

# Work study syllabi from the Indian universities and professional bodies

## 1 Indian Institution of Industrial Engineering for the Grad. I.E Examinations

### IEA 05: Work Systems Design

- A. Concept & need of productivity at operator level in any activity-Inputs-Process Output relationship, Work Study approach in improving Productivity; Factors affecting productivity. Necessity of standard method; good working condition and measuring work content.
- B. Method Study Definition, scope and application of method study as a logical approach to problem solving in a wide range of activities; Basic procedure Select, record, Analyse and Examine, Develop New Method, Install, Maintain Report to management - presentation, Discussion; Installation; Maintaining.
- C. Work Measurement - Aims and objectives of work measurement, definitions of terms, tools, techniques.
  - (a) Stop watch study: (i) Equipment used, procedure for conducting a study, (ii) Recording data-forms, timing methods, timing aids, (iii) Rating Concept- scales, methods; Allowances-Concept, types and calculations; Standard time, standard production; Comments on stop - watch study.
  - (b) Activity Sampling - Definition, objectives scope of application; Statistical aspect-sampling, confidence level, accuracy, number of observations, use for determination of standard time, idle time, standard production.
  - (c) Production study - definition, scope of application, procedure, limitations; Predetermined Time Standard systems - (i) Background of PTS (ii) Detailed study of MTM-1.
- D. Job evaluation, Incentive system design, Theory of learning curve.
- E. Ergonomics - Definitions and scope of ergonomics. Need of Fit the job Operator; Anthropometry - Definition and applications in work

study; Environment Factors-noise, light heat vibration, humidity their sources, effect on human body, effect on productivity and corrective actions. Place of Ergonomics in work study and their interdependence.

## 2 Anna University

### Subject - IE8303 Work System Design

**Unit I: Productivity:** Total time for a job or operation, total work content and ineffective time, - Production and Productivity - Productivity and standard of living, Factors affecting Productivity, Introduction to Productivity measurement Models.

**Unit II: Methods Engineering:** Methods Engineering-Steps -Tools and techniques, Motion study.

**Unit III: Work Measurement:** 9 Stop watch time study, performance rating, allowances, Development of Standard data, learning effect. Work measurement in Automated Processes. Computerised Labour standards.

**Unit IV: Applied Work Measurement:** Work sampling, Group Timing Technique (GTT), predetermined time systems, types, Methods Time Measurement (MTM), Introduction to MOST standard, Wage incentive plans.

**Unit V: Work Design for Office Work:** Organization and methods (O & M), Work measurement of office work, Work Analysis techniques applied to support staff, Form design and control.

## 3 Andhra University

### Subject IE 101E: Methods Engineering and Work Design

**Work Study:** Concept of work and productivity - Possibility guides - Methods study - Charting techniques - Concept of standard time and bench mark jobs - Timing techniques and work sampling - Elemental motions, THERBLIGS and principles of motion - Economy - Introduction to predetermined motion time standards.

**Human Factors Engineering:** Introduction to ergonomics and human factors - Engineering physiological basis of human performance - Biomechanics - Psychology of work and work load perception - Physical work environment - Basis of ergonomic problem identification - Safety.

Integration of methods and time - Learning theory implications on standard time - Work study applications in production, maintenance, quality and other service functions - Synthetic time standards - MTM system and its application to production and maintenance.

**Organization and Methods:** Procedure analysis and developing office standards - MTM application to office work - Forms design and control - Records management.

**Value Engineering:** VE concepts, Principles, Methodologies and standards - Methods of functional analysis - Creativity - VE case studies/project work. Job evaluation and incentive scheme: Job description and job analysis.

Job evaluation- different methods - Individual and group incentive concepts and implications - Different types of incentive schemes - Suggestion schemes.

#### 4 Andhra University

##### **DDMEC-302 (Management courses): Industrial Engineering and Management**

**Unit I: Concepts of Industrial Management:** Principles of management- Growth of management thought, Functions of management, Principles of organization, Types of organisation and committees. Introduction to personnel management-Functions, Motivation, Theories of motivation, Hawthorne studies, Discipline in industry, Promotion, Transfer, lay off and discharge, Labour turnover, Industrial relations Trade unions, industrial disputes, Strikes, Lock-out, Picketing Gherao, Settlement of Industrial disputes, Collective bargaining, Industrial dispute act 1947 and factories act 1948.

