Toppersnotes
Unleash the topper in you

UGC-NET
HOME SCIENCE

National Testing Agency (NTA)

PAPER 2 || VOLUME – 2

UGC NET Paper – 2 (HOME SCIENCE)

UNIT - VI : Housing and Interior Design

IV UNIT — Apparel Designing

1. Body Measurements – Procedure, Need, Figure Types, and Anthropometry

1.1 Introduction to Body Measurements

Body measurements are the systematic recording of human body dimensions, used to design garments that fit accurately, enhance comfort, and reflect aesthetic preferences. In India, where apparel ranges from traditional sarees to modern activewear, precise measurements are critical for both bespoke tailoring and ready-to-wear (RTW) production. **Anthropometry**, the scientific study of human body measurements, provides a standardized framework for understanding body proportions, figure types, and sizing systems.

Key Concepts:

- **Body Measurements**: Dimensions like bust, waist, hip, used for garment construction.
- **Procedure**: Standardized techniques using tools like measuring tapes.
- **Need**: Ensures fit, comfort, and marketability.
- **Figure Types**: Classifications (e.g., hourglass, pear) based on proportions.
- **Anthropometry**: Scientific measurement for ergonomic design, sizing standards.

Importance in India:

- Supports apparel industry: ₹7 lakh crore market, 15% export share (2023).
- Cultural relevance: Tailored ethnic wear (e.g., anarkalis, lehengas).
- Standardization: BIS IS 14377 for sizing, addressing diverse body types.
- Consumer satisfaction: Reduces returns, enhances RTW fit.

Diagram 1: Body Measurement Framework
Description: A flowchart outlining:

- Goal: Well-Fitted Garments → Components:
- Measurements (bust, waist) → Procedure (tools, techniques) → Figure Types (hourglass) → Anthropometry (standards) → Outcome: Patterns, Sizing. Annotations: Highlights measurement-to-design process.

1.2 Need for Body Measurements

- **Accurate Fit**: Ensures garments conform to body contours (e.g., fitted kurtas).
- **Comfort**: Prevents tightness or looseness (e.g., loose salwars for mobility).
- **Aesthetic Appeal**: Enhances silhouette (e.g., flared anarkali proportions).
- **Standardization**: Supports RTW sizing (e.g., S, M, L for Indian women).
- **Customization**: Critical for bespoke tailoring (e.g., bridal lehengas).
- **Production Efficiency**: Reduces alterations, waste in manufacturing (links to Sub-topic 6).
- **Consumer Satisfaction**: Minimizes returns (e.g., 20% RTW returns due to poor fit).
- **Cultural Adaptation**: Accommodates traditional drapes (e.g., saree blouse fit).
- **Ergonomic Design**: Aligns with anthropometric data for functional clothing (e.g., sportswear).

Table 1: Need for Body Measurements

Need	Purpose	Example	Unit-IV Linkage
Accurate Fit	Conforms to body	Fitted kurta	Sub-topic 5 (Pattern Making)
Standardization	RTW sizing	S, M, L shirts	Sub-topic 6 (Manufacturing)
Customization	Bespoke tailoring	Bridal lehenga	Sub-topic 9 (Clothing Selection)
Consumer Satisfaction	Reduces returns	Well-fitted jeans	Sub-topic 7 (Quality Testing)

1.3 Procedure for Body Measurements

Accurate measurement procedures are essential for consistent and reliable data, using standardized techniques and tools.

1.3.1 Preparation

- **Client Positioning**: Stand upright, relaxed posture, arms slightly away from body.
- **Clothing**: Minimal, form-fitting (e.g., leggings, camisole) to avoid bulk.
- **Environment**: Well-lit, private space with full-length mirror.
- **Tools**:
  - **Measuring Tape**: Non-stretch, 150 cm, 0.5 cm accuracy.
  - **Calipers**: For precise bone measurements (e.g., shoulder width).
  - **Anthropometer**: For advanced measurements (e.g., height).
  - **Notepad/Software**: Record data (e.g., CLO 3D for digital logging).
- **Standardization**: Follow BIS IS 14377 or ISO 8559 for measurement points.

1.3.2 Key Measurement Points

- **Upper Body**:
  - **Bust**: Around fullest part, parallel to floor (e.g., 86 cm for medium size).
  - **Waist**: Narrowest part, above navel (e.g., 68 cm).
  - **Shoulder Width**: Across back, acromion to acromion (e.g., 38 cm).
  - **Arm Length**: Shoulder to wrist, arm bent (e.g., 58 cm).
  - **Neck**: Around base, below Adam's apple (e.g., 34 cm).
- **Lower Body**:
  - **Hip**: Around fullest part of hips (e.g., 92 cm).
  - **Inseam**: Crotch to ankle (e.g., 76 cm for pants).
  - **Thigh**: Around fullest part (e.g., 54 cm).
  - **Waist-to-Knee**: Waist to knee cap (e.g., 56 cm).

- **Vertical Measurements**:
  - **Height**: Floor to crown (e.g., 165 cm).
  - **Torso Length**: Shoulder to crotch (e.g., 70 cm).
  - **Waist-to-Floor**: Waist to floor (e.g., 104 cm).
- **Special Measurements**:
  - **Sleeve Girth**: Around upper arm (e.g., 28 cm).
  - **Back Width**: Across shoulder blades (e.g., 40 cm).
  - **Crotch Depth**: Sitting, waist to chair (e.g., 26 cm).

1.3.3 Procedure Steps

- **Identify Points**: Mark landmarks (e.g., bust point, waistline) with pins or chalk.
- **Measure Horizontally**: Keep tape snug, parallel to floor (e.g., bust, hip).
- **Measure Vertically**: Align tape with body contours (e.g., height, inseam).
- **Record Data**: Note measurements in cm, double-check for accuracy.
- **Consider Ease**: Add 2–5 cm for comfort (e.g., 4 cm at bust for blouses).
- **Validate**: Cross-check with standard size charts (e.g., BIS IS 14377).
- **Document**: Use forms or software for pattern development.

1.3.4 Precautions

- **Consistency**: Same measurer, tools for repeatability.
- **Posture**: Avoid slouching, ensure natural stance.
- **Tape Tension**: Snug but not tight to prevent distortion.
- **Cultural Sensitivity**: Respect privacy, modesty (e.g., female measurers for women).
- **Accuracy**: Measure twice, average for precision.

Table 2: Key Body Measurements

Measurement	Description	Example (cm)	Purpose
Bust	Fullest chest, parallel to floor	86	Blouse, kurta fit
Waist	Narrowest part, above navel	68	Pant, skirt fit
Hip	Fullest part of hips	92	Lehenga, jeans fit
Inseam	Crotch to ankle	76	Trouser length
Height	Floor to crown	165	Overall garment proportion

Diagram: Body Measurement Points

Description: A schematic diagram showing:

- Female figure with labeled points: Bust, waist, hip, shoulder, inseam, height.
- Annotations: Tape placement (e.g., horizontal for bust, vertical for inseam).
- Tools: Measuring tape, caliper positions. Annotations: Illustrates standard measurement landmarks.

