



**DR. A P J ABDUL KALAM UNIVERSITY,
INDORE**

SYLLABUS

For

DIPLOMA MECHANICAL ENGINEERING

(THIRD YEAR, 5th SEM)

Dr. A P J Abdul Kalam University, Indore

DR. A P J ABDUL KALAM UNIVERSITY, INDORE

Syllabus for Diploma Electronics & Telecommunication

List of Subject (Third Year, V Semester)

S. No.	Subject Code	Subject name	Page No.
1	MED 501	PROCESS PLANNING, ESTIMATING AND COSTING	3
2	MED 502	MACHINE TOOL TECHNOLOGY	5
3	MED 503	ENGINEERING MEASUREMENTS AND MAINTENANCE PRACTICES	8
4	MED 504	MODERN PRACTICES IN MANUFACTURING & MANAGEMENT	11
5	MED 505	INDUSTRIAL ENGINEERING	14
6	DE 9999	PROFESSIONAL ACTIVITIES	17

Unit 1

Introduction to Planning: Process engineering, its scope and relation with product engineering and manufacturing, production system, types and characteristics.

Unit 2

Selecting and Planning the Process of Manufacture: Function, fundamental rules for the manufacturing process, basic design of product, influence of process engineering on product design, rechecking specifications, how materials selected affect process cost, using materials more economically, material cost balance sheet, eliminating operations, combined operations, selecting the process tooling, availability of equipment, make or buy decisions.

Unit 3

Determining the Manufacturing Sequence: Operation, classifications and the manufacturing sequence, purpose of major process sequence.

Unit 4

Operation Routing - Routing uses, routing descriptions.

Unit 5

Elements of Costs and their Allocation : Definition and objective of Estimating & costing, desirable conditions for a costing system, advantages of costing, elements of cost, , direct material cost, direct labour cost, direct expenses, prime cost overheads, indirect materials, indirect labour, indirect expenses administrative and selling expenses, analysis of total cost fixed cost and variable cost. Break even analysis.

Unit 6

Depreciation: Definition & Concept, causes of depreciation methods of depreciation calculation.

Unit 7

Profit: Profit methods of increasing profit, effects of the methods on production, market and sales.

Unit 8

Budget: Definition, departmental budget and purpose of budgetary control.

Unit 9

Overhead Allocation: Definition and classification of overheads, methods of overheads allocation viz-direct material cost, direct labour cost, man hour rate and machine hour rate, selection of appropriate method limitation of various methods.

Unit 10

Actual Cost Estimation: Process Materials and Manpower - Terminology associated with estimation, Calculation of volume, weight and cost of materials.

Unit 11

Machine Shop: Process, Materials and Man power - Terminology used in machine shop estimation, use of standard table to determine time elements for various machining processes, use of formulas to calculate actual machining time for different operations of machine tools, Calculation of production operation time per product per cycle, batch production time,

Unit 12

Welding shop: process, materials and Man-power Gas and Arc. Welding terminology, production operation time, labour cost, materials cost, cost elements, batch production cost.

Unit 13

Forging Shop: Process, Materials and Man power - Forging gross and net weight of forging, forging losses, materials cost, labour cost and batch production cost.

Unit 14

Foundry Shop: Process, Materials and Man- power - Pattern cost, production time for casting, material cost of casting, moulding cost, batch production time.

Unit 15

Sheet Metal Shop Estimation: Sheet Metal shop labour cost, materials cost, production time in piece work.

References

- 1 Cost Control by G. R. Sharma. (National Productivity Council)
- 2 Engineer' s Glude to Costing (Institute of cost works Accounts)
- 3 Mechanical Estimating And Costing by T.R. Banga and & S. C. Sharma (Khanna Pub.)
- 4 Mechanical Estimation and Costing by R.L. Shrimali & P.C. Jain (Jain Pub. House)
- 5 Mechanical Estimation And Costing (Resource Persons of Hill Publishing Co. T.T.T.L, Madars Tata McGraw Hill)
- 6 Machine Shop Estimation by Nordoff .
- 7 Learing Packing In Costing And Estimating (T.T.T.I. Bhopal Publication)
- 8 Process Engineering For Manufacturing By Eary and Johnson (Prentice Hall)
- 9 Fundamentals of Process Engineering by Benjaman W. Nicbel, Alon & Ropy
- 10 Produce Design And Process Engineering (McGraw Hill)
- 11 Yantriki Abhyantriki Abhikalpan (Hindi) by K. D. Saxena. (Deepak Prakashan, Morar, Gwalior) .