**Unit II: Production Planning and Control:** Types of productions. Production cycle, Product design and development, Process planning Forecasting, Loading, Scheduling, Dispatching, Routing, Progress, Control, Simple Problems.

**Unit III: Plant Layout:** Economics of plant location, Rural Vs Suburban sites, Types of layouts, Types of building, Travel chart technique, Assembly line balancing simple problems. Materials Handling-Principles, Concept of Unit load, Containerisation, Palletisation, Selection of material handling equipment, Applications of belt conveyors, Cranes, Forklift trucks in industry, Plant Maintenance-Objective and types.

**Unit IV: Work Study:** Concept of productivity (Simple problems), Method Study- Basic steps in method study, Process chart symbols, Charts, Diagrams and Models used, Principles of motion economy, Therbligs, Simo chart, Work Measurement-Stop watch procedure of time study, Performance rating and allowances, Work sampling, Simple problems.

**Unit V: Materials Management:** Introduction, Purchasing, Objectives of purchasing department, Buying techniques, Purchase procedure, Stores and material control, Receipt and issue of materials, Store records, Quantity Control - Inventory, Functions of inventory, Simple EOQ model, ABC analysis, Simple problems. Quality Control - Single and Double sampling plans. Control charts of variables and attributes (Use of formulae only).

#### 5 Jawaharlal Nehru Technological University (JNTU) Hyderabad

##### **B.Tech 4th Year 1 sem Mechanical Engineering**

##### **Industrial Management (Elective - I) R13 syllabus**

**Unit I: Introduction to Management:** Entrepreneurship and organization - Nature and Importance of Management, Functions of Management, Taylor's Scientific Management Theory, Fayol's Principles of

Management, Maslow's Theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Herzberg's Two-Factor Theory of Motivation, Systems Approach to Management, Leadership Styles, Social responsibilities of Management.

**Unit II: Designing Organizational Structures:** Departmentalization and Decentralization, Types of Organization structures - Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, Virtual Organization, Cellular Organization, team structure, boundary less organization, inverted pyramid structure, lean and flat organization structure and their merits, demerits and suitability.

**Unit III: Operations Management:** Objectives- product design process- Process selection-Types of production system (Job, batch and Mass Production), Plant location-factors- Urban-Rural sites comparison- Types of Plant Layouts- Design of product layout- Line balancing (RPW method) Value analysis- Definition-types of values- Objectives- Phases of value analysis- Fast diagram.

**Unit IV: Work Study:** Introduction - definition - objectives - steps in work study - Method study - definition - objectives - steps of method study. Work Measurement - purpose - types of study - stop watch methods - steps - key rating - allowances - standard time calculations - work sampling. Statistical Quality Control: variables-attributes, Shewart control charts for variables- chart, R chart, - Attributes-Defective-Defect- Charts for attributes- p-chart -c chart (simple Problems), Acceptance Sampling- Single sampling- Double sampling plans-OC curves.

**Unit V: Job Evaluation:** Methods of job evaluation - simple routing objective systems - classification method - factor comparison method - point method - benefits of job evaluation and limitations. Project Management (PERT/CPM): Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing (simple problems).

## **6 DR. B. R. Ambedkar National University of Technology, Jalandhar**

### **B.Tech in Industrial and production Engineering**

#### **IPX 303 Work Study and Ergonomics**

**Work-Measurement:** Definition, various techniques of work-measurement work-sampling, stopwatch time study & its procedure, Job selection, Equipment and forms used for time study, rating, methods of rating, allowances and their types, standard time, numerical problems, predetermined - time standards and standard data techniques.

**Incentive:** Meaning, objectives of an incentive plan, various types of incentive plans.

## Course Contents

### Section-A

**Productivity:** Definition, reasons for low productivity, methods to improve productivity, work-study and productivity

**Human factor in work-study:** Relationship of work-study man with management, supervisor & workers, qualities of a work-study man.