1.4 Figure Types

Figure types classify body shapes based on proportions, guiding garment design for optimal fit and aesthetics.

1.4.1 Classification of Figure Types

- **Hourglass**:
  - **Features**: Bust and hip nearly equal, defined waist (e.g., bust 86 cm, waist 68 cm, hip 88 cm).
  - **Prevalence**: 20% of Indian women (anthropometric studies).
  - **Garments**: Fitted kurtas, sarees with cinched waists.
- **Pear (Triangle)**:
  - **Features**: Hips wider than bust, smaller waist (e.g., bust 82 cm, hip 92 cm).
  - **Prevalence**: 30% of Indian women.
  - **Garments**: A-line skirts, anarkalis to balance hips.
- **Apple (Oval)**:
  - **Features**: Wider midsection, less defined waist (e.g., bust 88 cm, waist 80 cm).
  - **Prevalence**: 25% of Indian women.
  - **Garments**: Empire-waist tops, loose tunics.

- **Rectangle**:
  - **Features**: Bust, waist, hips similar (e.g., bust 84 cm, waist 80 cm, hip 86 cm).
  - **Prevalence**: 15% of Indian women.
  - **Garments**: Belts, peplum tops to create curves.
- **Inverted Triangle**:
  - **Features**: Bust wider than hips, broad shoulders (e.g., bust 90 cm, hip 84 cm).
  - **Prevalence**: 10% of Indian women.
  - **Garments**: Flared pants, V-neck tops to balance shoulders.
- **Petite/Plus-Size**:
  - **Features**: Shorter height (<155 cm) or larger proportions (e.g., bust >100 cm).
  - **Prevalence**: 10% petite, 15% plus-size in India.
  - **Garments**: Vertical stripes for petites, structured fits for plus-size.

1.4.2 Identification

- **Proportions**: Compare bust, waist, hip ratios (e.g., hourglass: 1:0.8:1).
- **Visual Analysis**: Observe silhouette (e.g., pear: wider lower body).
- **Anthropometric Data**: Use sizing charts (e.g., BIS IS 14377).
- **Tools**: 3D body scanners for precise shape analysis (e.g., Vitronic scanners).

1.4.3 Design Implications

- **Pattern Adjustments**: Alter darts, seams for figure type (links to Sub-topic 5).
- **Silhouette Selection**: Choose flattering styles (e.g., A-line for pear).
- **Cultural Context**: Adapt for Indian wear (e.g., anarkali for apple figures).
- **RTW Sizing**: Develop inclusive size ranges (e.g., XS–5XL).

Table 3: Figure Types

Figure Type	Features	Prevalence (%)	Garment Example
Hourglass	Equal bust/hip, defined waist	20	Fitted kurta
Pear	Wider hips, smaller bust	30	A-line skirt
Apple	Wider midsection	25	Empire-waist top
Rectangle	Similar bust/waist/hip	15	Peplum top
Inverted Triangle	Wider bust, narrow hips	10	Flared pants

Graph 1: Figure Type Distribution in India

Figure Type Distribution in India

Pear (30%)
Apple (25%)
Hourglass (20%)
Rectangle (15%)
Inverted Triangle (10%)
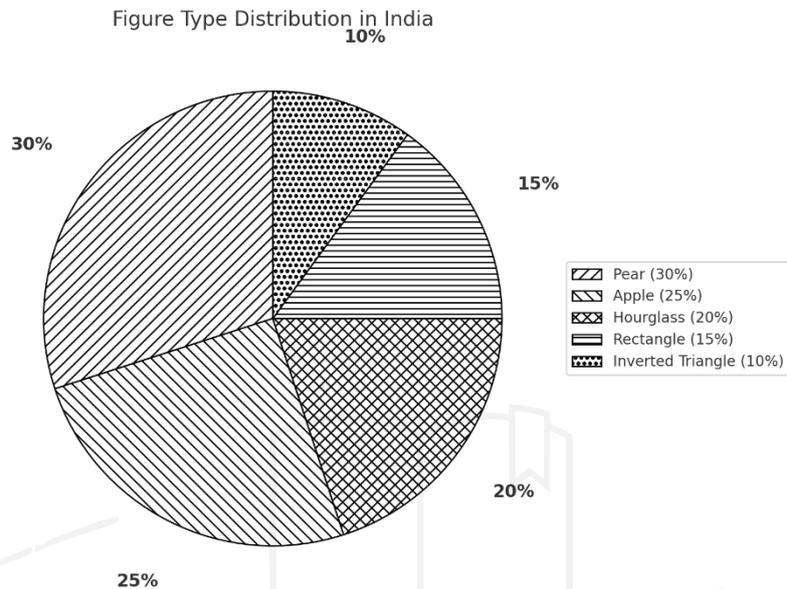
1.5 Anthropometry

Anthropometry provides a scientific basis for body measurements, ensuring ergonomic and standardized garment design.

1.5.1 Principles

- **Definition**: Measurement of human body dimensions, proportions, and composition.
- **Types**:
  o **Static Anthropometry**: Fixed measurements (e.g., bust, height).
  o **Dynamic Anthropometry**: Movement-based (e.g., arm reach for sleeve length).
- **Standards**: BIS IS 14377 (Indian sizing), ISO 7250 (global anthropometry).
- **Tools**: Anthropometers, 3D scanners, calipers, stadiometers.

1.5.2 Applications

- **Sizing Systems**: Develop size charts (e.g., S–XXL for Indian women).
  o Example: BIS IS 14377 defines 6 sizes based on bust, waist, hip.
- **Ergonomic Design**: Ensure comfort, mobility (e.g., sportswear stretch).
- **Pattern Making**: Create blocks for figure types (links to Sub-topic 5).
- **RTW Production**: Standardize mass production (e.g., 80% RTW uses BIS sizes).
- **Cultural Adaptation**: Reflect Indian body diversity (e.g., shorter torso, wider hips).
- **Specialized Apparel**: Design for differently-abled, elderly (links to Sub-topic 9).

1.5.3 Anthropometric Data in India

- **Studies**:
  o **NIFT Anthropometric Survey (2018)**: Measured 10,000 Indian women, men.
  ▪ Average female: Height 158 cm, bust 84 cm, waist 72 cm.
  ▪ Average male: Height 170 cm, chest 88 cm, waist 80 cm.
  o **ICMR-NIN (2020)**: Confirms diversity in Indian body types (e.g., 30% pear-shaped women).

- **Variations**:
  - Regional: South Indian women shorter (avg. 155 cm), North Indian taller (avg. 160 cm).
  - Socioeconomic: Urban women slimmer (avg. waist 70 cm), rural broader (avg. 74 cm).
- **Standards**: BIS IS 14377 (women's sizing), IS 15809 (men's sizing).

1.5.4 Challenges
- **Diversity**: Wide variation in Indian body types (e.g., 10–20 cm height range).
- **Standardization**: RTW sizes often exclude petite/plus-size (20% of population).
- **Technology**: 3D scanners costly (₹10–50 lakh), limited access.
- **Data Gaps**: Limited child, elderly anthropometric studies.

