

GTH 502 Apparel Industrial Engineering Question Bank

UNIT I: INTRODUCTION TO APPAREL ENGINEERING

PART A: MULTIPLE CHOICE QUESTIONS (STANDARD)

1. Which of the following best defines "Tailoring"?

- a) Mass production of standardized sizes
- b) Custom-made clothing for specific individuals
- c) Automated garment assembly
- d) Export-oriented manufacturing

Correct Answer: b) Custom-made clothing for specific individuals

2. In a Garment Unit, the primary focus is on:

- a) Individual body measurements
- b) High skill variety for a single operator
- c) Economies of scale and volume
- d) Traditional hand-stitching techniques

Correct Answer: c) Economies of scale and volume

3. Productivity is mathematically expressed as:

- a) Input / Output
- b) Output / Input
- c) Input + Output
- d) $((\text{Output} - \text{Input}) \times 100)$

Correct Answer: b) Output / Input

4. Which factor represents the "Effectiveness" of an apparel unit?

- a) Total number of machines
- b) Total number of laborers
- c) Value of output relative to resources used
- d) The speed of the fastest machine

Correct Answer: c) Value of output relative to resources used

5. Labour productivity is calculated based on:

- a) Total units produced per machine hour

- b) Total units produced per man-hour
- c) Total fabric consumed per day
- d) Total revenue divided by number of styles

Correct Answer: b) Total units produced per man-hour

6. Which of the following is a "Material Productivity" metric?

- a) Pieces produced per needle break
- b) Garments produced per yard of fabric
- c) Stitch density per inch
- d) Operators per production line

Correct Answer: b) Garments produced per yard of fabric

7. "Production" refers to the _____ of output.

- a) Efficiency
- b) Quality
- c) Volume
- d) Cost-effectiveness

Correct Answer: c) Volume

8. Increasing productivity in a garment unit leads to:

- a) Higher unit cost
- b) Lower unit cost
- c) Decreased operator wages
- d) Increased fabric wastage

Correct Answer: b) Lower unit cost

9. A key "Activity" of an Apparel Engineer is:

- a) Marketing the brand
- b) Fabric sourcing and procurement
- c) Method study and work measurement
- d) Designing seasonal mood boards

Correct Answer: c) Method study and work measurement

10. Which is an "Internal Factor" affecting productivity?

- a) Market demand

- b) Government policies
- c) Plant layout and machine maintenance
- d) Availability of raw materials in the global market

Correct Answer: c) Plant layout and machine maintenance

11. "Overall Productivity" takes into account:

- a) Only the labor cost
- b) Only the material cost
- c) All input factors (labor, material, capital, etc.)
- d) The speed of the assembly line only

Correct Answer: c) All input factors (labor, material, capital, etc.)

12. In tailoring units, the "Lead Time" for a single garment is usually:

- a) Shorter than industrial units
- b) Highly variable depending on the tailor
- c) Exactly 30 minutes
- d) Managed by a Progressive Bundle System

Correct Answer: b) Highly variable depending on the tailor

13. Machine Productivity is most affected by:

- a) Operator absenteeism
- b) Down-time and maintenance schedules
- c) The color of the thread
- d) The office layout

Correct Answer: b) Down-time and maintenance schedules

14. A benefit of Apparel Engineering to the management is:

- a) Increased fashion sense
- b) Better production predictability
- c) Use of traditional tailoring methods
- d) Elimination of all manual labor

Correct Answer: b) Better production predictability

15. What is the main goal of "Method Study" performed by an apparel engineer?

- a) To find the most expensive way to sew

- b) To simplify work and reduce unnecessary movements
- c) To choose the most colorful fabric
- d) To increase the number of staff

Correct Answer: b) To simplify work and reduce unnecessary movements

16. Material productivity is crucial in the apparel industry because:

- a) Fabric accounts for a large percentage of garment cost
- b) It determines the color of the garment
- c) It measures the weight of the sewing machine
- d) It is related to the thread count only

Correct Answer: a) Fabric accounts for a large percentage of garment cost

17. Which of the following is an "External Factor" affecting productivity?

- a) Technical skills of workers
- b) Power supply and infrastructure
- c) Style of management
- d) Machine age

Correct Answer: b) Power supply and infrastructure

18. In a Garment Unit, "Standardization" helps in:

- a) Making every piece unique
- b) Reducing the skill required for each operation
- c) Increasing the price of the garment
- d) Reducing the speed of production

Correct Answer: b) Reducing the skill required for each operation

19. "Total Factor Productivity" is another name for:

- a) Labour productivity
- b) Overall productivity
- c) Machine efficiency
- d) Material utilization

Correct Answer: b) Overall productivity

20. The primary benefit of increasing productivity for workers is:

- a) Longer working hours

- b) Potential for higher wages and incentives
- c) More manual effort
- d) Reduced machine speed

Correct Answer: b) Potential for higher wages and incentives

21. Apparel Engineering is a bridge between:

- a) Fashion design and marketing
- b) Design concepts and mass production efficiency
- c) Tailoring and boutiques
- d) Fabric manufacturing and spinning

Correct Answer: b) Design concepts and mass production efficiency

PART A: MULTIPLE CHOICE QUESTIONS (ANALYTICAL)

22. If a factory increases its production by 20% but increases its labor force by 30%, the Labour Productivity has:

- a) Increased
- b) Decreased
- c) Remained Constant
- d) Doubled

Correct Answer: b) Decreased

23. Which scenario indicates an improvement in Material Productivity?

- a) Producing 100 shirts from 150 meters of fabric instead of 160 meters
- b) Hiring 5 more tailors to finish the same 100 shirts
- c) Increasing the speed of the sewing machines by 10%
- d) Switching from cotton to polyester

Correct Answer: a) Producing 100 shirts from 150 meters of fabric instead of 160 meters

24. A plant produces 500 garments with 10 workers in 8 hours. Another plant produces 500 garments with 8 workers in 10 hours. Which statement is true?

- a) Plant 1 has higher labor productivity
- b) Plant 2 has higher labor productivity
- c) Both have the same labor productivity
- d) Productivity cannot be calculated

Correct Answer: c) Both have the same labor productivity

25. An apparel engineer observes an operator performing unnecessary hand movements during sleeve attachment. Addressing this will primarily improve:

- a) Material productivity
- b) Machine productivity
- c) Labour productivity
- d) Overall factory electricity consumption

Correct Answer: c) Labour productivity

26. Why might a highly automated garment unit still have low "Overall Productivity"?

- a) High machine speed
- b) Excessive machine downtime and high maintenance costs
- c) Use of standardized sizes
- d) High volume of production

Correct Answer: b) Excessive machine downtime and high maintenance costs

27. If the "Output Value" is \$10,000 and the "Total Input Cost" is \$8,000, the productivity index is:

- a) 0.8
- b) 1.25
- c) 2.0
- d) 0.25

Correct Answer: b) 1.25

28. Which change represents a "Technical Factor" improvement in productivity?

- a) Changing the workers' shift timings
- b) Introducing an automatic under-bed thread trimmer (UBT)
- c) Increasing the base salary of the supervisor
- d) Moving the factory to a different city

Correct Answer: b) Introducing an automatic under-bed thread trimmer (UBT)

29. A "Tailoring Unit" decides to switch to a "Garment Unit" model for a large uniform order. What is the most likely result?

