Chapter 2: Production Planning and Control (PPC)

Repeated Questions:

1. PPC – Functions, Role and Phases:

- **Q.** Explain with reference to PPC, the following: Routing, Scheduling, Loading and Dispatching. **(SUMMER 2025, 4 Marks; SUMMER 2026)**

Answer:

- **Routing:** Determines the path/sequence of operations and resources required to manufacture a product. It specifies "where and how work will be done."
- **Scheduling:** Determines when each operation will be performed. It fixes start and finish times for jobs on machines.
- **Loading:** Assigns work to machines/facilities based on capacity. It decides how much work is allotted to each resource.
- **Dispatching:** Releases work orders to the shop floor and authorizes actual execution as per schedule.
- **Expediting:** Follow-up function that tracks progress, identifies delays, and takes corrective action to meet schedules.

- **Q.** Explain the terms Loading, Scheduling, Dispatching, and Expediting. **(SUMMER 2022, 7 Marks OR; WINTER 2024, 7 Marks OR; WINTER 2025, 4 Marks)**

Answer:

- **Routing:** Determines the path/sequence of operations and resources required to manufacture a product. It specifies "where and how work will be done."
- **Scheduling:** Determines when each operation will be performed. It fixes start and finish times for jobs on machines.
- **Loading:** Assigns work to machines/facilities based on capacity. It decides how much work is allotted to each resource.
- **Dispatching:** Releases work orders to the shop floor and authorizes actual execution as per schedule.
- **Expediting:** Follow-up function that tracks progress, identifies delays, and takes corrective action to meet schedules.

- **Q.** What is the role of production planning and control in industry? Also explain the functions of PPC. **(WINTER 2023, 7 Marks; WINTER 2024, 7 Marks OR)**

Answer:

Role of PPC in Industry:

- **Coordination:** Integrates men, machines, materials, and methods for smooth production.
- **Resource Optimization:** Ensures efficient utilization of plant capacity, labour, and materials.
- **Delivery Reliability:** Plans and controls production to meet customer delivery dates.
- **Cost Control:** Reduces idle time, overtime, inventory, and production delays.
- **Quality and Flexibility:** Maintains consistent output and adapts to demand changes.

Functions of PPC:

- **Forecasting:** Estimating future demand for products.
- **Process Planning:** Deciding operations, machines, and tools.
- **Routing:** Determining sequence of operations.
- **Scheduling:** Fixing time schedule for production.

- **Loading:** Assigning work to machines/facilities.
- **Dispatching:** Releasing work orders for execution.
- **Expediting/Follow-up:** Tracking progress and correcting deviations.
- **Inventory Control:** Maintaining optimum raw material, WIP, and finished goods.

- **Q.** Give a detailed explanation of the three phases of PPC. **(SUMMER 2024, 7 Marks OR; SUMMER 2026 OR)**

Answer:

1. Planning Phase:

- Demand forecasting and sales order analysis.
- Product design and process planning.
- **Routing:** Sequence of operations.
- **Scheduling:** Time allocation for jobs.
- **Loading:** Assignment of work to machines.
- Material and capacity planning.

2. Action Phase:

- **Dispatching:** Release of work orders, drawings, tools, and materials to shop floor.
- Execution of production as per plan.
- Coordination between departments.
- Recording of actual progress.

3. Control Phase:

- Comparison of actual output with planned output.
- **Expediting/Follow-up** to identify delays.
- Corrective action for deviations.
- Feedback to planning for future improvements.
- Inventory and cost control.

- **Q.** What is Routing? Explain in brief. **(SUMMER 2023, 3 Marks; WINTER 2024, 3 Marks)**

Answer:

Routing: Routing is the determination of the sequence of operations and the resources required to manufacture a product.

- Specifies operations, machines, tools, and inspection points.
- Determines the path of material through the plant.
- Forms the basis for scheduling and loading.

Example: Raw material → Cutting → Turning → Drilling → Inspection → Assembly.

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2. Process Planning:

- **Q.** What do you mean by Process Planning? Explain the step-by-step procedure of Process Planning. **(WINTER 2022, 3 Marks; SUMMER 2025, 4 Marks)**

Answer:

Process Planning: Process planning is the systematic determination of manufacturing operations, sequence, machines, tools, and time required to convert raw material into a finished product.

Step-by-Step Procedure:

1. Study product drawing and specifications.
2. Determine required operations and their sequence.
3. Select machines, tools, and fixtures.
4. Decide inspection points and quality requirements.
5. Estimate operation times and material requirements.
6. Prepare process sheet/route sheet.
7. Estimate manufacturing cost.

