : Modern Manufacturing Methods

# L T P 3 1 0

#### UNIT-I

 INTRODUCTION: History, Classification, comparison between conventional and non-conventional machining process selection.
 02 Hrs
 2.MECHANICAL PROCESS: Ultrasonic machining(USM): Introduction, Equipment, tool materials & tool Size, Abrasive slurry, Cutting tool system design:-Magnetostriction assembly, Tool cone(Concentrator), Exponential concentrator of circular cross section & rectangular cross section, Hallow cylindrical concentrator. Mechanics of cutting:-Theory of Miller & Shaw., Effect of parameter:-Effect of amplitude and frequency and vibration, Effect of grain diameter, Effect of applied static load, Effect of slurry, Tool & work material., USM process Characteristics:-Material removal rate, tool wear, Accuracy, surface finish., Applications, Advantages & Disadvantages of USM UNIT-II

- ABRASIVE JET MACHINING(AJM): Introduction, Equipment, Variables in AJM:-Carrier Gas, Type of abrasive, Size of abrasive grain, velocity of the abrasive jet, Mean No. abrasive particles per unit volume of the carrier gas, Work meterial, stand off distance(SOD), nozzle design, Shape of cut. Process characteristics-Material removal rate, Nozzle wear, Accuracy & surface finish. Applications, Advantages & Disadvantages of AJM 04Hrs
- 4. ELECTORCHEMICAL AND CHEMICAL METAL REMOVAL PROCESS:-

Electrochemical machining(ECM): Introduction, Study of ECM machine, Elements of ECM process:-Cathode tool, Anode work piece, source of DC power, Electrolyte. Chemistry of the process, ECM process characteristics-Material removal rate, Accuracy, Surface finish., ECM Tooling:-ECM tooling technique & example, Tool & insulation materials, Tool size Electrolyte flow arrangement, Handling of slug., Economics of ECM, Applications such as Electrochemical turning, Electrochemical Grinding, Electrochemical Honing, deburring, Advantages, Limitations. 5 Hrs

- CHEMICAL MACHINING(CHM): Introduction, Elements of process, Chemical blanking Process:-Preparation of workpiece, preparation of masters, masking with photo resists, etching for blanking, Accuracy of chemical blanking, Applications of chemical blanking, chemical milling(Contour machining):- Process steps-masking, Etching, process characteristics of CHM:- material removal rate accuracy, surface finish, Hydrogen embrittlement, Advantages & application of CHM. 05 Hrs
- 6. THERMAL METAL REMOVAL PROCESSES: Electrical discharge machining(EDM)-introduction, machine, mechanism of metal removal, dielectric fluid, spark generator, EDM tools(electrodes) Electrode feed control, Electrode manufacture, Electrode wear, EDM tool design: Choice of machining operation, electrode material selection, under sizing and length of electrode, Machining time. Flushing-Pressure flushing, suction flushing, side flushing, pulsed flushing synchronized with electrode movement, EDM process characteristics: Metal removal rate, Accuracy surface finish, Heat affected Zone. Machine tool selection, Application: EDM accessories /applications, electrical discharge grinding, Travelling wire EDM.

#### UNIT-IV

10. **PLASMA ARC MACHINING(PAM):** Introduction, equipment non-thermal generation of plasma, selection of gas, Mechanism of Metal removal, PAM parameters, Process characteristics. Safety precautions, Applications, Advantages and limitations. 05 hrs

#### UNIT-V

11. **Derived and Hybrid Modern manufacturing Methods**:Introductionof process like rotary ultrasonic machining, electro stream drilling, shape tube eletro machining, wire electro discharge machining, electro chemical grinding, electro chemical honing, electro chemical deburring and electro chemical spark machining. 8

#### **REFERENCE** :

- 1. Production Technology, by HMT TATA McGraw Hill.
- 2. Modern machining process by PANDEY AND SHAH, TATA McGraw Hill
- 3. New technology by BHATTACHARAYA
- 4. Modern Machining Process by ADITYA.

# PRODUCTION OF GEARS AND SCREWS

#### EMT 031

#### Unit I

#### INTRODUCTION TO GEARS

Types of gears, classification, gear drawings, gearboxes, application of gears, gear production methods, an overview.