- a) Increased cost per garment

- b) Increased consistency and lower unit cost
- c) Higher skill requirement for every worker
- d) Slower production speed

Correct Answer: b) Increased consistency and lower unit cost

30. If machine productivity is high but labor productivity is low, the likely cause is:

- a) The machines are too slow
- b) There are too many idle workers relative to machine runtime
- c) The fabric quality is poor
- d) The factory layout is perfect

Correct Answer: b) There are too many idle workers relative to machine runtime

PART B: DESCRIPTIVE QUESTIONS (5 / 10 MARKS)

- Differentiate between a Tailoring Unit and a Garment Production Unit based on:**
 - Production volume
 - Skill level of operators
 - Cost per unit
 - Use of technology
- Define Productivity. Explain the various factors (Internal and External) that influence the productivity of an apparel manufacturing plant.**
- Discuss the different types of productivity metrics used in the garment industry (Labour, Machine, Material, and Overall). Provide formulas for each.**
- Elaborate on the role and activities of an Apparel Engineer in a modern garment industry. How does their work contribute to the overall benefits of the organization?**

PART B: ANALYTICAL QUESTION WITH SUBDIVISIONS

1. Scenario Analysis: Productivity Improvement

Scenario Description:

ABC Garments produces 1,200 denim jackets per day (8-hour shift) using 40 operators. The fabric consumption is 2.5 meters per jacket. Due to a new method study implemented by the Apparel Engineer, the production increased to 1,400 jackets per day with the same number of operators, and fabric wastage was reduced, bringing consumption down to 2.3 meters per jacket.

Subdivisions to Answer:

- Calculate the percentage increase in Labour Productivity.

- b. Calculate the percentage improvement in Material Productivity.
- c. Analyze how this change affects the "Cost per Garment" and the "Overall Productivity" of the plant.
- d. Identify two potential "Activities" the Apparel Engineer might have performed to achieve these results.

UNIT II: APPAREL PRODUCTION SYSTEM AND LAYOUT

PART A: MULTIPLE CHOICE QUESTIONS (STANDARD)

1. Which production system involves a single operator performing all sewing operations to assemble a complete garment?

- a) Progressive Bundle System
- b) Whole Garment Production System
- c) Unit Production System
- d) Quick Response Sewing System

Correct Answer: b) Whole Garment Production System

2. The primary objective of the Progressive Bundle System (PBS) is to:

- a) Maximize individual operator efficiency through specialization
- b) Eliminate all work-in-progress (WIP) in the line
- c) Reduce the throughput time to a few minutes
- d) Eliminate the need for line balancing supervisors

Correct Answer: a) Maximize individual operator efficiency through specialization

3. In a Unit Production System (UPS), how are garment parts transported to individual workstations?

- a) In large tied bundles carried manually
- b) Via automated overhead trolley carriers
- c) On flatbed push carts managed by helpers
- d) Inside plastic bins passed along gravity rollers

Correct Answer: b) Via automated overhead trolley carriers

4. What is a key disadvantage of the Whole Garment Production System?

- a) Low requirement for skilled labor
- b) High volume of Work-in-Progress (WIP)
- c) Extremely high cost per unit due to low productivity
- d) Rigid and inflexible production lines

Correct Answer: c) Extremely high cost per unit due to low productivity

5. The "Group System" (Section System) is characterized by:

- a) One operator sewing the entire garment alone
- b) Workers divided into teams, with each team completing a section of the garment
- c) Automated computer systems making real-time scheduling decisions
- d) Individual operators working completely independent of each other

Correct Answer: b) Workers divided into teams, with each team completing a section of the garment

6. Which production system is specifically designed to handle high style flexibility, small order quantities, and rapid style changes?

- a) Progressive Bundle System
- b) Unit Production System
- c) Quick Response Sewing System
- d) Whole Garment Production System

Correct Answer: c) Quick Response Sewing System

7. What is the fundamental objective of an apparel plant layout?

- a) To increase the overall physical size of the factory building
- b) To minimize material handling costs and ensure smooth material flow
- c) To separate supervisors physically from the operators
- d) To ensure every operator uses identical machinery

Correct Answer: b) To minimize material handling costs and ensure smooth material flow

8. Which layout configuration moves materials forward along a single, direct path without any backtracking?

- a) Block Layout
- b) Comb-shaped Layout
- c) Flow Forward Layout
- d) Side-to-Side Flow Layout

Correct Answer: c) Flow Forward Layout

9. In which layout do materials cross the aisle continuously between machines on opposite sides?

- a) Linear Layout
- b) Side-to-Side Flow Layout
- c) U-Shaped Layout
- d) Block Layout

Correct Answer: b) Side-to-Side Flow Layout

10. A major benefit of a U-shaped layout is that it:

- a) Restricts operator communication to minimize talking
- b) Maximizes the total floor space occupied by the sewing line
- c) Allows operators to easily multi-task and assist adjacent stations
- d) Eliminates the need for quality control inspections

Correct Answer: c) Allows operators to easily multi-task and assist adjacent stations

11. Which layout is most rigid and highly susceptible to severe bottlenecks if a single machine breaks down?

- a) U-shaped Layout
- b) Comb-shaped Layout
- c) Linear Layout

- d) Block Layout

Correct Answer: c) Linear Layout

12. A "Comb-shaped Layout" is ideal for garments that:

- a) Require no assembly of secondary parts
- b) Have multiple sub-assemblies (like collars and cuffs) feeding into a main assembly line
- c) Are made of highly stretchable fabrics only
- d) Are produced using the Whole Garment System

Correct Answer: b) Have multiple sub-assemblies (like collars and cuffs) feeding into a main assembly line

13. What does a "Block Layout" represent in apparel factory planning?

- a) The detailed arrangement of individual sewing machine needles
- b) The macroscopic allocation of space to different departments or sections
- c) A layout design that prevents operators from seeing each other
- d) A layout exclusively used for block printing on fabrics

Correct Answer: b) The macroscopic allocation of space to different departments or sections

14. Which sewing system utilizes computerized tracking to monitor individual operator performance in real-time?

- a) Progressive Bundle System
- b) Group System
- c) Unit Production System
- d) Whole Garment Production System

Correct Answer: c) Unit Production System

15. What is a prominent advantage of the Progressive Bundle System (PBS)?

- a) It has the lowest Work-in-Progress (WIP) among all systems
- b) It allows easy tracking of piece-rate wages
- c) It has a very short throughput time of less than a day
- d) It requires minimal floor space for storage

Correct Answer: b) It allows easy tracking of piece-rate wages

16. High inventory buffer (Work-In-Progress) is a defining characteristic of which system?

- a) Unit Production System
- b) Quick Response Sewing System

- c) Progressive Bundle System
- d) Whole Garment Production System

Correct Answer: c) Progressive Bundle System

17. In Modular Manufacturing (a form of QRSS), operators are usually paid based on:

- a) Individual piece-rate performance
- b) Total team output and quality
- c) Hourly attendance regardless of output
- d) The number of years of experience

Correct Answer: b) Total team output and quality

18. Material handling time is reduced to almost zero in:

- a) Progressive Bundle System
- b) Whole Garment Production System
- c) Unit Production System
- d) Group System

Correct Answer: c) Unit Production System

19. Which system requires highly versatile operators who are thoroughly cross-trained in multiple operations?

- a) Progressive Bundle System
- b) Quick Response Sewing System
- c) Section System
- d) Traditional Tailoring Unit

Correct Answer: b) Quick Response Sewing System

20. What is the main drawback of a Linear (Straight-line) Layout?

- a) It requires massive floor area compared to other layouts
- b) It is highly inflexible to modifications or style changes
- c) It makes it impossible to track material movement
- d) It increases the physical walking distance for material handlers

Correct Answer: b) It is highly inflexible to modifications or style changes

21. The main layout goal when positioning fabric cutting tables relative to the sewing room is to:

- a) Place them as far apart as possible to reduce dust contamination
- b) Ensure flow forward proximity to minimize material transportation effort

- c) Interlock them to save electric wiring costs
- d) Place them in separate buildings to manage noise levels

Correct Answer: b) Ensure flow forward proximity to minimize material transportation effort

PART A: MULTIPLE CHOICE QUESTIONS (ANALYTICAL)

22. If a factory transitions from a Progressive Bundle System (PBS) to a Unit Production System (UPS) for a run of polo shirts, which of the following changes is most likely to occur?