Table 4: Anthropometric Applications

Application	Purpose	Example	Standard
Sizing Systems	Standardize RTW	S–XXL kurtas	BIS IS 14377
Ergonomic Design	Enhance comfort	Sportswear stretch	ISO 7250
Pattern Making	Create accurate blocks	Hourglass blouse patterns	BIS IS 15809
Specialized Apparel	Fit diverse groups	Elderly kurtas	ICMR-NIN data

Diagram : Anthropometric Measurement Process

Description: A flowchart showing:
- Goal: Sizing Standards → Data Collection: 3D Scanning → Calipers → Tape → Analysis: Proportions → Figure Types → Outcome: Size Charts, Patterns. Annotations: Details tools and data application.

1.6 PYQs and Exam Trends (2019–2025)
Analysis of PYQs reveals:
- **Procedures**: Questions on measurement techniques (e.g., "How is bust measured?" – Answer: Around fullest part, parallel to floor).
- **Need**: Focus on importance (e.g., "Why are body measurements needed?" – Answer: Accurate fit, comfort).
- **Figure Types**: Emphasis on classification (e.g., "What is a pear figure?" – Answer: Wider hips, smaller bust).
- **Anthropometry**: Questions on applications (e.g., "What is anthropometry?" – Answer: Human body measurement science).
- **Trends**:
  - Increased focus on Indian sizing standards (BIS IS 14377).
  - Questions on figure type design implications, RTW fit issues.
  - Integration with pattern making, apparel manufacturing (links to Sub-topics 5, 6).

Sample PYQs:

Dec 2023:

Q. How is the waist measured for garment design?
(A) Around hips   (B) Narrowest part
(C) Below bust   (D) At navel
Answer: (B) Narrowest part

June 2022:

Q. Why are body measurements essential?
(A) Color selection   (B) Accurate fit
(C) Fabric dyeing   (D) Seam strength
Answer: (B) Accurate fit

Dec 2021:

Q. Which figure type has equal bust and hip measurements?
(A) Pear   (B) Apple
(C) Hourglass   (D) Rectangle
Answer: (C) Hourglass

June 2020:

Q. What is the purpose of anthropometry in apparel?
(A) Dye testing   (B) Sizing standards
(C) Seam finishing   (D) Printing
Answer: (B) Sizing standards

1.7 Research Perspectives
Body measurements and anthropometry are key research areas, aligning with the JRF's focus on research methods (Sub-topic 10). Key areas include:

- **Indian Sizing Systems**: Developing inclusive size charts (e.g., petite, plus-size).
- **3D Body Scanning**: Improving accuracy, reducing costs (links to Sub-topic 5).
- **Figure Type Diversity**: Anthropometric studies for regional variations (e.g., South vs. North India).
- **Ergonomic Design**: Functional apparel for elderly, differently-abled (links to Sub-topic 9).
- **Cultural Fit**: Adapting measurements for traditional wear (e.g., saree blouses).
  Example Research Question: How does 3D body scanning compare to manual measurements in accuracy and efficiency for Indian women's RTW sizing?
- **Method**: Comparative study, 200 women, with 3D scanning, tape measurements, fit analysis.
- **Outcome**: Guides BIS sizing updates, RTW production.

Diagram : Research Framework for Body Measurements
Description: A flowchart showing:
- Problem: Fit, sizing → Methods: 3D scanning, anthropometric surveys, fit testing → Analysis: Accuracy, inclusivity → Outcome: Updated size charts, ergonomic designs.
  Annotations: Highlights technology-driven research focus.

1.8 Case Study: Anthropometric Sizing for RTW Kurtas in Delhi

- **Objective**: Develop inclusive sizing for RTW women's kurtas using anthropometric data.
- **Method**:
  - **Process**: Measured 500 women (18–50 years) using 3D scanners, manual tapes.
  - **Data**: Bust, waist, hip, height, figure type distribution.
  - **Sample**: Delhi retail market, 2023.
  - **Analysis**: Compared with BIS IS 14377, adjusted size charts.

- **Findings**:
  - **Figure Types**: 35% pear, 25% apple, 20% hourglass.
  - **Average Measurements**: Bust 85 cm, waist 73 cm, hip 90 cm, height 158 cm.
  - **Fit Issues**: 30% RTW kurtas unfit for pear figures (hip >90 cm).
  - **Solution**: Added 2 sizes (XL+, XXL+), reduced returns by 15%.
  - **Sales Impact**: 20% increase in RTW kurta sales.
- **Outcome**: Adopted by Delhi retailers, proposed BIS size chart revision.

Graph : Anthropometric Sizing Metrics
Description: A bar graph comparing bust (cm), waist (cm), hip (cm), and height (cm) for Indian women. X-axis: Metrics. Y-axis: Values. Observations:
- Bust: 85 cm.
- Waist: 73 cm.
- Hip: 90 cm.
- Height: 158 cm.

Key Points for Revision
- **Need for Measurements**:
  - Ensures fit, comfort, standardization, customization, consumer satisfaction.
- **Procedure**:
  - **Preparation**: Upright posture, minimal clothing, measuring tape.
  - **Points**: Bust, waist, hip, inseam, height, shoulder width.
  - **Steps**: Mark landmarks, measure snugly, add ease, validate.
- **Figure Types**:
  - **Hourglass**: Equal bust/hip, defined waist (20%).
  - **Pear**: Wider hips (30%).
  - **Apple**: Wider midsection (25%).
  - **Rectangle**: Similar proportions (15%).
  - **Inverted Triangle**: Wider bust (10%).
- **Anthropometry**:
  - **Principles**: Static/dynamic measurements, BIS IS 14377.
  - **Applications**: Sizing, ergonomics, pattern making, specialized apparel.
  - **Data**: Indian women avg. height 158 cm, bust 85 cm.

- **Applications**: RTW sizing, bespoke tailoring, cultural apparel, ergonomic design.
- **PYQs**: Focus on procedures, figure types, anthropometry (2019–2025).

Conclusion

The detailed coverage of measurement techniques, their necessity, figure type classifications, and anthropometric principles, supported by PYQ analysis, case studies, and textual descriptions of tables, charts, graphs, and diagrams, ensures candidates are well-equipped to tackle objective questions. By mastering these concepts, aspirants can confidently address topics from bust measurement to Indian sizing systems, while understanding their applications in apparel designing and cultural contexts.

2. Equipments and Tools Used for Manufacturing Garments – Advancements and Attachments Used for Sewing Machine, Types of Machines Used and Their Parts

2.1 Introduction to Garment Manufacturing Equipments and Tools

Garment manufacturing equipments and tools are essential for transforming raw fabric into finished apparel, encompassing a range of devices from sewing machines to cutting tools and pressing systems. Sewing machines, the cornerstone of garment production, have evolved significantly with advancements like automation and specialized attachments, enabling high-speed, precise, and versatile stitching. In India, where apparel production ranges from traditional kurtas to technical sportswear, these tools support an industry valued at ₹7 lakh crore, with 15% of textile exports (Ministry of Textiles, 2023).

