SCHEME OF EVALUATION				
(Scoring indicators) SET B				
REVISION	**2021**		**COURSE CODE**	**4024 B**
COURSE TITLE	**INDUSTRIAL ENGINEERING**			
QUESTION NO.	SCORING INDICATORS	SPLIT UP SCORE	SUB TOTAL	TOTAL
	Part A			
1	Value Engineering	1	1	9×1 =9
2	Scheduling	1	1	
3	Quality	1	1	
4	Outline Process Chart	1	1	
5	Fixed Position Layout	1	1	
6	Micro Motion Study/Micro Motion Analysis	1	1	
7	Depreciation	1	1	
8	Blow holes in Castings	1	1	
9	Electricity or gas used in a factory	1	1	
	Part B			
II 1	1.Improved quality 2.Improvement in Manufacturing Process 3.Improved Productivity 4.Maximum Space Utilization 5.Safe and improved environment to workers. 6.Minimizes material and men movements.	Any three 3x1	3	3
2	<u>Applications of String Diagram</u> 1.It is used for recording complex movements of men or material 2.Back tracking, bottlenecks, underutilized paths are easily find out 3. It is used to record irregular movements.	Any three 3x1	3	3
3	1.The production is the conversion of raw materials in to products 2. The productivity is the development of an attitude to find better, cheaper, easier and safer means of doing a job. 3. The production is a group of process and productivity is development of an attitude respectively.	3x1	3	3
4	Multiple Activity chart is also known as Man Machine Chart. It records the related sequence of activities of more than one subject, men and machine on a common type scale showing the relationship between them. The activities of different workers and machines are recorded against a common time scale in sequence in terms of working time and idle time. This timing can be observed by an ordinary wrist watch or a stop watch according to the accuracy required and the duration of the activity.	3	3	3
5	The Principal constituents of Estimation are 1.Design time 2.Drafting Time 3.Materials	6x0.5	3	3

	4.Labour 5.Time allowances 6.Over heads			
6	The objectives of work study has three aspects 1.The most effective use of plant and equipment 2.The most effective use of human effort 3.The evaluation of human work to make it more convenient.	3x1	3	3
7	**14.8 COMPARISON BETWEEN ESTIMATING AND COSTING :** **Table 14.1** **S. No. | Estimating | Costing** 1. It is the calculation of expected cost of the product before manufacturing starts. | 1. It is the determination of actual cost of product by adding all the expenses incurred. 2. Estimator should be an Engineer who possess high technical knowledge. This work is of technical nature. | 2. Cost accounting is usually done by a person qualified for Accounts. The work is of clerical nature. 3. It forecasts probable cost and helps to determine whether the manufacturing is profitable or not in advance. | 3. It helps manufacturer to know whether the organisation is running in profits or loss. 4. It helps to fix up market price for proposed production. | 4. It helps for budget preparation. 5. To arrive at a standard probable expenditure for comparison with actual costs after making the product. | 5. It facilitates comparison with estimates to know whether the estimates are over, under or realistic. Also helps to identify the un necessary wastage of men, materials, machines money and to keep control over them.	Each 3 points 6x0.5	3	3
8	<u>Inspection</u> 1.It is one of the function of Quality Control 2.It finds out whether the products are acceptable or not. 3.It does not control the production process. <u>Quality Control</u> 1.It includes quality development, quality maintenance etc. 2. It aims at only production of quality products. 3.It controls the production process.	Each 3 points 6x0.5	3	3
9	Indirect costs include costs which are frequently referred to as overhead expenses such as rent and utilities and general and administrative expenses for example officer's salaries, accounting department costs and personnel department costs.	3	3	3
10	Arrange the series in ascending order Serial No. 1 2 3 4 5 6 7 8 9 X . 3 4 4 5 6 7 7 7 10 In odd Number Series Median = Size of (N+1)/2 the item Median = Size of (9+1)/2 the item i.e. 5 the item= 6	Data 1+ Formula1+ Answer1	3	3

