

**FIFTH SEMESTER****5SP1 DESIGN OF MACHINE ELEMENTS****SECTION-A**

Unit I : Introduction to M/c design, Design procedure, factors affecting M/c design, types of stresses in machine members compound stresses, theories of material failure. Factor of safety, properties and selections of material, designation of material as per I.S.I.; elementary ideas of inertia and thermal stresses.

Design of levers and threaded fastness. (12)

Unit II : Design of joints : Pin, Cotter, Knuckle, shrink friction rivetted and welded joints. (12)

**SECTION-B**

Unit III : 1. Design procedure for parts subjected to alternating, shock and impact loads. Stress concentration. Endurance limit.

2. Design of Helical, leaf and spiral spring.

3. Design of keys and splines. (12)

Unit IV : 1. Design of pressure vessels and pipes.

2. Design of shafts, spindle and coupling.

3. Design of columns and frames with direct and eccentric loading.

**PRACTICALS:**

1. Design of cotter joint.
2. Design of Knuckle joint.
3. Design of circumferential/longitudinal rivetted joint of boiler.
4. Design of springs in parallel of a buffer.
5. Design of rigid flange coupling.
6. Design of flexible coupling (Bush pin type)
7. Design of lever of a safety valve.
8. Design of eccentrically loaded bracket.
9. Design of pipe and pipe joints subjected to internal pressure.
10. Design of shaft carrying one pulley and supported in two bearing.

Atleast five exercises from above list, will consist the term work.

**REFERENCE BOOKS:**

1. Machine Design : Moliey, Hartman
2. Machine Design : Black
3. Machine Design : Shigley
4. Machine Design : Spott
5. Machine Design : Pandya, Shah
6. Design Data Books : a) Shivalkar, Kulkarni  
b) K.Mahadevan  
c) N.R.Chakrabarti
7. Machine Design : R.K.Jain

**5SP2 COMPUTERAPPLICATIONS IN PRODUCTIONENGINEERING****SECTION-A**

- Unit I : File system versus DBMS, an overview of DBMS, DBMS models, DBMS system architecture, databases in industrial applications. (6)
- Unit II : Data abstraction, instances & schemas, data independence, data models, database languages, database administrators, overall system structure. (6)
- Unit III : Relational database, Relational algebra, Relational calculus, modification of database views, database applications in CAPP. (6)

**SECTION-B**

- Unit IV : SQL - Basic structure, operations. Functions, relations, DDL & DML, Database applications in MRP. (6)
- Unit V : Relational database design, integrity constraints, triggers, normalization, shop floor data collection system. (6)
- Unit VI : Object Oriented Databases, applications, the object oriented data model, object oriented languages, persistent programming languages. (6)

**PRACTICALS:**

At least six practical shall be conducted based on industrial applications.

**REFERENCES:**

- 1) Jeffrey O. Ulman: Principles of Database Systems.
- 2) Naveen Prakash : Introduction to Database Management.

- 3) C.J.Date: An Introduction to Database Systems.
- 4) Korth : Database System Concepts.

**5 SP 3****TOOLENGINEERING-I****SECTION -A**

- Unit I : Mechanics of metal cutting : Common features of machining processes. Basic wedge action of cutting tools, mechanism of chip formation; type of chips. Concept of cutting speed, feed, depth of cut, shear angle, velocity relation, shear strain. Merchant theory of metal cutting, cutting forces and power, metal removal rate, energy consideration in metal cutting. (6)
- Unit II : Single point cutting tool : Classification, systems of nomenclature, design of single point tool, cutting speeds, feeds and tool angles, chip breakers, form tools, classification, design of flat & circular form tool, clamping arrangement of form tools. (6)
- Unit III : 1) Drills : Types, geometry of twist drill, cutting variables, and chip formation, forces and torque in drilling.  
2) Milling cutters : Conventional & climb milling, types of cutters, geometry of plain milling cutter, face milling cutter, machining process and cutting variables, force acting on plain milling cutter. Design considerations in milling cutter.  
3) Reamers : Types, tool geometry, tolerance, design considerations. (7)

**SECTION - B**

- Unit IV : Broaches : a) Cutting process in broaching, geometric elements of broach teeth, cutting variables in broaching classification of broach design of broaches, cutting forces in broaching.  
b) Gear Cutting Tools : (Different types) gear shaper cutter, gear hob and their geometry.  
c) Thread cutting tools : Geometry of tapes & dies.  
d) Tools for NC/CNC machines. (6)
- Unit V : Tool wear, tool life, machinability and coolants : Wear mechanism, type of tool wear and chipping of different tool material, tool failure criteria, direct and indirect. Tool life equation, effect of process parameters on tool life,

**APPENDIX-A**  
**FOUR YEAR B.E. DEGREE COURSE**  
**PRODUCTION ENGINEERING (SEMESTER PATTERN)**  
**SEMESTER : FIFTH**

L : Theory Lecture  
T : Tutorial  
P : Practical  
D : Drawing / Design

ABBREVIATIONS :-  
S - SEMESTER PATTERN  
M - MECHANICAL  
P - PRODUCTION

Sr. No.	Sub. Code No.	SUBJECT	Teaching Scheme			Examination Scheme									
			L	T	P/D	Theory				Practical					
						Total Hours/Week	Duration of Papers	Maximum Marks		Total	Min. Pass Marks	Maximum Marks		Total Marks	Minimum Passing Marks
								Theory (Hrs)	College Papers			External	Internal		
1.	5SP1	DESIGN OF MACHINE ELEMENTS	4	-	2	6	3	80	20	100	40	25	25	50	25
2.	5SP2	COMPUTER APPLICATIONS IN PRODUCTION ENGINEERING	3	1	2	6	3	80	20	100	40	25	25	50	25
3.	5SP3	TOOL ENGINEERING-I	3	-	2	5	3	80	20	100	40	25	25	50	25
4.	5SMP4	MEASUREMENTS SYSTEMS	4	-	2	6	3	80	20	100	40	25	25	50	25
5.	5SP5	DESIGN OF MATERIAL HANDLING SYSTEMS	3	1	-	4	3	80	20	100	40	--	--	--	--
6.	5SP6	MACHINE SHOP PRACTICE	-	-	4	4	-	--	--	---	--	--	25	25	12
<b>TOTAL</b>			17	2	12	31				500				225	
<b>GRAND TOTAL : 725</b>															
<b>SEMESTER : SIXTH</b>															
1.	6SP1	TOOL ENGINEERING-II	4	-	2	6	3	80	20	100	40	25	25	50	25
2.	6SP2	METROLOGY AND QUALITY CONTROL	4	-	2	6	3	80	20	100	40	25	25	50	25
3.	6SP3	CONTROL SYSTEM ENGINEERING	3	1	2	6	3	80	20	100	40	25	25	50	25
4.	6SP4	WORK STUDY	3	1	2	6	3	80	20	100	40	—	25	25	12
5.	6SP5	MACHINE TOOL DESIGN	4	-	2	6	3	80	20	100	40	25	25	50	25
6.	6SP6	INDUSTRIAL VISIT	-	-	-	-	-	-	-	-	-	-	25	25	12
7.	6SP7	COMMUNICATION SKILLS	2	1	-	3	2	40	10	50	20	15	10	25	12
<b>TOTAL</b>			20	3	10	33				550				275	
<b>GRAND TOTAL : 825</b>															

tool life tests-machinability, criteria for machinability, distribution of heat generated in metal cutting, functions of cutting fluids, types and selection of cutting fluid.

(6)

Unit VI : Tool materials and economics of machines : Properties and applications of various tool materials HSS, cast cobalt alloys, Carbides, ceramics, diamonds, UCON, CBN, Recent tool materials. Classification of carbides.

Component of machining costs, optimisation criteria, high efficiency zone, tool life for minimum cost of production and for maximum production rate.

Surface finish : effect of machining parameters, surface finish expression, cost of surface finish.

#### TERMWORK :

- 1) Measurement of forces on lathe tool dynamometer.
- 2) Drawing and design of single point tool.
- 3) Drawing and design of circular form tool for two jobs.
- 4) Drawing and design of flat form tools.
- 5) Design of broach.
- 6) Study of geometry of drill and reamer and measurement of axial thrust and torque by drill tool dynamometer.
- 7) Study of geometry of taps and dies.
- 8) Study of geometry of gear cutting tools.