Unit 1

Introduction: Concept of machine tool technology, needs, area of use etc.

Unit 2

Metal Cutting Theory : Stages in cutting, factors affecting cutting, types of chips, built up edge (BUE) formation conditions and effect upon surface finish, definition of cutting force, feed force, radial force with the help of merchant circle diagram. Power requirement for each type of force. Tool geometry and influence of tool angles, desirable properties of cutting tool materials and their influences on the choice of tool material.

Primary and secondary function of cutting fluids and properties of cutting fluids commonly used, types of cutting fluids. Cutting variables, tool wear and tool life. Taylor's tool life equation and cutting speed calculation. Economy of metal cutting.

Unit 3

Lathe: Basic difference between centre, turret and Capston lathes, constructional details and specification. working principles and features of mechanical hydraulic and electrical copying system, rate of production, skill requirement, accuracy and cost of production. Working principles and types of automatic lathes, work holding and tool holding and tooling used for Capston and turret lathes, operation planning and tool layout for internal, external threading.

Unit 4

Shaper, Drilling & Boring Machine. Shaper- Construction, operation. application, Types of Drilling Machines, construction, operation and application, Horizontal and vertical boring machines constructional features, Jig boring machine, its construction, operation and application.

Unit 5

Milling Machines: Define milling, Classification of milling machines, Principles, parts and their functions, types of table movement in universal milling machine, specifications of milling M/C. Conventional and climb milling, different milling operations and their application, milling cutters and tool angles, specification and cutter materials, use of arbor, collets and adapters machine attachments, methods of mounting the cutter, work holding devices, dividing heads. Direct, simple and differential indexing, selection of cutters, speed feed, procedure for setting up operations and inspections, maintenance of milling.

Unit 6

Grinding Machines and Finishing processes : Definition of grinding and cutting action in grinding, types of abrasive materials and their properties, binding materials, grinding wheel classification and standard marking system, conditions for selection of grinding wheels. Balancing of grinding wheels, glazing and loading, methods of dressing and tracing, Principles of working of grinding machines, types of grinding process, functions of tool and work holding devices, feed arrangement, table drive in surface and cylindrical grinders.

Types of lubricants and coolants used in grinding, grinding defects, their remedy and safety practices.

Definition of honing, lapping, super finishing methods, equipments involved, Materials used, tolerances obtained and limitations, applications of honing and lapping processes.

Unit 7

Special purpose Machines: Difference between forming and generation of gears, principle of gear shaping, hobbing and shaving, rate of production accuracy and limitations. Thread production: thread rolling and thread milling. Broaching Machines: Definition of Broaching, types of broaches, broaching machines, advantages and limitations.

Unit 8

Jigs and Fixtures: Functions of Jigs and fixtures, 3-2-1 principle of location, Design criteria for simple jigs and fixtures

Unit 9

Machine Tool Drives : Requirements of machine tools, elements of machine tools and their purpose Drive Systems : Stepped and step less drives, advantages and limitations of the gear box drives, function of feed box, types of feed gear boxes, working and advantages. Principle of straight line motion, multihandle, single lever and pre-selective control system

Unit 10

Plastic Moulding: Types of plastic, Compression moulding, Transfer moulding , Injection moulding, Blow moulding, Vacuum forming, Extrusion