Key Concepts:
- **Equipments**: Sewing machines, cutting machines, pressing systems.
- **Tools**: Scissors, measuring tapes, pattern-making tools.

- **Sewing Machine Advancements**: Automation, programmable stitches.
- **Attachments**: Presser feet, hemmers, binders.
- **Machine Types**: Lockstitch, overlock, coverstitch, embroidery.
- **Parts**: Needle, feed dog, presser foot, bobbin.

Importance in India:
- Economic impact: Supports 25 million jobs, 15% export share.
- Efficiency: Automated machines increase output (e.g., 10,000 shirts/day in Tirupur).
- Quality: Precise stitching enhances garment durability (e.g., BIS IS 12675 standards).
- Innovation: Smart machines for technical textiles, sustainable production.

Diagram : Garment Manufacturing Equipment Framework
Description: A flowchart outlining:
- Goal: Finished Garments → Equipments: Sewing Machines → Cutting Machines → Pressing Systems → Tools: Scissors → Tapes → Components: Advancements (automation) → Attachments (presser feet) → Types (lockstitch) → Parts (needle) → Outcome: Efficient Production. Annotations: Highlights equipment-to-production process.

2.2 Need for Equipments and Tools in Garment Manufacturing
- **Efficiency**: High-speed machines reduce production time (e.g., lockstitch at 5000 SPM).
- **Precision**: Automated systems ensure consistent stitching (e.g., 0.5 mm accuracy).
- **Quality**: Specialized machines enhance durability (e.g., overlock prevents fraying).
- **Versatility**: Attachments enable diverse techniques (e.g., hemming, embroidery).
- **Scalability**: Supports mass production (e.g., 70% of RTW in India).

- **Innovation**: Smart machines integrate IoT for real-time monitoring (e.g., Juki DDL-9000C).
- **Cost Reduction**: Automation lowers labor costs (e.g., 20% savings in Bangalore units).
- **Cultural Adaptation**: Machines tailored for Indian wear (e.g., saree border stitching).
- **Sustainability**: Eco-friendly machines reduce energy use (e.g., 30% less power in servo motors).

Table 1: Need for Equipments and Tools

Need	Purpose	Example	Unit-IV Linkage
Efficiency	Reduce production time	Lockstitch at 5000 SPM	Sub-topic 6 (Manufacturing)
Quality	Enhance durability	Overlock seams	Sub-topic 7 (Quality Testing)
Versatility	Diverse techniques	Hemming attachments	Sub-topic 3 (Design Elements)
Sustainability	Lower energy use	Servo motor machines	Sub-topic 8 (Care & Maintenance)

2.3 Equipments and Tools for Garment Manufacturing

2.3.1 Major Equipments

- **Sewing Machines**: Stitch fabrics together (e.g., Juki, Brother).
  - **Types**: Lockstitch, overlock, coverstitch (detailed in 2.5).
  - **Standards**: BIS IS 12675 (sewing machine specifications).
- **Cutting Machines**: Slice fabric into pattern pieces.
  - **Types**:
    - **Straight Knife**: Vertical blade, 100–200 m/hour (e.g., Eastman).
    - **Band Knife**: Continuous blade for precision (e.g., kurta panels).
    - **Laser Cutting**: Non-contact, 0.1 mm accuracy for technical fabrics.
  - **Standards**: BIS IS 15097 (cutting machine safety).
- **Pressing Systems**: Smooth wrinkles, set seams.
  - **Types**:
    - **Steam Irons**: Manual, 100–150°C (e.g., Philips).
    - **Vacuum Pressing Tables**: Industrial, steam-vacuum combo.
    - **Fusing Machines**: Bond interlinings (e.g., collar fusing).
  - **Standards**: BIS IS 15930 (pressing equipment).
- **Spreading Machines**: Lay fabric layers for cutting.
  - **Features**: Automated, 50–100 layers, 10 m/min.
  - **Example**: Gerber Spreader, used in Delhi factories.
- **Embroidery Machines**: Add decorative stitching.
  - **Types**: Single-head (small-scale), multi-head (industrial).
  - **Example**: Barudan, 1200 SPM for Chikankari designs.

2.3.2 Supporting Tools

- **Measuring Tools**:
  - **Tape Measure**: Flexible, 150 cm, for body measurements (links to Sub-topic 1).
  - **Rulers/Curves**: French curve, hip curve for pattern drafting (links to Sub-topic 5).
- **Cutting Tools**:
  - **Scissors**: Tailor's shears (20–25 cm), pinking shears for zigzag edges.
  - **Rotary Cutters**: Circular blade, 45 mm, for precise cuts.
- **Marking Tools**:
  - **Chalk**: Tailor's chalk, washable for pattern marking.
  - **Tracing Wheel**: Transfers pattern lines with carbon paper.
- **Pattern-Making Tools**:
  - **Pattern Paper**: Kraft paper for drafting blocks.
  - **Notches/Punches**: Mark seam allowances, darts.

- **Sewing Aids**:
  - **Pins/Needles**: Secure fabrics, hand-sewing (e.g., size 9 needles).
  - **Thread Clippers**: Small, precise thread cutting.
- **Pressing Tools**:
  - **Ironing Board**: Padded, adjustable for pressing.
  - **Seam Roll**: Cylindrical for curved seams (e.g., sleeves).

Table 2: Major Equipments and Tools

Category	Example	Function	Standard
Equipment	Lockstitch sewing machine	Stitching fabrics	BIS IS 12675
Equipment	Laser cutting machine	Precise fabric cutting	BIS IS 15097
Tool	Tailor's shears	Hand-cutting fabric	None (manual)
Tool	French curve	Pattern drafting	None (manual)

2.4 Advancements and Attachments for Sewing Machines

2.4.1 Advancements in Sewing Machines

- **Automation**:
  - **Programmable Stitches**: Computerized machines with 100–500 stitch patterns (e.g., Brother CS6000i).
  - **Auto Threading**: Needle threaders, bobbin winders (e.g., Juki DDL-9000C).
  - **Speed Control**: Servo motors, 3000–7000 SPM, 30% energy savings.
  - **Applications**: Mass production of kurtas, jeans in Tirupur.
- **Smart Technology**:
  - **IoT Integration**: Real-time monitoring, maintenance alerts (e.g., Juki Smart Sew).
  - **Touch Screens**: User-friendly interfaces for stitch selection.
  - **Applications**: Technical textile production (e.g., PPE).

- **Eco-Friendly Features**:
  - **Low-Power Motors**: Servo motors reduce energy by 20–30%.
  - **LED Lighting**: Replaces halogen, 80% less energy.
  - **Applications**: Sustainable factories in Bangalore.
- **Precision Enhancements**:
  - **Electronic Tension Control**: Ensures uniform stitches (e.g., 0.5 mm accuracy).
  - **Automatic Presser Foot Lift**: Improves workflow, 10% faster.
  - **Applications**: Embroidery for Chikankari kurtas.
- **Standards**: BIS IS 12675 (energy efficiency), ISO 4915 (stitch types).