- a) The overall throughput time will decrease significantly
- b) The material handling workload of the operators will increase
- c) The level of Work-in-Progress (WIP) on the floor will rise
- d) Operator skill requirements will drop to zero

Correct Answer: a) The overall throughput time will decrease significantly

23. A sewing line is struggling with severe bottlenecks because Operation A (attaching pockets) takes 30 seconds, while Operation B (assembling the shoulder) takes 55 seconds. Under a Progressive Bundle System (PBS), what is the immediate physical consequence of this mismatch?

- a) Huge piles of bundled parts will accumulate between station A and station B
- b) Station B will remain idle for most of the shift
- c) The overhead carrier will automatically route bundles to other machines
- d) The line will automatically stop due to computerized interlocks

Correct Answer: a) Huge piles of bundled parts will accumulate between station A and station B

24. A factory receives a high-fashion, low-volume order of 200 custom evening gowns with highly complex, non-repetitive designs. Which production system should the apparel engineer select?

- a) Progressive Bundle System
- b) Unit Production System
- c) Whole Garment Production System
- d) Group System

Correct Answer: c) Whole Garment Production System

25. In a U-shaped layout, Operator X is cross-trained to perform Operation 2 (front placket attachment) and Operation 8 (bottom hemming), which are physically positioned opposite each other. How does this layout configuration boost productivity?

- a) It reduces the operator's mental fatigue by varying the tasks

- b) It allows the operator to jump between tasks based on local buffer states without long walking delays
- c) It eliminates the need for any quality checkpoints on the line
- d) It ensures the machine speeds are identical for both operations

Correct Answer: b) It allows the operator to jump between tasks based on local buffer states without long walking delays

26. A manufacturer of basic t-shirts wants to design a layout for a stable, high-volume production line where styles rarely change. Space is narrow and long. Which layout configuration is most cost-efficient and logical?

- a) Comb-shaped Layout
- b) Block Layout
- c) Linear Layout
- d) Side-to-Side Flow Layout

Correct Answer: c) Linear Layout

27. A factory manager notices that operators in a Group System are constantly arguing over who should perform which task, leading to low morale and high idle times. What is the root cause of this analytical failure?

- a) Group systems naturally require no supervisory structure
- b) Improper balance of skill levels and lack of clear standard operating procedures within the team
- c) The physical layout is too compact for group activities
- d) The machines are operating at speeds faster than human capabilities

Correct Answer: b) Improper balance of skill levels and lack of clear standard operating procedures within the team

28. During a jacket assembly process, the lining, the sleeves, and the front/back bodies are pre-assembled in independent, parallel mini-lines before being integrated. Which layout structure is mathematically most sound to feed this final assembly line?

- a) Linear Layout
- b) Comb-shaped Layout
- c) Block Layout
- d) Side-to-Side Layout

Correct Answer: b) Comb-shaped Layout

29. An apparel engineer calculates that changing a sewing line from a straight line to a U-shaped layout reduces the total transport distance of a garment piece by 45%. This directly results in:

- a) An increase in the Standard Allowed Minutes (SAM) of the garment
- b) A reduction in non-value-added material handling time
- c) Automatic increase in machine sewing speeds (RPM)
- d) A reduction in the direct fabric consumption per garment

Correct Answer: b) A reduction in non-value-added material handling time

30. In a modular production cell (QRSS), if one operator becomes absent, the team's output drops by only 10% instead of completely halting. Why does this system demonstrate such resilience?

- a) Other operators are cross-trained and dynamically adjust their work boundaries to absorb the gap
- b) The remaining operators work overtime automatically without pay
- c) The automated UPS overhead rails run twice as fast to compensate
- d) The system uses temporary robot operators to fill empty workstations

Correct Answer: a) Other operators are cross-trained and dynamically adjust their work boundaries to absorb the gap

PART B: DESCRIPTIVE QUESTIONS (5 / 10 MARKS)

- Analyze the Progressive Bundle System (PBS) versus the Unit Production System (UPS) in apparel manufacturing. Discuss with respect to:**
 - Material handling mechanisms
 - Process bottlenecks and Work-in-Progress (WIP) inventory
 - Space requirements and capital investment barriers
- Define "Quick Response Sewing System" (QRSS). Elaborate on its core objectives, merits, and demerits compared to traditional linear assembly methods.**
- What is the primary objective of a Plant Layout in an apparel factory? Explain with neat flow diagrams how a "Comb-shaped Layout" feeds into main assembly operations compared to a "Flow Forward Layout".**
- Write explanatory notes on the following layout designs with their industrial applications:**
 - U-Shaped Layout (specifically focusing on operator utilization)
 - Block Layout (specifically focusing on macroscopic planning)

PART B: ANALYTICAL QUESTION WITH SUBDIVISIONS

1. Scenario Analysis: Factory Transition from Mass Production to Flexible Customization

Scenario Description:

An established garment unit currently uses a rigid Progressive Bundle System (PBS) set up in a Linear (straight line) configuration to produce basic, high-volume T-shirts.

The manager decides to transition to a Modular Manufacturing System (under a Quick Response model) to cater to low-volume, fast-changing fashion orders.

Subdivisions to Answer:

- a. Formulate the physical modifications required to shift the layout from Linear to a U-shaped configuration. How does this enhance face-to-face operator interactions?
- b. Examine the mathematically expected changes in Work-In-Progress (WIP) levels and Overall Throughput Time following the shift.
- c. Discuss the operational challenges regarding operator cross-training requirements and the change in wages (from individual piece-rate to team-based incentives).
- d. Propose a technical method to balance the line in real-time if one operator in the newly formed U-shaped module is absent.

UNIT III: WORK MEASUREMENT

PART A: MULTIPLE CHOICE QUESTIONS (STANDARD)

1. What does the acronym SAM stand for in the apparel industry?

- a) Standard Allowed Minutes
- b) Sewing Assembly Method
- c) Standard Allocation Machine
- d) Systematic Apparel Management

Correct Answer: a) Standard Allowed Minutes

2. Which of the following is the primary use of SAM in a garment production unit?

- a) Determining the physical length of the sewing thread

- b) Cost estimation, capacity planning, and operator scheduling
- c) Calculating the chemical properties of fabric dyes
- d) Monitoring the overall room temperature in the warehouse

Correct Answer: b) Cost estimation, capacity planning, and operator scheduling

3. "Rating Factor" is defined as the process of:

- a) Inspecting the physical quality grade of finished garments
- b) Assessing the speed and effectiveness of an operator compared to a standard concept
- c) Grading patterns for larger sizes
- d) Measuring the mechanical needle speed in stitch cycles

Correct Answer: b) Assessing the speed and effectiveness of an operator compared to a standard concept

4. What is the fundamental purpose of adding "Allowances" in SAM calculation?

- a) To increase the overall cost of fabric sourcing
- b) To compensate for human fatigue, personal needs, machine delays, and unavoidable interruptions
- c) To increase the sewing speed limit of single needle lock stitch machines
- d) To give operators a standard financial bonus at the end of the day

Correct Answer: b) To compensate for human fatigue, personal needs, machine delays, and unavoidable interruptions

5. Which allowance is specifically given to enable an operator to recover from physical or mental fatigue?

- a) Interference Allowance
- b) Contingency Allowance
- c) Relaxation Allowance
- d) Process Allowance

Correct Answer: c) Relaxation Allowance

6. When an operator is managing multiple machines and one machine is forced to stand idle while the operator services another, what allowance is applied?