#### BOOKS RECOMMENDED :

- 1) Metal Cutting Theory and Cutting Tool Design : MIR Pub. by Arshinov.
- 2) Fundamentals of Metal Cutting and Machine Tools by WFL, Juneja.
- 3) Metal Cutting Theory and Practice : Central Book Pub. by A. Bhattacharya.
- 4) Production Technology : PHI Astme.

#### PRACTICALEXAMINATION :

It consist of oral based on above term work.

#### 5SMP4 MEASUREMENTSSYSTEM

##### SECTION -A

UNIT I :- 1. Generalised measurement system:- significance of

measurement, generalised systems, application of measuring instruments, types of measuring instruments.

2. General configuration and functional elements of measuring instruments, types of inputs, various methods of correction for interfering and modifying inputs.

(6 Hrs)

UNIT II :- General performance characteristics:-

1. Static characteristics, different types of errors, combination of component errors in overall systems.
2. Dynamic characteristics: general mathematical model of zero order, first order and second order instruments, response of first and second order instruments to following inputs step, ramp, impulse and frequency.

(10 Hrs)

UNIT III :- 1. Strain measurement:-

types of strain gauges, strain gauge circuits, calibration, temperature compensation, use of strain gauges on rotating shafts, selection and installaiton of strain gauges.

2. Pressure measurements:-

basic methods of pressure measurement, manometers, transducers-elastic, gravitational, elastic : draph, strain gauge pressure cell, high pressure measurement Bridgeman type, low pressure measurement - Mcleod, Krudsen, ionisation, thermal conductivity gauges.

(8 Hrs)

##### SECTION - B

UNIT IV :- 1. Force measurement :- various mechanical, hydraulic, pneumatic and electrical methods.

2. Torque and power measurements :- various mechanical, hydraulic & electric methods.

3. Flow measurements : construction- Venturi, Orifice, Dall tube, rotameter, pressure probes- Pitot static tube, yaw tube anemometer, positive displacement flow meters, turbine meter, electro-magnetic flow meter. (8 Hrs)

UNIT V :- 1. Temperature measurements:- standards, various temperature measuring devices, bimetallic strip, liquid in glass thermometer, pressure thermometers, thermo couples, electrical resistance thermometers, thermistors,

radiation thermometers. (6 Hrs)

- Liquid level measurements :- various methods such as single float, displacement or force transducers, pressure sensitivity, bubbler or pipe system, capacitance variation type (for both conducting and non conducting type liquids) resistance variation type, radioisotope.

(2 Hrs)

- UNIT VI :-
- Speed measurements:- various mechanical type tachometers, electrical types tachometers, stroboscope etc.
  - Vibration measurements:- seismic, strain gauge and piezoelectric accelerometers.
  - Displacement measurements:- linear and angular displacement measurements, LVDT, LDR, capacitive & inductive pick ups. (8 Hrs)

**LIST PRACTICALS:-** Atleast of eight practicals from the following list.

- Measurement of strain using strain gauges.
- Calibration of pressure gauge with pressure gauge tester.
- Measurement of linear displacement by LDR and inductive pick-up transducers.
- Performance of capacitance transducer as an angular displacement measuring device.
- Performance of inductive transducers.
- Flow measurement.
- Speed measurement by a stroboscope.
- Speed measurement by magnetic pick up or photoelectric pick up tachometer.
- Pressure measurement by strain gauge type transducer.
- Vibration measurement.
- Liquid level measurement.
- Temperature measurement.

**REFERENCES:-**

- Measurement Systems:- By Ernest O. Doebeling - MC Graw Hill.
- Mechanical Measurements:- By T.G. Beckwith & N.L. Bulk - Addison Wesley.
- Experimental Methods for Engineers:- By J.P. Holman - Mc Graw Hill.

- Instrumental Measurement & Analysis : By Nakra Choudhari Tata Mc Graw Hill.
- Instrumentation : Ramgan: Sharma & Mani - Tata Mc Graw Hill.
- Mechanical Measurement & Control : By D.S.Kumar.
- Engineering Measurement : By Collette & Hope ELBS.

## 5 SP 5 DESIGN OF MATERIAL HANDLING SYSTEMS

### SECTION-A

- Unit I : Introduction, definition of material handling, its relationship with plant layout. Types of industries, related material handling equipment. Design of plant layout. Site selection for plant. (4)
- Unit II : Principles of mechanical handling, types of material handling equipments and their field of applications, selection and specification of equipments. Screw conveyor. Introduction, calculation of HP of motor used, characteristics and field of application of screw conveyers, determination of application of screw conveyers of salient dimensions and power requirements.
- Unit III : Belt conveyers : Introduction, types of drives used for belt conveyers, methods of maintaining belt tensions. Optimization of cross sectional area of belt conveyers supported on (a) two roller system (b) three roller system, determination of salient dimensions and power requirements.

### SECTION-B

- Unit IV : Types of cranes and their application : Electric Overhead Travelling (E.O.T.) cranes, types of EOT cranes and their application, design of mechanical system used for :  
 a) Cross travel of the crane,  
 b) Longitudinal travel of the crane and  
 c) Hoisting and lowering motion of the crane load.  
 Design of braking, system of various of EOT cranes, functions of limit switches used EOT cranes. (8)
- Unit V : Introduction, working principles, and field of applications of the following mechanical handling equipments (No mathematical treatment is contemplated)

- a) Pneumatic conveyers
- b) Hydraulic conveyers
- c) Escalators
- d) Robots in material handling. (4)

- Unit VI : A) Introduction, working principles and field of applications of following mechanical handling equipments. (No mathematical treatment is contemplated)
- 1) Ladle crant
  - 2) Electric lifts
  - 3) Skip hoists
  - 4) Fork lift trucks
  - 5) Winches
- B) Repairs and maintenances of material handling equipments and hazards with M.H.E. (6)

#### BOOKS :

- 1) Material Handling System Design : Lames Apple
- 2) Plant Layout and Material Handling : Lames Apple
- 3) Plant Layout and Material Handling : National Productivity Council
- 4) Material Handling Equipments : Alexandrov

#### 5 SP 6 MACHINE SHOP PRACTICE

##### PROJECT

#### TERMWORK :

Term work shall consists of minimum 2 composite jobs involving operations on the lathe, shaping, milling, drilling and slotting machine.

Each student shall submit details of operations, process analysis alongwith flow process charts for the jobs prepared and time estimation of each job in the form of journal.

#### PRACTICALEXAMINATION :

Practical examination shall consist of assessment of above term work and oral based on above term work.

#### SIXTH SEMESTER

#### 6 SP 1 TOOL ENGINEERING-II

##### SECTION-A

- Unit I & II : Jigs & Fixtures : Design economics, principles of locations,

types of location, preparation of jaming problem of chips & dust in location, use of dowels, redudant location, principles of clamping, types of clampes, power clamping drill bushes, types of drill jigs and their design, milling fixtures, turning fixtures, grinding & broaching fixtures, indexing devices in jigs of fixtures. (18)

- Unit III : a) Rolling : principle, classification of rolling mill, construction of rolling mill, layout of rolling mills, maximum permissible reduction in one pass, no. passes, roll pass design, box pass and oval pass, defects in rolling, sectional rolling passes, rolling torque of power.
- b) Extrusion : process fundamental; forward, backward, impact, hydrostatic extrusion, pressure required in extrusion. (8)

##### SECTION-B

- Unit IV & V : Press Tools : Classification of presses, shear action in die cutting operation, clearance, cutting forces, shear on punch and die, centre of pressure, classifications of cutting operation, operating of metals, drawing fundamental, types of die construction, function of nomenclature of die components, planning for cupping operation.