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3. Production Systems:

- **Q.** Define the following types of production systems: Job Shop, Batch Production, Mass Production, and Continuous Production, with example. **(WINTER 2022, 7 Marks; SUMMER 2025, 7 Marks OR)**

Answer:

- **Job Shop Production:** Customized products in small quantities with high variety. General-purpose machines and skilled labour are used. **Example:** Machine tool fabrication, custom furniture.
- **Batch Production:** Products manufactured in lots/batches with moderate volume and variety. Same equipment is used for different batches. **Example:** Pharmaceuticals, paint manufacturing.
- **Mass Production:** Large quantity of standardized products with low variety. Product layout and special-purpose machines are used. **Example:** Automobile assembly, television manufacturing.
- **Continuous Production:** Non-stop flow of highly standardized product for 24/7 operation. Highly automated and capital-intensive. **Example:** Cement plant, steel plant, chemical plant.

- **Q.** Compare: Job type production and Batch type production system. **(WINTER 2023, 3 Marks; WINTER 2024, 3 Marks)**

Answer:

Basis	Job Production	Batch Production
Volume/Variety	Very low volume, high variety	Moderate volume, moderate variety
Equipment/Layout	General-purpose machines; process layout	General/special-purpose machines; batch layout
Example	Custom furniture, shipbuilding	Pharmaceuticals, paint batches

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4. Sales Forecasting:

- **Q.** Name the various methods of sales forecasting. Describe any two of them. **(SUMMER 2022, 7 Marks; WINTER 2025, 7 Marks)**

Answer:

Methods of Sales Forecasting:

- **Qualitative:** Delphi method, market survey, expert opinion, sales force composite, consumer survey.
- **Quantitative:** Moving average, weighted moving average, exponential smoothing, regression analysis, trend projection.

Description of Any Two:

1. Moving Average Method: Forecast is the average of the most recent n periods.

$F(t+1) = [D(t) + D(t-1) + ... + D(t-n+1)] / n$

It smooths short-term fluctuations; simple but gives equal weight to all periods.

2. Exponential Smoothing: Forecast is updated using actual demand and previous forecast.

$F(t+1) = \alpha \cdot D(t) + (1 - \alpha) \cdot F(t)$

where α is smoothing constant ($0 < \alpha < 1$). Higher α gives more weight to recent demand.

- **Q.** List sales forecasting techniques to develop a production plan. Explain any one in detail. **(SUMMER 2024, 3 Marks - source note: paraphrased - "Enlist the six applications..."; SUMMER 2025, 7 Marks)**

Answer:

Techniques: Market survey, Delphi method, expert opinion, sales force composite, moving average, weighted moving average, exponential smoothing, regression, trend projection.

Detailed Explanation — Moving Average:

Forecast for next period is average of last n periods:

$F(t+1) = [D(t) + D(t-1) + ... + D(t-n+1)] / n$

For three-month moving average, forecast for month 4 is average of months 1, 2, and 3. It reduces random variation but lags behind trends.

- **Q.** Discuss the following methods of sales forecasting: (i) Exponential smoothing (ii) Method of weighted moving average. **(WINTER 2023, 7 Marks OR; WINTER 2024, 7 Marks)**

Answer:

(i) Exponential Smoothing:

Formula: $F(t+1) = \alpha \cdot D(t) + (1 - \alpha) \cdot F(t)$

- $F(t+1)$ = forecast for next period, $D(t)$ = actual demand, $F(t)$ = previous forecast, α = smoothing constant.
- Requires previous forecast and actual demand only.
- Higher α responds faster to demand changes.

(ii) Weighted Moving Average:

Formula: $F(t+1) = [W1 \cdot D(t) + W2 \cdot D(t-1) + ... + Wn \cdot D(t-n+1)] / (W1 + W2 + ... + Wn)$

- Assigns different weights to past periods; recent data usually given higher weight.
- More responsive than simple moving average.

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5. Line Balancing:

- **Q.** What is line balancing? What is the procedure for line balancing? **(SUMMER 2025, 7 Marks OR; WINTER 2025, 3 Marks; SUMMER 2026)**

Answer:

Line Balancing: Line balancing is the assignment of tasks to workstations so that the required output rate is achieved with minimum idle time and balanced workload.

Procedure:

1. Identify all tasks and their precedence relationships.
2. Draw precedence diagram.
3. Determine cycle time: C = Available production time per day / Required output per day
4. Calculate minimum number of workstations: $N(min) = \Sigma t(i) / C$

5. Assign tasks to workstations using largest-candidate or ranked-positional-weight rule.
6. Ensure workstation time does not exceed cycle time.
7. Calculate efficiency and balance delay; improve if needed.