#### **GEAR MATERIALS**

Non-metallic, ferrous and non-ferrous gears. Properties of gear materials, selection of material for typical gears and applications – blank preparation methods for different gears, size, type and material. **7** 

#### Unit II

# **PRODUCTION OF GEARS & SCREW THREADS**

Gear milling different gears, cut quality obtainable. Gear hobbing, description and operation of machine, types of gears cut, hobbing cutters, work holding methods gear shaping, disc type and rack type gear shapers, Production of straight bevel gears and spiral gears, milling, generation by straight bevel gear generator. Duplex cutter, straight bevel gear generator, Spiral bevel gear generator.

**PRODUCTION OF SCREW THREADS:** Screw thread terminology, Types of screw thread, Methods of producing screw threads, Effect of pitch errors, measurement of various elements of screw threads. Thread rolling, Thread Grinding, Mass Production of Screws.

12

7

8

#### Unit III

#### HEAT TREATMENT OF GEARS

Through hardening, case hardening, flames hardening, induction hardening of gears, Nitriding of gears. Tuft riding of gears. Inspection of gears for hardening defects

#### **GEAR FINISHING**

Gear finishing advantages, finishing of gears by grinding, shaving, lapping, honing methods and cold rolling of gears. Description of machines, process and process parameters

Unit IV

# **GEAR INSPECTION**

Types of gear errors, gear quality standards tooth thickness and base tangent length measurement, pitch errors, radial run out errors, profile errors, pitch error measurement. Composite error measurement. Computerized gear inspection centers. Reasons and remedies for gear errors

#### UNIT V

#### **MODERN GEAR PRODUCTION METHODS**

Gear production by stamping, die casting, power metal process, injection and compression Moulding in plastics. Die casting, cold and hot rolling, mass production methods shear speed shaping. Gear broaching – Gleason. G-Trac Gear generation method

#### References

- HMT, "Production Technology "TMH, INDIA 1992 1
- 2 Week, M "Handbook Tools" Vol 1, Jhon Wiley and Sons 1984
- Society of Manufacturing engineers, Gear Priocessing and Manufacturing", 2<sup>nd</sup> Edition 1984 3

#### EMT-032 : ADVANCED METROLOGY AND MEASUREMENT

ТР L 3 1 0

#### METROLOGY

#### UNIT-I

(6)

(8)

- Computer Aided Metrology Principles and interfacing, software metrology.
- Laser metrology Applications of Lasers in precision measurements Laser • interferometer, speckle measurements, Laser scanners. Introduction to Nanometrology.

#### UNIT-II

Coordinate Measuring Machine – Types of CMM – Probes used – Applications – ٠ Non-contact CMM using Electro optical sensors for dimensional metrology -Non-contact sensors for surface finish measurements.

#### MEASUREMENT

#### **UNIT-III**

Basic functional elements and classification of instruments. Basic concepts like sensitivity, threshold, resolution, precision and accuracy, linearity, zero drift, sensitivity drift, etc. Relation between concepts.

#### UNIT-IV

(6)

Definition for source of error and methods of minimizing for eliminating the effects of error sources like friction, play, temperature, loading error, etc. Error and least count through four-quadrant diagram.

Uncertainty of measurements, static calibration, Error in computed value and rounding -off procedure. (10)(10)

UNIT-V

Dynamic characteristics of zero- order, first-order, and second-order instruments for step, ramp, sinusoidal and impulse inputs. Signal conditioners like bridge circuit, amplifiers, and low pass filter and radio telemetry. Analysis of random signals. Measurement of quantities like displacement, velocity, acceleration, force, torque, temperature, pressure, vacuum, sound, flow, and level. (10)

#### **Text Books / References:**

1.Parsons. S. A. J. Metrology and 20Gauging, MacDonald and Evans, UK, 1970 2. Hume K. J., Engineering Metrology, Kalyani Publishers, India, 1970.

