

Q.1(a) Attempt any THREE of the following: [12]

Q.1(a) (i) State any six techniques used for improving productivity. [4]

Ans.: **Technique for improving Productivity** [Any six techniques - 4 marks]

- (a) **Work Study:** Work study aims two objectives one is to find out the best method of doing job and another one is to find the time taken to do it. This is done by breaking down the job into its various elements, eliminating all unnecessary movements and estimating the time taken to do this job with the help of stopwatch. Second aim is to ensure that all workers engaged in the job are trained to do it in the best way.
- (b) **Human Relations:** Good human relations help in co-operative behavior from workers which results in increase in productivity. Human relations can be improved by labour participation in goal setting, simplification in communication system minimizing the conflicts, encouragement and awarding rewards etc.
- (c) **Incentives:** When incentives schemes are introduced in a firm, it results a considerable improvement in productivity. It is something that encouraged a worker to put in more productivity effort. Workers will not give 100% unless their interest in work is created by some kind of reward.
- (d) **Cost Control:** Productivity can be increased by reducing the cost of production. This can be done by keeping careful watch over expenditure, reduction in wastage, reducing machine breakdown time, reducing waiting time for inventory avoiding excessive handling, minimizing overtime expenses etc.
- (e) **Product design:** A good design of product helps in economical and convenient manufacturing. It will also minimize wastage or scrap and reduce the cost of production. In order to achieve high productivity, product design must be simple to understand, standardization and simplification increases the production efficiency, research and development contributes improvement in product design, product development reduces ineffective time due to change in design, design must consider the current available technology.
- (f) **Working Conditions or ergonomics:** It is nothing but the design the man machine system in such a way that to ensure high productivity and safety of workers. Working conditions like lighting, ventilation, working hours, supervision etc. definitely affects the productivity. Also water facility, sitting room, bathroom, and toilets in sufficient numbers are considered to maintain working conditions. To motivate workers productivity related statement are displayed in a firm such that workers can read it frequently.
- (g) **Management by objectives:** It is process where the superior and subordinate management jointly identify common goal and define individual responsibility in terms of results expected from him
- (h) **Total Quality Management:** By this it obtained the greater customer satisfaction, fewer defects and less waste improved profitability and increased productivity.

Q.1(a) (ii) Explain the concept of production system with proper input output model. [4]

Ans.: [Concept of Production System - 2 marks, Input Output Model of Production System- 1 mark, Explanation - 1 mark]

Concept of Production System:

The Production System of any organization is that part which produces the organizations products.

- 1) Production is the basic activity of any organization and all the other activities revolve around production activity.
- 2) The output of production is the criteria of goods of services, which satisfy the needs of the customer.

- 3) The production system of an organization is that part, which produces products of an organization.
- 4) It is that activity whereby resources, flowing within a defined system, are combined and transformed in a controlled manner to add value in accordance with the policies communicated by management.

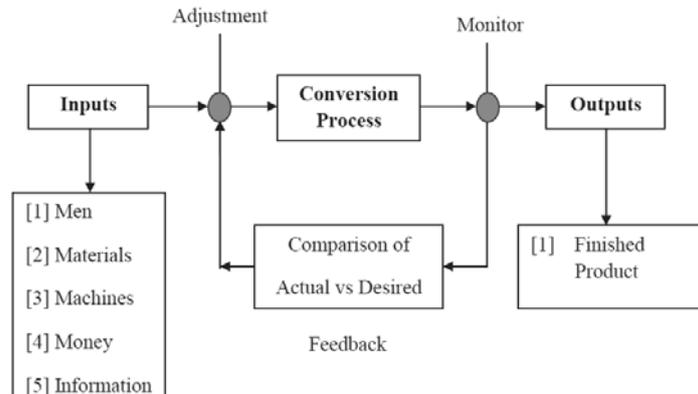


Figure: Input-Output Model of Production System

A simplified Production System with Input-Output Model is shown in above figure.

- 1) In this, Men, materials, machineries, money etc, are the part of Inputs of the system.
- 2) The finished goods and services are the outputs of the system through the different conversion processes like product design, process and production planning and control, maintenance etc.
- 3) The inputs are processed by a service of operations in a predetermined sequence.
- 4) Also there is a feedback system about the activities, which is essential to control and improve system performance.

Q.1(a) (iii) State different activities involved in dispatching function of PPC.