Miscellaneous dies : Horn die, cam action die, rubber & bulging, subpressing die. (18)

- Unit VI : Forging : process fundamental, classification & schedule of forging equipment, classification of forging process, type of forging product, perform stages & design of product for close die forging, shape of perform stages for class III forgings, strength of forged component, trimiting, mounting of dies, non classified forgings upset forging. (8)

#### TERMWORK :

- 1) Design of drawing of jigs & fixtures - 3 sheets
- 2) Design of drawing of press tools - 3 sheets
- 3) Design of drawing of forging dies - 1 sheet
- 4) Problem on roll pass design - 1 sheet

Above mentioned design work should be done by a batch of not more than ten students for each component.

**PRACTICALS :**

Shall consist of oral based on above syllabus &/or design & drawing of any tool out of the above term work, taken jointly by internal & external examiner.

**BOOKS RECOMMENDED :**

- 1) An Introduction Jig & Tool Design - EKBs, T.M.H.A., Kempster.
- 2) Jigs & Fixtures - P.H.Joshi, T.M.H.
- 3) Rolling Practice - Burtsev, MIR.
- 4) Techniques Press Working Sheet Metal - Eary, P.H. Inc.
- 5) Fundamentals of Tool Design - P.H.Astme.
- 6) Tool Design - Donaldson, T.M.H.
- 7) Manufacturing Technology - P.N.Rao, T.M.H.
- 8) Forging - Sharma.

**6 SP 2 METROLOGY AND QUALITY CONTROL****SECTION -A**

- Unit I : 1) Standards of measurements :  
principles of measurements, line and end standards, slip gauges, end bars, wave-length standards, classification of standards.
- 2) Interchangeability.  
Universal and local interchangeability, selective assembly, concept of limits, tolerance and allowances, types of fits and gauges.  
B.S. system and Indian standard specification for limits and fits, design of plain limit gauges and their manufacture.
- 3) Screw thread limit, fits, design of screw thread limit gauges.
- Unit II : Measuring instruments :
1. Linear measurements - length measuring instruments based on Vernier principle, Micrometers, Dial gauges.
  2. Comparators : various comparators such as mechanical, electrical, and electronic optical and pneumatic comparators, their principle of operation and application.
  3. Angular measurements :  
Vernier and Universal Bevel protractor, Sine bar, levels,

clinometers, optical dividing head. Angular slip gauges, taper gauges, autocollimeter.

4. Optical instruments :  
Projector, tool makers microscope, interferometers.

- Unit III : Measurements :
1. Screw thread measurement : measurement of elements of screw threads, major & minor pitch and effective diameters, errors in screw thread elements and their effects, external and internal screw threads.
  2. Gear measurements : inspection of gears for tooth thickness, measurement of tooth profile, pitch measurement, alignment error, master gear, Parkinson gear tester.
  3. Surface roughners : surface texture measurements and gauging, surface roughness in various manufacturing process.
  4. Geometrical features : flatness, squareness, roundness, cylindricity.
  5. Automated inspection : in process gauging and principle of co-ordinate measuring machine.

**SECTION -B**

- Unit IV : 1) Basic concepts of quality and quality control : fitness, for use, quality characteristics, parameters of fitness for use quality function, quality control, quality assurance.
- 2) Quality policies and objectives : the need for quality policies, formulation of quality policies, quality objectives for break through and control.
- 3) Quality costs : phases in quality cost program, discovering the optimum quality cost.
- 4) Process acceptance is product acceptance, advisory Vs. mandatory process, quality mindedness, quality control circles, vendor inspection, vendor rating, process capability study. (9)
- Unit V : Statistical quality control : importance of statistical methods in quality control, basic philosophy and principles of subgrouping, meaning of statistical control, variables and attributes, measurements and inspection, different types of control charts (X-R, MP, P and C charts) (8)

Unit VI : Acceptances sampling : sampling inspection, viz hundred percent inspection, basic concepts of sampling inspection, operating characteristics curve, conflicting interests of consumer and producer's producers and consumer's risk, AQL, LTPO, AOQL, Single and double sampling plans, acceptance/ rejections, acceptance rectification plans. (7)

### PRACTICALS :

Term work shall consist of six experiments based on the following:-

- 1) Design and drawing of atleast two types of limit gauges.
- 2) Study of comparators
- 3) Study of angular measurement
- 4) Study of screw thread measurement
- 5) Study of gear measurement
- 6) Study of flatness and squareness measurement

### BOOKS :

- 1) Metrology and Quality Control : R.K.Jain
- 2) Quality Control Hand Book : J.M.Juran
- 3) Statistical Quality Control : Grant
- 4) Statistical Quality Control : Gupta R.C.
- 5) Metrology : I.C.Gupta
- 6) Metrology and Measuring Instruments : M.R.Taher.
- 7) Engg. Metrology : K.W.B.Sharp,  
Sir Issac Pitman.
- 8) Statistical Quality Control : Grant E.L.,  
R.S.Leavenwogth.

## 6 SP 3 CONTROL SYSTEM ENGINEERING

### SECTION-A

Unit I : Introduction, system concept, open and closed loop systems, mathematical models, transfer functions, formalation of mathematical model of mechanical, hydraulic, thermal and simple electrical systems. Concept of block diagram, block diagram algebra, signal flow graphs. (8 Hrs.)

Unit II : Basic control actions : proportional, integral and PID controllers, principle of working and characteristics performance of control system and components for the

following types :- position, velocity, temperature, pressure, force, torque, flow level etc. (for mechanical, hydraulic, pneumatic and electrical systems). Study of important automatic speed systems in various prime movers. (8 Hrs.)

Unit III : Transient Response Analysis :- method of analysis transient and steady state response of first, second and higher order systems, impulse and step input responses. Transient response specification, steady state errors and error constant. (8 Hrs.)

### SECTION-B

Unit IV : Concept stability, necessary condition for stability, Rauths stability criterion, root locus concept, construction of root loci, systems with transportation lag. (8 Hrs.)

Unit V : Logarithmic and polar plots, Nyquist stability criterion; stability analysis, determination of system parameter from experimental results. (8 Hrs.)

Unit VI : Design and compensation techniques : introduction, preliminary design considerations; lead and lag compensations. (8 Hrs.)

### PRACTICALS :

At least six practicals shall be conducted based on the above syllabus.

### BOOKS RECOMMENDED :

- 1) Modern Control Engineering : Katsuhiko, Ogata Prentice Hall.
- 2) Automatic Control Engineering : Francis H. Raven, McGraw Hill
- 3) Control System Engineering : I.J.Nagrath & M.Gopal, Wesley Eastern.
- 4) Automatic Control System : Kuo B.C.
- 5) Automatic Control Introduction : Webb C.R.
- 6) Control System Engineering : Dorf R.C.

## 6SP4

## WORK STUDY

### SECTION-A

UNIT-I:- Defination of work study, objectives, brief history and evolution, work stud and productivity, problems in increasing productivity through work study, the human

factor in the application of work study. (8)

Unit II :- Classification of work study method study, definition, objectives and basic procedure, different techniques used in methods improvement, process chart symbols, process chart for operator of material process chart, process chart for assemblies, how diagram analysis and critical examinations of operation and development of Improved method. (8)

Unit-III :- Man machine charts, multiple activity charts, two handed charts. Introduction to menomotion and micromotion study, simochart, cycle graph, cronocycle graph, pre examination, installation and maintenance of improved methods. (6)

#### SECTION-B

Unit-IV :- Work measurement, definition, development, application basic procedure various work measurement techniques. Time Study :- Equipment, steps in making time study, breaking of an operation into elements, different rating systems, normal time, different types of allowances an standard time. (10)

Unit-V :- Work sampling :- Steps, applications, concept of sampling errors, confidence level, limitations, introduction to standard data and synthetic time study devices. Introduction of work study into organisation, criticism of time study, training of personnel in work study, introduction idea about incentives. (8)

Unit-VI :- Ergonomics :- man machine systems, display instrument, types of controls, relationship between control and display instruments. Working environment- effects of fatigue, noise, heat and lighting at work and its control. (8)

#### TERMWORK :-

- 1) Analysis of how of man, material and machine using how process chart for any work station.
- 2) Evaluation of assigning 'M' machine to 'N' operators using man machine chart.
- 3) Use of two handed process chart for an assembly operation.
- 4) Method study application.
- 5) Calculation of standard time for any work situation.

6) Design of work place using motion economy principle.

7) Design of environment for work station.