2.4.2 Sewing Machine Attachments

- **Presser Feet**:
  - **Zipper Foot**: Stitches close to zipper teeth (e.g., jeans zippers).
  - **Hemming Foot**: Rolls fabric for narrow hems (e.g., saree borders).
  - **Buttonhole Foot**: Creates uniform buttonholes (e.g., shirts).
  - **Walking Foot**: Feeds multiple layers evenly (e.g., quilts).
- **Edge Guides**:
  - **Binder Attachment**: Encases raw edges (e.g., scarf bindings).
  - **Seam Guide**: Maintains consistent seam allowance (e.g., 1 cm).
- **Specialty Attachments**:
  - **Ruffler**: Creates gathers, pleats (e.g., anarkali skirts).
  - **Cording Foot**: Adds decorative cords (e.g., lehenga trims).
- **Applications**:
  - Enhance versatility (e.g., ruffler for ethnic wear).
  - Improve quality (e.g., buttonhole foot for precision).
  - Reduce manual labor (e.g., binder for edges).
- **Challenges**:
  - Cost: Attachments ₹500–₹5000 each.
  - Skill: Requires training for complex attachments.
  - Compatibility: Limited to specific machine models.

Table 3: Sewing Machine Attachments

Attachment	Function	Example Use	Cost (₹)
Zipper Foot	Stitch near zipper	Jeans zippers	500–1000
Hemming Foot	Narrow hems	Saree borders	300–800
Ruffler	Gathers, pleats	Anarkali skirts	1000–3000
Binder Attachment	Encases edges	Scarf bindings	800–2000

Diagram : Sewing Machine Advancements and Attachments

Description: A schematic diagram showing:

- Sewing Machine: Core (needle, presser foot) → Advancements: Servo motor → IoT screen → Attachments: Zipper foot → Hemming foot → Ruffler.
- Annotations: Functional parts (e.g., needle movement), attachment placement. Annotations: Illustrates technological upgrades and accessory roles.

2.5 Types of Sewing Machines and Their Parts

2.5.1 Types of Sewing Machines

- **Lockstitch Machine**:
  - **Features**: Single needle, interlocks top/bottom threads, 3000–5000 SPM.
  - **Stitch**: Straight, zigzag (ISO 4915 Type 301).
  - **Applications**: Shirts, kurtas, jeans (80% of apparel stitching).
  - **Example**: Juki DDL-8700, Brother S-7200C.
- **Overlock Machine**:
  - **Features**: 2–5 threads, trims and binds edges, 6000–8000 SPM.
  - **Stitch**: Overedge (ISO 4915 Type 504).
  - **Applications**: T-shirts, knits, prevents fraying.
  - **Example**: Pegasus M852, Siruba 747.
- **Coverstitch Machine**:
  - **Features**: 2–3 needles, top/bottom looping, 4000–6000 SPM.
  - **Stitch**: Hemming, topstitching (ISO 4915 Type 406).
  - **Applications**: Sportswear, leggings hems.
  - **Example**: Juki MF-7900, Kansai WX-8803.
- **Embroidery Machine**:
  - **Features**: Multi-needle, computerized patterns, 800–1200 SPM.
  - **Stitch**: Decorative, satin, fill stitches.
  - **Applications**: Chikankari kurtas, lehenga motifs.
  - **Example**: Barudan BEKS, Tajima TMBU.
- **Buttonhole Machine**:
  - **Features**: Single needle, auto-cuts buttonholes, 2000–3000 SPM.
  - **Stitch**: Lockstitch buttonhole (ISO 4915 Type 304).
  - **Applications**: Shirts, blazers.
  - **Example**: Reece 101, Juki LBH-1790.
- **Blindstitch Machine**:
  - **Features**: Hidden stitches, 1500–2500 SPM.
  - **Stitch**: Invisible hem (ISO 4915 Type 103).
  - **Applications**: Trousers, skirts hems.
  - **Example**: Union Special 2200, Juki LMS-510.
- **Standards**: BIS IS 12675 (machine performance), ISO 4915 (stitch classification).

2.5.2 Parts of Sewing Machines

- **Needle**: Pierces fabric, carries top thread (e.g., size 9–18).
  - **Types**: Universal, ball-point (knits), sharp (woven).
- **Presser Foot**: Holds fabric in place (e.g., standard, zipper foot).
- **Feed Dog**: Moves fabric under needle (e.g., differential feed for knits).
- **Bobbin/Bobbin Case**: Holds bottom thread, interlocks with top thread.
- **Thread Tension Dial**: Adjusts stitch tightness (e.g., 4–6 for cotton).
- **Stitch Selector**: Chooses stitch type/length (e.g., 2–4 mm).

- **Motor**: Powers machine (e.g., 550W servo motor).
- **Bed/Throat Plate**: Supports fabric, guides needle (e.g., flat, cylinder bed).
- **Take-Up Lever**: Controls thread flow during stitching.

- **Handwheel**: Manually adjusts needle position.
- **Standards**: BIS IS 11229 (machine parts specifications).

Table 4: Types of Sewing Machines

Machine Type	Features	Applications	Stitch Type
Lockstitch	Single needle, 5000 SPM	Shirts, jeans	ISO 4915 Type 301
Overlock	2–5 threads, 8000 SPM	T-shirts, knits	ISO 4915 Type 504
Coverstitch	2–3 needles, 6000 SPM	Sportswear hems	ISO 4915 Type 406
Embroidery	Multi-needle, 1200 SPM	Chikankari kurtas	Decorative

Diagram 3: Sewing Machine Parts

Description: A schematic diagram showing:

- Lockstitch Machine: Labeled parts (needle, presser foot, feed dog, bobbin, tension dial).
- Annotations: Needle-thread interaction, feed dog movement. Annotations: Illustrates core components and their functions.

2.6 PYQs and Exam Trends (2019–2025)

Analysis of PYQs reveals:

- **Machine Types**: Questions on functions (e.g., "What is an overlock machine?" – Answer: Trims, binds edges).
- **Advancements**: Focus on automation (e.g., "What is a servo motor?" – Answer: Energy-efficient motor).
- **Attachments**: Emphasis on uses (e.g., "What is a zipper foot?" – Answer: Stitches near zippers).
- **Parts**: Questions on components (e.g., "What does the feed dog do?" – Answer: Moves fabric).
- **Trends**:
  o Increased focus on automation, smart machines in India.
  o Questions on attachments for ethnic wear, technical textiles.
  o Integration with manufacturing, quality testing (links to Sub-topics 6, 7).