**Method-study:** Definition, objectives, step-by-step procedure, questioning techniques, charts and diagrams for recording data. Like outline process charts, flow process charts, multiple activity charts, two handed process chart, string diagram, travel chart, cycle graph, Chrono-cycle graph, therbligs, micro motion study and film analysis, Simo chart, principles of motion economy. Development and installation of new method.

### Section-B

**Work-Measurement:** Definition, various techniques of work-measurement work-sampling, stopwatch time study & its procedure, Job selection, Equipment and forms used for time study, rating, methods of rating, allowances and their types, standard time, numerical problems, predetermined - time standards and standard data techniques.

**Incentive:** Meaning, objectives of an incentive plan, various types of incentive plans.

### Section-C

**Ergonomics:** Introduction, history of development, man-machine system and its components. Introduction to structure of the body- features of the human body, stress and strain, metabolism, measure of physiological functions- workload and energy consumption, biomechanics, types of movements of body members, strength and endurance, speed of movements. NIOSH lifting equation, Lifting Index, Maximum acceptable Weights and Forces, Distal upper extremities risk factors, Strain Index, RULA, REBA. Applied anthropometry - types, use, principles in application, design of work surfaces and seat design. Visual displays for static information, visual displays of dynamic information, auditory, tactual and olfactory displays and controls. Assessment of occupational exposure to noise, heat stress and dust. Effect of vibration/ noise, temperature, illumination and dust on human health and performance.

## 7 National program on technology enhanced learning, - a joint initiative of lits and lisc

### 1. Work Study

- a. Historical background; Work study definition; Role of work study in improving productivity; Ergonomics and work study.
- b. Work study procedure: selection of jobs; Information collection and recording; Recording techniques -charts and diagrams; critical analysis; developing better method; installation and follow up of standard method.

### 2. Motion Study

Memomotion and micromotion study; therbligs; cyclegraph and chronocyclegraph; simochart; Principles of motion economy; Design of work place layout.

### 3. Work Measurement

Definition; Procedure; Performance rating; Concept of normal time; allowances. Work sampling technique of work measurement. Introduction to pre-determined motion time system.

## 8 Amaravathi University

### Subject: Work Study

1. What is Work Study? It is the systematic examination of the methods of carrying out activities such as to improve the effective use of resources and to set up standards of performance for the activities carried out. "It is one of the most important management techniques which is employed to improve the activities in production. The main objective of WS is to assist the management in the optimum use of the human & material resources." Main aim of this WS is to finding the best & most efficient way of using available resources i.e. men, material, money & machinery.
2. What is Work Study? "It is especially concerned with productivity. To increase the productivity from a given quantity of resources." Work study is a generic term for the techniques of method study and work measurement. These techniques are used in the examination of human work in all its contexts. They lead systematically to the investigation of all the factors which affect the efficiency and economy at the work place in order to affect improvement.
3. Components of Work Study. It has three aspects 1. More effective use of plant & equipment 2. More effective use of human effort 3. Evaluation of human work.
4. Applications of Work Study: Industries: production operations, research and development. Marketing: sales & distribution. Offices: stores & warehouses. Material handling in designing field. Building & other construction, Transport, Hospital, Army, Agriculture.
5. Advantages/Objectives of work Study.
6. Method Study Method Study Flow Chart "Method study is the technique of systematic recording and critical examination of existing and proposed ways of doing work and developing an easier and economical method." Method study examines the way a task (changing the clutch on a car, preparing a flower bed for planting, cleaning a hotel room) is done. The industrial engineer has an eye on operational efficiencies and costs, quality of processes, service reliability, staff safety, etc. Method study techniques are applicable from factory/workshop manufacturing to cabin crew activities.
7. Basic Procedure for Method Study Method Study Flow Chart The basic procedure for conducting method study is as follows: 1. Select the work