#### PRACTICALEXAMINATION :-

Shall consist of Viva-Voce based on above term work, taken by internal examiner.

- 1) Work Study by ILO
- 2) Work Study & Engg. by Dr.Dalela
- 3) Work Study by O.P.Khanna
- 4) Motion and Time Study by Barnes.
- 5) Motion and Time Study by Mundel.

#### 6 SP 5

#### MACHINE TOOL DESIGN

##### SECTION-A

Unit-I :- Design of spur, helical, bevel and worm gear drives design of belt and chain drives. (8)

Unit-II :- Design of clutches and brakes, journal bearing and lubrication, selection of ball and roller bearings. (8)

Unit-III :- General classification, general requirements of m/c tools, aim of speed and feed rate regulation, classification of speed and feed boxes, stepless regulation of speed and feed rates. (8)

##### SECTION-B

Unit-IV :- Design of speed and feed boxes :- stepped regulation of speed, break up of speed step, selection of best possible structure diagram, speed chart, design of feed box, determining the no. of teeth of gears. (8)

Unit-V :- Design of m/c tool structure :- Functions, and their requirements design criteria, materials used, profiles used, basic design procedure, guideways, slideways and antifiction ways, shapes and material used, method of adjusting clearance in slide ways, protecting devices for slide ways. Design of spindles. (10)

Unit-VI :- Regulation of speed in electrical control circuits, electrical circuits diagram for starting and stopping the motor of a m/c tool, electrical brakes, electromagnetic clutch, ferromagnetic power clutch, thermal relay in m/c tools, electrical automation in m/c tools. Acceptance test of lathe and drilling. (6)

**TERMWORK :**

- 1) Design of gear drive.
- 2) Design of clutches or breaks drive.
- 3) Design of belt or chain drive.
- 4) Design of gear box.
- 5) Design of electrical circuits.
- 6) Inspection and acceptance test.

**PRACTICALS :** Consists of term work based on above syllabus.

**BOOKS :**

- 1) Principles of Machine Tools by G.I.Sen and Bhattacharya.
- 2) Machine Tool Design, Vol. III by Acharken.
- 3) Machine Tool Design by N.K.Mehta.
- 4) Machine Tool Design by S.K.Basu & Pal.
- 5) Machine Tool Design by Nagpal.
- 6) Design of Machine Element by V.B.Bhandari.

**6 SP 6 INDUSTRIAL VISIT**

The students are expected to visit various types of industries and students are supposed to write and submit detailed report about one of the industry visited. (preferably a medium scale or large scale industry)

**6 SP7 COMMUNICATION SKILLS**

Unit I : **Comprehension over an unseen passage :-**

Comprehension - A - word study :-

Synonym, antonym, meanings, matching words, adjectives, adverbs, prefix and suffix, correct forms of commonly misspelled words, understanding of the given passage.

Comprehension - B - Structure study :-

Simple and compound sentences, types of conjunctions, singular and plural, tenses and their effect on verb forms. Use of - not only - but also, if clause, since, may, can, could, would, too etc.

Active and passive forms, negative and interrogative, punctuation and capitalization. (10 Hours)

Unit II : **Principles of Communication :-**

Theoretical background - importance of communication, its process, model of communication its components &

barriers.

Verbal communication, its significance, types of written communication and its style, organization of a text (Titles, summaries, headings, sequencing, signaling, cueing etc.), Important text factors (length of paragraph, sentences, words, clarification and text difficulty). Evaluation of written communication for its effectivity and subject content.

Verbal and non-verbal objectives in interpersonal skills. (10 Hours)

Unit III : **Aspects in professional communication :-**

Specific formats for written communication like - business correspondence, formal reports, technical proposals, research papers and articles, advertising and graphics. Format for day-to-day written communication like applications, notices, minutes, quotations, orders, enquiries etc.

Types of graphics and pictorial devices

Oral communications - face to face communications, group discussion and personal interviews.

Methodology of conduction of meetings, seminars, symposia, conference and workshop. (10 Hours)

**BOOKS RECOMMENDED :**

- 1) Krishna Mohan, Meera Banerjee : Developing Communication Skills, MacMillan India Limited.
- 2) Chrissie Wright (Editor) : Handbook of Practical Communication Skills, Jaico Publishing House.
- 3) Curriculum Development Centre, TTTI WR, Bhopal : A Course in Technical English, Somaiya Publication Pvt. Ltd.
- 4) F.Frank Candlin : General English for Technical Students, University of London Press Ltd.

**COMMUNICATION SKILLS LABORATORY**

**Objective :**

On completion of this laboratory the candidate should be able to demonstrate adequate skills in oral and written communication for technical English language, actively participate in group discussions and interviews and exhibit the evidence of vocabulary building. Candidates should be assessed through continuous monitoring and evaluation.

The sample list of experiments is given below. This list

can be used as guideline for problem statements but the scope of the laboratory should not be limited to the same. Aim of the list is to inform about minimum expected outcomes.

1. Assignments and tests for vocabulary building
2. Technical report writing
3. Group discussions
4. Interview techniques
5. Projects and tasks such as class news letter
6. Writing daily diaries and letters
7. Interactive language laboratory experiments.

**TEXT BOOK :** Norman Lewis : Word Power Made Easy  
<http://www.teachingenglish.org.uk>

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## SEVENTH SEMESTER

### 7SP1 PRODUCTION PLANNING AND CONTROL

#### SECTION-A

Unit-I : Introduction : objectives and advantages of PPC, production procedure, functions of PPC, production consumption cycle, centralised & decentralised PPC, Pre-requisites of PPC, types of PPC systems.

Scheduling : introduction, inputs of scheduling, loading and scheduling devices, factors influencing scheduling, procedure for scheduling, techniques of Scheduling.  
(8)

Unit-II : Production Forecasting : introduction, definition, importance of forecasts, qualitative model ; Delphi Technique, quantitative models : simple moving average, weighted moving average, simple exponential smoothing.

Forecasting error and selection of forecasting model. Types of Forecasts : constant, linear, cyclic forecasts.

Verification and Controlling : the moving range chart, average MR, out of control condition. (8)

Unit-III : Production Planning : the production order, procedure for formulating order production order, Master Programmer, Basic problems in production planning, quantities in batch production, criteria for batch size determination, minimum cost batch size, production Range, maximum profit batch size, maximum return, maximum rate of return, economic batch size. (8)

#### SECTION-B

Unit-IV : Machine Output : machine output, multimachine supervision by one operator, machine interference, Ashcroft tables, average number of consecutive servicing task, the Ashcroft Number. (8)

Unit-V :- Analytical Structure of Inventory : definition of inventory, types of inventory and its classification, structure of inventory problems and its analysis, the Relevant cost, objectives of carrying inventories, selective inventory analysis. (ABC analysis)

Static Model :- general characteristics, incremental analysis, opportunity cost. Cost of risk, decision criterias under uncertainty. (8)

- Unit-VI : A] Dynamic Model : Certainty Case : general characteristic, optimum lot size model with constant demand, quantity discounts.  
Risk case : general characteristics, 'P'system and 'Q' system.  
B] Material Requirement Planning (MRP) : introduction to MRP, manufacturing resource planning (MRP-II), just in time, comparison of MRP, MRP-II. (8)

#### BOOKS RECOMMENDED:

- 1] Elements of Production Planning and Control by Simuel Eilon Macmillan.
- 2] Production Control - John E Biegal - Prentice Hall
- 3] Production Management- Hedge - John Wiley.
- 4] Production Planning and Control and Management - K.C.Jain & L.N.Agrawal
- 5] Production Systems Planning and Analysis & Control - James L.Riggs.
- 6] Production Control - F.G.Moore-Mc Graw Hill
- 7] Inventory Control, Theory & Practice - Starr & Miller.
- 8] Scientific Inventory Management - Buchan & Kenigshery - Prentice Hall.
- 9] Production Planning and Control - L.C.Jhamb, Aaditya, Publishing House, Punne.
- 10] Production and Operations Management - Chunawala & Patel, Himalaya PUBlication House.
- 11] Production and Operations Management - A.Muhleman, J.Oakland & K.Lackyar, Mcmiollan India, Ltd.
- 12] Production and Operations Mgt. - E.E.Adam, Jr.R.J.Ebert - Prentice Hall of India.
- 13] Production Planning and Inventory Control - S.L.Narasimhan, D.W.Mcleavey, P.J.Billingten - PHI
- 14] Nair N.G : Production and Operation Management - Tata McGraw Hill Edition, 1997.
- 15] Cherry S.N. - Theory and Problems in Production and Operation Management, Tata McGraw Hill, Edition 1995.