References

1. Workshop Technology Vol. I & II by Hajra Chaudhary, (Media Promoters & Publishers Pvt. Ltd. Mumbai)
2. Workshop Technology Vol. I , II and III by W.A.J. Chapman, (ELBS)
3. Manufacturing Processes & Systems by Phillip F. Ostwald & Jairo Minoz (John Willey & Sons.)
4. Production Technology – HMT Handbook (HMT)
5. Production Technology by Jain Gupta, (Khanna Publishers, New Delhi)
6. Manufacturing Processes by Begeman Amstead, (Wiley.)
7. Manufacturing Processes by Rusinoff, (Tata McGraw Hill Publishing Co. Ltd.)
8. Advanced Manufacturing Technology by Kalpakjian (Addison Wesley)
9. Manufacturing Technology – Metal Cutting & Machine Tools by P. N. Rao (TMH).
10. Workshop Technology Vol. II by Bawa H. S. (TMH).
11. Manufacturing Science and Technology Vol. I & II. by Suresh Dalela (Umesh Publication).
12. Workshop Technology Vol. I and II by B. S. Raghuvanshi (Dhanpat Rai & Sons).
13. Production Technology by R. K. Jain (Khanna Publishers, Delhi).
14. Vijayvargiya P.N.”Machine Tool” Shilp Vigyan (Hindi) (Deepak Prakashan, Morar Gwalior .)

List of Experiments

1. Demonstration of formation of chips on a lathe, continuous, discontinuous and fractured by changing variables like rake angle, speed feed and depth of cut.
2. Demonstration of built up edge on the finished tool point by changing speed and depth of cut while machining on a mild steel bar.
3. Measuring of angles of a single point tool with reference to main plane with the aid of tin templates.
4. Grinding of single point (H.S.S.) tools.
5. Demonstration of preparing soluble oil cutting fluid and its use for improving the surface.
6. Practice of taper turning and screw cutting on a centre lathe.
7. Practice of making the pins or rivets of any size on a capstan lathe.
8. Demonstration of making a flanged bush on a capstan lathe including setting.
9. Practice of drilling, boring and reaming on a lathe.
10. Practice of mounting cutters on the milling m/c and setting of m/s.
11. Practice of up milling and down milling operation.
12. Practice of cutting the spur gear on milling machine.
13. Practice on a shaper square block on a shaper and milling machine (Comparison of surface produced).
14. Surface grinding or tapping on a flat surface.
15. Practice of cutting a helical gear on a milling m/c.
16. Performance test of a lathe by making a long mandrel.
17. Study of special purpose machines using web aid
18. Study of different machine tool drive using physical machines and web aid

Sub Code: MED 503 Sub Name: Engineering Measurements & Maintenance 6 Credits
Practices

Unit 1

Inspection: Meaning and application of inspection, daily life examples of inspection, concept of inspection as applied in industries. Effect of absence of inspection in an industry. Classification of inspection, function, meaning and advantages of each concept of inspection applied to metrology. Definition & meaning of precision. accuracy and error, need of precision measurement in industry, relationship between cost and accuracy, Interchangeability and selective assembly.

Unit 2

General Measurement Concept: Limits, fits and tolerances, selection of fit, calculation of fundamental deviation, tolerance and limits, selection of limits, tolerances and allowances.

Unit 3

Linear Measurement: Standards of length, classification and use of slip gauges, wringing process, precautions to be observed while using slip gauges, classification of linear measuring instrument, direct and indirect, construction and working of vernier calipers, micrometers, vernier height gauge, dial vernier and dial height gauge, finding least count, precautions. Dial gauge-types, construction, principle, accuracy and precautions, comparators - principle, types, working and field of application of Mechanical, electrical, optical and pneumatic comparators.

Unit 4

Angular Measurement: Need of angular measurement, various instruments used. Methods of measurement and field of application of protractor, angle gauges, Sine bars, spirit levels, clinometers and angle dekkor.

Unit 5

Straightness, Flatness, Squareness and Roundness Testing: General concept straight edge method, light gap and feeler gauge method, wedge method, use of V- Block and dial indicator for checking roundness.

Unit 6

Surface Roughness: Definition of primary and secondary texture, CLA value, R.M.S value, Types of surface measuring instrument, working principle of Tomlinson mechanical surface finish recorder.