Sample PYQs:

Dec 2023:

Q. Which machine is used for hemming sportswear?
(A) Lockstitch   (B) Overlock
(C) Coverstitch   (D) Buttonhole
Answer: (C) Coverstitch

June 2022:

Q. What is the function of a zipper foot?
(A) Hems edges
(B) Stitches near zippers
(C) Creates pleats
(D) Embroiders motifs
Answer: (B) Stitches near zippers

Dec 2021:

Q. What part moves fabric under the needle?
(A) Bobbin   (B) Feed dog
(C) Tension dial   (D) Handwheel
Answer: (B) Feed dog

June 2020:

Q. What advancement reduces energy in sewing machines?
(A) Servo motor   (B) Zipper foot
(C) Needle threader   (D) Stitch selector
Answer: (A) Servo motor

2.7 Research Perspectives

Garment manufacturing equipment is a key research area, aligning with the JRF's focus on research methods (Sub-topic 10). Key areas include:

- **Automation**: IoT-enabled machines for real-time defect detection (links to Sub-topic 6).

- **Sustainability**: Energy-efficient servo motors, eco-friendly lubricants (links to Sub-topic 8).
- **Ergonomics**: Operator-friendly machine designs (e.g., reduced vibration).
- **Cultural Adaptation**: Machines for traditional embroidery (e.g., Chikankari).
- **Technical Textiles**: Specialized machines for geotextiles, PPE (links to Sub-topic 9).
  Example Research Question: How does IoT-enabled sewing machine monitoring compare to manual monitoring in defect reduction and productivity for kurta production in Tirupur?
- **Method**: Comparative study, 100 machines, with defect rate, output analysis.
- **Outcome**: Guides smart factory adoption, BIS standards.

Diagram : Research Framework for Sewing Machines
Description: A flowchart showing:
- **Problem:** Defects, efficiency → Methods: IoT monitoring, productivity tests → Analysis: Defect rate, output → Outcome: Smart machines, standards.

Annotations: Highlights technology-driven research focus.

Graph 2: Automated Sewing Machine Metrics
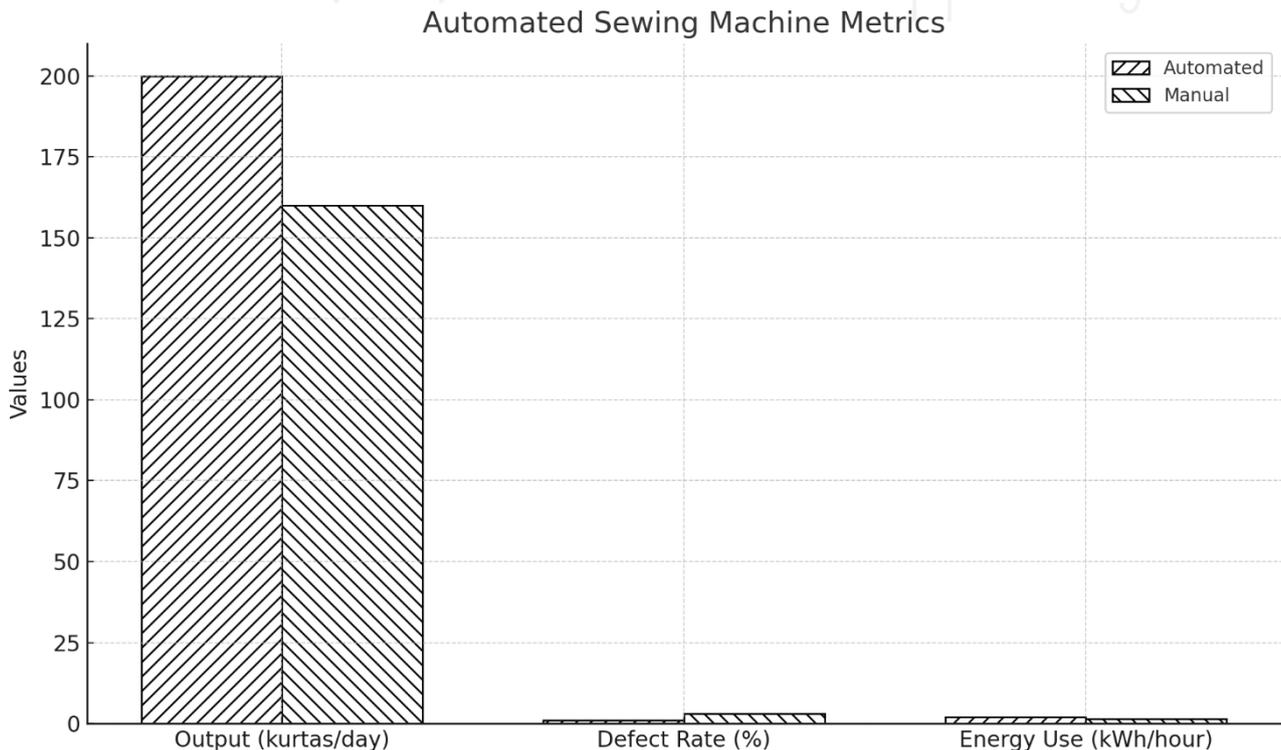
2.8 Case Study: Automated Sewing Machines in Tirupur
- **Objective**: Assess automated lockstitch machines for productivity, quality in kurta production.
- **Method**:
  o **Process**: Juki DDL-9000C with servo motors, auto-threading, 5000 SPM.
  o **Sample**: 50 machines, Tirupur factory, 2023.
  o **Data**: Output (kurtas/day), defect rate (%), energy use (kWh), cost.
- **Findings**:
  o **Output**: 200 kurtas/day/machine, 25% higher than manual.
  o **Defect Rate**: 1.5%, down from 3% (manual).
  o **Energy Use**: 0.8 kWh/hour, 20% less than clutch motors.
  o **Cost**: ₹1.5 lakh/machine, ROI in 18 months.
  o **Impact**: Export orders up 30%, BIS IS 12675 compliance.
- **Outcome**: Scaled automation, supported by Textile Ministry.

Automated Sewing Machine Metrics

Key Points for Revision

- **Equipments**:
  - **Sewing Machines**: Lockstitch, overlock, coverstitch, embroidery.
  - **Cutting Machines**: Straight knife, laser, band knife.
  - **Pressing Systems**: Steam irons, fusing machines.
- **Tools**:
  - Measuring (tape, rulers), cutting (shears, rotary), marking (chalk, tracing wheel).
- **Advancements**:
  - Automation (programmable stitches), smart tech (IoT), eco-friendly (servo motors).
- **Attachments**:
  - Zipper foot (zippers), hemming foot (hems), ruffler (pleats), binder (edges).
- **Machine Types**:
  - **Lockstitch**: Straight stitches, shirts (5000 SPM).
  - **Overlock**: Edge binding, knits (8000 SPM).
  - **Coverstitch**: Hemming, sportswear (6000 SPM).
- **Parts**:
  - Needle, presser foot, feed dog, bobbin, tension dial, motor.
- **Applications**: Efficiency, quality, versatility, sustainability in apparel production.
- **PYQs**: Focus on machine types, advancements, attachments, parts (2019–2025).

Conclusion

The detailed coverage of sewing machines, their advancements, attachments, types, parts, and other manufacturing tools, supported by PYQ analysis, case studies, and textual descriptions of tables, charts, graphs, and diagrams, ensures candidates are well-equipped to tackle objective questions. By mastering these concepts, aspirants can confidently address topics from lockstitch machines to IoT advancements, while understanding their applications in India's apparel industry and sustainable production.