Other Important Questions:

1. PPC – Objectives, Functions and Advantages:

- **Q.** List out the advantages of Production Planning and Control. **(SUMMER 2025, 3 Marks)**

Answer:

- Reduces production delays and bottlenecks.
- Ensures efficient utilization of men, machines, and materials.
- Minimizes inventory and production cost.
- Helps meet delivery schedules and customer satisfaction.
- Improves coordination between departments.
- Provides basis for control and corrective action.

- **Q.** Explain the functions of Production Planning and Control. **(WINTER 2022, 4 Marks)**

Answer:

- Forecasting of demand.
- Process planning and routing.
- Scheduling and loading of work.
- Dispatching of work orders.
- Expediting/follow-up and progress control.
- Inventory control and feedback.

- **Q.** List any eight objectives of Production Planning and Control. **(SUMMER 2024, 4 Marks)**

Answer:

- Meet delivery dates.
- Minimize production cost.
- Optimize inventory levels.
- Efficient utilization of resources.
- Maintain smooth production flow.
- Improve product quality.
- Provide flexibility to demand changes.
- Maximize customer satisfaction.

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2. Process Planning and Dispatching:

- **Q.** Write the steps for process planning. **(SUMMER 2022, 3 Marks)**

Answer:

1. Study product drawing and specifications.
2. Determine operations and sequence.
3. Select machines, tools, and fixtures.

4. Decide inspection points.
5. Estimate operation times.
6. Prepare process sheet.
7. Estimate manufacturing cost.

- **Q.** What are the major functions of the dispatching process? **(SUMMER 2022, 4 Marks)**

Answer:

- Release work orders to shop floor.
- Assign jobs to machines and operators.
- Issue materials, tools, and drawings.
- Set priority of jobs.
- Record start and completion times.
- Coordinate with inspection and maintenance.
- Provide feedback to scheduling.

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3. Production Systems:

- **Q.** Explain job order production system. **(SUMMER 2026)**

Answer:

[Answer not available in the chat text. Add the explanation of the job order production system here.]

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4. Line of Balance and Line Balancing:

- **Q.** What is line of balance? Describe the procedure of line of balance. **(SUMMER 2023, 7 Marks)**

Answer:

[Answer not available in the chat text. Add the line of balance (LOB) explanation and procedure here.]

- **Q.** Define line balancing. Explain what is a precedence diagram with a simple example. **(WINTER 2022, 7 Marks OR)**

Answer:

Line Balancing: Assignment of tasks to workstations to achieve required output with minimum idle time.

Precedence Diagram: A network diagram showing tasks as nodes and precedence relationships as arrows. It indicates which tasks must be completed before others.

Simple Example: Task A must be completed before B and C; both B and C must be completed before D.

Diagram Description: Draw four circles labelled A, B, C, D. Draw arrows from A to B, A to C, B to D, and C to D. A is the starting task; D is the final task.

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5. Sales Forecasting (Numerical):

- **Q.** The data given in the table below shows sales data of XYZ company for the last 10 years. Forecast the sales for the year 2024 using three months moving average. [Diagram required – refer to the original question paper] **(SUMMER 2023, 7 Marks OR)**

Answer:

Given: Sales data table as per the original question paper (for the 11th-month question: two-month and three-month averages; for the exponential smoothing question: α = 0.2 and January forecast = 100 cars).

To Find: Forecast for the required month/year.

Formula:

- Two-month moving average: F(t+1) = [D(t) + D(t-1)] / 2
- Three-month moving average: F(t+1) = [D(t) + D(t-1) + D(t-2)] / 3
- Exponential smoothing: F(t+1) = α·D(t) + (1 − α)·F(t)

Solution Steps:

1. Write demand values month-wise (or year-wise).
2. For moving average, average the last n periods before the forecast period.
3. For exponential smoothing, start with the January forecast = 100; compute February, March, … recursively using α = 0.2.
4. Substitute table values and calculate.

Final Answer: Numeric forecast after substituting the data table from the original question paper.

[Data table not available in the chat text (given in the original question paper). Substitute the table values into the method above to get the numerical forecast.]

- **Q.** For the following given data, calculate the forecast for the 11th month using 1) two months average; 2) three months average. [Diagram required – refer to the original question paper] **(SUMMER 2024, 4 Marks)**

Answer:

Given: Sales data table as per the original question paper (for the 11th-month question: two-month and three-month averages; for the exponential smoothing question: α = 0.2 and January forecast = 100 cars).

To Find: Forecast for the required month/year.