Unit 7

Screw Thread Measurement: Types of screw threads, threads nomenclatures, errors in screw thread, equipment required for measuring pitch, effective diameter and angle- procedure, advantages, limitation and precautions of each method

Unit 8

Limit Gauges: Definition of gauge and gauging, necessity of gauging in industrial practice, types according to use (shop inspection and reference gauge), limit gauges for specific use - screw pitch gauge, template feeler gauge, working tolerance of gauges, maximum and minimum metal conditions to tolerance. Selection and specification as per IS 2251, 3455, 3484 Wear allowances and its selection for design, Taylor's principle for design of ' Go ' and ' No Go' gauges . Calculation of gauge dimensions from formula given in IS 3455 and selection of parameters necessary for calculation.

Unit 9

Transducers: Meaning, function, primary and secondary transducers . Classification-mechanical electrical, active, passive . Comparison of electrical and mechanical transducers, Working principle and application of resistance type, inductance type, capacitance type and piezo electric type.

Unit 10

Temperature measurement: Principle on which temperature measuring devices work-example of each type. Comparison of resistance thermometer and thermister. Thermocouple-Principle, material, and working. Working principle of optical and radiation pyrometers.

References

1. Engineering Metrology. by R.K. Jain (Khanna Pub. Delhi)
2. Engineering Metrology. by I.C. Gupta (DANPAT RAI & SONS)
3. Inspection & Gauging by Kennedy (The Industrial Press, 93, Wortinstreet, New york)
4. Engineering Metrology by K.J. Hume. (Macdonald & Co. Ltd. London)
5. Practical Metrology by K.J. Hume . (Macdonald & Co. Ltd. London)
6. Hand book of Industrial Metrology by R.S.T.M.E. (Prentice Hall of India)
 - a. Metrology & Gauging S.A.J. Parsons. . (Macdonald & Erass . Ltd. London) .
7. Industrial Instrumentation by D.P. Eckman (Wiley Easter Ltd. New Delhi)
8. Measurement Techniques in Mechanical Engineering by R.J. Sweeny
 - i. (jon wiley & Sons, New York Addson Wesley Pub. London)
9. Mechanical Measurement by Becjwith Buck (Addson Wesley Pub. London)
10. Instruments For Measurement Control by W.G. Holzbock (Rainold Pub. Co-operation)
11. Mechanical & Industrial Measurement R.K. Jain (Khanna Publishers New Delhi)
12. IS Code: 2986, 5979, 5876, 5939
13. Maap Vigyan Avum Yantrikaran (Hindi) by Yogendra Varshneya. (Deepak Prakashan, Morar,Gwalior)
14. Industrial maintenance – H.P. Garg (S. CHAND & Company Ltd)
15. Accident Prevention Manual For industrial Operations by Frank E. McElroy, P.E., C.S.P. Editor in Chief National Safety Council Chicago, U.S.A.
16. Accident Prevention Manual For Administration And Programs.
 - i.By Frank E. McElroy, P.E., C.S.P. Editor in Chief National Safety Council Chicago, U.S.A.
17. Commentary on Factories Act with M.P. Rules by Krishanlal Sethi (The law-years Home Indore -7)

18. Industrial Accident Prevention by H.W. Heinrich (Mc Graw Hill Book Company, INC)
19. An Introducton to Safety Engineering and Management by N.V. Krishnan (CPS Pub. Pvt. Ltd. Calcutta)
20. aintenance of Industrial Equipment by B. Gelberg, G. Peklis.
21. Guide to Efficient Maintenance Management by H.V. Mstwatt.
22. Modern Maintenance Management by Miller and Bood.
23. Maintainability by Benjamin S. Blanshard, E. Edward, Lowery
24. Maintenance Engineering Hand Book by Morrow.
25. Repair of Industrial Equipment by B. G. Edberg, G. Peklis.
26. Sanyantra Anurakshan Avum Suraksha Abhiyantriki (Hindi) by Yogendra Varshney (Deepak Prakashan, Morar, Gwalior)