[4]

Ans.: Activities involved in dispatching function:

[Any Eight - 4 marks]

- 1) To issue work order to different departments.
- 2) To release material orders from stores.
- 3) To ensure release of correct tools, jigs and fixtures.
- 4) Keep a record of starting and completion date of each operation.
- 5) Collection of route sheet and other document from the shops.
- 6) Issue of inspection order of each operation.
- 7) Return of surplus material back to store.
- 8) Forwarding finished part to store.

Q.1(a) (iv) What is line balancing? Why it is necessary?

[4]

Ans.: Concept of Line Balancing:

[2 marks]

Assembly Line Balancing is associated with a product layout in which products are processed as they pass through a line of work centres. It means balancing the production line or assembly line for producing same amount of the work.

- 1) An Assembly line can be considered as a Production sequence, where parts are assembled together to form an end product.
- 2) In Assembly lines the operations are carried out at different work stations situated along the line.
- 3) Line balancing is the appointment of sequential work activities into work stations in order to gain a high utilization of labor and equipment so as to minimize the idle time.
- 4) There are different balancing methods are used to solve the line balancing problems such as Heuristic Method, Rank Position Weightage Method, Linear Programming, Dynamic Programming and Computerized Methods.

Necessity/Requirement of Line Balancing:

[2 marks]

- 1) To distribute the tasks evenly at every work station so that the idle time of men and machines is distributed equally.
- 2) To minimize the idle time of men's and machines in line.
- 3) To provide perfect balance when the assignments provide no idle time.
- 4) To group the work and workers.
- 5) To obtain an optimum balance of capacities on assembly line.

Q.1(b) Attempt any ONE of the following:

[6]

Q.1(b) (i) Discuss in brief important factors to be considered while making 'site selection' for a new industry/plant.

[6]

Ans.: **Factors to be considered while making "site selection" for new industry/plant:** [Any Six - 6 marks]

- 1) **Availability of raw material:** As far as possible the site selected should be near the source of raw materials so that cost of transportation can be minimized and storing cost can be reduced especially when the raw material is heavy and bulky or cheap but loses a good amount of weight during processing. For example most of the iron and steel industries are situated in Orissa and Bihar, Paper industries in Ballarpur due to availability of raw material in these areas.
- 2) **Availability of labour:** Available of right kind of labour in required numbers of reasonable rates is also deciding factor in site selection. Unskilled labours are amply available at major industrial areas and rural areas but however firms requiring skilled labour be situated near the urban industrial area.
- 3) **Climatic condition:** Climatic conditions largely affect certain production processes and also the efficiency of employees. For example textile industries required moist climate due to which these types of industries are situated near Ahmadabad and Mumbai; similarly Tea and Coffee near Assam.
- 4) **Proximity of market:** Market is another important factor affecting site selection. Industrial units using raw material should be located near the markets to serve the customer with minimum service cost.
- 5) **Transport and communication facilities:** While selecting the site, adequate transportation facilities should be considered. The optimum site is the site which is well connected by various modes of transportation.
- 6) **Availability of water:** Water is required for drinking and sanitary purpose of all industries. Therefore, clean and adequate water should be available near the site.
- 7) **Availability of power and fuel:** All industries require power and fuel to run the prime movers. Therefore, the site selected should have these facilities available at cheaper rate.
- 8) **Legal Aspects:** Local bye laws, taxes etc. are also important because they directly reflect in total cost. So while selection, it should also consider legal aspects.
- 9) **Amenities and recreational facilities:** Facilities like schools, hospitals, garden, play grounds should also be needed for employee and their family.
- 10) **Scope of Future expansion:** Site selected should be in such a way that a plenty of land other facilities must be available for future expansion.

Q.1(b) (ii) Differentiate between product layout and process layout on the basis of

[6]

- | | |
|-----------------------------|------------------------------|
| (1) Initial investment cost | (2) Cycle time |
| (3) Type of machines used | (4) Skill of labour required |
| (5) Inventory levels | (6) Arrangement of machines. |

Ans.:

[Each point : 1 mark]

Parameter	Product layout	Process layout
1) Initial investment cost.	It requires higher initial investment.	Less initial investment.
2) Cycle Time.	Less cycle time for manufacturing a product.	More cycle time for manufacturing a product
3) Types of machines used.	Special purpose machines are used.	General purpose machines are used.

4) Skill of labour required.	Comparatively less skill labours are required.	Comparatively High skill labours are required to operate number of general purpose machines.
5) Inventory level.	Less	More
6) Arrangement of machine.	Machines are arranged in a sequence in which the operations are performed on the product.	All the machines of similar operation are grouped together to make a section, like lathe section, milling section etc.