- a) Machine Allowance
- b) Interference Allowance
- c) Relaxation Allowance

- d) Special Allowance

Correct Answer: b) Interference Allowance

7. A "Contingency Allowance" is typically added for:

- a) Long coffee breaks taken during production
- b) Small, infrequent, and unavoidable delays that cannot be measured individually
- c) Major power outages lasting more than an hour
- d) Training periods of newly recruited line helpers

Correct Answer: b) Small, infrequent, and unavoidable delays that cannot be measured individually

8. An allowance applied during automated machine sewing cycles where the operator must wait for the machine to finish is known as:

- a) Machine Allowance
- b) Relaxation Allowance
- c) Contingency Allowance
- d) Interference Allowance

Correct Answer: a) Machine Allowance

9. What is the very first step in the systematic procedure for calculating the SAM of an apparel operation?

- a) Adding a 15% allowance to the cycle
- b) Conducting a method study to break down the operation into elements and recording cycle times
- c) Printing the final Operation Bulletin
- d) Determining the piece-rate wage

Correct Answer: b) Conducting a method study to break down the operation into elements and recording cycle times

10. What is the mathematical formula used to compute the "Basic Time" of an operation?

- a) Basic Time = Observed Time x (100 / Rating Factor)
- b) Basic Time = Observed Time x (Rating Factor / 100)
- c) Basic Time = Observed Time + Allowances
- d) Basic Time = Observed Time / Allowances

Correct Answer: b) Basic Time = Observed Time x (Rating Factor / 100)

11. Once the Basic Time is established, how is the SAM calculated?

- a) SAM = Basic Time x Rating Factor

- b) $SAM = \text{Basic Time} + \text{Allowances}$
- c) $SAM = \text{Observed Time} - \text{Allowances}$
- d) $SAM = \text{Basic Time} / 100$

Correct Answer: b) $SAM = \text{Basic Time} + \text{Allowances}$

12. What is a "Capacity Study" in apparel manufacturing?

- a) Calculating the physical volume of raw fabric rolls stored in a warehouse
- b) A structured study that measures the individual output potential of operators or machines over a specific timeframe
- c) A study designed to check the maximum weight-bearing capacity of the factory floor
- d) Determining the total electrical intake of all sewing motors

Correct Answer: b) A structured study that measures the individual output potential of operators or machines over a specific timeframe

13. Which of the following is a direct benefit of conducting regular Capacity Studies?

- a) Reducing the physical width of the fabric
- b) Identifying production bottlenecks and optimizing individual operator performance
- c) Increasing the cost of sewing machines
- d) Decreasing operator work hours

Correct Answer: b) Identifying production bottlenecks and optimizing individual operator performance

14. Operator Performance (Efficiency) is fundamentally calculated as a ratio of:

- a) Attended minutes to earned minutes
- b) Total Earned Minutes to Total Attended Minutes, expressed as a percentage
- c) Machine speed to stitch rate
- d) Total completed bundles to total fabric consumption

Correct Answer: b) Total Earned Minutes to Total Attended Minutes, expressed as a percentage

15. What does the term WIP represent on an apparel assembly line?

- a) Work-In-Progress
- b) Weekly Incentive Plan
- c) Worker Inspection Program
- d) Waste Integration Percentage

Correct Answer: a) Work-In-Progress

16. Which of the following is an effective "Activity to manage WIP" to keep line operations smooth?

- a) Increasing bundle size to 500 pieces per batch
- b) Line balancing, tracking buffer sizes, and deploying helper operators
- c) Stopping all quality inspection checkpoints
- d) Placing extra machinery in the storage corridors

Correct Answer: b) Line balancing, tracking buffer sizes, and deploying helper operators

17. An "Operation Bulletin" is a technical document that contains:

- a) A list of all active employee home addresses
- b) The structured sequence of garment operations, machine types, SAM values, and target operators required for a specific style
- c) The legal contract between the buyer and fabric mill
- d) Design layout plans of the administrative office block

Correct Answer: b) The structured sequence of garment operations, machine types, SAM values, and target operators required for a specific style

18. The main objective of "Line Balancing" is to:

- a) Make sure all sewing machines weigh the same
- b) Equalize operator capacities to match production pitch times and minimize idle times
- c) Ensure the line has equal numbers of male and female operators
- d) Keep all machinery running at identical RPM speeds

Correct Answer: b) Equalize operator capacities to match production pitch times and minimize idle times

19. "Motion Study" is defined as the systematic study of:

- a) The mechanical speed of the sewing machine feed dog
- b) The manual hand, body, and tool movements of an operator performing a task to eliminate waste and fatigue
- c) The transport movement of cargo containers on ships
- d) The movement of cutting machines across fabric plies

Correct Answer: b) The manual hand, body, and tool movements of an operator performing a task to eliminate waste and fatigue

20. One of the major uses of "Motion Study" in the garment industry is to:

- a) Design more colorful logos for branding
- b) Standardize working methods, reduce cycle times, and improve workstation ergonomics
- c) Increase the raw cost of fabrics
- d) Track the geographical position of shipment trucks

Correct Answer: b) Standardize working methods, reduce cycle times, and improve workstation ergonomics

21. Effective line balancing on a sewing floor directly improves:

- a) The thread count of raw fabrics
- b) Overall Line Efficiency and machine operator utilization
- c) The speed of fabric cutting
- d) The office reception decor

Correct Answer: b) Overall Line Efficiency and machine operator utilization

PART A: MULTIPLE CHOICE QUESTIONS (ANALYTICAL)

22. An industrial engineer measures an operator's cycle time to attach a patch pocket. The observed cycle time is 0.50 minutes, and the rating factor assigned is 120%. Calculate the Basic Time.

- a) 0.42 minutes
- b) 0.60 minutes
- c) 0.50 minutes
- d) 0.75 minutes

Correct Answer: b) 0.60 minutes

23. An operation has a Basic Time of 1.20 minutes. The total allowances (relaxation, contingency, etc.) are calculated to be 15% of the Basic Time. What is the calculated SAM of this operation?

- a) 1.20 minutes
- b) 1.38 minutes
- c) 1.02 minutes
- d) 1.80 minutes

Correct Answer: b) 1.38 minutes

24. An operator attends a shift for 480 minutes and produces 400 pieces of an operation with a standard SAM of 1.0 minute. Calculate the operator's performance (efficiency).

- a) 120%
- b) 83.33%

- c) 80%
- d) 95%

Correct Answer: b) 83.33%

25. A sewing line has a total garment SAM of 12 minutes. The bottleneck operation takes 1.5 minutes, and there are exactly 10 workstations. What is the current Line Balancing Efficiency of this assembly line?