List of Experiments

1. Study of application of various types of instruction.
2. Study of different type of fits with their practical application
3. Study of Indian standareds IS: 919 recomanded for limit and fits.
4. Demonstration of selective assembly.
5. Demonstration of concept of interchangeability using different objects.
6. Measurement of diameter, length, thickness etc. Using different calipers and steel rule.
- 7 Measurement of various parameters of different objects using vernier caliper & Micro-meter .
8. Measurement of various parameters of different objects using combination set.
9. Build up gauage blocks to produce different dimensions.
10. Measure different angles usidng vernier protractor .
11. Measure of unknown angle with the help of a sine bar and a slip gauge set.
12. Measure different angles using angle gauges.
13. Check for flatness, and parallelism of an object using a dial indicator and surface plate.
14. Check for roundness of an object using a dial indicator and a V-block.
15. Examine the surface texture of the machined surface by a microscope.
16. Examine the surface roughnees of a machined surface using Tomlinson surface meter .
17. Use of plug and ring gauges for checking holes and shafts.
18. Demonstration and explanation of different types of transducers.
19. Study of different types of pyrometers.
20. Visit of large/ medium/small scale industries for colleting the information regarding various measurement techniques and instruments .
21. Maintance practice on lathe and shaper m/cs .
22. Fault tracing and trouvel shooting on tube light , table fan, Room heater, hand drill m/c etc.
23. Measurement of wear on flat surfaces by Hydrostatic method.
24. Measurement of wear on cylindrical objects by micrometer and Dial indicator & V- block.
25. Lubrication practices on different machine tools.
26. Visit of large /Medium /Small scale indidustries for collecting information regarding record keeping for condition of equipment , maintenance scheduling & various practices , lubrication plan , tools & equipments used , safety measure etc.,

Management

Unit 1

Unconventional Machining Methods: Limitations of conventional machining. Working Principle, operating parameters and application of unconventional machining. Electro Chemical Machining, Chemical Machining, Electric Discharge Machining, Electron beam Machining, Ultra Sonic Machining, Abrasive Jet Machining, LASER Beam Machining, Plasma Arc Machining.

Unit 2

Coating & Deposition processes: plating & related processes, physical vapor deposition, chemical vapor deposition, Organic Coating,

Unit 3

Rapid Prototyping: Need, Fundamentals, Technologies and applications.

Unit 4

Manufacturing Automation: Introduction to Numerical control, Computer Numerical control, Direct Numerical Control, CNC Millings M/c, CNC Turning M/c, Turn mill centers, flexible manufacturing system, Preliminary idea of robotics. Introduction to G and M code as used in part programming. Use of Canned cycles. Simulation of parts, drawing generated through CAD, its modeling and transfer

Unit 5

Flexible Manufacturing systems: Elements, Limitations, Feature & Characteristics, New development.

Unit 6

Robotics: Introduction to robotics, concept, and application, A4 level automation

Unit 7

Total Quality Management (TQM)-Evolution, definition, preparation stages in TQM implementation, Integrated TQM model, customer satisfaction, Employee involvement. Continuous Process Improvement, 5s, Kaizen, and KANBAN, Supplier Partnership, Performance Measures. Just in Time systems (JIT) – Introduction, application and advantages

Unit 8

Total Productive Maintenance (TPM)- Introduction, Plan, New Philosophy Improvement needs, Six Major losses Life cycle costing, work groups.

Unit 9

Introduction to Quality Standards:

ISO 9000- Introduction History, Indian Equivalence, System requirements for ISO 9001, 9002, 9003, steps for installation, How to apply. QS 9000 Quality Management systems.

ISO 14001- Introduction, Environment Management system, Background, vocabulary and Application

OHSAS 18001- Occupational Health and Safety Assessment Series Introduction, scope, related terms, structure and operating features

TS 16949 – Quality system certificate consisting following standard

- a. APQP – Advance product quality planning
- b. FMEA - Failure mode and effect analysis
- c. MSA – Measurement system analysis

Unit 10

Lean manufacturing: System design for Lean manufacturing adopting.