Q.2 Attempt any TWO of the following :

[16]

Q.2 (a) Name different types of material handling equipments used in industry. Explain any one with neat sketch.

Ans.: **Types of material handling devices**

[Classification, Sketch, Explanation - 2 marks each]

1) Trucks

(i) Power lift :

(a) Fork lift (b) elevating platform

(ii) Hand Lift

(iii) Porters trolley.

2) Tractors and trailers

3) Hoist and cranes

(i) Hoist

(a) Chain hoist (b) Electric hoist

(ii) Crane

(a) Over bridge crane (b) Jib crane.

4) Conveyers

(a) Belt conveyer (b) Roller conveyer (c) Chain Conveyer (d) Screw conveyer

5) Automated guided vehicle

Belt Conveyer:

- 1) Belt conveyers are particularly suitable for package handling because of their smooth, noiseless operation.
- 2) It can be used for handling of materials in horizontal or inclined direction.
- 3) Belt conveyer consists of an endless belt, idler roller, structure, a head pulley, a tail pulley and suitable drive.
- 4) The width of belt ranges from 8 cm to 100 cm. and material of belt can be rubber, plastic, leather, sometimes flat steel bands can also be used.
- 5) Speed of belt normally ranges from 1 m/s to 70 m/s.

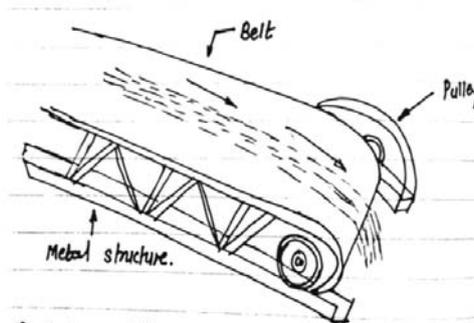


Fig.: Belt Conveyer

Q.2(b) State and explain various factors affecting process planning.

[6]

Ans.: **Factors affecting process planning :**

[Any Six factors - 6 marks]

(1) Size and shape of part

The size and shape of many components decides the basic operations for the manufacturing of part. For example : For manufacturing a shaft, the necessary information is shape of raw

material, size of shaft, according to that we select the sequence of operations, machines to be used and material handling activities.

(2) Strength characteristics of the part

The part strength also decides that which type of process is employed for producing it. Because the different types of load acted on the part during its working such as impact load, tensile load or shock load etc. according to that process planning is done.

(3) Quantity required

According to the no. of output produced, the process planning is decided. For example: Part which is manufacture in large no. for that general purpose machine is used and for large size and less no. of part special purpose machines are used.

(4) The accuracy and surface quality required

For achieving accuracy, product should be manufactured such a way that it should give higher dimensional accuracy and high degree of surface finish according to that machines and process is to be selected.

(5) Utilization of existing equipments

While selecting the process, full capacity of existing machines & its tooling must be utilized, otherwise the existing machinery will remain idle and more capital will be invested on new machines.

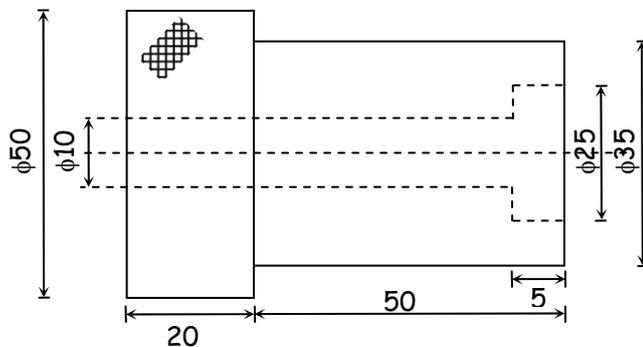
(6) Skill of manpower

Skill of available manpower must be known to determine the need for added operations to avoid defectives due to poor workmanship.

(7) Delivery date of components or product

Short time period of delivery generally do not allow process engineer to select most economical process and tool for economic production. Due to insufficient time, he may use less efficient machine and tool on hand. On other hand, longer delivery schedule give process engineer sufficient time to go details of each aspect to select most economical process.

Q.2(c) Prepare operation process sheet and decide sequence of operation for the component shown [6] in figure. Assume suitable material and cutting conditions.