- a) 100%
- b) 80%
- c) 120%
- d) 65%

Correct Answer: b) 80%

26. A capacity study indicates that the line target is 100 pieces per hour. Operator A's individual output capacity is calculated as 80 pieces per hour. What is the percentage capacity gap of Operator A relative to the target?

- a) 10%
- b) 20%
- c) 25%
- d) 5%

Correct Answer: b) 20%

27. An apparel engineer audits the physical work-in-progress (WIP) on a line and records: Station A = 10 units, Station B = 150 units, Station C = 5 units. Based on this analytical snapshot, which station is the operational bottleneck?

- a) Station A
- b) Station B
- c) Station C
- d) No bottleneck exists

Correct Answer: b) Station B

28. An Operation Bulletin states that the total SAM for a jacket is 15.0 minutes. If the line needs to produce a target of 120 jackets per hour, what is the theoretical minimum number of operators required?

- a) 15 operators
- b) 30 operators
- c) 60 operators
- d) 12 operators

Correct Answer: b) 30 operators

29. An engineer conducts a motion study on a collar attachment workstation and replaces a dual hand pickup method with an ergonomically placed gravity feed tray. This motion economy change primarily targeted:

- a) Sewing machine stitch speed (RPM)
- b) Non-value added operator handling and reach times
- c) The tensile strength of the stitching threads
- d) The chemical composition of the collar fusing

Correct Answer: b) Non-value added operator handling and reach times

30. If an operator's observed cycle time is 1.0 minute and their rating factor is evaluated at 90% (meaning they are working slower than standard pace), what will be the calculated Basic Time?

- a) 1.11 minutes
- b) 0.90 minutes
- c) 1.00 minute
- d) 0.10 minutes

Correct Answer: b) 0.90 minutes

PART B: DESCRIPTIVE QUESTIONS (5 / 10 MARKS)

- 1. Define Standard Allowed Minutes (SAM). Detail the complete, step-by-step industrial engineering procedure used to calculate the SAM of a specific sewing operation.**
- 2. What is the "Rating Factor"? Discuss its significance in work measurement and write explanatory notes on the various types of allowances (relaxation, machine, interference, process, contingency, and special) applied in the garment industry.**
- 3. Explain the objectives and methodology of a "Capacity Study" on a sewing floor. How do the results of a capacity study help a line supervisor improve overall operator performance?**
- 4. What is "Line Balancing"? Discuss how an "Operation Bulletin" (OB) is drafted and explain its role in managing Work-In-Progress (WIP) and maximizing line efficiency.**

PART B: ANALYTICAL QUESTION WITH SUBDIVISIONS

1. Scenario Analysis: Line Balancing and Capacity Assessment of a Polo Shirt Line

Scenario Description:

A sewing line is configured with 10 operators to produce basic knit polo shirts. The total SAM of the polo shirt is 10.0 minutes. An industrial engineer conducts a capacity study and compiles the following operation-wise breakdown of SAM values for each operator station:

- Station 1 (Collar Prep): 0.85 min
- Station 2 (Cuff Prep): 0.75 min
- Station 3 (Placket Attach): 1.10 min
- Station 4 (Shoulder Join): 0.65 min
- Station 5 (Collar Attach): 1.25 min (Bottleneck Operation)
- Station 6 (Sleeve Attach): 0.90 min
- Station 7 (Side Seam): 1.05 min
- Station 8 (Cuff Attach): 0.80 min
- Station 9 (Bottom Hem): 0.70 min
- Station 10 (Final Inspection): 0.95 min

The line runs for a single 8-hour shift (480 active minutes) per day.

Subdivisions to Answer:

- a. Calculate the current Pitch Time (Average SAM per workstation) and the mathematical Line Balancing Efficiency of this assembly line.
- b. Determine the theoretical maximum output of this line per day (assuming 100% efficiency of the balance) versus the actual maximum daily output dictated by the bottleneck operation (Station 5).
- c. Propose two practical line balancing actions an apparel engineer can implement to resolve the bottleneck at Station 5 (Collar Attach).
- d. Analyze the direct impact of successfully balancing this line on the Work-In-Progress (WIP) storage levels and the total Throughput Time of the garment.

UNIT IV: ERGONOMICS & SCIENTIFIC METHOD OF TRAINING (SMT)

PART A: MULTIPLE CHOICE QUESTIONS (STANDARD)

1. Ergonomics is fundamentally defined as:

- a) The study of fabrics and their chemical reactions
- b) The science of designing the job, equipment, and workplace to fit the worker
- c) The process of training operators to work faster
- d) A software system used for line balancing

Correct Answer: b) The science of designing the job, equipment, and workplace to fit the worker

2. The term "Ergonomics" is derived from which two Greek words?

- a) Ergon (Work) and Nomos (Natural Laws)

- b) Ergo (Machine) and Nomics (Economics)
- c) Ergon (Human) and Nomos (Stitch)
- d) Aero (Air) and Nomics (Study)

Correct Answer: a) Ergon (Work) and Nomos (Natural Laws)

3. Which of the following is a major division of ergonomics?

- a) Chemical, mechanical, and biological
- b) Physical, cognitive, and organizational ergonomics
- c) Direct, indirect, and static ergonomics
- d) Standard, advanced, and automated ergonomics

Correct Answer: b) Physical, cognitive, and organizational ergonomics

4. What is the main cause of Cumulative Trauma Disorders (CTD) among sewing operators?

- a) Inadequate fabric quality
- b) Highly repetitive motions, awkward postures, and lack of rests
- c) Excessively high needle sewing speeds
- d) Poor classroom training methods

Correct Answer: b) Highly repetitive motions, awkward postures, and lack of rests

5. To reduce fatigue, what is the recommended angle for a sewing machine foot pedal relative to the horizontal floor?

- a) Exactly 90 degrees
- b) Between 10 to 25 degrees
- c) Over 60 degrees
- d) 0 degrees (completely flat)

Correct Answer: b) Between 10 to 25 degrees

6. Why is seat height adjustability critical for an industrial sewing machine operator?

- a) To allow operators to stand up while stitching
- b) To ensure the operator's thighs are horizontal and feet rest flat on the floor or pedal
- c) To increase the visibility of the line supervisor
- d) To match the color scheme of the sewing room

Correct Answer: b) To ensure the operator's thighs are horizontal and feet rest flat on the floor or pedal

7. When designing a manual fabric-lifting task, the load should be kept:

- a) As far from the body as possible
- b) Close to the body at waist height
- c) Placed on the floor directly behind the operator
- d) Kept above shoulder level

Correct Answer: b) Close to the body at waist height

8. What lighting level (illuminance) is generally recommended for highly detailed sewing operations on dark-colored fabrics?