Unit 11

Why Why analysis (5W 1 H): Use of Why Why analysis to know the actual cause of failures and problems.

Unit 12

Six Sigma systems: Basics of Six Sigma, competitive advantage of implementing six sigma systems. Briefs of what, why and how six sigma works to initiate and sustain greater productivity, profitability and customer satisfaction rates.

References

1. Fundamentals of Manufacturing processes, G. K. Lal & S. K. Choudhary, Narosa Publishing House.
2. A Text book of production Technology (Manufacturing Processes) by P.C. Sharma, S. Chand & Co.
3. Manufacturing Technology Vol. II by P.N. Rao, Tata McGraw Hill Publishing Co.
4. Fundamentals of Modern Manufacturing By Mikell P. Groover, Wiley Student Edition.
5. Quality Management By Donna C.S. Summers Pearson Prentice Hall
6. Total Quality Management By L. Sugandhi & Anand A. Samuel Prentice Hall of India Pvt. Ltd.

List of Experiments

- 1) Visit to a nearby installation / Study and practice at least two of the following:
 - a. ECM
 - b. CM
 - c. EDM
 - d. EBM
 - e. USM
 - f. Laser and Beam Machining
 - g. Abrasive Jet Machining
 - h. Plasma Arc Machining
- 2) Visit to a nearby installation having coating facilities/practical on coating process.
- 3) Visit to a nearby installation / Study and practice at least two of the following:
 - a. NC
 - b. CNC
 - c. DNC
 - d. CNC Milling
 - e. CNC Turning
- 4) Manual part programming (for simple jobs) on a CNC Milling or Turning machine.
- 5) Visit to a nearby factory and estimation of six major losses on the critical machine
- 6) Prepare a plan for getting ISO 9001 Certification for an Industry.
- 7) Seminar on TQM Philosophy, TPM.
- 8) Seminar on Six Sigma practice.

Unit 1

Introduction: Definition of industry and industrial engineering, scope and role of industrial engineering fields of applications.

Unit 2

Productivity: Production and productivity, production systems and their impact on productivity, its significance and benefits of higher productivity. Long term and short term factors affecting productivity, productivity cycle.

Unit 3

Work Study: Introduction, its relation with productivity aims, objectives and application of work study, basic procedure and techniques of work study . Human factors in work study. Role of manager, supervisor and workers. Working conditions, environment of industry affecting work study.

Unit 4

Method Study: Definition objectives, basic procedures of methods study. Recording techniques, operation process chart, flow process chart, machine chart, flow diagrams, string diagrams, two hand process charts, questioning technique procedure to develop, install and maintain new methods.

Unit 5

Principles of Motion Economy: Meaning, basic rules design of efficient work place- layout, classification of human body movements and their preferred order.

Unit 6

Material Handling and Plant Layout : Importance and its effects on productivity, requirements of good material handling system, classification and selection of material handling equipment. Requirements of good layout. Effect of bad layout, Factors affecting plant layout, types of layout, advantages and limitations of each type of layout selection of layout, factors affecting the plant location.

Unit 7

Micro Motion Study: Definition and objectives, techniques of micromotion study, therbligs and their symbols, use of therbligs, SIMO chart and its application.

Unit 8

Work Measurement: Definition, Basic procedure and technique to work measurement. Stop watch time study, types of stop watch study, factors considered in selecting a job for time study, qualified and representative workers, procedure of stop watch time study, job element and their

need of identification, general rules for break down of job into elements, work cycle, methods of time measurement, performance rating, its meaning, standard rating , rating of operators, conditions for operators variation at work place rating scales, rating factors, calculation of basic time. Allowances- purpose, types. Calculation of standard time synthesis method- meaning, data, complication, advantages and limitations.

PMTS- Definition principle and use, calculation of standard time.

MIM - Meaning, tables and use. Application of MIM analysis for LH-RH charts, calculation of standard time.

Work/ Activity Sampling: Definition, statistical basics, determination of number of observation for given accuracy, sources of error, application and calculation of standard time.