Ans. : [Deciding correct sequence of operations - 4 marks, Preparing Operation sheet - 2 marks]

	Description of Operation	Machines Used	Tool/Fixtures Used	Machining Parameters		
				Cutting Speed (m/min)	Feed (mm/rev.)	Depth of Cut (mm)
1)	Cut the blank for a length of 80 mm	Cutting Machine	Hack Saw	30	0.0025	
2)	Clamp the blank in chuck with a projecting length of 80 mm	Centre Lathe	3 Jaw Chuck	30	0.025	
3)	Facing operation to remove 1 mm of stock	Centre Lathe	HSS, R. H. Single Point Cutting Tool	30	0.025	

4)	Turn Diameter of 50 mm for a length of 70 mm	Center Lathe	HSS, R. H. Single Point Cutting Tool	30	0.025	
5)	Turn Diameter of 35 mm for a length of 50 mm	Centre Lathe	HSS, R. H. Single Point Cutting Tool	30	0.025	
6)	Drilling hole of 4> 10 mm at the centre for a length of 70 mm (through out)	Centre Lathe	Drill Bit	30	Medium	
7)	Drilling hole of 4> 25 mm at the centre for a length of 5 mm	Centre Lathe	Drill Bit	25	Medium	
8)	Cutting Off the job at 70 mm length	Centre Lathe	Parting Tool	30	0.025	
9)	Knurling Operation on 4>50 mm rod for length of 20 mm	Centre Lathe	Knurling Tool with knurling wheel	25	Medium	

Q.3 Attempt any FOUR of the following :

[16]

Q.3(a) Suggest appropriate material handling device for

[4]

- (i) Transporting coal in thermal power plant
- (ii) Transporting cotton in ginning unit
- (iii) Transporting pallets
- (iv) Transporting packed boxes of biscuits within industry.

Ans. : (i) Transporting coal in thermal power plant - Belt Conveyor.

[1 mark each]

(ii) Transporting cotton in ginning unit - Trucks, Tractors and trailers.

(iii) Transporting pallets - Fork lift truck, hand lift truck.

(iv) Transporting packed boxes of biscuits within industry - Hand wheel barrow or hand trolley or Porter's trolley.

Q.3(b) State and explain the basic principle to be followed to develop a good plant layout.

[4]

Ans. : Following are the basic principle to be followed to develop a good plant layout [Explanation - 4 marks]

- 1) **Overall integration:** A good layout is one that integrates men, materials, machine and supporting services, and others in order to get the optimum utilization of resources and maximum effectiveness.
- 2) **Smooth flow of product:** A good layout is one that makes the material to move in forward direction towards the completion stage, i.e., there should not be back tracking.
- 3) **Minimum distance travelled:** This means minimum movement of men and materials. The facilities should be arranged such that, the total distance travelled by the men and material should be minimum and as far as possible straight line movement should be preferred.
- 4) **Space utilization:** The good layout is one that utilized both horizontal and vertical space. It is not only enough if only the floor area is utilized optimally but the third dimension, i.e., the height is also utilized effectively.
- 5) **Flexibility:** The good layout is that can be altered without much cost and time, i.e., future requirements should be taken into account while designing the present layout.
- 6) **Minimum handling:** A good layout is that which reduced the material handling to minimum.
- 7) **Maximum visibility:** The plant should be planned in such a way that, there should not be any difficulty in supervision, co-ordination and control. There should not be no "hiding space" into which goods can be mislaid.
- 8) **Employee satisfaction and safety:** A good layout is one that gives due consideration to workers safety and satisfaction and safeguard the plant and machinery against fire, theft etc.

- 9) **Maximum accessibility:** All servicing and maintenance point should be readily accessible without making any hindrance to the production process. For this purpose there must be sufficient space between different machines.

Q.3(c) What are the factors to be considered to determine stages of inspection during process planning? [4]

Ans.: Factors to be considered to determine stages of Inspection during Process Planning:

- 1) Type of Production System [Any four - 1 mark each]
- 2) Type of Facility Layout
- 3) Type (Nature) of Product/Components
- 4) Type of Machines/Equipments used
- 5) Application of the Product/Components etc.
- 6) Strength/characteristics of the product

Q.3(d) State and explain how the different operations can be combined? [4]

Ans.: By two methods operation can be combined. [2 marks each method]

1) Simulation method

In this method, different operations are combined together and performed the simultaneously in one setting. For example, straddle milling, gang milling operation, slot making operation on CNC machine centers etc.

2) Integration Method

When a set of operations selected for a process arranged so as to perform one after other, not simultaneously is the method of integration.