- a) 100 to 200 lux
- b) 1000 to 1500 lux
- c) 50 lux
- d) 5000 lux

Correct Answer: b) 1000 to 1500 lux

9. Which of the following is an environmental hazard in the garment industry?

- a) Excessively soft chairs
- b) Airborne fabric dust (cotton micro-fibers) and high noise levels
- c) Use of computer-aided design (CAD) systems
- d) Use of automatic thread trimmers

Correct Answer: b) Airborne fabric dust (cotton micro-fibers) and high noise levels

10. What is the primary objective of the Scientific Method of Training (SMT) in the apparel industry?

- a) To eliminate the need for supervisors
- b) To reduce the operator learning curve and develop high-speed, systematic skills safely
- c) To train operators to design their own garment patterns
- d) To cut down the wages of trainee operators

Correct Answer: b) To reduce the operator learning curve and develop high-speed, systematic skills safely

11. In SMT, which phase comes immediately after administering Selection Tests?

- a) Advanced fabric production assembly
- b) Basic exercises to build finger dexterity and machine control
- c) Final quality inspection check

- d) Packaging and folding exercise

Correct Answer: b) Basic exercises to build finger dexterity and machine control

12. What is the main purpose of a "Selection Test" in SMT?

- a) To select the cheapest sewing machines
- b) To assess a candidate's innate hand-eye coordination, finger dexterity, and color vision
- c) To check the educational qualification certificates of operators
- d) To select the fabric for the next production run

Correct Answer: b) To assess a candidate's innate hand-eye coordination, finger dexterity, and color vision

13. A typical selection test used to measure finger dexterity and motor coordination is:

- a) Fabric tensile strength test
- b) Peg Board test (or Pin Board test)
- c) Standard Allowed Minute test
- d) Pattern grading test

Correct Answer: b) Peg Board test (or Pin Board test)

14. "Basic Exercises" in SMT primarily aim to:

- a) Teach complex sewing operations directly on premium fabrics
- b) Develop basic sensory-motor skills, needle control, and pedal coordination without sewing
- c) Teach cutting room operations
- d) Train operators on computer layout patterns

Correct Answer: b) Develop basic sensory-motor skills, needle control, and pedal coordination without sewing

15. What is a "Paper Exercise" in SMT?

- a) Designing garment patterns on paper sheets
- b) Stitching on pre-printed paper templates without thread to master path control and speed
- c) Writing theoretical exams about sewing machine mechanisms
- d) Folding paper boxes for garment shipments

Correct Answer: b) Stitching on pre-printed paper templates without thread to master path control and speed

16. During paper exercises, templates with complex shapes (curves, zig-zags, spirals) are used to train:

- a) The mechanical belt tension of the motor
- b) Hand-pedal coordination and precision corner guiding
- c) The operator's drawing skills
- d) The chemical properties of printing inks

Correct Answer: b) Hand-pedal coordination and precision corner guiding

17. In SMT, "Fabric Exercises" are introduced after:

- a) The operator starts working on the main production line
- b) The operator has achieved proficiency in basic and paper exercises
- c) The operator completes one year in the industry
- d) The cutting department runs out of paper sheets

Correct Answer: b) The operator has achieved proficiency in basic and paper exercises

18. Anthropometry is the science of measuring:

- a) The speed of air currents in the factory
- b) Physical dimensions and proportions of the human body for equipment design
- c) The weight of a standard fabric bale
- d) The moisture level inside cotton fibers

Correct Answer: b) Physical dimensions and proportions of the human body for equipment design

19. Which muscle groups are most prone to static strain when an operator sews without arm support?

- a) Lower calves and feet
- b) Neck, shoulders, and upper back muscles
- c) Abdominal muscles
- d) Facial muscles

Correct Answer: b) Neck, shoulders, and upper back muscles

20. What is the main benefit of using a "U-shaped" cut-out on a sewing table surface?

- a) It makes the table look modern and stylish
- b) It provides forearm support, bringing the operator closer to the needle without hunching
- c) It lets fabric pieces fall directly into waste bins
- d) It reduces the total wood weight of the table

Correct Answer: b) It provides forearm support, bringing the operator closer to the needle without hunching

21. Fabric exercises in SMT help trainees master:

- a) Designing raw knit structures
- b) Fabric handling, edge guiding, managing stretch, and tension control while sewing
- c) Repairing sewing machine motors
- d) Counting the total bundles produced in other lines

Correct Answer: b) Fabric handling, edge guiding, managing stretch, and tension control while sewing

PART A: MULTIPLE CHOICE QUESTIONS (ANALYTICAL)

22. An ergonomic audit of a sewing line reveals that 75% of operators have tilted their necks forward by more than 45 degrees. To fix this posture issue, the apparel engineer should:

- a) Instruct the supervisors to verbally warn the operators
- b) Tilt the sewing machine head forward slightly or adjust the table and seat heights
- c) Increase the speed of the sewing machine motor
- d) Lower the light level in the sewing line

Correct Answer: b) Tilt the sewing machine head forward slightly or adjust the table and seat heights

23. A factory is training operators using traditional "on-the-job training" (buddy system) and has a learning curve of 16 weeks. Shifting to the Scientific Method of Training (SMT) is expected to:

- a) Increase the training duration to 24 weeks
- b) Reduce the learning curve to 4 to 6 weeks with standardized high-speed habits
- c) Double the cost of raw materials wasted during training
- d) Force operators to design their own training models

Correct Answer: b) Reduce the learning curve to 4 to 6 weeks with standardized high-speed habits

24. An operator complains of numbness in the thumb, index, and middle fingers after 6 months on an overlock machine. This clinical presentation most likely indicates:

- a) Plantar Fasciitis due to standing
- b) Carpal Tunnel Syndrome due to continuous wrist flexion and vibration
- c) Eye strain from poor lighting
- d) Respiratory issues from fabric dust

Correct Answer: b) Carpal Tunnel Syndrome due to continuous wrist flexion and vibration

25. During a pin board selection test, Candidate X places 30 pins in 45 seconds, while Candidate Y places 30 pins in 75 seconds. What is the analytical conclusion regarding Candidate X?

- a) Candidate X has lower finger dexterity and should not be hired
- b) Candidate X has superior finger dexterity and high potential for high-speed sewing
- c) Candidate X is highly prone to wrist injuries
- d) Candidate X is slow but highly accurate

Correct Answer: b) Candidate X has superior finger dexterity and high potential for high-speed sewing

26. A trainee operator is practicing a "Paper Exercise" with a spiral pattern. The engineer notices that the puncture line constantly deviates more than 3mm off the spiral line. What should the trainee master next?

- a) Moving directly to sewing silk fabrics
- b) Speed control and precise hand coordination through basic exercises and simpler straight-line paper sheets
- c) Increasing the sewing machine speed to its maximum RPM
- d) Swapping the sewing needle for a thicker size

Correct Answer: b) Speed control and precise hand coordination through basic exercises and simpler straight-line paper sheets

27. An apparel factory has an ambient temperature of 36 degrees Celsius and relative humidity of 85% in the sewing hall. Operators are showing high fatigue and low productivity. The first ergonomic intervention should be to:

- a) Increase the operator piece-rate incentives
- b) Implement proper ventilation, air cooling systems, and humidity controls
- c) Replace all sewing machine motors
- d) Increase the lighting level to 2000 lux

Correct Answer: b) Implement proper ventilation, air cooling systems, and humidity controls

28. Why are fabric exercises in SMT conducted using inexpensive scrap fabrics first before moving to actual cut panels?

- a) Scrap fabric is heavier and builds stronger wrist muscles
- b) To minimize the cost of material wastage while the trainee masters raw handling, curves, and edge control

- c) Scrap fabric requires no needles to stitch
- d) It prevents the sewing machines from wearing out

Correct Answer: b) To minimize the cost of material wastage while the trainee masters raw handling, curves, and edge control

29. An operator using straight shears to cut heavy denim fabric reports severe pain at the base of the thumb. An ergonomic tool redesign would replace these shears with:

- a) Thicker straight shears
- b) Bent-handle ergonomic shears that keep the wrist straight during cutting
- c) Computerized laser cutters only
- d) Standard household scissors

Correct Answer: b) Bent-handle ergonomic shears that keep the wrist straight during cutting

30. A trainee in SMT shows high accuracy in straight paper exercises but struggles with a wavy line paper exercise, often skipping steps and losing control of the pedal. What is the primary analytical diagnosis?