#### 7SP2

#### COMPUTERAIDED DESIGN

##### SECTION-A

- Unit-I : Introduction to CAD/CAM, definition, applications, types of CAD systems, benefits of CAD, design process, application of computer for design, creating the

manufacturing data base, hardware in CAD.

- Unit-II : Computer graphics software and data base, graphics system and functions of graphics package, constructing the geometry, transformations, database structure and content, wire frame, surface and solid modeling.
- Unit-III : Computer aided drafting and documentation, principles and concepts of automated drafting, drafting packages, introduction to PC based and high end packages like Auto CAD and their applications.

##### SECTION-B

- Unit-IV : Interactive computer graphics for CAD/CAM applications, configuration of graphic work station, techniques of image generation and types of graphics terminals, colour monitors, input/output devices, animation concept in graphics, concept of virtual manufacturing and virtual reality.
- Unit-V : Graphics Standards : Introduction, standards for graphics programming GKS, data exchange formats, general file structure, IGES, product data based format.
- Unit-VI : Concurrent Engineering, introduction, concept, principles, traditional verses concurrent approach, schemes and tools of concurrent Engg., application of computers in practice of concurrent Engg., approach in manufacturing systems.

**LIST OF PRACTICALS:-** Atleast Six Practicals should be performed from the following :-

1. Drafting of basic geometrical shapes in a graphics package.
2. Drafting of Geometry by using Drawing aids like snap, grid, otho, limits, units and layer commands.
3. Study of Editing commands.
4. Study of dimensioning and tolerancing commands.
5. Generation of gear or cam profile in a graphics package.
6. Drafting of simple primitives.
7. Computer aided design of any machine element with C programming.
8. Computer aided design of cutting tool with C Programming.
9. Study of finite element analysis package.
10. Assembly drawing of machine element using graphics package.

#### BOOKS RECOMMENDED:-

1. Computer Integrated Design & Manufacturing by David Bedworht,

McGraw Hill.

2. CAD/CAM by Mickel Groover, PHI
3. Concurrent Design of Product and Processes, McGraw Hill.
4. CAD/CAM/CIM by P.RadhaKrishnan, New Age International
5. CAD/CAM by C.B.Basant, John Wiley & Sons.
6. CAD/CAM by Dr.Surendrakumar & Dr.Jha, Dhanpat Rai & Sons.

### 7SMP3 INDUSTRIAL MANAGEMENT & COSTING

#### SECTION -A

- UNIT -I : Business Management:  
 Meaning of business, Business system, Business organization, Forms of Business organization, Concept of management science, Evolution of management thought, Scientific management (Taylorism), Modern management (Fayolism), Principles of management, Administration Vs. Organisation, Functions of management, Planning & Decision making, Organisation structure & relationships, Delegation, Decentralization, Communication, Direction, Coordination, Motivation and Control. (8 Hours)
- UNIT -II : Marketing and Sales Management:  
 Marketing strategy, Market research, Buying motives, Types of markets, New product development, Product life cycle, Product presentation & its effect on consumer, Sales organisation, Advertising, Method of selling, Sales performance objectives.  
 International Marketing: Introduction to international marketing, International Marketing decisions, Practices & Problems of international marketing, Import & Export procedure. (8 Hours)
- UNIT III :- a) Functions of personnel management, Human resource planning, personnel research, Recruitment, training and development workers participation in management, joint consultation, collective bargaining.  
 b) Materials management, classes of materials, scope of material control, scope and function of purchasing department, purchasing procedure ,inventory control, ordering procedure, material identification, store function. (6 Hrs)

#### SECTION -B

- UNIT IV :- Objectives, functions, principle factors, miscellaneous and estimating procedure. Estimation of weights and materials, Estimation of machining time, estimation of fabrication cost, forging cost, foundary cost. (8 Hrs)
- UNIT V :- a) Introduction to costing and costing Techniques:-  
 Definetions, objectives, elements of costs, components of cost, job costing, simple process costing, normal and abnormal losses in process, waste, scrap. (6 Hrs)
- UNIT VI :- a) Financial statement :- Profit and loss statement , balance sheet.  
 b) Financing of bussiness :- Basis of bussines finance, need of finance, Kinds of capital, sources of fixed & Working captial.  
 c) Defreciation Analysis:- Causes & significance, method of calculation of deprecitation.

#### Books Recommended :-

1. Industrial Engineering & Management - O.P.Khanna.
2. Business & Ind. Organisation and Marketing Management- S.A.Sherlekar & V.S.Sherlekar.
3. Principles on Marketing Management- Philip Kotler.
4. Personnel Mqs & Ind. Relations - C.B.Mammoria.
5. Business Orgnisation - N.C.Shukla
6. Principles & Practice of Cost Accounting - N.N.Prasad.
7. Cost Accounting - Bhar.
8. Cost Accounting - Mehta.
9. Estimating and Costing - TTTI Madras.
10. Estimating & Costing - J.S.Chareya & G.S.Nainy.
11. Practical Costing - Khanna, Pandey, Ahuja & Arora.
12. Estimating & Costing -T.R.Banga & S.C.Sharma.

### 7 SP 4

### MECHATRONICS

#### SECTION-A

- Unit I : Introduction to Mechatronics  
 Scope of Mechatronics, Basics of sensors and transducers, Selection, Contact and non Contact, Optical types, performance, examples. Actuators, principle,

hydraulic, pneumatic, electrical, Contact speed, Multi speed, stepped and continuous variable, Actuator with stepping motor. (6 Hrs.)

Unit II : Computer Process Control

Computer process interface, interface hardware. Direct Digital control, Supervisory Computer Control. (6 Hrs.)

(Ref. APS & CIM by MP Groover)

Unit III : Design of Mechatronic elements

Measuring System, Control Software and user interface, Gauging, Tool Monitoring System, Spindle drives, feed drives, Servo principles, Configuration CNC System, Interfacing, Monitoring, Dignostics. (6 Hrs.)

#### SECTION-B

Unit IV : Automatic loading & unloading devices, their purpose, Magazines, Bunkers, Orientation, Mechanism Unit Heads, Automatic production lines. (6 Hrs.)

Unit V : Pneumatic System

Study of different control components of pneumatic system & their conversion valves, auxiliary devices, synchronizing, clamping, declamping etc. Application to robotics. (6 Hrs.)

Unit VI : Hydraulic System

Study of different control components of Hydraulic System, Valves and auxiliary devices, design and analysis of Hydraulic circuits sequencing, Synchronizing, Pneumohydraulic, CNC lubrication, Machine Tool Applications. (6 Hrs.)

#### PRACTICALS :

Practical based on above syllabus (Total 5 practicals.)

#### References :

- 1) Mechatronics by HMT, Tata McGraw Hill.
- 2) Introduction to Mechatronics & Measurement System by Michal B. Histan & David G.Aiciatore by McGraw Hill.
- 3) Automation, Production System and CIM by M.P.Groover, PHI
- 4) Automation by Maleev, MIR Publication.

5) Industrial Automation by Turgam, MIR Publication.

6) Pneumatics & Hydraulics by Steward.

7) CMTI Handbook by CMTI.

#### 7SP5

#### ELECTIVE

#### (I) MARKETING AND SALES MANAGEMENT

#### SECTION - A

Unit I : Market Management : marketing concept, market segmentation, characteristics, affecting consumer behaviour, marketing decision related to product, pricing policies. marketing control "Ratio analysis, Profit-volume relationship. (8)

Unit II : Marketing Research: importance and scope, the marketing research process, sources of information, techniques of marketing.

Motivation Research : the nature & importance of motivation research, techniques of motivation research.

Unit III : Export Marketing: composition of Indian exports, exports promotion agencies in India, exports procedure, export strategy for the future.

