Methodology
Chapter 4

Methodology

In the present study knitted fabrics were treated with commercially available Acrylic emulsion, Silicon emulsion and DMDHEU; and modification in physical properties of knitted fabrics was examined. Skirts were designed and finished; and their drape characteristics were studied.

The details pertaining to the materials used and the methods adopted during the course of investigation are presented in this chapter under following sections:

4.1 Material
   4.1.1 Fabric
   4.1.2 Chemicals

4.2 Equipment used

4.3 Method
   4.3.1 Determination of preliminary data of fabrics
   4.3.2 Scouring treatment
   4.3.3 Application of resins and determination of percent add on of the finish

4.4 Determination of physical properties after application of finish
   4.4.1 Determination of pilling of fabrics
   4.4.2 Determination of shrinkage of fabrics
   4.4.3 Determination of elongation and elastic recovery of fabrics
   4.4.4 Determination of stiffness of fabrics
   4.4.5 Determination of the percent drape coefficient of fabrics
   4.4.6 Determination of bursting strength of fabrics

4.5 Designing of skirt
   4.5.1 Preparation of dress form
   4.5.2 Designing and construction of skirts

4.6 Determination of drape coefficient of skirts

4.7 Application of finish on designed skirts

4.8 Determination of aesthetic appeal of designed skirts and of these skirts after finishing

4.9 Statistical analysis of data

4.1 Material-
4.1.1 Fabric-

Commercially available grey knitted fabrics were selected. These were purchased from KNIT FAB (Shree Balaji Hoisery Udhog), Nehru place, New Delhi. Total nine knitted fabrics, which are commonly used by consumers, were selected for this study. Table 1 shows particulars of the fabrics.

Table 1
Particulars of the Fabrics

<table>
<thead>
<tr>
<th>S. no.</th>
<th>Fabric Name</th>
<th>Blend Ratio</th>
<th>Stitch type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cotton</td>
<td>100%</td>
<td>Single Jersey</td>
</tr>
<tr>
<td>2</td>
<td>Polyester</td>
<td>100%</td>
<td>Single Jersey</td>
</tr>
<tr>
<td>3</td>
<td>Nylon</td>
<td>100%</td>
<td>Single Jersey</td>
</tr>
<tr>
<td>4</td>
<td>Viscose</td>
<td>100%</td>
<td>Single Jersey</td>
</tr>
<tr>
<td>5</td>
<td>Wool</td>
<td>100%</td>
<td>Single Jersey</td>
</tr>
<tr>
<td>6</td>
<td>Cotton/Polyester blend</td>
<td>35%/ 65%</td>
<td>Interlock</td>
</tr>
<tr>
<td>7</td>
<td>Cotton/Nylon blend</td>
<td>70% / 30%</td>
<td>Single Jersey</td>
</tr>
<tr>
<td>8</td>
<td>Cotton/viscose blend</td>
<td>50%/50%</td>
<td>Single Jersey</td>
</tr>
<tr>
<td>9</td>
<td>Polyester/Wool blend</td>
<td>50%/50%</td>
<td>Single Jersey</td>
</tr>
</tbody>
</table>

4.1.2 Chemicals-

Commercially available three resin finishes were used in the study. Two thermoplastic and one thermosetting resin were selected-

4.1.2.1. Acrylic Emulsion – Acrylic Emulsion commonly known as INDOFIL-K-87 was used. It is non ionic in nature and acidic in character. It is self cross linking resin. It was supplied by INDOFIL CHEMICALS COMPANY, THANE, Mumbai.

4.1.2.2. Silicone Emulsion – Silicone Emulsion commonly known as RESIL AST4 was used. It was supplied by RESIL CHEMICALS PVT.LTD Gurgaon.

4.1.2.3. DMDHEU- DMDHEU commonly known as SANDUPRES-2 was selected. SANDUPRES-2 is a cross linking agent of Dimethylol Dihydroxy Ethylene Urea. It was supplied by NAVEEP CHEMICALS PVT.LTD, Mumbai.
4.2 Equipments Used

4.2.1 Squeezing roller type laboratory padding mangle was used for application of finish.
4.2.2 Thickness gauge of Heal’s was used for the determination of thickness of the fabric.
4.2.3 Sasmira launder o meter was used for washing.
4.2.4 Weight was taken on electronic balance of Adair Dutt AD-180.
4.2.5 Stiffness of the sample was tested on stiffness tester of Eureka Precision Instrument Company.
4.2.6 Fabric pilling tester of Eureka Precision Instrument Company was used to test pilling property of the fabric.
4.2.7 A drape meter was constructed as described by CHU et. al., and used to find percent drape coefficient.
4.2.8 Bursting test was checked on TruBurst\textsuperscript{3} bursting strength tester of Halifax Company.