- a) The trainee is color blind
- b) The trainee lacks foot-pedal coordination and continuous speed modulation control
- c) The sewing machine motor belt is loose
- d) The paper used is too thin

Correct Answer: b) The trainee lacks foot-pedal coordination and continuous speed modulation control

PART B: DESCRIPTIVE QUESTIONS (5 / 10 MARKS)

1. **Define Ergonomics. Explain the divisions of ergonomics and discuss the importance of ergonomic principles in the garment industry.**
2. **Elaborate on the ergonomic principles of designing an ideal operator workplace in a sewing room, covering the workstation dimensions, seating, tool design, material handling, and lighting.**

3. **Compare the traditional "On-the-Job" training method with the Scientific Method of Training (SMT). Discuss the core objectives, methodology, and industrial advantages of SMT.**
4. **Explain the structured sequence of training exercises in SMT:**
 - i) Selection tests (Pin Board, etc.)
 - ii) Basic exercises (Pedal/needle coordination)
 - iii) Paper exercises (Mastering curves and corners)
 - iv) Fabric exercises (Handling stretch and edges)

PART B: ANALYTICAL QUESTION WITH SUBDIVISIONS

1. Scenario Analysis: Ergonomic Overhaul and SMT Implementation in a Sewing Factory

Scenario Description:

A high-volume garment production unit is facing severe problems: operator absenteeism is at 18% due to neck, shoulder, and wrist pain; fabric wastage in training is costing the company \$5,000 per month; and newly hired trainees take an average of 14 weeks to reach 80% line target under the traditional "on-the-job" buddy system. The factory management has asked you, as an Apparel Engineering Consultant, to completely overhaul their training and operator workplace using Ergonomics and SMT principles.

Subdivisions to Answer:

- a. Analyze the ergonomic causes of the physical pain reported by the operators. Propose specific, cost-effective adjustments to the sewing table, chair, and lighting to mitigate these symptoms.
- b. Develop a structured 6-week Scientific Method of Training (SMT) plan to replace the buddy system. Clearly show the progression from Selection Tests to Fabric Exercises.
- c. Explain how the implementation of "Paper Exercises" (stitching without thread on pre-printed paper templates) will help reduce the high fabric wastage during training.
- d. Formulate the quantitative metrics (KPIs) you will track to prove to the management that this overhaul has improved overall factory productivity, reduced learning curves, and decreased absenteeism.

UNIT V: PRODUCTION PLANNING

PART A: MULTIPLE CHOICE QUESTIONS (STANDARD)

1. Which of the following best defines "Production Planning" in apparel manufacturing?

- a) Sourcing raw materials from local suppliers
- b) Designing the seasonal portfolio catalog
- c) Coordinating and scheduling resources, machinery, and labor to meet delivery targets
- d) Grading patterns into different standardized sizing options

Correct Answer: c) Coordinating and scheduling resources, machinery, and labor to meet delivery targets

2. The total maximum output that a plant can physically achieve under theoretical ideal conditions is called:

- a) Committed Capacity
- b) Required Capacity

- c) Potential Capacity
- d) Excess Capacity

Correct Answer: c) Potential Capacity

3. "Committed Capacity" represents:

- a) The capacity currently booked for active and scheduled orders
- b) The capacity wasted during style changeovers
- c) The theoretical limits of machine speed
- d) The total space allocated to fabric cutting

Correct Answer: a) The capacity currently booked for active and scheduled orders

4. What is "Available Capacity" in production planning?

- a) The total capital budget allocated for buying sewing machines
- b) The total potential capacity minus committed capacity and scheduled downtime
- c) The storage space available inside the raw material warehouse
- d) The number of operators on leave on a given day

Correct Answer: b) The total potential capacity minus committed capacity and scheduled downtime

5. The capacity required to execute a specific order within its designated timeline is known as:

- a) Potential Capacity
- b) Required Capacity
- c) Excess Capacity
- d) Individual Operation Capacity

Correct Answer: b) Required Capacity

6. "Individual Operation Capacity" is calculated to:

- a) Measure the shipping weight of finished shipments
- b) Determine the specific output limits of a single workstation or operation in the line
- c) Calculate the factory's monthly electrical bill
- d) Decide the brand name of sewing thread to buy

Correct Answer: b) Determine the specific output limits of a single workstation or operation in the line

7. "Excess Capacity" occurs when:

- a) Committed capacity exceeds available capacity

- b) Available capacity is greater than required capacity
- c) There is zero fabric inventory in the warehouse
- d) The plant efficiency is exactly 100%

Correct Answer: b) Available capacity is greater than required capacity

8. How do production standards (SAM) relate directly to capacity?

- a) SAM determines the fabric cost per unit
- b) SAM acts as the quantitative baseline to compute plant capacity, labor needs, and runtimes
- c) SAM dictates the physical style layout of the showroom
- d) There is no logical relationship between standards and capacity

Correct Answer: b) SAM acts as the quantitative baseline to compute plant capacity, labor needs, and runtimes

9. What is the main objective of Inventory Control in a garment factory?

- a) To store as much fabric as possible on the floor
- b) To maintain optimum stock levels to support uninterrupted production while minimizing holding costs
- c) To eliminate the need for warehouse security staff
- d) To track the daily attendance of cutting room workers

Correct Answer: b) To maintain optimum stock levels to support uninterrupted production while minimizing holding costs

10. What does the acronym EOQ stand for?

- a) Estimated Operation Quantity
- b) Economic Order Quantity
- c) Efficient Operator Quota
- d) Equal Order Quality

Correct Answer: b) Economic Order Quantity

11. In the classical EOQ model, which two costs are balanced to find the optimal order size?

- a) Cutting cost and sewing cost
- b) Holding cost (carrying cost) and ordering cost (procurement cost)
- c) Direct labor cost and indirect overhead cost
- d) Machine maintenance cost and fabric scrap cost

Correct Answer: b) Holding cost (carrying cost) and ordering cost (procurement cost)

12. Holding cost (carrying cost) in inventory control includes:

- a) The cost of placing a purchase order with a fabric supplier
- b) Warehouse rent, insurance, interest on capital, and stock obsolescence costs
- c) The salary of the production planning manager
- d) Freight transport charges for delivery to the customer

Correct Answer: b) Warehouse rent, insurance, interest on capital, and stock obsolescence costs

13. In the EOQ formula, when order quantity increases, the total annual ordering cost:

- a) Increases
- b) Decreases
- c) Remains constant
- d) First increases, then drops to zero

Correct Answer: b) Decreases

14. What is "Lead Time" in garment inventory management?

- a) The time spent cutting fabric panels
- b) The duration between placing an order for materials and receiving them at the warehouse
- c) The time taken by the fastest operator to finish a style
- d) The tenure of the head planning engineer

Correct Answer: b) The duration between placing an order for materials and receiving them at the warehouse

15. The "Reorder Point" (ROP) is defined as:

- a) The maximum level of stock the warehouse can hold
- b) The specific inventory level at which a new purchase order must be placed
- c) The point where fabric is sent to the cutting room
- d) The time of day when planning meetings are held