**3.** Rembold et al. U, Computer Integrated Manufacturing Technology and Systems, Marcel Dekker Inc., USA, 1985.

**4.** Robinson S. L. and R. K. Miller, Automated Inspection and Quality Assurance, Marcel Dekker, 1989.

5. Galyer J. and C. Shotbolt, Metrology for Engineers, Cassel, London, 1980

6. Doebelin E. O., "Measurement Systems-Application and Design", McGraw Hill, 1990

7. Raman R., "Principles of Mechanical Measurements" Oxford & IBH, 1992.

8. Holman J. P., "Experimental Methods for Engineers", McGraw Hill, 1966.

9. Beckwith, T. G., and Buck N. L., "Mechanical Measurements", Addison Wesley, 1965.

## EMT-041

# ARTIFICIAL INTELLIGENCE IN MANUFACTURING

## UNIT I

Artificial Intelligence - Definition - Components - Scope - Application Areas; Knowledge -Based Systems (Expert Systems) - Definition - Justification - Structure -Characterization.

# UNIT II

Knowledge Sources - Expert - Knowledge Acquisition - Knowledge Representation - Knowledge Base - Interference Strategies - Forward and Backward Chaining.

# UNIT III

Expert System Languages - ES Building Tools or Shells; Typical examples of Shells. Expert System software for manufacturing application in CAD, CAPP, MRP, Adaptive Control.

# UNIT IV

Robotics, Process control, Fault diagnosis, Failure Analysis; Process Selection, GT etc. Linking expert systems to other software such as DBMS, MIS, MDB.

# UNIT V

Process control and office automation. Case studies of typical applications in tool selection, Process selection, part classification, inventory control, Process Planning etc.

#### References

1. Artificial Intelligent Hand book, Jhon & Andrew Kusiak.

2. Artificial Intelligent, T. Barnold.

3. Introduction to Artificial Manufacturing Export system, Dan. W. Patterson.

# **Applied Electronics & Microprocessor**

# Unit-I

1. **Digital Logic Families and Comparison** : MSI logic - Multiplexers, Decoders, Adders, Subtractors, JK Flip Flops and Counters. D to A Converters, Counter type and successive approximation A to D Converters. (8)

# Unit-II

2. Semiconductor Memory - ROM, EPROM, RAMs. Magnetic Memory - Drum and disk type (4)

3. Display Devices - LED, LCD and CRO, Principles of Sampling and storage oscilloscope.

(4)

#### Unit-III

4. **Power Control** - SCR and Triac. Principles of converter, Inverter and choffer. Block diagrams of DC Motor and Induction Motor Control. (7)

# **Unit-IV**

#### 4. Introduction, Classification of Microprocessor and Applications :

**Organisation** : Organisation of 8085 and 8086 processors. Interrupts and addressing modes available. (8)

# **Unit-V**

**8085 Processor** - Instruction set, assembler directives, Assembly level programming - examples. Memory and I/O interfacing. (5)

Applications : Microprocessor for pressure, flow and temperature control, Introduction to stepper motor and Data Acquisition system. (4)

# **REFERENCES :**

1. Gaonkar, "Microprocessor Architecture programming and application," Wiley Eastern Ltd., New Delhi.

2. A.P.Mathur, "Introduction to Microprocessor", TATA McGraw Hill Pub. Co. New Delhi

3. Melvio, "Digital fundamentals"

# EMT-043 LOGISTICS AND SUPPLY CHAIN MANAGEMENT

**Unit-I** Introduction to Logistics: - Scope of Logistics, Logistics in the system Life Cycle, Need for Logistics Engineering, Related Terms and Definitions.

# EMT-043 LOGISTICS AND SUPPLY CHAIN MANAGEMENT

**Unit-I Introduction to Logistics: -** Scope of Logistics, Logistics in the system Life Cycle, Need for Logistics Engineering, Related Terms and Definitions.

**Unit-II Measures of Logistics: -** Reliability, Maintainability, Availability factors, Supply supports, Facility and Software Factors.

**System Engineering Process:** -Definition of Problem and Need analysis, System Feasibility Analysis, System Operational Requirements, Functional Analysis.

Supportability Analysis: - Processes, Methods, Tools and Applications.

**Unit-III Logistics in The Design and Development Phase:-** Design Process, Related Design Discipline, Supplier Design Activities, Design Integration and Reviews, Test and Evaluation.

**Logistics in The Production / Construction Phase:** - Production / Construction Requirements, Industrial Engineering and Operations Analysis, Quality Control, Production Operation, Transition from Production to user operation.

**Logistic in The Utilization and Support Phase:** - System / Product Support, TPM, Data Collection, Analysis and System Evaluation, Evaluation of Logistic Support Elements, System Modification.