4.3 Method

4.3.1 Determination of preliminary data of fabrics:-

4.3.1.1 Wales and Course count - The fabric was spread on the table and squares of 1”x1” sizes were marked. Number of wales and course, within these squares were counted with the help of magnifying glass. Total five readings were taken. Average of five readings was recorded as wales and course count.

4.3.1.2 Thickness (IS: 4919-1970) - Thickness of fabric was measured under 5 gm/cm\textsuperscript{2} pressure. The pressure foot and anvil were cleaned by drawing some clean paper between them. After cleaning, the gauge was set to zero. Sample was placed on the anvil and pressure foot was released slowly. Thickness in mm was noted from the dial of the instrument. Ten readings were taken at different places on the fabrics. Average of ten readings was recorded as thickness of fabrics.

4.3.1.3 Weight/unit area - Five specimen of 5”x4” were cut and weighted on an analytical balance. Weight/unit area was calculated according to the following formula.
Weight (ounce/sq yd) = \( \frac{W \text{ (gm)}}{28} \times \frac{36\times36}{\text{Square inches}} \)

\( W = \text{Weight of fabric sample} \)

4.3.1.4 **Tightness factor** - Tightness factor was calculated according to the formula:

\[ \text{Tightness factor (tf)} = \frac{\text{Yarn count (N)}}{\text{Loop length (L)}} \]

Yarn count was determined in Tex system. One meter long yarn was taken out from the fabric, weight was taken and count determined as

\[ \frac{W \times l}{L} \]

Yarn count (N) = \( \frac{W \times l}{L} \)

Where, \( W \) is the weight of sample, \( L \) is the length of the sample and \( l \) is the unit length of the system.

Loop length was determined by the formula:

\[ \frac{\text{Length of yarn}}{\text{Number of loops}} \]

Loop length (L) = \( \frac{\text{Length of yarn}}{\text{Number of loops}} \)

Yarn covering 100 loops was taken out from the knitted fabric. Its length was measured.

4.3.2 **Scouring treatment**-

Cotton, nylon, polyester, viscose, cotton/nylon, cotton/polyester and cotton/viscose fabrics were treated at 60°C temperatures for 30 minutes in soap solution containing 5g/l detergent. Wool and polyester/wool blends were treated at 40°C temperature for 30 minutes in soap solution containing 5g/l Ezee. After that fabrics were rinsed thoroughly in tap water and dried on flat surface.

4.3.3 **Application of resins and determination of percent add on of the finish**-

Silicone emulsion was applied by pad dry method. DMDHEU resin and acrylic
emulsion were applied by pad- dry -cure process. Resins were applied by the recipe and method prescribed by the respective company. Fabrics were treated with one concentration of each finish.

4.3.3.1 Application of Silicone finish- 3% solution of silicone was prepared. Finish was applied at 40°C temperature keeping time of treatment of 20min.

4.3.3.2 Application of DMDHEU finish- 90g/l solution was prepared; pH of solution was maintained at 7-8. 10% magnesium chloride (on the weight of finish) was used as catalyst with DMDHEU resin. After application of finish knitted samples were dried. These dried samples then cured for 3-5 minutes at 150°C to 160°C temperatures.

4.3.3.3. Application of Acrylic Emulsion- 5g/l solution was prepared for application. After application of finish fabric was dried at room temperature. Curing was done at 130°C temperature for 3-5 minutes.

The solutions of above finishes were spread in a flat tray. Measured samples of knitted fabrics were entered into the tray. Extra finish was squeezed out with the help of padding mangle. All the samples were dried at room temperature at flat surface.

Add on percentage is defined as the ratio of weight of fabric after add on of the finishing agent to the original weight of the fabric expressed in percentage.