	Part C			
III	**TYPES OF PRODUCTION AND ITS CHARACTERESTICS** ❖ **JOB PRODUCTION** *Single production at unit time* *Eg: ship, car etc..* ➢ **Characteristics** • Production based on customer only • Each job order is different • Volume of output is small • Higher degree of production control is required • Special type of tools not possible ❖ **BATCH PRODUTION** *Number of productions at unit time in the form of batches* *Eg: cloth, book, paper, pen etc..* ➢ **Characteristics** • Production in batches • Process type layout is used • Process planning is done for each best • Division of labor is possible • Flow of material is intermittent ❖ **MASS and FLOW/ CONTINOUS PRODUCTION** *Production continuously takes place in 24 hours in three shifts* *Eg: electricity, automobile industry, soft drink* ➢ **Characteristics** • Low production cost • Scope for division of labor • Work cycle is short • Time study can be applied.	List out1 +Explain 6	7	7
	or			
IV	Production Planning and Control function involves the planning of various production activities and making them to happen as per the program. **Objectives of PPC** 1.To find out the demand for a new product 2.To execute in advance the cost of a new product 3.To make route sheet 4.To control labour and activity 5.To simplify the activity	Define2 +Objective 5X1	7	7
V	Method study is the group of activities for increasing the efficiency of a particular work.	Define1+ Explain6	7	7

Procedure

Motion Study procedure involves the following factors.

1. ***Select and Define*** : The work to be studied is selected. Define the objectives to be achieved. Breakup the operations of the job. Prepare detailed list of all operations in the present method of manufacturing a job.

The following points may be considered before selecting a job for Work Study.

(a) **Economic aspects :** The cost of the job is the basis for selection because its objective is reducing it's cost. It is no use of carrying out the study if the economic importance of the job is small.

(b) **Technical aspects :** It should be made sure that required technical knowledge is available to carryout the study.

(c) **Human reactions :** It is a natural tendency of workers and other staff to resist the introduction of new methods and new changes with the fears of unemployment and transfers. Therefore the subject should not be proceeded where resistance to change or reaction likely to be the great until acceptance has been gained.

2. ***Record :*** The facts about the existing methods should be clearly recorded by using following recording techniques.

(a) **Charts :**
- (i) Out line process chart
- (ii) Flow process chart
- (iii) Two hand process chart
- (iv) Multiple activity chart
- (v) Travel chart

(b) **Diagrams :**
- (i) Flow diagram
- (ii) String diagram
- (iii) Cycle graph
- (iv) Chrono cycle graph

(c) **Motion and Film analysis**
- (i) S I M O chart
- (ii) P M T S

(d) **Layout Models :**
- (i) Two dimensional model
- (ii) Three dimensional model

3. ***Critical Examination*** : Question each detail of the job. The following questions should be asked on himself by the Motion Study Engineer about the way in which these operations are to be performed and about the tools and equipment needed. The procedure of this Questioning is known as "Critical Examination". Questions are to be put on the following five points.

(i) **Purpose :** What is the purpose of this operation ?

Does this fulfill the requirements ? and whether this can be eliminated ?

(ii) **Place :** Where is the best place to perform this operation ?

(iii) **Sequence :** When is the best time to do this operation ?

Whether it can be done at the same time as before or at any other better time ? When will it be more suitable and economical ?

(iv) **Person :** Who will do this operation ? Who can do it in better manner? Why ?

(v) **Means :** How this operation can be performed ? Which machines and tools are to be used ? Is it possible to simplify the work and introduce more easier and safer methods both for worker and equipment ?

4. ***Develop a new Method :*** After examining all the facts and analysis of results, a better way of doing an activity can be developed. The most practicable, economical and efficient methods of manufacturing are discovered. The following principles may be followed to develop a new method.

(i) **Elimination :** Every operation or detail of the job should be thought whether it can be eliminated without harm.

(ii) **Combine :** In this aspect, it should be observed whether two or more operations can be combined without any adverse effect to save operation time.

(iii) **Rearrangement :** Sometimes the rearrangement of sequence of operations helps in simplification of work. For example in a factory the sequence of operations was :