Correct Answer: b) The specific inventory level at which a new purchase order must be placed

16. Safety stock is maintained in a factory to protect against:

- a) High fabric prices
- b) Variations/uncertainties in demand and lead times
- c) Machine breakdown delays
- d) Direct sunshine fading stored fabrics

Correct Answer: b) Variations/uncertainties in demand and lead times

17. Which of the following is considered an "Ordering Cost" in inventory control?

- a) Warehouse depreciation
- b) Preparation of purchase orders, vendor communication, and inspection costs
- c) Thread damage insurance premiums
- d) Raw materials physical deterioration

Correct Answer: b) Preparation of purchase orders, vendor communication, and inspection costs

18. Plant Capacity is typically calculated and expressed in:

- a) Number of stitching patterns
- b) Machine revolutions per minute (RPM)
- c) Productive minutes (or hours) or equivalent pieces per day
- d) Linear yards of fabric purchased

Correct Answer: c) Productive minutes (or hours) or equivalent pieces per day

19. If a planning department schedules more orders than the plant's available capacity can produce, it results in:

- a) Excess capacity
- b) Capacity underload
- c) Capacity overload (leading to missed delivery dates or excessive overtime)
- d) Low holding costs

Correct Answer: c) Capacity overload (leading to missed delivery dates or excessive overtime)

20. The relationship of production standards to capacity planning is such that if direct operator efficiency increases:

- a) The plant's effective daily capacity increases
- b) The plant's effective daily capacity decreases
- c) The standard SAM of the garment automatically changes
- d) The reorder point of the warehouse doubles

Correct Answer: a) The plant's effective daily capacity increases

21. Material Requirement Planning (MRP) relies on which document to calculate raw fabric and trim needs?

- a) Operator Bulletin
- b) Bill of Materials (BOM)
- c) Standard Allowed Minutes (SAM) list
- d) Peg Board Test sheet

Correct Answer: b) Bill of Materials (BOM)

PART A: MULTIPLE CHOICE QUESTIONS (ANALYTICAL)

22. A factory has 50 sewing machines running for 8 hours a day. The average line efficiency is 80%. What is the Available Capacity of this plant in minutes per day?

- a) 24,000 minutes
- b) 19,200 minutes
- c) 30,000 minutes
- d) 16,000 minutes

Correct Answer: b) 19,200 minutes

23. Based on the previous question, if the available capacity is 19,200 minutes per day and a polo shirt has a SAM of 12.0 minutes, how many polo shirts can this plant produce per day?

- a) 2,000 pieces
- b) 1,600 pieces
- c) 1,200 pieces
- d) 2,400 pieces

Correct Answer: b) 1,600 pieces

24. A plant needs to execute an order of 10,000 jackets. Each jacket has a SAM of 18 minutes. The required capacity to complete this order in minutes is:

- a) 180,000 minutes
- b) 100,000 minutes
- c) 555.55 minutes
- d) 1,800 minutes

Correct Answer: a) 180,000 minutes

25. If the factory from the previous questions has an available capacity of 15,000 minutes per day, how many production days are required to complete the 10,000 jacket order?

- a) 10 days
- b) 12 days
- c) 15 days
- d) 18 days

Correct Answer: b) 12 days

26. An apparel plant has a Committed Capacity of 80% for the next month. A buyer approaches with a new order that requires 30% of the plant's total capacity. Which planning decision is correct?

- a) Accept the order immediately as excess capacity is 40%
- b) Reject the order or negotiate delivery dates because accepting it creates a capacity overload of 10%
- c) Accept the order and reduce the SAM of the garments to fit
- d) Lay off 10% of workers to save costs

Correct Answer: b) Reject the order or negotiate delivery dates because accepting it creates a capacity overload of 10%

27. An annual demand for sewing needles is 10,000 boxes. The ordering cost is \$20 per order, and the annual holding cost per box is \$4. Calculate the Economic Order Quantity (EOQ).

- a) 100 boxes
- b) 316 boxes
- c) 500 boxes
- d) 1,000 boxes

Correct Answer: b) 316 boxes

28. A factory uses 100 meters of sewing elastic per day. The supplier takes 5 days to deliver the order. If safety stock is 150 meters, calculate the Reorder Point (ROP).

- a) 500 meters
- b) 650 meters
- c) 150 meters
- d) 350 meters

Correct Answer: b) 650 meters

29. An operation has a bottleneck capacity of 50 pieces per hour, while all other operations have capacities above 70 pieces per hour. If the line targets an output of 65 pieces per hour, the planned target is:

- a) Completely achievable
- b) Unachievable because the bottleneck individual operation capacity limits the entire line output to 50 pieces per hour
- c) Achievable by increasing fabric inventory on the floor
- d) Achievable by decreasing the safety stock level

Correct Answer: b) Unachievable because the bottleneck individual operation capacity limits the entire line output to 50 pieces per hour

30. A planning engineer realizes that the actual line efficiency has dropped from a standard 85% to 65% due to high absenteeism. The available plant capacity will:

- a) Remain the same as long as machines are there
- b) Decrease proportionally, requiring rescheduling of committed orders to avoid delayed shipments
- c) Increase because fewer workers consume fewer resources
- d) Automatically trigger a reduction in reorder point levels

Correct Answer: b) Decrease proportionally, requiring rescheduling of committed orders to avoid delayed shipments

PART B: DESCRIPTIVE QUESTIONS (5 / 10 MARKS)

1. **Define Production Planning in the apparel context. Classify plant capacities (Potential, Committed, Available, Required, and Excess capacity) and explain how planners monitor these balances.**
2. **Explain the relationship between Production Standards (SAM) and Plant Capacity. How does changing operator efficiency affect the calculations of daily available plant capacity? Provide mathematical justifications.**
3. **Elaborate on the concept of Inventory Control in a garment manufacturing unit. Detail the Economic Order Quantity (EOQ) model, its mathematical formula, variable meanings, and assumptions.**
4. **Discuss the steps involved in production scheduling and capacity matching. How do individual operation capacities and line balancing affect the overall committed capacity of an apparel assembly line?**

PART B: ANALYTICAL QUESTION WITH SUBDIVISIONS

1. Scenario Analysis: Plant Capacity Calculations and Inventory Management Strategy

Scenario Description:

XYZ Apparel Unit has a production facility with 60 active sewing machines running one 8-hour shift per day (480 minutes/shift) for 25 days a month. The standard target efficiency of the factory is 80%.

The factory has received an export order for 32,000 units of standard knit trousers with a calculated SAM of 9.0 minutes.

Simultaneously, the warehouse manager audits the stock of zippers for these trousers. The factory uses 40,000 zippers annually. The cost to place a purchase order with the zipper manufacturer is \$50, and the holding cost per zipper per year is calculated at \$0.20. The delivery lead time from the zipper supplier is 6 days, and the factory maintains a safety stock of 1,000 zippers.

Subdivisions to Answer:

- a. Calculate the Available Capacity of the plant in productive minutes per day and per month.
- b. Determine the Required Capacity (in minutes) to execute the trouser order. Check whether the plant can complete the 32,000 trouser order within a single month (25 production days) based on its available capacity.
- c. Calculate the Economic Order Quantity (EOQ) for the zippers. How many orders will the factory place in a year using the EOQ model?
- d. Assuming 300 working days in a year for the warehouse, calculate the daily zipper consumption and the corresponding Reorder Point (ROP).