Formula:

\[
\text{Add on \%} = \frac{W_3 - W_1}{W_1} \times 100
\]

where,

\( W_1 = \) Original weight of sample
\( W_3 = \) Dry weight of sample after finishing
4.4 Determination of physical properties after application of finish-

4.4.1 Determination of pilling of fabric ( ) -

A piece of fabric measuring 11.4cm. X11.4cm was cut and sewn so that it fits when placed around a rubber tube 6 inches long 1/14 inches outside diameter and 1/8 inch thick. After placing the fabric on tubes, the tubes were placed in a box measuring 9 inches x 9 inches x 9 inches which was lined with 1/8 inch thick cork. Box was rotated at the rate of 60 revolutions/minute for 5 hour. After 5 hour, the fabric was unmounted, seam was opened, and the pills were counted. Result has been reported in the terms of number of pills formed, on fabric surface.

4.4.2 Determination of shrinkage of fabrics (IS: 648-1979):-

To find out effect of resin on shrinkage control of pure and blended fabrics, treated samples and one control sample (untreated) were washed in launder o meter. For washing ISO test no. 1 was used.

The fabric samples were conditioned in a standard testing atmosphere before marking out. Test specimen of 12x12" size was taken and laid flat on a smooth surface. After removing all the creases and wrinkles, datum line was carefully marked with sewing thread on an inside square of 10x10" (fig.4)

Then washing treatment was given to the samples. Detergent solution was prepared containing 5g/l soap. Samples were washed in launder o meter for a period of 30 minute at 40°C temperature. After washing, samples were washed with cold water, extra water was extracted and surface were air dried on a flat surface at room temperature. Then the samples were again laid flat on smooth surface and creases and wrinkles were removed. The distance between the datum lines was measured.

The percent shrinkage was calculated from the mean change in between the datum lines.

\[ Lo-L_1 \]
Percent Shrinkage (s) = \frac{\text{Lo}}{} \times 100

Where Lo is distance between the datum line before resin treatment and L_1 is distance between the datum lines after resin treatment. Warp wise and weft wise shrinkage was reported separately.

Figure 4

Marking of sample for shrinkage test
4.4.3 Elongation and Elastic Recovery:-

The ASTM method D1775-60 slightly modified by Mahaiskar (1978) was used to determine extensibility, the elastic recovery and permanent growth of the knitted fabrics.

The extension and elastic properties of the samples were determined by the constant rate of loading. Three samples of 12 inches in both wales and course wise direction were cut and three benchmarks at three different places at equal distance were marked. Top and bottom edges along the short dimension of samples were stitched to form a loop. The effective length of samples was 7.5 inch. Stainless steel rod was passed through the fabric loop at the top and suspended from a nail on wall. Another rod was suspended from bottom loop. The samples were hung with the load 250gm, 500gm and 1000gm. Deformation in terms of extension was noted immediately and after 12hr. The sample was then removed and allowed to recover from stress. The immediate and delayed (after 24 hr.) elastic recovery was measured.

\[
\text{Total extension} - \text{Initial length} \times 100
\]

\[
\% \text{ Immediate Extension} = \frac{\text{Total extension} - \text{Initial length}}{\text{Initial length}} \times 100
\]

\[
\text{Total extension after 12 hr} - \text{Initial length} \times 100
\]

\[
\% \text{ Extension after 12 hr} = \frac{\text{Total extension after 12 hr} - \text{Initial length}}{\text{Initial length}} \times 100
\]

\[
\text{Total Extension} - \text{Immediate Recovery} \times 100
\]

\[
\% \text{ Immediate Recovery} = \frac{\text{Total Extension} - \text{Immediate Recovery}}{\text{Total Extension} - \text{Original Length}} \times 100
\]

\[
\text{Total Extension} - \text{After 24hr Recovery} \times 100
\]

\[
\% \text{ Delayed Recovery} = \frac{\text{Total Extension} - \text{After 24hr Recovery}}{\text{Total Extension} - \text{Original Length}} \times 100
\]
Figure 5
4.4.4 Determination of Stiffness of fabrics (IS: 6490-1971):-

The most important quality of cloth, namely stiffness was measured by employing "Eureka" stiffness tester, which measures the bending length of fabric, using a scale of IX, which formed the template.

Five samples were cut in both warp and weft direction. The instrument was placed on a level table in such a manner that the mirror was facing towards the operator. Each sample along with the scale was mounted on the platform which was horizontal and the template was moved with the sample under it till the strip of the fabric commenced to drop over the edge of the platform with the sample coinciding with the index line which was viewed in the mirror.

When the specimen curled, the midpoint of the specimen end was aligned with the index line. The bending length was read from the scale marks. Mean value for the bending length in warp and weft directions was then calculated.