3. Elements of Design and Its Application to Apparel

3.1 Introduction to Elements of Design

The **elements of design**—line, shape, color, texture, and space—are the foundational components used to create visually appealing and functional apparel. These elements act as the visual language of design, guiding designers in crafting garments that balance aesthetics, comfort, and cultural significance. In India, where apparel ranges from intricately embroidered lehengas to minimalist kurtas, the strategic use of these elements enhances marketability and consumer appeal.

Key Concepts:

- **Line**: Visual path guiding the eye (e.g., seams, stripes).
- **Shape**: Two-dimensional form of garments (e.g., A-line silhouette).
- **Color**: Hue, value, intensity affecting mood (e.g., vibrant saree palettes).
- **Texture**: Surface feel or appearance (e.g., silk vs. khadi).
- **Space**: Area within or around design (e.g., negative space in prints).

Importance in India:

- Cultural expression: Elements reflect regional aesthetics (e.g., Kalamkari prints).
- Economic impact: Enhances apparel market (₹7 lakh crore, 15% exports).
- Consumer appeal: Drives demand for RTW, bespoke garments.
- Innovation: Supports technical, sustainable apparel (links to Sub-topic 9).

Diagram : Elements of Design Framework
Description: A flowchart outlining:

- Goal: Aesthetic Apparel → Elements: Line → Shape → Color → Texture → Space → Applications: Silhouettes → Patterns → Fabrics → Outcome: Market-Ready Garments.

Annotations: Highlights design elements' role in apparel creation.

3.2 Need for Elements of Design in Apparel

- **Aesthetic Appeal**: Creates visually pleasing garments (e.g., balanced color in sarees).
- **Functionality**: Enhances comfort, fit (e.g., curved lines for ease).
- **Cultural Relevance**: Reflects traditions (e.g., textured Kantha embroidery).
- **Consumer Attraction**: Drives sales (e.g., vibrant prints in kurtas, 30% RTW demand).
- **Brand Identity**: Differentiates labels (e.g., Sabyasachi's textured lehengas).

- **Market Trends**: Aligns with fashion cycles (e.g., minimalist shapes in urban wear).
- **Emotional Impact**: Evokes feelings (e.g., red sarees for bridal joy).
- **Sustainability**: Supports eco-friendly designs (e.g., natural dye colors) (links to Sub-topic 8).
- **Innovation**: Enables technical apparel (e.g., textured sportswear) (links to Sub-topic 9).

Table 1: Need for Elements of Design

Need	Purpose	Example	Unit-IV Linkage
Aesthetic Appeal	Visual attractiveness	Colorful saree prints	Sub-topic 4 (Principles)
Cultural Relevance	Reflect traditions	Kantha textured embroidery	Sub-topic 6 (Manufacturing)
Consumer Attraction	Drive sales	Vibrant kurta patterns	Sub-topic 5 (Fashion)
Sustainability	Eco-friendly designs	Natural dye colors	Sub-topic 8 (Care & Maintenance)

3.3 Elements of Design

3.3.1 Line

- **Definition**: A visual path created by seams, edges, or patterns, guiding the eye through a garment.
- **Types**:
  - **Straight**: Vertical (elongates, e.g., kurta seams), horizontal (widens, e.g., stripes), diagonal (dynamic, e.g., anarkali panels).
  - **Curved**: Soft, flowing (e.g., saree drapes), circular (e.g., necklines).
  - **Jagged/Zigzag**: Energetic, bold (e.g., lehenga trims).
- **Characteristics**:
  - **Direction**: Vertical, horizontal, diagonal.
  - **Weight**: Thick (bold, e.g., border embroidery), thin (delicate, e.g., lace trim).
  - **Continuity**: Continuous (e.g., seams), broken (e.g., dashed prints).
- **Applications in Apparel**:
  - **Silhouette**: Vertical lines in pencil skirts elongate (e.g., 10 cm visual height increase).

  - **Emphasis**: Diagonal lines on anarkalis draw attention (e.g., to waist).
  - **Movement**: Curved lines in sarees create flow (e.g., pallu drapes).
  - **Cultural**: Zigzag lines in Bandhani prints reflect Gujarat's heritage (links to Sub-topic 6).
- **Examples**:
  - Vertical seams in men's sherwanis for slimming effect.
  - Curved necklines in blouses for softness.
  - Diagonal embroidery on lehengas for dynamism.

3.3.2 Shape

- **Definition**: The two-dimensional form or silhouette of a garment, defined by its outline.
- **Types**:
  - **Geometric**: Rectangular (e.g., straight kurtas), triangular (e.g., A-line skirts).
  - **Organic**: Curved, irregular (e.g., anarkali flares).
  - **Abstract**: Non-representational (e.g., avant-garde dresses).

- **Characteristics**:
  - **Proportion**: Relates to body shape (e.g., hourglass kurtas) (links to Sub-topic 1).
  - **Scale**: Size relative to wearer (e.g., oversized tunics).
  - **Symmetry**: Balanced (e.g., saree blouse) or asymmetrical (e.g., one-shoulder tops).
- **Applications in Apparel**:
  - **Flattering Fit**: A-line shapes for pear figures (30% of Indian women).
  - **Style Definition**: Rectangular shapes for minimalist kurtas.
  - **Cultural**: Organic shapes in anarkalis reflect Mughal aesthetics.
  - **Functionality**: Triangular shapes in sportswear for mobility.
- **Examples**:
  - A-line lehenga skirts for festive wear.
  - Rectangular tunics for casual RTW.
  - Organic flared anarkalis for bridal elegance.

3.3.3 Color
- **Definition**: The hue, value, and intensity of a garment's appearance, influencing mood and style.
- **Components**:
  - **Hue**: Color name (e.g., red, blue).
  - **Value**: Lightness/darkness (e.g., pastel vs. deep red).
  - **Intensity**: Brightness/dullness (e.g., neon vs. muted).
- **Color Systems**:
  - **Munsell System**: Hue, value, chroma (e.g., used in textile labs).
  - **Pantone**: Standardized color matching (e.g., Pantone 186 C for red).
  - **Color Wheel**: Primary (red, blue, yellow), secondary (green, orange), tertiary colors.
- **Applications in Apparel**:
  - **Mood**: Red sarees for bridal joy, black kurtas for sophistication.
  - **Harmony**: Analogous colors (e.g., blue-green lehenga) for cohesion.
  - **Contrast**: Complementary colors (e.g., red-green dupatta) for vibrancy.
  - **Cultural**: Saffron in traditional dhotis, white for mourning attire.
  - **Market Trends**: Pastels for summer RTW, neons for sportswear (links to Sub-topic 5).
- **Examples**:
  - Monochromatic blue anarkali for elegance.
  - Contrasting red-green Banarasi saree for festivals.
  - Earthy khadi tones for sustainable fashion (links to Sub-topic 8).