**Unit-IV** Logistics in the System Requirement, Material Recycling and Disposal Logistic Management: - Logistic Planning, Development of a Work Breakdown Structure, Scheduling of Logistics Tasks, Cost Estimation and control, Organization for Logistics, Management and control.

**Unit-V Supply Chain Management:** - Overview, Managing the customer interface. Managing the supplier interface. Measures of Supply chain performance, Supply Chain links to operations strategy, Supply Chain Dynamics, Supply Chain Software, Supply chain management across the organization.

#### Reference Books: -

Logistics Engineering and Management-Benjamin S. Blanchard. Oneration Management-Lee J Kraiewski & P. Ritzman.

Note: - Each student has to submit chain supply scheme for 5-production units.

#### EMT801

#### Advanced Manufacturing Systems

L T P 3 1 0

#### PREAMBLE:

The contents of this course are designed to outfit the students with an overview of manufacturing systems through simulation.23Computerization of manufacturing

machines, materials handling and storage, and support functions like process planning, scheduling etc., has led to their inter linking as well as integration. It is aimed to familiarize the students with the different elements of the manufacturing systems, and tools and techniques used in their inter linking and integration.

# UNIT-I

• FUNDAMENTAL OF MANUFACTURING AND AUTOMATION: Manufacturing operations and automation strategies; Hard and soft automation. Transfer systems, automated flow lines, feeders, assembly and line balancing.

# [03 Hrs]

- FUNDAMENTAL OF COMPUTER AIDED MANUFACTURING: Introduction to CAD/CAM. N.C. Machine Tools; P, L and C type; CNC, DNC, Adaptive control. Manual part programming through simple examples; computer assisted part programming. [06 Hrs]
- UNIT-II
- AUTOMATED STORAGE AND MATERIALS HANDLING SYSTEMS: Automated materials handling (including AGV), storage and retrival systems; Robots and its applications in manufacturing. [6 Hrs]
- PROCESS PLANNING : Introduction to process planning (PP), Computer aided process planning (CAPP); scheduling; sequencing of manufacturing operations. [03 Hrs]
- UNIT-III
- **GROUP TECHNOLOGY (GT):** Introduction to coding and classification; Benefits of GT. [2 Hrs]
- **PRODUCTION ECONOMICS**: Kinds of costs, evaluation of capital investments, capital budgeting, break-even-analysis, make-buy decisions, evaluation of alternatives, discounted cash flow, equivalent comparison methods, depreciation.

[5 Hrs]

- UNIT-IV
- **MATERIALS MANAGEMENT:** Purchasing, distribution and inventory control, Inventory concepts; Material requirement planning; Just in time.

[3Hrs]

- **QUALITY MANAGEMENT:** Economics of quality assurance; Quality control; Process control, Control charts and acceptance sampling, concept of total quality management. [5Hrs]
- INTRODUCTION TO CONCURRENT ENGINEERING AND AGILE MANUFACTURING [3 Hrs]
- UNIT-V
- **FMS and CIMS** : Flexible manufacturing systems (FMS); FMS work stations; FMS planning and applications. Computer integrated manufacturing systems (CIMS); net work and data bases for manufacturing system. Simulation of Manufacturing systems. [10 Hrs]

# REFERENCE BOOKS :

- 1. Automation, Production Systems, & CIM by Grover; Prentice Hall
- 2. CAD CAM by C. McMahon and J.<sub>24</sub> Browne; published by Addison-Wesley.

- 3. Computer Aided Manufacturing by Chang, Wysk, Wang; Prentice Hall.
- 4. Agile Manufacturing by A. Gunsekaran; Elsevier.
- 5. Concurrent Engineering by Hartely J. R.; Cambridge, M. A.; Productivity by Press.
- 6. CAD/CAM by Grover and Zimmersl Prentice Hall.
- 7. Computer Integrated Manufacturing and Engineering by V. Rembold, B. O. Nanji and A. Storr; Addin-Wesley.
- 8. Theory and Problems in Production and Operations Management, S. N. Chang, Tata McGraw Hill, 1995.
- 9. Modern Production/ Operations Management, E. S. Buffa and R. K. Sarin, John Wiley International, 1994.