(a) Assembling

(b) Storage

	(c) Inspection (d) Dispatching In this sequence, inspection was carried before dispatching and defective components were being sent back to department for correction. After sometime it is felt that material handling and internal transport of defective components are more. It can be avoid if inspection is carried our before sending the products for storage. Then this sequence of operations can be rearranged to avoid unnecessary more material handling. (a) Assembling (b) Inspection (c) Storage (d) Despatching *(ie) Simplification* : The work can be simplified by (a) Placing materials, tools and equipment at proper working area. (b) Using gravity feed hoppers and such other material handling equipment. (c) Taking useful work by both the hands. (d) Using special Jigs and Fixtures. If any operation is found possible with any other easy, safe and economical method that should be adopted. 5. ***Install the new Method*** : After having developed the method, this is required to install. The new method must first be got approved from the supervisors, workers and management. Then the workers must be trained to work according to the new method. For sometime close contacts must be maintained with the progress of the job until it runs satisfactorily and gives encouraging results. 6. ***Maintain new Method*** : Once the new method has been installed, it should be maintained in its specified form and the workers should not be allowed to slip back to old method or introduce any other unauthorized changes. Copies of job instruction sheets are to be distributed to all the concerned. Selection and training of persons must be done according to the job specifications for this new method. Routine checks are necessary to check up and see that workers adhere to new method.			
	or			
VI	String diagram is used when flow diagram becomes congested with many paths involving great deal of movement. String diagram is defined as a scale plan or model in which a thread is used to trace and measure the path of workers, materials or equipment during specified sequence of events. **Construction :** 1. Draw the scale layout of the shop area and mark various features such as machinery, work benches, stores etc. 2. Mount this drawing on a soft board and strike pins or pegs at all the places which form the path of workers and materials. 3. A continuous coloured unstretchable string taken from the first to the last peg, is wound to mark the paths followed by workers or materials. 4. The thread when measured gives approximately the total distance travelled by a worker or material. **Uses :** 1. To examine the areas having greatest concentration of movements. 2. It is preferred where the movements are not regular as regards their frequency and distance travelled. 3. It traces existing path of movements for necessary modifications if any. 4. It shows the pattern of movements and thus helps in deciding the most economical routes to do a particular operation. 5. It is advantageous in studying the movements of an individual operator, gang or material. **Draw backs :** If the worker or materials move in some irregular or curvilinear path, it is not possible to trace exactly the same on the string diagram and thus no estimate can be made regarding the total distance travelled by the workers or the materials.	Define 2 + Construct3+ Drawback2	7	7
VII	Quality Control may be defined as 'that industrial management technique by means of which products of uniform acceptable quality are manufactured'. **<u>Objectives</u>** 1.To assure quality 2.Overall performance of the firm can be improved 3.To achieve required standard of product 4.To ensure uniform acceptable quality 5.To increase production and profit.	Define 2+ Objective 5	7	7
	or			
VIII	Quality costs can be classified into three		7	7

	1.Failure Cost **a)Internal failure cost** i)Scrap and rework cost ii) Cost involved in testing, inspection. iii)Losses due to avoidable processing iv)Expenses on failure analysis **b)External failure cost** i)Warranty charges ii)Cost of processing complaints iii)Cost of replacing the defective products iv)Failure analysis cost **2.Appraisal/Detection cost** i)Cost of auditing ii)Equipment calibration cost iii)Maintenance cost iv)Evaluation of customer satisfaction **3.Prevention Costs** i)Cost of quality planning ii)Cost of product review iii)Cost of process control iv) Cost of training and education.	Listout1 +Explain6		
IX	**.1.5 Labour :** The Labour employed in any organisation is of two types: a. Direct Labour b. Indirect Labour **a. Direct Labour :** The labour actually engaged in performing the manufacturing operation on direct material for making a product is called direct labour. Direct Labour process the material either ma:.ually or with the help of machines. They are called Productive Labour. The workers actually working manually or on production machines in various shops such as machine shop, welding shop, Pattern making shop and assembly section etc are examples of direct labour. **b. Indirect Labour :** Indirect Labour help the direct labour in discharging their duties. They are called non-Productive labour. Indirect labour services are also essential in any organisation. Indirect labour also discharge their duties of important nature but they are not actually engaged in production. Their wages can not be charged directly to a particular job. Their wages can be charged under overhead expenses of the factory. Foreman, supervisor, watchman, storekeeper, gatekeeper, crane driver, helpers etc. are examples of Indirect Labour.	3.5 + 3.5	7	7
	or			
X	Estimation: It is the pre determination of total cost of a particular activity.	Define 1+ Objective3+ Function 3	7	7