Here operations are carried out in succession without disturbing setups. For example operations on turret lathe, multi spindle automats, CNC operations etc.

Q.3(e) What are the objectives of method study? [4]

Ans.: Objectives : [Any Eight - $\frac{1}{2}$ mark each]

- 1) Improvement in process and procedures.
- 2) To find the best way of doing job.
- 3) Better workplace layout and better working condition.
- 4) Less fatigue to operators.
- 5) Better product quality.
- 6) Improvement in the use of materials, machines and manpower.
- 7) Efficient and fast material handling.
- 8) Greater job satisfaction, higher standards of safety and health.
- 9) Reduction in waste and scrap.
- 10) Smooth and streamline flow of production and processes.

Q.3(f) State different components of jigs/fixtures. [4]

Ans.: Different components of Jigs and Fixtures: [Any four - 4 marks]

1) Body

It is a plate, box or frame type structure in which the components to be machined are loaded. It should be quite sturdy and rigid.

2) Locating Elements

These elements position the work piece firmly in the proper position against the action of cutting forces.

3) Clamping elements

These elements held the work piece firmly in located components.

4) Guiding and Setting elements

In jig, the guiding element used is drill bush. It guides the cutting tool till the surface of work piece where hole is to be drilled. In fixtures, the setting element is setting block.

5) Positioning elements

These elements include different types of fastening devices which are used in securing the jigs and fixture to the machine at proper position.

6) Indexing Elements

Sometimes the work piece may have to be indexed to different position in order to perform machining operations at different locations.

In such case indexing elements are to be used.

Q.4(a) Attempt any THREE of the following : **[12]**

Q.4(a) (i) Explain the concept of Kaizen with example. **[4]**

Ans. : KAIZEN : [Explanation : 3 marks, Example : 1 mark]

- Kaizen means gradual, orderly, continuous improvement. It is an approach to productivity improvement.
- Kaizen is a daily activity where the purpose goes beyond simple productivity improvements.
- Kaizen is aimed at producing more and more value with less and less wastage, attaining better working environment, and developing stable processes by standardization.
- This never ending process of achieving small improvements within the company everyday is in contrast to trying to achieve breakthrough results from larger improvements once in a while.
- Kaizen implementation is said to operate on the following principles:
 - (i) Human resources are the company's most important assets.
 - (ii) Success cannot be achieved by some occasional radical changes alone, but more so by incremental yet consistently arriving improvements.
 - (iii) Improvements must be based on statistical or quantitative study of the performance process.

Example : A mobile manufacturing company continuously upgrades versions of operating system like android for better performance is an example of kaizen.

Q.4(a) (ii) Explain the concept of ERP. **[4]**

Ans. : [Explanation : 4 marks]

Enterprise resource planning (ERP) is a business management software - usually a suite of integrated applications - that a company can use to collect, store, manage and interpret data from many business activities, including:

- Product planning, cost
- Manufacturing and sales
- Inventory management
- Shipping and payment



ERP came to represent a larger whole that reflects the evolution of application integration beyond manufacturing.

ERP provides an integrated view of core business processes, often in real-time, using common databases maintained by a database management system. ERP system track business resources- cash, raw materials, production capacity- and the status of business commitments: orders, purchase orders, and payroll.

ERP (Enterprise Resource planning) systems typically include the following characteristics:

- An integrated system that operates in (or near) real time without relying on periodic updates
- A common database that supports all applications
- A consistent look and feel across modules

Q.4(a) (iii) Enlist any four basic components used in robotic systems also write their functions. [4]

Ans.: [One component : 1 mark]

Enlist any four basic components used in robotics systems also write their functions. Basic components used in robotics system with their functions:

1. **Arm:** The arm is the part of the robot that positions the end effectors and sensors to do their pre-programmed task.
2. **End-effectors:** It is designed to perform the task like grasping, transporting, lifting etc. It also be used to perform operations on work piece.
3. **Actuator:** An actuator is a device that produces translatory or rotary movement of the links or makes the freedom possible. These are the drives for the manipulator, which connects the controller with manipulator.
4. **Sensors:** They convert one form of energy into another for useful purpose. They perform two major tasks. One is to collect information about the different links, arms with their status and other one is to inform controller about outside environment.
5. **Controller:** Controller coordinates the movement of the arm. The controller receives the input data from the computer, controls the actuator motion and takes the feedback information through various sensors.
6. **Drive:** The drive is the engine or motor that moves the links into their designated positions.