4.4.5 Determination of the percent drape co-efficient (IS: 8357-1977):-

For determining the drape co-efficient of fabrics, a simple drape meter was made as described by CHU et al. and use has been further discussed by KASWELL, CHU et al and CUSTICK.

A stand (a) with a 28cm long center rod was taken and a clamp (b) was fixed 8cm below the top edge of the rod. A 30 cm. diameter wooden disc (c) was placed on the clamp. Another two discs of 18cm in diameter were cut from wood. One disc (d) was fixed on the top edge of the rod. Another was used as a lid (e) of the instrument.
Circular fabric specimen of 30cm diameter was cut from each fabric using a hard paper template; circular paper of the same diameter was placed on a 30cm diameter wood disc and used for making shadows of the draped specimens as noted below.

30cm wood disc (c) was raised close to the upper disc (d). A specimen was placed in such a way that center of the specimen coincided with center rod. The second disc 18 cm (c) was placed over the fabric so as to hold the specimen in position. The 30 cm disc (c) was slowly taken down on the clamp thus allowing the specimen to drape under its own weight. With the help of narrow light, a shadow
of the draped specimen was obtained on the circular paper placed on the 30cm disc (c). The outline of the shadow was drawn on the paper. The percentage drape co-efficient of fabric was calculated by the following formula-

\[
\text{Percent drape coefficient of fabric} = \frac{A_s - A_d}{A_D - A_d} \times 100
\]

As = actual projected area of specimen

\( A_d \) = area of supporting disk (18cm diameter).

\( A_D \) = area of 30 cm diameter sample

**4.4.6 Bursting strength (ISO/13938-2, ASTM/D3786)**

For measurement of bursting strength total pressure required is to distend the diaphragm and to burst the specimen.

In this test fabric to be tested was clamped over a rubber diaphragm by means of an annular clamping ring and an increasing air pressure was applied to the underside of the diaphragm until the specimen bursts. Pressure in the air increases at such a rate that the specimen bursts within 20 ± 3s. Mean bursting strength in kg/cm\(^2\) and extension in cm was recorded.

**4.5 Designing of Skirt –**

To study the drape in garment, skirt was selected. Skirts were drafted and stitched. Viscose, cotton/viscose, Cotton/Polyester, Nylon and Cotton/Nylon fabrics were used for stitching skirts. To study drape in skirt, two designing techniques were used- (a) use of angular panels in basic skirts by varying their placement (b) use of seam flare (semi circular skirt). Skirts were finished with resin. Designed and finished skirts were arranged and draped shadows of the garment were obtained by hanging skirt on the dress form. With the use of formula, drape coefficient of skirts was calculated.

**4.5.1 Preparation of Dress Form–**

Dress form was prepared according to method followed by Etoiledunord 2010. (www.youtube.com)
4.5.1.1 Material required for dress form-

- 3-4 rolls of Brown Tape
- An old t-shirt and slack
- Scissors
- Cotton for stuffing

4.5.1.2 Method for preparing dress form-

Little modifications were done in method given by Etoiledunord for preparing dummy. Duct tape was replaced by brown tape (due to unavailability of duct tape). Moreover, as only lower part was needed to drape skirt so upper part of dummy was not constructed.

To prepare dress form, a 14 years old girl was selected. The method for preparing dummy is given below-

4.5.1.2.1 Preparing dress form by wrapping the tape

An old well fitted t-shirt and slack was put on selected girl and then checked the waistband of the bottoms. Brown tape was wrapped over the body. Wrapping of tape was started by making an "X" that goes from one shoulder to below the opposite breast to the hip. The center of long piece of tape was put on the center on shoulder and then the rest of the tape was wrapped to the hip on each side

When the X was formed, it was used as a foundation to create the crotch of the dress form. It was started from the center of the X (it can go from front or back to start). The tape was stacked down to the X, and then the tape was unrolled as it went between the legs to the center of the X on the opposite side. It was repeated several times, fanning the tape out from the starting point on the X to each side, until the crotch area was basically covered.

When this part was done, it has achieved enough stability to start creating a waist. Now tape was wrapped around natural waist. Layers were slowly built; it should be tight enough so that it reflects the actual size. The same thing was done for the hips, again, started by sticking tape to tape each time.
Formation of X for preparing dummy

After that gaps were filled around the body following the curves of the body. With shorter pieces of tape, ends were stacked to a previously taped area. Any missed spot was filled in to achieve overall smoothness.

