SCHEME OF EVALUATION				
(Scoring indicators) SET A				
REVISION	**2021**		**COURSE CODE**	**4024 A**
COURSE TITLE	**INDUSTRIAL ENGINEERING**			
QUESTION NO.	SCORING INDICATORS	SPLIT UP SCORE	SUB TOTAL	TOTAL
	Part A			
1	Industrial Engineering	1	1	9×1 =9
2	Gantt Chart	1	1	
3	Work Sampling	1	1	
4	a)Man type b) Equipment type c) Material type	Any two 2x0.5	1	
5	Quality	1	1	
6	Depreciation	1	1	
7	Dispatching	1	1	
8	Dimensions	1	1	
9	Rent and utilities, Administrative expense	Any one1	1	
	Part B			
II 1	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
2	<u>PLANT LAYOUT</u> *It is the arrangement of machines, equipments and other facilities in a production system.* ❖ <u>FACTORS AFFECTING PALNT LAYOUT</u> ✓ Management policy ✓ Manufacturing process ✓ Nature of product ✓ Volume of production ✓ Type of equipment ✓ Type of building ✓ Service facility ✓ Possibility of future expansion	Define 1+ Factors2	3	3
3	Method study is the group of activities for increasing the efficiency of a particular work.	Define1+ Objective 2	3	3

<table>
<tr><td></td><td>1. To eliminate wastage of time and labour.
2. To reduce fatigue of work by eliminating unnecessary movements.
3. To find best way of doing job and obtain greater job satisfaction.
4. To utilize effectively men, machines and material.
5. To improve the factory and offices layout and also design of plant equipment and building.
6. To standardize the method, obtained after conducting Motion Study.
7. To train the workers as per standardized method.
8. To provide better working conditions and environment.</td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>Inspection
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.
Quality Control
1. It includes quality development, quality maintenance etc.
2. It aims at only production of quality products.
3. It controls the production process.</td><td>Each 3 points
6x0.5</td><td>3</td><td>3</td></tr>
<tr><td>5</td><td>The following factors are considered while selecting material handling equipment
1.Material to be moved
2.Path of Travel
3.Types of building
4.Space available
5.Type of Production activity
6.Operating Costs</td><td>6x0.5</td><td>3</td><td>3</td></tr>
<tr><td>6</td><td>Two hand processes chart records the activities of the left hand and right hand of an operator as related to each other while he is doing a job. The recording comprises of two parallel charts, one for the activities of left hand another for right hand. After recording, the activities are to be examined in order to eliminate wasteful, unnecessary, uneconomical motions.
This chart is used for analyzing repetitive jobs of short duration and assembly work. The symbols used are same as used for process charts.
Example 6.8 :
ACTIVITY : BOLT AND NUT ASSEMBLE
Two hand Process Chart
<table>
<tr><th></th><th colspan="2">Symbols</th><th></th></tr>
<tr><th>Left hand</th><th>LH</th><th>RH</th><th>Right hand</th></tr>
<tr><td>Pick up bolts</td><td>○</td><td>D</td><td>Idle</td></tr>
<tr><td>Hold</td><td>▽</td><td>○</td><td>Pick up nut</td></tr>
<tr><td>Hold</td><td>▽</td><td>⇨</td><td>To left hand</td></tr>
<tr><td>Hold</td><td>▽</td><td>○</td><td>Assemble (Screw up)</td></tr>
</table>
FIG. 6.9</td><td>Explain2+
Fig 1</td><td>3</td><td>3</td></tr>
<tr><td>7</td><td>Direct Costs are the expenses associated explicitly with a business operations. Labour, materials and fuel are typically direct costs because they tangibly contribute to production</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>8</td><td>Man Machine chart 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.</td><td>3</td><td>3</td><td>3</td></tr>
</table>

<table>
<tr><td>9</td><td>Arrange the series in ascending order
Serial No. 1 2 3 4 5 6 7 8 9
X . 3 4 4 5 6 8 8 8 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</td><td>Data1+
Formula1
+Answer1</td><td>3</td><td>3</td></tr>
<tr><td>10</td><td>

14.8 COMPARISON BETWEEN ESTIMATING AND COSTING :

Table 14.1

<table>
<tr><th>S. No.</th><th>Estimating</th><th>Costing</th></tr>
<tr><td>1.</td><td>It is the calculation of expected cost of the product before manufacturing starts.</td><td>1. It is the determination of actual cost of product by adding all the expenses incurred.</td></tr>
<tr><td>2.</td><td>Estimator should be an Engineer who possess high technical knowledge. This work is of technical nature.</td><td>2. Cost accounting is usually done by a person qualified for Accounts. The work is of clerical nature.</td></tr>
<tr><td>3.</td><td>It forecasts probable cost and helps to determine whether the manufacturing is profitable or not in advance.</td><td>3. It helps manufacturer to know whether the organisation is running in profits or loss.</td></tr>
<tr><td>4.</td><td>It helps to fix up market price for proposed production.</td><td>4. It helps for budget preparation.</td></tr>
<tr><td>5.</td><td>To arrive at a standard probable expenditure for comparison with actual costs after making the product.</td><td>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.</td></tr>
</table>