Q.4(a) (iv) State basic difference between push and pull type of manufacturing system. [4]

Ans.: [Any four point : 4 marks]

	Pull Type	Push Type
1	Production is based on actual demand	Production is not based on actual demand. It means make to stock.
2	Production schedule changes with changes in customer order	Production schedule remains unchanged despite of customer order
3	Capacity utilization is lower	Capacity utilization is higher
4	Capacity requirements planning are critical	Capacity requirements planning are comparatively simple
5	Just in Time (JIT) is a pull system which is also known as Make to Order Production	It is often said that Material Requirements Planning (MRP) is a Push system

Q.4(b) Attempt any ONE of the following : [6]

Q.4(b) (i) What is lean manufacturing? State its advantages. [6]

Ans.: [Explanation : 3 marks; Advantages : 3 marks]

Lean manufacturing or lean production, often simply "lean", is a systemic method for the elimination of waste ("Muda") within a manufacturing process. Lean manufacturing is a production practice that considers the expenditure of resources for any goal other than the creation of value for the end customer to be wasteful, and thus a target for elimination. Working from the perspective of the customer who consumes a product or service. It gives values for processes that a customer would be willing to pay for.

Lean is the management philosophy developed by Toyota production system. It focuses on reducing waste.

Advantages :

- (i) It eliminates waste.
- (ii) It enhances productivity.
- (iii) It helps to obtain higher customer satisfaction.
- (iv) It reduces per unit cost.
- (v) It controls inventory.

Q.4(b) (ii) Construct two handed Process chart for the assembly of Nut and Bolt with summary. [6]

Ans. : [4 marks for Chart and 2 mark for Summary]

Left Hand		Right Hand	
Description	Symbol	Symbol	Description
Washer to the workstation			Bolt to the workstation
Position Washer on bolt			Grasp the bolt securely
Nut to the Workstation			Wait/Delay
Positioned & Thread nut			Hold the bolt
Inspect			Hold
Wait			Transfer assembly to left hand
Drop the assembly to bin			Wait/Delay

Summary

Symbol				
Frequency (LH)	3	2	1	1
Frequency (RH)	2	1	0	

Q.5 Attempt any FOUR of the following :

[16]

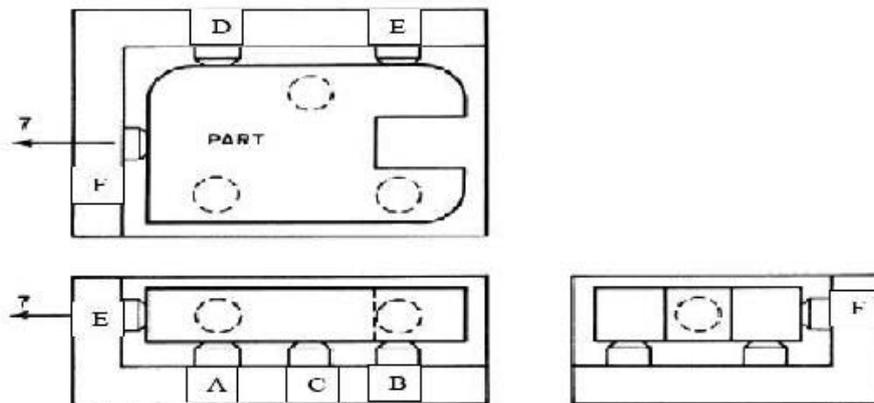
Q.5(a) Explain 3-2-1 principle of location with suitable example.

[4]

Ans. :

[Explanation : 4 marks]

1. It is also known as six pin or six point location principle. In this, the three adjacent locating surfaces of the blank (work piece) are resting against 3, 2 and 1 pins respectively, which prevent 9 degrees of freedom.
2. The rest three degrees of freedom are arrested by three external forces usually provided directly by clamping. The 3-2-1 principle states that the six locators are sufficient to restrict the required degree of freedom of any work piece. In this, motion is restricted using clamps and locators. A three pin base can restrict five motions and six pins restrict nine motions.