# EMT-051

# Mechatronics

#### UNIT-I INTRODUCTION

Introduction to mechatronics, systems, measurement systems, control systems, microprocessor-based controllers, The mechatronics approach, Problems. 03 Hrs **REVIEW OF TRANSDUCERS** 

Sensors and transducers, performance terminology, Displacement position and proximity, velocity & motion, Force, Fluid pressure, Liquid flow, liquid level, Temperature, Light sensors, Selection of sensors, Inputting data by switches, Problems. 05 Hrs **UNIT-II** 

# SIGNAL CONDITIONING

Signal conditioning, The operational amplifier, Protection, Filtering, Wheatstone bridge, Digital signals, Multiplexers, Data acquisition, Digital signal processing, Pulse moulation, Problems. 05 Hrs

# DATA PRESENTATION SYSTEMS

Displays, Data presentation elements, Magnetic recording, Displays, Data acquisition systems, Measurement systems, Measurement systems, Testing and calibration, Problems. 06 Hrs

#### UNIT-III

# PNEUMATIC AND HYDRAULIC SYSTEMS

Actuation systems, Pneumatic and hydraulic systems, Directional control valves, Pressure control valves, Cylinders, Process control valves, rotary actuators, Problems. 05 Hrs

# MECHANICAL ACTUATION SYSTEMS

Mechanical systems, Types of motion, Kinematics chains, Cams, Gear trains, Ratchet and pawl, Belt and chain drives, Bearings, Mechanical aspects of motor selection, Problems. 04 Hrs

#### UNIT-IV

# ELECTRICAL ACTUATION SYSTEMS

Electrical systems, Mechanical Switches, Solid-state switches, Solenoids, DC motors, AC motors, Stepper motors, Problems. 07Hrs

# UNIT-V

# BASIC SYSTEM MODELS

Mathematical models, mechanical system building blocks, Electrical system building blocks, Thermal system building blocks, Problems. 07 Hrs **REFERENCE :** 

1. Mechatronics - W. Bolton, 2 Ed. Addison Wesley Longman, Pub, 1999 (Delhi)

2. Mechatronics by HMT, TMH.

- 5. Introduction to Robotics Mechanics and Control, Third Edition, John J. Craig ISBN 0201-54361-3: Prentice Hall
- 6. 4.Analytical Robotics and Mechatronics, Wolfram Stadler, ISBN 0-07-060608-0, McGraw-Hill

## EMT-052

# STATISTICAL QUALITY CONTROL

LTP 3 1 0

5

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#### Unit-I

Introduction:

Concept and evoluation of quality control Measurement & Metrology, Precision vs accuracy. Process capability, standrdisation & Interchangeability. 3

#### Inspection and Gauges:

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

# 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-charts, 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. 8

# Unit-IV

#### **Reliability:**

Introduction to reliability, bath-tub curve. Life expectancy. Reliability based design. Series & Parallel system.

# 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.

#### 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. 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. 3

#### Reference:

1. Statistical Quality Control by Grant and Leavarworth McGraw HIII.

2. Maintenance for Reliability by Rao.

# EMT-053

# **Heat Treatment of Metals**

#### UNIT-I

1. Introduction : Objective & advantages of heat treatment of metals .02 Hrs2. Fundamentals of Heat Treatment : Binary phased diagram, iron carbon equilibriumdiagram, heat treatment technology, heat treatment of cast iron, heat treatment of nonferrous metals. Heat treating of steel.04 Hrs

# UNIT-II

**3. Heat Treatment of Steel** : Principles of heat treating of steels, quantitative prediction of transformation hardening in steels, stress-relief heat treating of steel, normalizing of steel, annealing of steel, continuous annealing of steel, quenching of steel, tempering of steel, mar tempering of steel, austempering of steel, induction heat treating of steel, cold treating and cryogenic treatment of steel, heat treating of ultra high strength steels. Heat treating maraging steels, heat-treating of powder metallurgy steels, thermo mechanical processing of steels.