Rural Marketing : the profile of rural market of India, channel management, sales force management and marketing communication in rural markets. (8)

#### SECTION-B

Unit IV : Sales Management and Sales Personnel : sales organisation, setting salesforce objectives, selection, training and motivation of sales personnel. methods of salesforce control. (8)

Unit V : Advertising and Sales Promotion : advertising message creation, media selection, advertising budget, advertising evaluation, Importance of sales promotion, sales promotion techniques. (8)

Unit VI : Sales Forecast : importance, methods of sales forecasting, types of forecast, factors affecting sales forecast, relation between national income and sales forecast. channels of distribution : channel design decisions, factors affecting selection of channel, Relatiling and wholesaling. (8)

TERM WORK : Case study for minimum two local products context to :

- a) Marketing.
- b) Pricing.
- c) Sales personnel.
- d) Advertising.
- e) Channel of distributions.
- f) Sales forecast.
- g) Existing Market and future growth.

PRACTICAL : Viva-voce based on above syllabus,

**Reference Books :**

1. Marketing Management - An analysis, Planning and Control By Philip Kotler.
2. Principles of Marketing - By Philip Kotler.
3. Modern Marketing Management - By R.S. Dawar.
4. Fundamentals of Marketing - By W.J. Stamtion.
5. Marketing Management - By S. Namakumari.
6. Marketing & Higher Management - By Esmond Pearce.

**7SP5**

**ELECTIVE**

**(II) PLASTIC ENGINEERING**

**SECTION-A**

Unit I : Classification of Plastics , properties, applications and methods of indentification of thermosetting and thermoplastic materials. Additives and their effects on properties. (10)

Unit-II : Processing of plastics by compression transfer. Injection, extrusion, blow moulding, rotational moulding and calendering, reaction injection moulding (10)

Unit III : Casting, thermoforming, foaming, laminating, reinforcing, welding and heat sealing of plastics. (10)

**SECTION - B**

Unit IV : Injection Moulds : general mould construction feed system, nozzels, runners and gates injection systems, mould heating and cooling systems, types if injection muulds, multidylight moulds, runnerless moulds. (10)

Unit V : Compression Moulds : types: Positive, semipositive and flash type, general mould construction, ejection system,

mould heating and cooling system. Extrusion dies : Pipe/ tube, film/sheet and cable dies. (10)

Unit VI : Injection moulding machines, compression moulding presses extrudes, decoration of plastics, machining of plastics, adhesives for plastics, forging of plastics. Plastic composites fiber reinforced, sandwich & laminar composites, properties, strength & applications of these composites

TERM WORK :-

Design and drawing of injection moulds by a batch of not more than 4 students for each component in addition to above, students are expected to prepare industrial case study on any topic/area covered in the subject/syllabus. Practical examination consists of viva-voce based on above syllabus and term work.

**REFERENCE BOOKS :-**

- 1) Plastic Materials Hand Book, Vol-I & II - A.S. Atheley
- 2) Plastic Technology - W.J.Patton
- 3) Plastic Engineering - R.J.Crawford
- 4) Plastic - Harry dubois.
- 5) Plastics - N.J.Mills
- 6) Injection Moulding - A.S.Atheley
- 7) Injection Mould Design - R.G.W.Pye
- 8) Plastic Materials - J.A.Brydson
- 9) Extrusion Technology - Sidney Levy
- 10) Handbook of Polymer Composites for Engineers - Leonard Hollaway.
- 11) Machining of Plastics - A Kobayishi.

**7SP5**

**ELECTIVE**

**(III) ADVANCED WELDING TECHNOLOGY**

**SECTION - A**

Unit I : Types of weld joints, edge preparation, cleaning of edge, welding fixtures, track welding, arc welding, welding electrode, types of coverings, welding technique for manual welding (in MAW) Gravity welding, power supply for arc welding, arc cutting submerged arc welding, TIG and MIG arc welding CO<sub>2</sub> welding and plasma arc welding.

(8)

Unit II : Gas welding processes, equipments, filler metals, fuel gases, torches, filler metal, fluxes, Back hand, fore hand welding, welding rods, specification. Atomic hydrogen welding and thermal welding. Thermal cutting of metals : Oxygen cutting flame, cutability of metals, effect of cutting on structure and property of steel, oxygen lancing, machine cutting.

Welding of carbon steel and a alloy steel, C.I. welding, welding of non ferrous metals and its alloys, Copper, Aluminium, Brass, Magnesium, Nickle and their alloys.

(8)

Unit III : Soldering and brazing : capillary and wetting action, temprage, filler metals and fluxes, process and applications, design and strength of weld joint.

Resistance welding : spot welding, electrod magnet, size, resistance and force, current and time. Types of equipments : Rocker arm press, multiple welding gun and portable welders, applications, seam welding projection welding, flash welding, applications.

(8)

#### SECTION - B

Unit IV : Solid phase welding : cold pressure welding, weld formation, techniques for lop and butt welding, application, diffusion joining, friction welding, process, variables, applications force welding, Ultrasonic welding.

Nature of bond, velocity of impact, angle of contact and application.

(8)

Unit V : Radiation Welding : Laser welding, electron beam welding, types of electron gun, spot size, beam power, operation voltage, pulse techniques, deep penetration and application. Weldability : Design process and metalurgical considerations, testing and improvement of weldability. Welding defects and remedies. Heat treat of welds, flame hardening procedure and applications.

(8)

Unit VI : Inspection and testing of welds : destructive and non destructive test for welds tension, bend, hardness, fatigue controlled. Thermal severity test. Liquid penetrant test flurocent penetrant test, magnetic particle inspection, Eddy current testing. Ultrasonic and radiology. (7)

#### PRACTICAL TERMWORK :

- 1) Design and Drawing of welding fixtures - 1 Job.
- 2) Seminar on any one of the topics from syllabus.

**PRACTICAL :** Consist of termwork based on above syllabus.

#### BOOKS RECOMMENDED :

- 1) A Text Book of Welding Tech. : O.P.Khanna.
- 2) Welding and Welding Tech. : Richard L.Little.
- 3) Welding Hand Book : A.W.S.

#### 7SP5

#### ELECTIVE

#### (IV) PRODUCT DESIGN FOR MANUFACTURING

#### SECTION - A

Unit I : Introduction to product design : definition of product design, Asimo's model for product design, design by evolution and innovation, essential factor of PD, it's chronological structure, product analysis, product parameters, product life cycle & its characteristics, Decay curve of new product ideas, production consumption cycle & its valuo addition, primary design phases product development process. (10)

Unit-II : Role of allowance, process capability & tolerance in design & assembly.

Design practice in industry product strategies, analysis of product, product characteristics, designer & role of designer, industrial design organisation, procedures, & models used by industrial designers, three S's interchangeability of product modular design of products, functonal design practics, designing for comfort & asthetics. (10)

Unit-III : Design Optimisation : introduction Siddal's classification, value engg. product design, design for reliability. (10)

#### SECTION - B

Unit IV : Strength consideration & material selection for products, design for stiffness & rigidity, introduction to FEA method. (10)

Unit V : Design for manufacturability : design of product to suit

for various manufacturing processes such as casting forging, press working, rolling, machining etc., design of plastic & other non-metal products. (10)

Unit VI : Use of Computer in product design & development, new approaches to product design & development - concurrent engg., Quality Function Development, (QFD), 3D modelling, manufacturing during design - Rapid Prototyping Techniques, product designs compatible to JIT manufacturing. (10)

#### **BOOKS RECOMMENDED:**

1. Product Design and Development by A.K.Chital & R.C. Gupta (PHI)
2. Hand Book of Product Design for Manufacturing by Bralla.
3. Quality Planning & Analysis by Jarah & Grona.
4. Plastics by J.Harry Dubois & Frederick John (VAN Nostrand).
5. Hand Book of Mechanical Design by Maitra & Prasad.
6. Mechanical Engg. Reference Book by Edward H. Smith.