Q.5(b) Enlist general principles of jig and fixture design. [4]

Ans.: Principle of jigs and fixture design: [1 mark each for Any 4 Points with explanation]

1. Before planning the design of a tool, compare the cost of production of the work with present tools with the expected cost of production, using the tool to be made. Confirm that the cost of building jigs & fixture is not in excess of expected gain.
2. Before lying out the jigs & fixture decide upon the location point & outline a clamping arrangement.
3. Make all clamping & building devices as quick acting as possible.
4. In selecting the location points, see that two component part of a machine can be located from corresponding points & surfaces.
5. Make the jig 'fool-proof' that means design it in such way that work cannot be inserted except in the correct way.
6. For rough casting, make some of the locating points adjustable.
7. Locate clamps so that they will be in the best position to resist the pressure of cutting tool when at work.
8. Wherever possible make all clamps, integral parts of jig or fixture.
9. Avoid complicated clamping arrangements which are liable to wear or get out of order
10. Place or clamps as nearly as possible opposite to some bearing point of the work to avoid springing.
11. Round all corners.

Q.5(c) What is meant by '5S'? State meaning of each "S" in detail. [4]

Ans.: Meaning of 5'S : [1 mark]

5'S is the name of a workplace organization methodology that uses a list of five. Japanese words which are seiri, seiton, seiso, seiketsu and shitsuke constitute the system.

Interpretation of "S" : [3 marks]

Japanese Term	English Equivalent	Meaning
SEIRI	Tidiness	Unrelated materials in workplace
SEITON	Orderliness	Set everything in proper for quick storage and retrieval
SEISO	Cleanliness	Clean the workplace, everything should be janitor
SEIKETSU	Standardization	Standardize the way of manipulating the cleanliness
SHITSUKE	Discipline	Practice 5's daily, make it a way of life this also means a commitment

Q.5(d) State any four types of grippers used in robots with one application of each. [4]

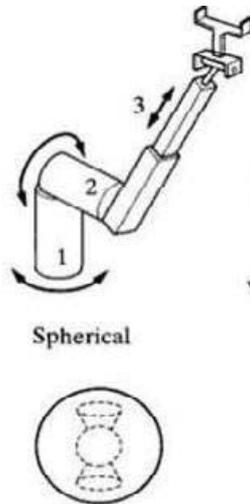
Ans.: [Any four types : 1 mark each]

- 1) Vacuum Gripper : Flat and light weight Surfaces / Palletizing materials
- 2) Pneumatic Gripper : Slightly weight parts
- 3) Hydraulic Gripper : Heavy parts in industry
- 4) Servo electric Gripper : Lightweight parts
- 5) Magnetic Gripper : Metal objects such as steel sheets or tables
- 6) Claw Grippers : Pick and lace and Assembly operations

Q.5(e) Describe spherical configuration used in robot with neat sketch. [4]

Ans.: Spherical Configuration : [Explanation : 2 marks, Neat sketch : 2 marks]

It uses telescopic arm that can be raised or lowered about a horizontal pivot point. The pivot point is mounted on a rotating base and gives the robot its vertical movement. These various joints provide the robot with the ability to move its arm within a spherical envelope.



Q.5(f) Differentiate between jig and fixture with respect to : [4]
 (i) Definition (ii) Cost (iii) Construction (iv) Application

Ans. : [1 mark for each point]

	Parameters	Jigs	Fixtures
1	Definition	A jig may be defined as a device, which holds and locates a work piece as well as guides and controls one or more cutting tools	A fixture is defined as a device used for holding and locating a component or work piece securely in a definite position but it does not guide the cutting tool.
2	Cost	More as compare to fixture as it includes tool guiding and holding arrangement.	Less as compare to jig.
3	Construction	Jigs are lighter in weight for quicker handling	Whereas fixtures are generally heavier in construction.
4	Application	It is used in drilling, reaming or tapping operations.	It is used for operations like milling, planing, Shaping, turning etc.

Q.6 Attempt any TWO of the following : [16]

Q.6(a) What is scheduling? State internal and external factors affecting scheduling. [8]

Ans. : **Scheduling :** [2 marks]

Scheduling means when and in what sequence the work will be done. It involves deciding as to when the work will start and in certain duration of time how much work will be finished. Scheduling deals with orders and machines - it determines which order will be taken up on which machine and which department by which operator. It ensures free flow of material along the production line.