Giving shape to dummy by filling the gaps

Length of dummy depends on the requirement. In this work waist to full leg dummy was required so full leg dummy was prepared.
4.5.1.2.2 Cutting

Cutting was done through both the shirt and tape, lifting the point of the scissors away from the body. Dress form was cut from one side completely.

4.5.1.2.3 Stuffing

The leg that was cut was taped back together by using short pieces of tape which were laid perpendicular to the line where it was cut — being very careful to line up the edges precisely. Dummy was stuffed by cotton. When little mass went in the legs and the shape was stable, tape was used to finish off the ends of the legs. Stuffing was added in plenty amount to get the actual size.

In this work only lower part of dummy (from waist to ankle) was required so the upper part of dummy was cut away, which could not be done properly.
Prepared dress form was hanged at an appropriate place. One movable stand was put below the end of dummy.

4.5.2 Designing and construction of skirt

A skirt is a garment, which drapes straight from the hip line forming series of waviness around hemline. It is thus easy to assess the drape of the garment at hemlines.

Basic skirt is called basic as it is primary to all other skirt patterns. It is a plain straight, two-piece skirt pattern with side seams, not wider at the hem than the hip width, and darted at places to fit at the waist line. This skirt is used as a guideline for getting varied skirt styles.

4.5.2.1 Drafting of basic block of skirt-

Measurement required-

<table>
<thead>
<tr>
<th>Description</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ready back length</td>
<td>54cm</td>
</tr>
<tr>
<td>Ready front length</td>
<td>54cm</td>
</tr>
<tr>
<td>Round waist front</td>
<td>37cm</td>
</tr>
<tr>
<td>Round waist back</td>
<td>36cm</td>
</tr>
<tr>
<td>Ready side seam length</td>
<td>55.5cm</td>
</tr>
<tr>
<td>Round hip</td>
<td>85cm</td>
</tr>
<tr>
<td>Waist to hip</td>
<td>15cm</td>
</tr>
<tr>
<td>Waist to abdomen</td>
<td>5cm</td>
</tr>
<tr>
<td>Round abdomen front</td>
<td>44.5cm</td>
</tr>
<tr>
<td>Round abdomen back</td>
<td>37cm</td>
</tr>
</tbody>
</table>
Back and Front-
1. Draw a vertical line 1-2 equal to back length
2. Draw a perpendicular 2-3 from point 2 equal to 1/2 round hip plus 1.0cm in length.
3. Draw a vertical line 3-4 from point 3 parallel to back length equal to front length.
4. Mark a point 5 as mid point of the line 2-3.
5. Draw a vertical line 5-6 from point 5 parallel to back length equal to side seam length.
6. Join points 1-6 and 6-4.
7. Mark points 7 and 8 from point 6 on the vertical line 5-6 at waist to abdomen level and waist to hip level respectively.
8. From point 7, draw perpendiculars towards the line 1-2 and 3-4 and mark as 9 and 10.
9. From point 8, draw perpendiculars towards the line 1-2 and 3-4 and mark as 11 and 12.
10. Mark point 14, away from point 4, on the line 4-6 measuring one half front waistlines.
11. Mark point 15, away from point 10, on the line 7-10 measuring one half front abdomen girth.
12. Join points 8, 15 and 14 with a curve for front side seam line.
13. Mark point 13 away from point 1 on the line 1-6 measuring one half back waistline.
14. Mark point 16 away from point 9 on the line 9-7 measuring one half back abdomen girth.
15. Join points 8, 16 and 13 with a curve for back side seam line.
16. Back piece of skirt is 1,2,5,8,16,13
17. Front piece of the skirt is 4, 3, 5,8,15 and 14.

4.5.2.2 Construction of skirt with angular panels-

Two angular panels (godets) of 90° angle were attached in front skirt and two in back skirt at a distance of 4.5” from center front and center back. They were placed at different levels in skirt-

1. Waist
2. Mid thigh
3. Knee

For stitching two slits were made according to length of panels. Panels were attached along the slash seam line with plain seam.

Figure 14
Placement of panels in skirt
To study the effect of panel placement on drape of skirt, four panels were attached at waist, at mid thigh and at knee level. Again two panels in front and two in back were stitched. Nylon, Cotton/Nylon, Viscose, Cotton/Viscose and Polyester/Cotton skirts were prepared.