</td><td>Each any
3 points
6x0.5</td><td>3</td><td>3</td></tr>
<tr><td></td><td>Part C</td><td></td><td></td><td></td></tr>
<tr><td>III</td><td>

PPC {PRODUCTION PLANNING AND CONTROL}

Ppc is system having the function such as production, planning and control for improving the quality of product, increase the rate of production with minimum possible cost and maximum output

FUNCTIONS OF PPC

- **FORCAST ING**
Estimation of quality and quantity of future work before the production
- **ORDER WRITING**
Giving authority to one or more person for taking the responsibility of a job
- **PRODUCT DE$ING**
Collection of information about material and drawing
- **PROCESS PLANNING AND ROUTING**
Finding the most simple and economical process for doing the work
- **MATERIAL CONTROL**
Determines the requirement about material control

</td><td>Define2 +
Explain 5</td><td>7</td><td>7</td></tr>
</table>

	❖ **TOOL CONTROLE** *Determine the requirement and control of tool* ❖ **LOADING** *Giving work to men and machine* ❖ **SCHEDULING** *It is the determination of when and in what sequence the work will done . it fixes starting and ending time* ❖ ***DISPATCHING*** Starting of action phase. In this worker get order to start work ❖ **PROGRESS REPORT** *Taking the progress of work* ❖ **CORRECTIVE ACTIONS** *Is there any corrections in production process will proceed*			
	or			
IV	Five Basic Types of Productivity improvement techniques **i)Employee based technique** * Financial Incentive * Fringe benefit * Skill enhancement programs * Quality circles * Job rotation * Employee promotion * Recognition * Good working environment * Punishment **ii) Material based technique** *Inventory control *Material requirement planning *Material handling systems *Material recycle and reuse **iii) Task based technique** *Methods engineering *Work measurement *Job design *Human factor engineering **iv) Product based technique** *Product diversification *Product simplification *Product standardization	List out 2 + Explain 5	7	7

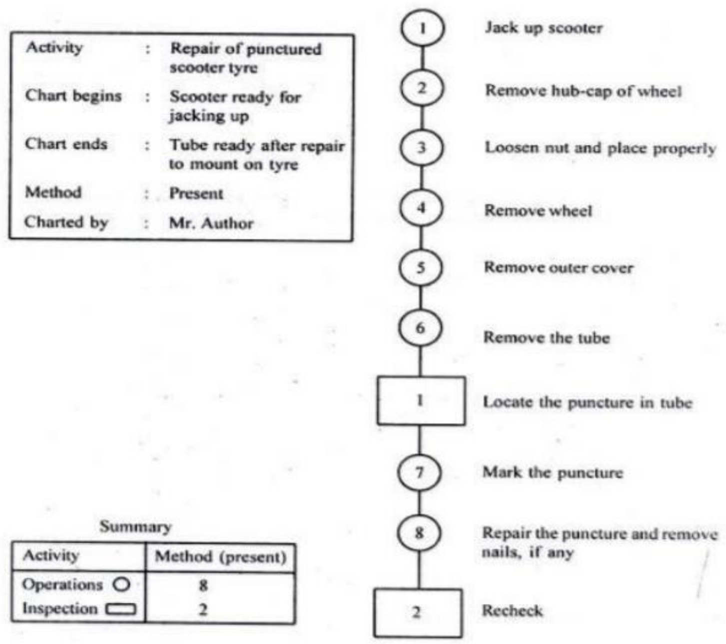
<table>
<tr><td></td><td>*R & D
*Advertising and promotion
*Value analysis

v)Technology based technique

*CAD/CAM
*Robotics
*Electronic data processing
*R & D
*Rebuilding old machinery</td><td></td><td></td><td></td></tr>
<tr><td>V</td><td>

1. Operation Process Chart

- An operation process chart is a graphic representation of the sequence of all operations and inspections taking place in a process.
- It is a process chart which gives an overall view of a process by recording only the main operations and sequences in proper sequence. So, it is obvious that such a chart requires only symbols for 'Operations' and 'inspection
- It is also known as Outline process chart.
- It gives a bird'seye view of the overall activities.
- Entry points of all material are noted in the chart.