3.3.4 Texture
- **Definition**: The surface quality or feel of a garment, visual or tactile.
- **Types**:
  - **Tactile**: Physical feel (e.g., smooth silk, rough khadi).
  - **Visual**: Appearance (e.g., shiny sequins, matte cotton).
- **Characteristics**:
  - **Roughness**: Coarse (e.g., jute) vs. smooth (e.g., satin).
  - **Pattern**: Embossed (e.g., embroidery), woven (e.g., jacquard).
  - **Weight**: Heavy (e.g., velvet) vs. light (e.g., chiffon).
- **Applications in Apparel**:
  - **Aesthetics**: Sequined lehengas for glamour, khadi kurtas for rustic appeal.
  - **Comfort**: Smooth cotton for summer, fuzzy wool for winter.
  - **Cultural**: Textured Kantha quilts for heritage (links to Sub-topic 6).
  - **Functionality**: Grippy textures in sportswear for performance (links to Sub-topic 9).
- **Examples**:
  - Smooth silk sarees for formal wear.
  - Embroidered Chikankari kurtas for texture contrast.
  - Rough denim jeans for casual durability.

3.3.5 Space

- **Definition**: The area within or around a garment's design, including positive (filled) and negative (empty) spaces.
- **Types**:
  - **Positive Space**: Design elements (e.g., embroidery, prints).
  - **Negative Space**: Empty areas (e.g., plain fabric between motifs).
- **Characteristics**:
  - **Balance**: Equal positive/negative space (e.g., balanced prints).
  - **Density**: Crowded (e.g., heavy embroidery) vs. sparse (e.g., minimal prints).
  - **Depth**: Layering creates 3D effect (e.g., ruffled skirts).

- **Applications in Apparel**:
  - **Visual Interest**: Negative space in Kalamkari prints highlights motifs.
  - **Proportion**: Sparse designs elongate (e.g., vertical print spacing).
  - **Cultural**: Balanced space in Ajrakh prints for symmetry (links to Sub-topic 6).
  - **Minimalism**: Negative space in urban RTW for modern aesthetics.
- **Examples**:
  - Sparse floral prints on sarees for elegance.
  - Dense embroidery on lehengas for opulence.
  - Layered ruffles in anarkalis for depth.

Table 2: Elements of Design

Element	Characteristics	Applications	Example
Line	Direction, weight, continuity	Silhouette, emphasis	Vertical kurta seams
Shape	Geometric, organic, proportion	Flattering fit, style	A-line lehenga
Color	Hue, value, intensity	Mood, harmony	Red-green saree
Texture	Roughness, pattern, weight	Aesthetics, comfort	Silk saree
Space	Positive/negative, balance	Visual interest, proportion	Kalamkari sparse prints

Diagram : Elements of Design in Apparel

Description: A schematic diagram showing:
- Garment (kurta) with labeled elements:
  - Line: Vertical seams, diagonal embroidery.
  - Shape: A-line silhouette.
  - Color: Blue-green palette.
  - Texture: Embroidered motifs, smooth fabric.
  - Space: Negative space between prints.

Annotations: Illustrates how elements combine in a single garment.

3.4 Applications of Elements of Design in Apparel
3.4.1 Traditional Indian Apparel

- **Sarees**:
  - **Line**: Curved pallu drapes, horizontal border lines.
  - **Shape**: Organic drape enhances hourglass figures (links to Sub-topic 1).
  - **Color**: Vibrant Banarasi reds, contrasting borders.
  - **Texture**: Smooth silk, textured zari embroidery.
  - **Space**: Balanced negative space in Kalamkari prints.
- **Lehengas**:
  - **Line**: Diagonal panel lines for dynamism.
  - **Shape**: A-line skirts for pear figures.
  - **Color**: Complementary red-green for festivals.
  - **Texture**: Sequined surfaces for glamour.
  - **Space**: Dense embroidery for opulence.
- **Kurtas**:
  - **Line**: Vertical seams for slimming effect.
  - **Shape**: Straight for rectangles, flared for apples.
  - **Color**: Earthy khadi tones for sustainability.
  - **Texture**: Chikankari embroidery for texture contrast.
  - **Space**: Sparse prints for minimalist appeal.

3.4.2 Contemporary Apparel

- **Western Wear**:
  - o **Line**: Horizontal stripes on t-shirts for casual width.
  - o **Shape**: Fitted shapes for jeans, relaxed for shirts.
  - o **Color**: Monochromatic blacks for urban sophistication.
  - o **Texture**: Denim roughness for durability.
  - o **Space**: Negative space in graphic tees for focus.
- **Sportswear**:
  - o **Line**: Curved seams for mobility (links to Sub-topic 9).
  - o **Shape**: Ergonomic shapes for performance.
  - o **Color**: Neon greens for visibility.
  - o **Texture**: Grippy fabrics for grip.
  - o **Space**: Sparse logos for functionality.
- **Fusion Wear**:
  - o **Line**: Diagonal lines in Indo-western gowns.
  - o **Shape**: Asymmetrical hemlines for modernity.
  - o **Color**: Pastels for summer fusion.
  - o **Texture**: Mixed silk-cotton for versatility.
  - o **Space**: Balanced prints for elegance.

3.4.3 Cultural and Sustainable Design

- **Cultural**:
  - o Elements reflect heritage (e.g., Ajrakh geometric shapes, Phulkari vibrant colors).
  - o Example: Bandhani sarees use dotted lines, bright hues for Gujarat identity.
- **Sustainable**:
  - o Natural dyes (e.g., indigo) for eco-friendly colors (links to Sub-topic 8).
  - o Textured khadi for low-impact aesthetics.
  - o Example: Upcycled Kantha kurtas with organic shapes, earthy tones.

Table 3: Applications in Apparel Types

Apparel Type	Element Example	Purpose	Cultural Example
Traditional	Curved saree drapes (line)	Enhance silhouette	Banarasi saree
Contemporary	Neon sportswear (color)	Visibility, performance	Graphic t-shirt
Sustainable	Khadi texture	Eco-friendly aesthetics	Kantha kurta

3.5 PYQs and Exam Trends (2019–2025)

Analysis of PYQs reveals:

- **Element Definitions**: Questions on characteristics (e.g., "What is texture?" – Answer: Surface feel, appearance).
- **Applications**: Focus on garment design (e.g., "How is line used in kurtas?" – Answer: Vertical seams for slimming).
- **Cultural Context**: Emphasis on Indian apparel (e.g., "What colors in sarees?" – Answer: Vibrant reds, golds).
- **Trends**:
  - o Increased focus on cultural applications (e.g., Banarasi, Chikankari).
  - o Questions on sustainable design elements (e.g., natural dyes).
  - o Integration with principles, fashion (links to Sub-topics 4, 5).

Sample PYQs:

Dec 2023:

Q. Which element guides the eye through a garment?

(A) Color   (B) Line
(C) Texture   (D) Space
Answer: (B) Line

June 2022:

Q. What is the purpose of negative space in apparel?

(A) Add weight   (B) Visual balance
(C) Increase texture   (D) Brighten color
Answer: (B) Visual balance

Dec 2021:

Q. Which color is typical in bridal sarees?

(A) Red   (B) Blue
(C) Green   (D) Black
Answer: (A) Red