Unit 9

MOST Technique for work measurement: Definition of terms, concept of the MOST, Basic MOST sequence models, Time Units, Parameter Indexing, Method Accuracy and Sensitivity, Levels of Work Measurement, Compatibility of MOST systems, Application of MOST

Unit 10

Job Evaluation, Wages and Incentives: Definition, need and scope of job evaluation. Job evaluation systems and their comparative merits and demerits and limitations.

Wage: Definition, wage components, wage fixation, real, minimum and fair wage. Financial and non- financial incentives and their examples. Wage plans- Halsey, Taylor, differential plan, Gantt task and bonus plan, 100 % premium plan.

Unit 11

Statistical Quality Control: Definition of quality and total quality, three stages of quality, quality control and SQC, difference between inspection and quality control, concept of variability, natural variation, its importance to quality control , classification of quality, characteristics, basic tools of SQC and their application, frequency distribution, measures of central tendency and dispersion, their need and calculations.

Normal Curve : Definition, characteristics, calculation of area under normal curve and its application, statistical tolerance their calculation and application. Process capability meaning calculation and use.

Unit 12

Control Charts for Variables: Statistical basic for control Charts for variables, construction of X and R Charts- their interpretation, use of X and R chart in establishment of process capability.

Unit 13

Control Charts for Attributes: Limitation of X and R charts, Meaning and use of attributes, their advantages, Calculation, construction, interpretation and application of p- chart, c- chart, ph-chart. Need of calculating the revised values of mean, and control limits and their calculation.

Unit 14

Acceptance Sampling: Meaning different techniques procedure involved sampling inspection meaning and comparison with 100 % inspection. Factors affecting sampling and their effects.

Single and double sampling plans, use of IS codes. **O.C. Curves** : Meaning, terms used, their definition, construction and use of O.C. curves. Selection of sampling plans.

Unit 15

Reliability: Definition quality control and reliability factors affecting reliability of product. Measures to ensure reliability of product, effect of product reliability marketing.

M.T.B.F and M.T.T.F. Definition programme for reliability. Maintainability and availability

References

1. Introduction To Industrial Engineering by Philip Hicks (McGraw Hills)
2. Productivity Means Property (Asian Productivity Organisation, Tokyo)
3. Introduction To Work Study (International Labour Office)
4. Work Study by M.D. Schmid & Subrammaniam
5. Motion and Time Study by Ralph M. Barnes John Willey New York
6. Work Study by Dalela.
7. Wage Administration by D.K. Roy. (N.P.C. Publication).
8. Quality Assurance Engineering by M.D. Schmid & Subramaniam.
9. S.Q.C. by E.L.Grant.
10. S.Q.C. by R.C. Gupta.
11. Industrial Engineering & Management by O. P. Khanna.
12. Industrial Engineering by Saxena.
13. MOST Work Measurement Systems, Kjell B. Zandin, Marcel Dekkar Inc. New York
14. Material Handling Equipment (N. Rudenki Place Pub)
15. Learning Package In Industrial Engineering by O.D.C. , T.T.T.I Bhopal .
16. Laboratory Manual Industrial Engineering by O.D.C. , T.T.T.I Bhopal .
17. Audyogiki Abhyantran (Hindi) by J.C. Varshneya. (Deepak Prakashan, Gwalior)
18. Audyogik Engineering (Hindi) by K.D. Saxena . (Deepak Prakashan, Gwalior)

List of Experiments

1. Preparation of flow process chart for existing and improved process.
2. Preparation of man and machine chart for existing and improved process.
3. Preparation of L.H. and R.H. charts for existing and improved process.
4. Use of decimal minute watch.
5. Performance rating.
6. Establishing standard time for given operation using time study techniques.
7. Use of Shewharts bowl and actual production for frequency distribution.
8. Preparation of X and R charts.
9. Preparation of p- chart and c- chart.
10. Work measurement using MOST
11. Acceptance sampling by attributes (single and double sampling plans)
12. Determination of the percentage utilization of equipment (work sampling) .
13. Application of principals of motion economy

1) Industrial Visits

Structured industrial visits be arranged and report of the same shall be submitted by the individual student, to form a part of the term work. The industrial visits may be arranged in the following areas / industries:

Sugar Factory / Dairy / Chemical Industry / Thermal Power Plant .