</td><td>Explain4+
Diagram3</td><td>7</td><td>7</td></tr>
<tr><td></td><td>or</td><td></td><td></td><td></td></tr>
<tr><td>VI</td><td>

S.I.M.O Chart (Simultaneous Motion Cycle Chart)

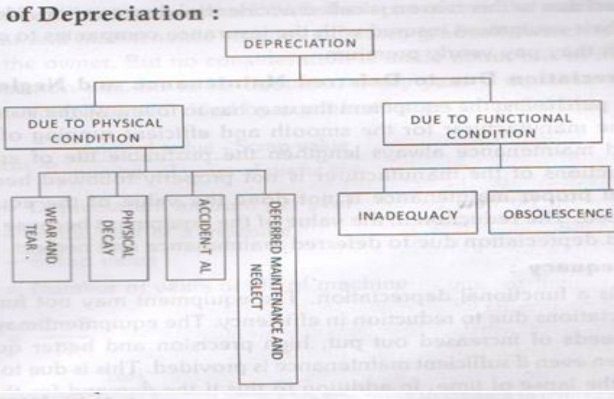
- It is an extremely detailed left-and right-hand operation chart.
- It showsbon a common time scale the simultaneous minute movements (therbligs) performed by the two hands of an operator.
- Besides hands, the movements of other limbs of an operator may also be recorded.
- The time scale is represented in winks (1/2000 of a minute)

</td><td>Explain3+
Construct
4</td><td>7</td><td>7</td></tr>
</table>

	S.I.M.O Chart :construction (1)Using a 16-mm movie camera a number of repetitive work cycles are filmed (at 16 frames per second) as the worker performs the job. For recording time, a timing device (wink counter) is placed in the field of view. (2)The film thus obtained is viewed and the most efficiently performed one whole cycle is selected for analysis. (A cycle involves complete series of motions from beginning to the end for completing a unit of work). (3)A projector is employed to study the work cycle recorded on the film. The work study Engineer analyses the film, frame by frame, studying one frame at a time, and concentrating first on the left-hand and then on right-hand movements. (4)The data noted in step-3 is recorded in the form of a therblig chart. The durations of actual movements are also read from the wink counter. (5) A simo chart is then drawn for further study and analysis. (6)This simo chart of the existing method is subjected to questioning procedure based on the principles of motion economy; the purpose is to develop a better and improved procedure for doing a job. (7) A new *Simo* chart is then prepared for the new method. (8) The new method is then checked as regards the advantages claimed for the same.			
VII	Inspection means checking the acceptability of the manufactured product. It measures the quality of a product or service in terms of pre decided standards. <u>Types of Inspection</u> 1.First piece Inspection 2.Floor/Process/Patrolling inspection 3.Centralized inspection 1. <u>First piece inspection</u> ● 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.<u>Floor/Process/Patrolling inspection</u> ● 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.<u>Centralized inspection</u> ● Inspection carried out at one place ● The components are brought to the inspection room	List out2 +Explain 5	7	7
	or			

<table>
<tr><td>VIII</td><td>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</td><td>7x1</td><td>7</td><td>7</td></tr>
<tr><td>IX</td><td>Solution :
C = 35,000, S = 5,000, N = 5 years.
Sum of the years digits = 1 + 2 + 3 + 4 + 5 = 15
C – S = 35,000 – 5,000 = Rs. 30,000
Depreciation amount to be collected for 5 years = Rs. 30,000
Depreciation charges for 1st year = $\frac{5}{15} \times 30{,}000 = \text{Rs.}10{,}000$
Depreciation charges for 2nd year = $\frac{4}{15} \times 30{,}000 = \text{Rs.}8{,}000$
Depreciation charges for 3rd year = $\frac{3}{15} \times 30{,}000 = \text{Rs.}6{,}000$
Depreciation charges for 4th year = $\frac{2}{15} \times 30{,}000 = \text{Rs.}4{,}000$
Depreciation charges for 5th year = $\frac{1}{15} \times 30{,}000 = \text{Rs.}2{,}000$
Total Rs. 30,000</td><td>Given data1+ Equations 4+Result 2</td><td>7</td><td>7</td></tr>
<tr><td></td><td>or</td><td></td><td></td><td></td></tr>
<tr><td>X</td><td>DEFINITION OF DEPRECIATION :
The value of the building, machinery or equipment decreases with the lapse of time due to use and wear and tear. The decrease in the value of physical asset with passage of time is called depreciation. This can be minimised up to some extent with proper care and regular maintenance but it can not be totally eleminated.
Depreciation may be defined as the reduction in the value and efficiency of machine or asset with the passage of time during use.</td><td>Define 2+ Explain 5</td><td>7</td><td>7</td></tr>
</table>

Causes of Depreciation :



Accidental Depreciation :

The reduction in the value of equipment caused due to accidents is called Accidental depreciation. Inspite of taking all care during installation and operation of equipment, about safety component to prevent accident, even then, accident may occur due to some wrong operation or loose component or some other cause which may result in heavy damage. The depreciation in machine caused due to this reason is called accidential depreciation. Most of the owners get their equipment insured with the insurance companies to cover this risk for which they pay yearly premium.