- to be studied. 2. Record all facts about the method by direct observation. 3. Examine the above facts critically. 4. Develop the most efficient and economic method. 5. Define the new method. 6. Install the new method. 7. Maintain the new method by regular checking.
8. Basic Procedure for Method Study: 1. Select: While selecting a job for doing method study, the following factors are considered: (a) Economical factors. (b) Human factors. (c) Technical factors. 2. Record: All the details about the existing method are recorded. This is done by directly observing the work. Symbols are used to represent the activities like operation, inspection, transport, storage and delay. Different charts and diagrams are used in recording. They are: 1. Operation process chart 2. Flow process chart 3. Two-handed process chart 4. Multiple activity chart 5. Flow diagram 6. String diagram
9. Basic Procedure for Method Study: 3. Examine: Critical examination is done by questioning technique. This step comes after the method is recorded by suitable charts and diagrams. The individual activity is examined by putting a number of questions. 4. Develop: Develop the most efficient and economic method. 5. Define: Once a complete study of a job has been made and a new method is developed, it is necessary to obtain the approval of the management before installing it. The work study man should prepare a report giving details of the existing and proposed methods.
10. Basic Procedure for Method Study: 6. Install: This step is the most difficult stage in method study. Here the active support of both management and trade union is required. Here the work study man requires skill in getting along with other people and winning their trust. 7. Maintain: The work study man must see that the new method introduced is followed. The workers after some time may slip back to the old methods. This should not be allowed. The new method may have defects. There may be difficulties also. This should be rectified in time by the work study man.
11. Objectives of Method Study: 1. Improvement of manufacturing processes and procedures. 2. Improvement of working conditions. 3. Improvement of plant layout and work place layout. 4. Reducing the human effort and fatigue. 5. Reducing material handling. 6. Improvement of plant and equipment design. 7. Improvement in the utility of material, machines and manpower. 8. Standardization of method. 9. Improvement in safety standard.

## 9 Rajiv Gandhi Technical University (RGTU)

### ME 701 (D) Work Study and Ergonomics Syllabus

**Unit 1: Method Study:** Purpose of work study, its objectives, procedure and applications; method study definition and basic procedure, selection of

job, various recording techniques like outline process charts, flow process charts, man machine charts, two handed process charts, string diagram, flow diagram, multiple activity chart, simo, cyclographs and chrono-cyclographs; critical examination, development, installation and maintenance of improved method; principles of motion economy and their application in work design; micro motion study, memo motion study and their use in methods study.

**Unit 2: Work Measurement:** Introduction & definition, objectives and basic procedure of work measurement; application of work measurement in industries; time study: basic procedure, equipment needed, methods of measuring time, selection of jobs, breaking a job into elements; numbers of cycles to be timed; rating and methods of rating, allowances, calculation of standard time. Work sampling: Basic procedure, design of work sampling study conducting work sampling study and establishment of standard-time.

**Unit 3: Job Evaluation and Incentive Schemes:** Starlight line, Taylor, Merrick and Gantt incentive plans Standard data system; elemental and non-elemental predetermined motion systems, work factors system; Methods Time Measurement (MTM), MOST.

**Unit 4: Human Factor Engineering:** Definition and history of development of human factors engineering, types & characteristics of man-machine-system, relative capabilities of human being and machines; development and use of human factor data; information input and processing: Introduction to information theory; factors effecting information reception and processing; coding and selecting of sensory inputs.

**Unit 5: Display Systems and Anthropometric Data:** Display- types of visual display, visual indicators and warning signals; factorial and graphic display; general principles of auditory and tactral display, characteristics and selection.

## 10 B.M.S. College of Engineering (Autonomous), Bengaluru-19

### 15IM4DCIEG INDUSTRIAL ENGINEERING:

**Unit 1: Productivity:** Definition of productivity, individual enterprises, task of management Productivity of materials, land, building, machine and power. Measurement of productivity, factors affecting the productivity, productivity improvement programs, wages and incentives (simple numerical problems).

**Unit 2: Work Study:** Definition, objective and scope of work study. Human factors in work study. Work study and management, work study and supervision, work study and worker. **Method Study:** Definition, objective and scope of method study, activity recording and exam aids. Charts to record moments in shop operation - process charts, flow process charts, travel chart and multiple activity charts. (With simple problems).