	OBJECTIVES OF ESTIMATION : 1. It helps to arrive at price setting 2. It helps in filling up the tender enquires. 3. To decide about whether a particular item is to be made or to buy. 4. To decide about Wage rates of workers after consulting Time study Engineers. 5. To decide about amount of over heads. 6. To know whether the project to be established is economical or not. 7. It helps in determining the time for manufacture of the component and the time of delivery of the component. 8. By estimating, a standard is set up against which subsequent expenditure can be measured and wastages calculated. **FUNCTIONS OF ESTIMATING :** The Functions of Estimation department is given below. 1. To find out material cost taking different allowances into consideration. 2. To determine labour cost. It can be calculated if the time required for each operation is known with the help of wage rates. 3. To calculate the cost of tools, equipment etc., to be purchased. 4. It helps in fixing the market price of the article proposed for production. 5. To determine different overhead charges. 6. To determine time required for each manufacturing operation by conducting time and motion study. 7. It helps in improving and modifying designs. 8. To determine most economical procedure for manufacturing the products. 9. To set up a standard estimation. Any subsequent expenditure can be compared and wastages may be calculated. 10. It helps to decide a particular part either to manufacture or buy from out side.			
XI	**TYPES OF PLANT MAINTENANCE** ➢ **CORRECTIVE OR BRAKE DOWN** • Maintenance provide after the failure of machine • General replacement is take place • This type of maintenance is used in small factories • Repair cost less • Few records and staffs • The machine should cheaper ➢ **SCHEDULED MAINTANANCE** • Maintenance is provide at predetermined dates • Overhauling of machine, cleaning of tank, white washing are the examples. • Breakdown should be minimize ➢ **PREVENTIVE MAINTENANCE** • This maintenance is done as routine action taken in planned manner • Main aim is to prevent breakdown • As scheduled maintenance there is no fixed time for preventive maintenance • The main principle is prevention better than cure. • Inspection, cleaning are the examples ➢ **PREDICTIVE MAINTENANCE** • It is a new technique • By using sensitive instruments and by human senses predict the trouble before failure	List out2+ Explain 5	7	7

	or			
XII	**PLANT LAYOUT** *It is the arrangement of machines, equipments and other facilities in a production system.* ❖ **FACTORS AFFECTING PALNT LAYOUT** ✓ Management policy ✓ Manufacturing process ✓ Nature of product ✓ Volume of production ✓ Type of equipment ✓ Type of building ✓ Service facility ✓ Possibility of future expansion	Define2 +Factors 5x1	7	7
XIII	**PROCEDURE TO DRAW X BAR AND R CHART** 1. A number of samples of components coming out of the process are taken over a period of time and each sample consisting of a number of units is taken at random. 2. For each sample the average value X bar of all the measurements and the range R, which is the difference between the highest and the lowest reading is calculated. 3. The grand average $\overline{\overline{X}}$ which is the average value of all the averages X bar and the average range R bar which is the average of all the ranges R are then found. 4. From the above values we can calculate central line, Upper Control Limit (UCL), and Lower Control Limit (LCL) of the X bar and R charts. $\overline{X}$ *Chart:* $UCL\ \overline{X} = \overline{\overline{X}} + A_2\bar{R}$ $LCL\ \overline{X} = \overline{\overline{X}} - A_2\bar{R}$ $\overline{\overline{X}}$ *Value* = *CentreLine (CL)* *R Chart:* $UCL\ R = D_4\bar{R}$ $UCL\ R = D_3\bar{R}$ $\bar{R}$ *Value* = *CentreLine (CL)* Where A2, D3, D4 are the constants that depends upon the number of items per sample, which is called sample size. 5. Plot UCL and LCL on X bar chart. Similarly draw for R chart 6. Plot the means of subgroups in X bar chart. similarly plot the range of subgroups for R chart 7. If the values of X bar and R for each sample lies within the control limit, process is in under control	Xbar4+ Rchart3	7	7
	or			
XIV	Inspection means checking the acceptability of the manufactured product. It measures the quality of a product or service in terms of pre decided standards. Types of Inspection 1.First piece Inspection 2.Floor/Process/Patrolling inspection 3.Centralized inspection 1. First piece inspection ● In automatic machines first three or four products are inspected carefully ● Sometimes a vendor must submit first pieces which will be inspected before giving order. ● E.g. book publishing 2.Floor/Process/Patrolling inspection ● The inspector walks round on the shop floor from machine to machine and checks samples of the work of various machine operators or workers. 3.Centralized inspection ● Inspection carried out at one place ● The components are brought to the inspection room	Define2+ Explain5	7	7