Depreciation Due to Deferred Maintenance and Neglect :

After purchasing the equipment the user has to follow all the instructions supplied by the manufacturer for the smooth and efficient running of the equipment. Good maintenance always lengthen the profitable life of equipment. If the instructions of the manufacturer is not properly followed because of neglect and if proper maintenance is not done the value of the equipment may be reduced. The reduction in the value of the equipment because of this reason is called depreciation due to deferred maintenance and neglect.

Inadequacy :

This is a functional depreciation. The equipment may not function up to the expectations due to reduction in efficiency. The equipment may not perform to the needs of increased out put, high precision and better quality. This may happen even if sufficient maintenance is provided. This is due to fall of efficiency with the lapse of time. In addition to this if the demand for the manufactured products increase, the plant may not cope up with the increased demand to produce more. Therefore it becomes necessary to expand the plant with additional similar equipment or replace with bigger size machinary. But this needs additional money which is to be collected from depreciation fund. This is called depreciation due to inadequacy

Obsolescence

Obsolescence is the depreciation of existing machinary or equipment due to invention of better or more efficient equipments or process etc.

The equipment purchased works through out its useful life period. Even if the equipment is in good condition it becomes useless or uneconomical to use it due to introduction of new machines to the market which are more efficient and more economical. To with stand to the market competition and to produce the products for cheaper rate, the producer may have to replace the present equipment by new equipment arrived in to the market. This existing good equipment becomes obsolete or out dated. This reduction in value of equipment due to new inventions is called obsolescence.

It is difficult for any estimator to calculate over heads as obsolescence as no body can predict when new and better machines are going to be invented. But it is a general practice to reduce the life of the machine in order to account this effect of obsolescence. The depreciation and obsolescence charges can be calculated in the reduced life period of equipment.

Examples of Obsolescence :

1. Due to manufacture of more efficient diesel and electric locomotives, the steam locomotives have become out dated.
2. When pocket calculators are introduced in the market, slide rules have become obsolete.
3. Due to introduction of quartz and automatic watches, the use of mechanical spring wound watches have been reduced very much.

XI	**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 out 2+ Explain 5	7	7
	or			
XII	**VARIABLE CHART** • measure the quality characteristics in numbers • More detailed • Small sample size • Relatively expensive because of greater cost of collecting measured data **ATTRIBUTE CHART** • No direct measurement of the product • Less detailed • Require comparatively bigger sample size • It is based upon GO and NO GO data Examples for Variable Chart- X bar, Sigma Chart Examples for Attribute Chart- P Chart, C Chart	Explain 5+ Example2	7	7

XIII

S.No.	Symbol	Therblig	Colour	Abbreviation	Explanation
1.		Search	Black	SH	Attempt to locate an object
2.		Find	Gray	F	Mental reaction at the end of search
3.		Hold	Gold ochre	H	Keep an object stationary
4.	→	Select	Light grey	ST	Choose one object from among a group
5.		Grasp	Red	G	Gain control or a hold on an object
6.		Released load	Cermine red	RL	Reliquish hold
7.		Transport loaded	Green	TL	More object with body member
8.		Transport empty	Dive green	TE	Reach for an object
9.		Position	Blue	P	Orient an object for use at its present
10.		Preposition	Pale blue	PP	Orient an object easy use at some later time in a different location
11.	#	Assemble	Violet	A	Put two or more parts together
12.		Disassemble	Light violet	DA	Separate two or more parts
13.	U	Use	Purple	U	Apply object or tool
14.		Respect	Burnet ochre	I	Examine object
15.		Avoidable delay	Lemon yellow	AD	A delay which operator can prevent
16.		Unavoidable delay	Yellow	UD	A delay which operator could not prevent
17.		Rest to over come falique	Orange	R	An attempt to recover from physical or mental work
18.		Plan	Brown	PN	Mental reaction before action

XIII	Any 7 7x1	7	7

or

XIV

Sampling inspection has the combined meaning of sampling and inspection

1.1 Advantages of Sampling Inspection :

1. The items which are to be subjected to destructive test must be inspected by sampling inspection only.
2. It consumes less time and it is less expensive.
3. Due to less inspection work fatigue is eliminated.
4. Only few items are handled for inspection. Therefore material handling is minimum and damage caused due to handling is minimum.
5. Less number of inspectors for inspection is sufficient.
6. The lot can be disposed quickly and there by scheduling and delivery are improved.
7. Rejection of entire lot on the basis of sample exerts pressure on producer for quality improvement.

XIV	7x1	7	7