#### UNIT-III

4. **Heat Treating Equipment** : Types of heat treating furnaces salt bath equipment, fluidized-bed equipment, heat treating in vacccum furnaces and auxiliary equipment, heat resistant material for furnace parts trays and fixtures. Enery-efficient furnace design and operation - like batch type, box muffle, and salt bath furnace. 08 Hrs **UNIT-IV** 

5. **Surface Hardening of Steel** : Introduction of surface hardening of steels, flame hardening, laser surface hardening, electron beam surface hardening, gas carburizing, pack carburizing, liquid carburizing and cyaniding, vacuum, carburizing, plasma (lon) nit riding, gaseous and plasma nitro carburizing, bronzing (Bronizing), thermo-reactive, deposition/diffusion process, methods of measuring case depth. 10 Hrs

#### UNIT-V

6. **Process and Quality Control Considerations** : Temperature control, furnace and atmospheres, furnace atmosphere control, control of surface carbon contents in heat treating of steel. Evaluation of carbon control in processed parts. Defects and distraction in heat-treated parts. Statistical process control of heat-treated parts, statistical process control heat-treating operations. Computerized properties prediction and technology planning in heat treatment of steel. Furnace Safety. 08 Hrs

#### REFERENCE :

- 1. Zakheror, "Heat Treatment of Metals", MIR Publications.
- 2. Y.Lakhtin, "Physical Metallurgical and Heat Treatment", MIR Publications.
- 3. Donald Schark & W.R.Varney, "Physical Metallurgical for Engineering", East West Publication.

## EMT-061

# JIT Manufacturing Unit-I

1. **JIT** - An Introduction : Spread of JIT movement, the new production system research association of Japan, some definitions of JIT, core Japanese practices of JIT, creating continuous manufacture, enabling JIT to occur, basic element of JIT, benefits of JIT.

02Hrs

2. Modern Production System : Key feature of Toyota's production system, basic framework of Toyota production system.

Kanban System : other types of kanban's . kanban rules, adapting to fluctuations in demand through kanban, whirlging, determining the number of kanban's in Toyota production system, detailed kanban system example, supplier kanban and the sequence schedule for use by suppliers. 04Hrs

#### Unit-II

Production smoothing in Toyota production system - production planning, production smoothing, adaptability to demand fluctuations, sequencing method for the mixed model assembly line to realize smoothed production. Criticism to Toyota production system by the communist party of Japan. EDP system for support of the Toyota production system. Shortening lead time in Toyota production system - reducing the setup time. Automation in Toyota production system, some comparisons with other manufacturers. 8 Hrs

3. Global Implementation of JIT : JIT in automotive industry, JIT in electronics, computer, telecommunication and instrumentation, JIT in process type industry, JIT in seasonal demand industry, other manufacturing industries, JIT in service and administrative operations, conclusion 03Hrs Unit-III

4. Design, Development and Management of JIT Manufacturing Systems : Plant configurations and flow analysis for JIT manufacturing, comparison of JIT's "demand pull" system with conventional "push type" planning and control systems, quality management system for JIT, product design for JIT human resource management in JIT, flexible workforce system at Toyota, creation and maintenance of teams of JIT, union organisation and conduct of industrial relations in JIT, interface of JIT with advanced manufacturing technology, assessing performance in JIT manufacturing systems, product costing information systems in JIT manufacturing, an example of overhead allocation in JIT, potential for developing countries, potential for small manufacturing.

10 Hrs

#### Unit-IV

5. Supply Management for JIT : JIT purchasing-the Japanese way, some studies in JIT purchasing, experience of implementation organisations, surveys on JIT purchasing, buyer-seller relationship in JIT purchasing, quality certification of suppliers in JIT purchasing, monitoring supplier performance for JIT purchasing, audit in JIT purchasing, implementation of JIT to international sourcing, frequency of shipments, inventory policy, supplier reaction capability, quality, communication sole sourcing, delivery performance and supplier flexibility, conclusion. 10 Hrs Unit-V

6. Framework for Implementation of JIT : Implementation risk, risks due to inappropriate understanding of JIT, risks due to technical, operational and people problems, risks associated with kanban system, some important activities to be performed during implementation, steps in implementation, a project work to approach to implementation, conclusion. 05Hrs

#### **REFERENCE**:

- 1. M.G.Korgaonker, "Just in Time Manufacturing", Macmillan India Ltd.
- 2. Richard J. Schonberger, "Japanese Manufacturing Techniques" The Free Press -Macmillan Pub. Co. Inc. New York.