- i) Machine shop having CNC machines.
- ii) ST workshop / Auto service station
- iii) City water supply pumping station
- iv) Manufacturing unit to observe finishing and super finishing processes.

2) Lectures by Professional / Industrial Expert lectures to be organized from any two of the following areas:

- Interview Techniques.
- Modern Boilers – Provisions in IBR
- Applications of Sensors and Transducers
- Alternate fuels – CNG / LPG , Biodiesel, Ethanol, hydrogen
- Piping technology

3) Information Search :

Information search can be done through manufacturer's catalogue, websites, magazines, books etc. and submit a report any one topic. Following topics are suggested :-

- i) Engine lubricants & additives
 - ii) Automotive gaskets and sealants
 - iii) Engine coolants and additives
 - iv) Two and Four wheeler carburetor.
 - v) Power steering
 - vi) Filters
 - vii) Different drives/Transmission systems in two wheelers.
 - viii) Types of bearings – applications and suppliers.
 - ix) Heat Exchangers
 - x) Maintenance procedure for solar equipment.
- Tools holder on general purpose machines and drilling machines.

4) Seminar :

Seminar topic shall be related to the subjects of fourth semester. Each student shall submit a report of at least 10 pages and deliver a seminar (Presentation time – 10 minutes)

5) Mini Project / Activities: (any one)

- a) Prepare one model out of card board paper / acrylic / wood / thermocol / metal such as:
 - i) Elliptical Trammel
 - ii) Pantograph
 - iii) Coupling
 - iv) Cams and Followers v) Geneva mechanism
- b) Dismantling of assembly (e.g. jig / fixtures , tool post , valves etc.) Take measurement and prepare drawings / sketches of different parts.
- c) Make a small decorative water fountain unit.
- d) Toy making with simple operating mechanisms.

LIST OF REFERENCES BOOKS:-

- 1) Time management by Marshall Cooks Adams (Viva Books)
- 2) Basic Managerial Skills for All by E.H. Mc Grath , S.J. (Prentice Hall of India, Pvt Ltd)
- 3) Body Language by Allen Pease (Sudha Publications Pvt. Ltd.)
- 4) Creativity and problem solving by Lowe and Phil (Kogan Page (I) P Ltd)
- 5) Decision making & Problem Solving by Adair, J (Orient Longman)
- 6) Develop Your Assertiveness by Bishop , Sue (Kogan Page India)
- 7) Make Every Minute Count by Marion E Haynes (Kogan page India)
- 8) Organizational Behavior by Steven L McShane and Mary Ann Glinow (Kogan page India)
- 9) Organizational Behavior by Stephen P. Robbins (Tata McGraw Hill)
- 10) Presentation Skills by Michael Hatto ((Canada – India Project) ISTE New Delhi)
- 11) Stress Management Through Yoga and Meditation (Sterling Publisher Pvt Ltd)
- 12) Target setting and Goal Achievement by Richard Hale ,Peter Whilom (Kogan page India)

INTERNET ASSISTANCE:-

1. <http://www.mindtools.com>
2. <http://www.stress.org>
3. <http://www.ethics.com>
4. <http://www.coopcomm.org/workbook.htm>
5. <http://www.mapfornonprofits.org/>
6. <http://www.learningmeditation.com> <http://bbc.co.uk/learning/courses/>
7. <http://eqi.org/>
8. <http://www.abacon.com/commstudies/interpersonal/indisclosure.html>
9. <http://www.mapnp.org/library/ethics/ethxgde.htm>
10. http://www.mapnp.org/library/grp_cnfl/grp_cnfl.htm
11. <http://members.aol.com/nonverbal2/diction1.htm>
12. http://www.thomasarmstron.com/multiple_intelligences.htm
13. <http://snow.utoronto.ca/Learn2/modules.html>
14. <http://www.quickmba.com/strategy/swot/>