#### **PRACTICALS (Any Four)**

- 1) Product design consideration for case of handling and operation
- 2) Study of design of products for good aesthetics
- 3) Study of design of products for Assembly.
- 4) Study of any one rapid prototyping technique for model/product generation.
- 5) Study of role of market, customer, competitors on product design.
- 6) Study of various development phases of a successful product.
- 7) Study of various product parameters.

Term Work : In addition to the above mentioned practicals practical term work shall consist of product design case study to convert an idea/market need in a real product. done by a batch of not more than four students.

7 SP 5

#### **ELECTIVE**

#### **(V) LOW COST AUTOMATION BY PNEUMATIC AND**

#### **HYDRAULIC SYSTEM**

#### **SECTION-A**

Unit I : Pneumatic and electropneumatic components and symbol compressed air physical properties, generation, preparation and distribution, compressed air drying, areas of application control element description - directional

control valves, flow control valves, OR, AND, quick exhaust, adjustable pressure sequence rotary actuator, linear actuator, two pressure valve, Exhausted valve, NRV, check valve, vacuum cup etc. (10)

Unit II : Design method considerations for sequential circuits, pneumatic and electropneumatic sequential logic circuit design with Karnaugh Veich mapping method. Design of circuit by cascade method. Step counter method, and design of compound circuit. (10)

Unit III : Pneumatic sensors, electrical sensors, Switenes practical application of switches in industries, proportional and servo valves.

Sizing of components of pneumatic and hydraulic system like cylinder, valve, tubing, compressor, air receiver, sump etc. (10)

#### **SECTION-B**

Unit IV : Hydraulic components and symbols. Description of control elements; hydraulic fluid - their properties and selection criteria. Areas of application. Hydraulic power pack pump, pipings, valves, filters. Hydraulic accumulators etc. (10)

Unit V : Design and analysis of Inley hydraulic, electro hydraulic, pneumo hydraulic circuits for sequencies, Sineromising, interlocking etc. Design of circuit for pneumatic control for hydraulic sequential power system. (10)

Unit VI : Electronic programmable controllers for fluid power P.L.C.'s, relays, ladder diagram, timer function, shunt module, simple cycle relation module, extended cycle selection module. Emergency stop for P.L.C. step counter. Introduction to P.L.C. programming. Basic electrical and electronic components used for automation.

#### **PRACTICALS:**

- 1) Design, analysis and performance of any one circuit for particular application of fully pneumatic system by using Karnaugh Veich mapping method. (Atleast for two cylinder sequencing.)
- 2) Design and analysis of circuit for particular specific material handling application of Electropneumatic system by using Karnaugh Veich map method.
- 3) Design and analysis of pneumatic and electropneumatic circuit for any particular application by using :

- i) Cascade method
  - ii) Step Counter method
  - iii) Combination circuit.
- 4) Laboratory performance of pneumatics, electropneumatics, hydraulic sequential circuit for One, Two and Three cylinder problem.
  - 5) Design of pneumatic and hydraulic circuit for plastic moulding machineries.
  - 6) Design and computer simulation of pneumatic and electropneumatic circuit for automating m/c operator.  
e.g. automating drilling m/c operation, automatic key way milling m/c etc.  
Practical examination consists of performance of any circuit by the batch of five students and viva-voce on the circuit and above term work.

#### RECOMMENDED BOOKS :-

- 1) Pneumatics and hydraulics by Stewart.
- 2) Pneumatic Control for Industrial Automation by Peter Rohner and Garden Smith, John Wiley and Sons, 1987.
- 3) Fluid Power Logic Circuit by Peter Rohner, The McMillan Press Ltd. 1979.
- 4) Hydraulic System Analysis by John Stringer, The McMillan Press Ltd. 1976.
- 5) Fluidics by Foster K. Parber, Wiley Eastern.
- 6) Introduction to Fluid Power Circuits and System by Russel W. Henke, Addison Wiley.
- 7) Hydraulic and Pneumatic Power Control by Franklin P. Yeaple.
- 8) Pneumatic Application by Depper and Stoll, Vogel Verlag, 1983.

### VIII SEMESTER

#### 8SP1 ADVANCED PRODUCTIVITY TECHNIQUES

##### SECTION-A

- Unit-I : Production and Production systems, production functions, system performance, system synthesis, importance of productivity, productivity ratio, total productivity index, productivity measurement. (7)
- Unit-II : Production System Models :  
Development, types, basic approach to model development, models of machine breakdown, models of task time variability.

- Codification - 7- digit coding, 9-digit coding. (7)
- Unit-III : Product development & Design :  
Company policy, effect of competition on design, long range planning, selecting the right product analysis, make & buy decision, standardisation, simplification, modification, line balancing models, diversification. (9)

#### SECTION-B

- Unit-IV : TQM, ISO 9000 & Product patenting : Historical perspective of quality concepts.  
TQM : Introduction, definition, implementation and benefits, concepts of TQM by Deming, Cross by & Juran.  
ISD 9000 : Objectives, models, major steps to get iso 9000  
Patenting of Products. (9)
- Unit-V : Value Engineering :  
Concept, advantages, role of creativity in value engineering, application, types of values, types of phases, function analysis system technique. (8)
- Unit-VI : Group Technology :  
Introduction, definition, benefits, fields of application, forming part families & group, group scheduling, desirable characteristics of group cellular manufacturing-concept. (6)

#### REFERENCES:-

- 1] Production System - James L.Riggs
- 2] Production Hand Book - John A.White
- 3] Production Engineering Science - R.C.Pandey & C.K.Singh
- 4] Production Planning & Control - Samuel Eilon
- 5] Production Planning & Control - Jain and Agrawal
- 6] Techniques of Valve Analysis and Engg.:-Miles(McGraw Hill)
- 7] Valve Engineering in Manufacturing :-ASTEM (Prentice Hall)
- 8] Valve Engineering for Management - Glauson, Auerbach
- 9] Total Quality Management - Sundara Raju (Tata McGraw Hill)
- 10] Getting More at Less Cost - Jagannathan (Tata McGraw Hill)
- 11] Automation, Production Systems and Computer Integrated Manufacturing - Mickell Groover (PHI)

#### 8SP2

#### PROCESS ENGINEERING

**SECTION-A**

- Unit-I : Process Engg./ Process Planning : introduction, importance, scope, product engineering, functions, process engg. functions, role, processes approaches to process planning, preliminary partprint analysis, partprint interpretation, problems & remedies, establishment of general characteristics of workpiece from part print, identification of critical areas, specifications relating w/p characteristics, with nature of work to be performed. Finishing & identifying operations. (7)
- Unit-II : Dimensional Analysis : angular & rectangular dimensioning systems. Geometry of form, limit stacks & tolerance stacks, cost of arbitrar tolerance selection.
- Tolerance Chart : functions, terms, & symbols, procedure of tolerance chart.
- W/p control, equilibrium theories, & concept of location, geometric control, dimensional control, mechanical control, alternate location theory, gauging. (7)
- Unit-III : Classifying operations, selection & planning of manufacturing processes, function, economy, asthetics, rules & approach of process planning, influence of product design and processing, eliminating, operations tooling selection, terminating process. (8)

**SECTION-B**

- Unit-IV : Manufacturing sequence, major process sequence, factors affecting operation sequence, case studies on operation sequences planning.
- Selection of equipment, special purpose machines, general purpose machines, factors in machine selection, leasing, review of standard special equipments, toolings classification. (8)
- Unit-V & VI : Process picture & operation routing process picture symbols, sheet, processing dimension. Operation routing uses, sheet. Tool layout of turret or capstan lathe. (12)

**Term Work :** Students are expected to do atleast six practicals out of the following :

- 1] Preliminary part print analysis for components.
- 2] Preparation of tolerance chart for two components.

- 3] Drawing of arrangement of locators, for standard shaped components like rectangular prism, pyramids, cylinder, tube, cones and any one non standard component for good geometric control.
- 4] Drawing of arrangement of locators for good mechanical control of any two component.
- 5] Illustration of centre line control in circular components for 30, 90, 120.
- 6] Sketching of two practical arrangement of alternate locators in tool Design.
- 7] Listing & classification of operations, for any two given engine parts ex.V.R.level, R.S.Braclet etc.
- 8] Study of considerations in the Operation sequence with respect to any one part ex. Oil hole coolant in let.
- 9] Preparation of process picture sheet for any two parts.
- 10] Preparation of operation routing sheet for any two parts.
- 11] Study considerations of tool layout for turret & or capstan lathe for any two component.