**Micro and Memo Motion Study:** Charts to record moment at work place - principles of motion economy, classification of moments two handed process chart, SIMO chart, and micro motion study. Development, definition and installation of the improved method, brief concept about synthetic motion studies.

**Unit 3: Work Measurement:** Definition, objective and benefit of work measurement. Work measurement techniques. Work sampling: need, confidence levels, sample size determinations, random observation, conducting study with the simple problems. **Time Study:** Time Study, Definition, time study equipment, selection of job, steps in time study. Breaking jobs into elements, recording information Rating & standard Rating, standard performance, scale of rating, factors of affecting rate of working, allowances and standard time determination; Predetermined motion time study - Method time measurement (MTM)

**Unit 4: Ergonomics:** Introduction, areas of study under ergonomics, system approach to ergonomics model, man-machine system. Components of man-machine system and their functions - work capabilities of industrial worker, study of development of stress in human body and their consequences. Computer based ergonomics.

**Design of Man-machine System:** Fatigue in industrial workers, Quantitative qualitative representation and alphanumeric displays, Controls and their design criteria, control types, relation between controls and displays, layouts of panels and machines. Design of work places, influence of climate on human efficiency. Influence of noise, vibration and light.

**Unit 5: Current Trends:** Introduction to Agile manufacturing, Lean and Six Sigma, Value Engineering, Just in time, Total quality management, Enterprise resource planning, Supply chain and logistics management.

### **Industrial Engineering Laboratory**

- I. Method Study** (1) Recording Techniques using charts. (i) Outline process chart. (ii) Flow process chart. (iii) Multiple Activity Chart. (2) Recording Techniques using diagrams. (i) Flow diagram. (ii) String diagram. (3) Application of principle of motion economy: (i) Two handed process chart. (4) Assembling simple components. (i) Peg board assembly. (5) Development of Plant Layout using: (i) Black board
- II. Work Measurement** (1) Rating practice using: (i) Walking simulator. (ii) Pin board assembly. (iii) Dealing a deck of cards. (iv) Marble collection activity. (2) Determining the standard time using: (i) Simple operations using stopwatch time study. (ii) Predetermined Method Time Study (PMTS).
- III. Ergonomics** (1) Measurement of heart beat rate, calorie consumption parameters using: (i) Walking simulator. (ii) Cycle Ergo-meter. (2) Effect of human efficiency in work environments: (i) Noise. (ii) Light.

## 11 Thiagarajar College of Engineering

### M.E. DEGREE (Industrial Engineering) PROGRAMME

#### 14IE130 Work Study and Cost Analysis

##### Syllabus:

**Productivity and Work Study:** Productivity and standard of living, Techniques to reduce work content and ineffective time. Productivity matrix, Quality route to productivity, better asset utilization, wages and salary, job evaluation, job description, job analysis and merit rating, Leveraging IT for improved productivity - Case studies. Work Study - Introduction - Human factors.

**Method Study:** Introduction - Selection of jobs - Recording - Tools and Techniques - Charts, Diagrams, Template and Models - Examining - Developing the improved method - Principles of motion economy. Work Measurement: Introduction to Work Measurement - Time study equipments - Selecting the job to be studied and making a Time Study- Rating - Allowances to Standard Time - Setting Time Standard for work with machines - Examples of time study. Other Techniques of work measurement - Production study - Activity Sampling - Synthesis - Analytical Estimating - Predetermined Motion Time Systems. The use of Time standards - Organization of a work study department.

**Ergonomics:** Psycho physiological Data - Anthropometry, information displays - Man Machine System - Working Environment -chair and table heights. Strength and force of body movements - speed and accuracy of motor responses.

**Activity Based Costing:** Definition - Purpose - cost estimation Vs cost accounting - components cost - Direct cost - indirect cost - overhead expenses. Estimation of cost elements - set up time and economic lot size - tool change time - Inspection time - performance factors - overheads. different methods of apportioning overheads - Data required for cost estimating -Steps in making a cost estimate - estimation of production cost of simple components - problems.