Factors affecting Scheduling

Internal Factors : [3 marks]

- 1) Stock of finished goods
- 2) Availability of men, machine, material
- 3) Availabilities of Manufacturing facilities
- 4) WIP

External Factors : [3 marks]

- 1) Customers Demand
- 2) Customers delivery dates
- 3) Stock of good already lying with dealers and retailers

Q.6(b) A shop floor activity consists of three elements. Calculate the standard time for the activity. The various allowances are given as percentage of normal time. [8]

Elements	A	B	C
Observed time (min)	1.25	1.2	2.85
Rating factor (%)	90	115	85
Relaxation allowances (%)	12	13	8
Delay allowances (%)	3	6	5
Personal allowances (%)	8	6	4

Ans. :

[Calculation : 4 marks]

Elements	Observed time	Rating	Basic Time (Normal time)
A	1.25	90	$= 1.25 \times (90/100)$ $= 1.125$
B	1.2	115	$= 1.2 \times (115 \times 100)$ $= 1.38$
C	2.85	85	$= 2.85 \times (85 \times 100)$ $= 2.4225$

$$\boxed{\text{Total time} = 1.125 + 1.38 + 2.42 = 4.9275 \text{ min}}$$

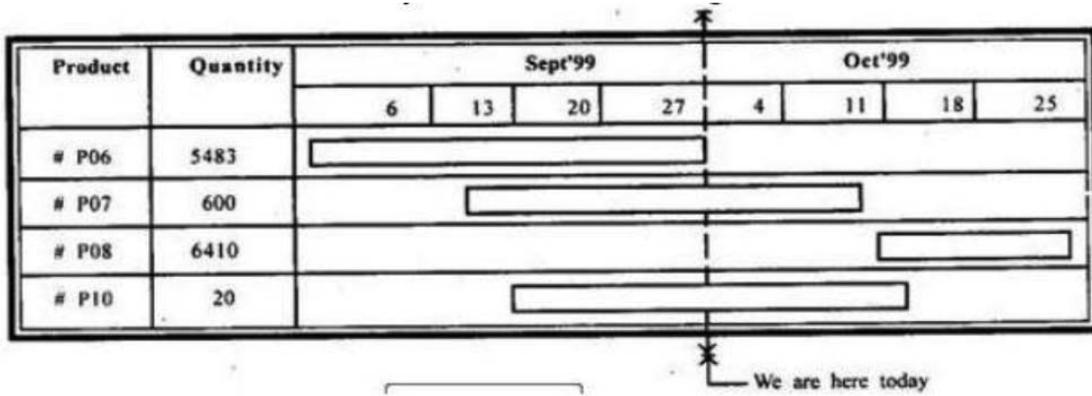
- 1) Relaxation Allowance = $(12/100 \times 4.9275) + (13/100 \times 4.9275) + (8/100 \times 4.9275)$
 $= 0.5913 + 0.6405 + 0.3942$
 $= \mathbf{1.626 \text{ Min}}$ [1 mark]
- 2) Delay Allowance = $(3/100 \times 4.9275) + (6/100 \times 4.9275) + (5/100 \times 4.9275)$
 $= 0.1478 + 0.2956 + 0.2463$
 $= \mathbf{0.6897 \text{ Min}}$ [1 mark]
- 3) Personal Allowance = $(8/100 \times 4.9275) + (6/100 \times 4.9275) + (4/100 \times 4.9275)$
 $= 0.3942 + 0.2956 + 0.1971$
 $= \mathbf{0.8869 \text{ Min}}$ [1 mark]
- Standard time = $(4.9245 + 1.626 + 0.6897 + 0.8869)$
 $= \mathbf{8.1301 \text{ Min}}$ [1 mark]

Q.6(c) Explain Gantt Chart used in PPC. State its advantages. [8]

Ans. : [Explanation : 4 marks; Diagram : 2 marks; Advantages - 2 marks]

Gantt Chart is a project planning tool that can be used to represent the timing of tasks required to complete a project. Because Gantt charts are simple to understand and easy to construct, they are used by most project managers for all but the most complex projects.

- 1) In a Gantt Chart, each task takes up on row.
- 2) Dates run along the top in increments of days, weeks or months, depending on the total length of the project.
- 3) The expected time for each task is represented by a horizontal bar whose left end marks the expected beginning of the task and whose right end marks the expected completion date.
- 4) Tasks may run sequentially, in parallel or overlapping.
- 5) Gantt charts are particularly helpful ways of dealing with scheduling tasks, understanding critical paths of project and planning of resources.



Advantages of Gantt chart:

- 1) Gantt Chart is simple graphical display technique, suitable for less complex situations [2] Gantt charts are extremely easy to understand.
- 2) It can quickly reveal the current or planned situation to all concerned.
- 3) It does not provide any rules for choosing but simply presents a graphical technique for displaying results (and schedule) and for evaluating results (make span, idle time, waiting time, machine utilization, etc.)
- 4) There is clarity in communicating important shop information by using Gantt chart

□ □ □ □ □