**PRACTICAL :-** Shall consists of oral based on above term work.

**Reference Book :-**

- 1] Process Engineering for Manufacturing, Donald F.Eary & Gerald E.Johnson, Prentice Hall, Inc. Englewoodd Cliffs, N.J.

**8SP3****COMPUTERAIDED MANUFACTURING****SECTION -A**

- Unit I : NC Machines : introduction, components of NC system, NC procedure, NC co-ordinate system, NC motion control system, MCU & other components of NC system, M/C tool application & other applications, economics of NC.
- Unit II : NC part programming : punched tape & tape formats, methods of NC part programming,
- Programming, computer assisted part programming, language,
- MACROS, manual data input, DNC, CNC & adaptive control.
- Unit III : Robot technology : Robot physical configuration, basic robot motions, technical features, elements of robotic system, types of industrial robots, robot system, robot control system; robot sensors, robot application, economic justification of robots.

**SECTION - B**

- Unit IV : Flexible manufacturing system : types of FMS, components & FMS, production equipment, support system, material handling system, Automated Guided Vehicles, automated storage & retrieval system optimisation of FMS, FMS application & benefits.
- Unit V : Computer integrated manufacturing : introduction, major elements of CIM, development of CIM, design aspects of CIM, CIM planning & implementation process.
- Unit VI : Manufacturing resources planning (MRP II) :  
introduction, role of MRP in CIM system, major modules of MRP, software, manufacturing application, engineering applications, financial applications. Marketing applications, other applications.

**PRACTICALS :**

- 1) Study practical on NC/CNC machines.
- 2) Preparing and executing NC part programming for any two component on CNC turning m/c.
- 3) Preparing and executing NC part programming on CNC milling.
- 4) Preparing and executing Robot programming for simple operation
- 5) Study practical of FMS.

**REFERENCE BOOKS :**

- 1) Computer Integrated Design & Manufacturing by David Bedworth, McGraw Hill.
- 2) CAD/CAM/CIM by P.Radhakrishan, S.Subramanyam, New Age Int. Pub.
- 3) Automation, Production System and Computer Integrated Manufacturing by M.P.Groover, PHI.
- 4) CAD/CAM by C.B. Basant, John Wiley & Sons.
- 5) CAD/CAM by Dr. Surendrakumar & Dr.Jha, Dhanpat Rai & Sons.

**8SMP4 OPERATIONS RESEARCH TECHNIQUES****SECTION-A**

- Unit I : Operations Research - introduction, characteristics, phases, limitations; model building and classification of O.R.Models. Linear Programming- formulation, simplex methods, primal dual relationship. (8)
- Unit II : Transportation problems : introduction, methods, LP

formulation of transportation problems, methods for finding initial solution, Modi method.

Assignment Problems : introduction, mathematical statement and solution methods of assignment problems, variations of assignment problems. (8)

- Unit III : Network Models : Network models - Network construction, PERT analysis, CPM analysis, cost analysis, updating, resource smoothening and leveling. (8)

**SECTION-B**

- Unit IV : Waiting line models : introduction classification of waiting line models, analysis of M/M/1 and M/M/S models, application of simulation to waiting line model and Monte-Carlo technique.

Sequencing-Processing of n jobs through 2 machines, n jobs through 3 machines, 3 jobs through n machines, n jobs through n machines. (10)

- Unit V : Replacement Models -individual and group replacement policies. simulation : Introduction, basic nature of simulation, when to simulate, advantages and limitations, role of random numbers in simulations, generation of random numbers. (8)

- Unit VI : Dynamic Programming -introduction, characteristics, development of an optimum decision policy, dynamic programming under certainty, application of dynamic programming to linear programming. (8)

**List of Practicals :-** Atleast 6 practicals from following. :-

- 1] Computer programme for PERT CPM analysis.
- 2] Computer programme for LPP.
- 3] Case study on PERT/CPM network
- 4] Formulation of LPP from real life situation.
- 5] Study of dynamic programming problems.
- 6] Case Study on transportation problems.
- 7] Case study on assignment problems.
- 8] Case study on sequencing problems.

**BOOKS RECOMMENDED:-**

1. Operations Research - Askhedkar-Kulkarni

2. Linear Programming - Paul Lomba.
3. Fundamentals of Operations Research - A. S. Sivasubramanian (Wiley Eastern)
4. PERT/CPM - Srinath
5. Operations Research - Hira & Gupta
6. Operations Research - J.C.Pant
7. Operations Research - Kanti Swarup
8. Operations Research - S.D.Sharma
9. Operations Research - C.R.Kothari
10. Operations Research - A.S.Phillipose
11. Operations Research - R.C.Patel
12. O.R. and Mathematical Models - A.S.Sharma, Tata McGraw Hill
13. Operations Research - H. Taha
14. Operations Research - Kapoor
15. Operations Research - B.E.Gillett
16. Simulation - By Narsingh Deo
17. Simulation - By J.Jordan
18. Mathematical Models in O.R. - J.K.Sharma.

**8 SP 5**

**PROJECT AND SEMINAR**

AS PER GIVEN IN THE SCHEME

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## APPENDIX-D

L : Theory Lecture  
T : Tutorial  
P : Practical  
D : Drawing / Design

FOUR YEAR B.E. DEGREE COURSE  
PRODUCTION ENGINEERING SEMESTER PATTERN  
SEMESTER : SEVENTH

ABBREVIATIONS :-  
S - SEMESTER PATTERN  
M - MECHANICAL  
P - PRODUCTION

Sr. No.	Sub. Code	SUBJECT	Teaching Scheme				Examination Scheme								
			L	T	P/D	Total Hours/Week	Theory			Practical					
						Dura- tion of Papers (Hrs)	Max. Marks Theory Papers	Maximum Marks College Assessment.	To- tal	Min. Pass Marks	Max. Marks College Assessment.	To- tal	Mini- mum Pass Marks		
<b>SEMESTER-VII</b>															
1.	7SP1	PRODUCTION PLANNING AND CONTROL	3	1	-	4	3	80	20	100	40	—	—	—	—
2.	7SP2	COMPUTER AIDED DESIGN	4	-	2	6	3	80	20	100	40	25	25	50	25
3.	7SMP3	INDUSTRIAL MANAGEMENT AND COSTING	3	1	-	4	3	80	20	100	40	—	—	—	—
4.	7SP4	MECHATRONICS	4	-	2	6	3	80	20	100	40	25	25	50	25
5.	7SP5	ELECTIVE	4	-	2	6	3	80	20	100	40	25	25	50	25
6.	8SP5	PROJECT & SEMINAR	-	-	4	4									
TOTAL			18	2	10	30				500				150	

**GRAND TOTAL : 650**

**7SP5 (ELECTIVE) :-**

- (I) MARKETING AND SALES MANAGEMENT      (IV) PRODUCT DESIGN FOR MANUFACTURING  
(II) PLASTIC ENGINEERING                      (V) LOW COST AUTOMATION BY PNEUMATIC & HYDRAULIC SYSTEM  
(III) ADVANCED WELDING TECHNOLOGY

**SEMESTER-VIII**

1.	8SP1	ADVANCED PRODUCTIVITY TECHNIQUES	4	-	-	4	3	80	20	100	40	—	—	—	—
2.	8SP2	PROCESS ENGINEERING	4	-	2	6	3	80	20	100	40	25	25	50	25
3.	8SP3	COMPUTER AIDED MANUFACTURING	4	1	2	7	3	80	20	100	40	25	25	50	25
4.	8SMP4	OPERATIONS RESEARCH TECHNIQUES	4	1	2	7	3	80	20	100	40	25	25	50	25
5.	8SP5	*PROJECT & SEMINAR	-	-	4	4	-	—	—	—	—	75	75	150	75
TOTAL			16	2	10	28				400				300	

**GRAND TOTAL : 700**

\*8SP5 1. College Assessment

- a) Project 50 ) 75 }  
b) Seminar 25 ) } 150

2. University oral Exam.

75 }