Formula:

- Two-month moving average: F(t+1) = [D(t) + D(t-1)] / 2
- Three-month moving average: F(t+1) = [D(t) + D(t-1) + D(t-2)] / 3
- Exponential smoothing: F(t+1) = α·D(t) + (1 − α)·F(t)

Solution Steps:

1. Write demand values month-wise (or year-wise).
2. For moving average, average the last n periods before the forecast period.
3. For exponential smoothing, start with the January forecast = 100; compute February, March, … recursively using α = 0.2.
4. Substitute table values and calculate.

Final Answer: Numeric forecast after substituting the data table from the original question paper.

[Data table not available in the chat text (given in the original question paper). Substitute the table values into the method above to get the numerical forecast.]

- **Q.** The following table represents sales data of cars sold by XYZ showroom during the January to December months. Take α = 0.2 and for the January month a forecast of 100 cars. Calculate the forecast value by the exponential smoothing method. [Diagram required – refer to the original question paper] **(SUMMER 2024, 4 Marks OR)**

Answer:

Given: Sales data table as per the original question paper (for the 11th-month question: two-month and three-month averages; for the exponential smoothing question: α = 0.2 and January forecast = 100 cars).

To Find: Forecast for the required month/year.

Formula:

- Two-month moving average: F(t+1) = [D(t) + D(t-1)] / 2
- Three-month moving average: F(t+1) = [D(t) + D(t-1) + D(t-2)] / 3
- Exponential smoothing: F(t+1) = α·D(t) + (1 − α)·F(t)

Solution Steps:

1. Write demand values month-wise (or year-wise).
2. For moving average, average the last n periods before the forecast period.
3. For exponential smoothing, start with the January forecast = 100; compute February, March, … recursively using α = 0.2.
4. Substitute table values and calculate.

Final Answer: Numeric forecast after substituting the data table from the original question paper.

[Data table not available in the chat text (given in the original question paper). Substitute the table values into the method above to get the numerical forecast.]

- **Q.** Calculate the sales forecast for the month of July 2020 if the sales for the last 8 months are shown as below: [Diagram required – refer to the original question paper] **(WINTER 2022, 7 Marks)**

Answer:

Given: Sales data table as per the original question paper (for the 11th-month question: two-month and three-month averages; for the exponential smoothing question: α = 0.2 and January forecast = 100 cars).

To Find: Forecast for the required month/year.

Formula:

- Two-month moving average: F(t+1) = [D(t) + D(t-1)] / 2
- Three-month moving average: F(t+1) = [D(t) + D(t-1) + D(t-2)] / 3
- Exponential smoothing: F(t+1) = α·D(t) + (1 − α)·F(t)

Solution Steps:

1. Write demand values month-wise (or year-wise).
2. For moving average, average the last n periods before the forecast period.
3. For exponential smoothing, start with the January forecast = 100; compute February, March, … recursively using α = 0.2.
4. Substitute table values and calculate.

Final Answer: Numeric forecast after substituting the data table from the original question paper.

[Data table not available in the chat text (given in the original question paper). Substitute the table values into the method above to get the numerical forecast.]

- **Q.** The data given below represents sales figures of ABC company for 12 months of the year 2010. Compute the three months moving average and forecast the demand for the month of Jan 2011. [Diagram required – refer to the original question paper] **(SUMMER 2026)**

Answer:

Given: Sales data table as per the original question paper (for the 11th-month question: two-month and three-month averages; for the exponential smoothing question: α = 0.2 and January forecast = 100 cars).

To Find: Forecast for the required month/year.

Formula:

- Two-month moving average: F(t+1) = [D(t) + D(t-1)] / 2
- Three-month moving average: F(t+1) = [D(t) + D(t-1) + D(t-2)] / 3
- Exponential smoothing: F(t+1) = α·D(t) + (1 − α)·F(t)

Solution Steps:

1. Write demand values month-wise (or year-wise).
2. For moving average, average the last n periods before the forecast period.
3. For exponential smoothing, start with the January forecast = 100; compute February, March, … recursively using α = 0.2.
4. Substitute table values and calculate.

Final Answer: Numeric forecast after substituting the data table from the original question paper.

[Data table not available in the chat text (given in the original question paper). Substitute the table values into the method above to get the numerical forecast.]

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6. Sales Forecasting (Methods and Factors):

- **Q.** List down the methods of forecasting and discuss the various factors affecting forecasting. **(SUMMER 2026 OR)**

Answer:

Methods:

- **Qualitative:** Delphi, market survey, expert opinion, sales force composite.
- **Quantitative:** Moving average, weighted moving average, exponential smoothing, regression, trend projection.

Factors Affecting Forecasting:

- Past sales data and demand pattern.
- Market conditions and competition.
- Economic and political conditions.
- Product life-cycle stage.
- Promotional activities and pricing.
- Seasonal and cyclical variations.
- Accuracy of available data.
- Forecasting time horizon.