Figure 15
Placement of panels on skirt at different level
On waist line-1cm, on side seam-2.5 cm seam allowance was kept while cutting the skirt. 5cm hem allowance was kept. Now the construction was done as per following steps given below-
At left side 12cm long, 2cm wide placket was attached. Side seams of back and front were joined. Waistline was finished with ready 3 cm wide belt. Belt was extended by 5cm on either side. On placket three sets of pressed button were stitched. The 5cm extended belt was overlapped and was held at waistline by use pressed button.

4.5.2.3 Construction of semicircular skirt

Measurement required-
Total waist circumference (TWC) – 73cm
Length – 54cm

Drafting of skirt-
1. Measure waist circumference and add wearing ease
2. fold brown paper at the corner to make a large triangle

3. Then use the formula- TWC/3.1416 = diameter
Diameter/2= radius
4. Measure from the tip of the triangle down each side the radius distance and connect the points with a curve.

5. Measure from the curve down each side of the paper to the desired length of skirt to be and connect with a curve.

4.6 Determination of drape coefficient of skirts

After construction of skirts with different fabrics and different angular panels, these were draped. This was done on dress form. The skirt was put on the dress form, and allowed to hang from the waist over the platform. Tracing paper was placed over the platform to mark the shadow of the skirt. From the top, light falling vertically over hipline casts a shadow of the draped garment on tracing paper. The shadow was traced. Paper was cut along the trace of the shadow outline and weighed. From the weight, area was calculated which is the shadow area of garment.

For calculating the drape coefficient of a garment, the formula used was:
% Drape Coefficient: \[
\frac{\text{Shadow area of garment}}{\text{Calculated hemline ellipse area}} \times 100
\]

Though the skirt is worn from the waistline, it actually drapes from the rounded hip and falls straight.
From the hip ellipse dimensions (used in the preparation of dress from), the two axis \( a, b \) were calculated and hip ellipse area was obtained. This is constant factor in all the skirts.

The circumference of skirt at hem measured and noted. From hip ellipse axis, the two axis ratios were calculated-

\[
\text{Ratio ‘r’} = \frac{b}{a}
\]

For obtaining the two axis in the hemline ellipse for the above measured circumference, an approximation.

\[
C = 2\pi \sqrt{\frac{a^2 + b^2}{2}}
\]

Was used along with the above ratio and new suitable ‘\( a \)’ and ‘\( b \)’ axis were calculated for different circumferences.

After calculating the ‘\( a \)’ and ‘\( b \)’ of ellipse with a particular circumference \( c \), hemline ellipse area was calculated with the use of formula-

Hem line ellipse area = \( \pi a b \)

‘\( a \)’ and ‘\( b \)’= axis of the ellipse

Thus the hemline area with a particular circumference of a skirt was calculated and used in the formula.

Representative calculation has been shown below:

Representative calculation of hemline ellipse area-

\[
\text{Suppose Ratio ‘r’} = \frac{b}{a} = 1.5
\]

therefore, \( b = 1.5a \)
\[ C = 2\pi \sqrt{\frac{a^2 + b^2}{2}} \]

In case \( C = 115 \text{cm} \)

\[
\begin{align*}
115 &= 2 \times \frac{22}{7} \sqrt{\frac{a^2 + (1.5a)^2}{2}} \\
44 &= \sqrt{\frac{4.25a^2}{2}} \\
7 &= \sqrt{\frac{4.25a^2}{2}} \\
115 &= 7.98a \\
Thus \ a &= 14.4 \\
=21.6
\]

Thus hemline ellipse area = \( \pi \ a \ b \)

\[
\begin{align*}
&= \frac{22}{7} \times 14.4 \times 21.6 \\
&= 977.55 \text{sq cm.}
\end{align*}
\]

4.7 Application of finishes on designed skirts-

To study the effect of finishing agents on drape of designed skirt, two types of skirts were prepared as mentioned before -

1. Skirt with angular panel
2. Skirt with seam flare (Semicircular or Umbrella)

Two methods were used to study effect of finishing agents on drape of skirts-

One was localized application of finish and other was application of finish on whole skirt.

(a) Acrylic finish was applied on skirt with angular panel to study the effect of localized application on drape. Finish was applied only on angular panels by spray technique on exposed specific areas by keeping other areas covered with blotting paper. Finished
area was dried at room temperature and then steam ironed for 1 minute. For simplicity of consumer application, curing was replaced by steam ironing.

(b) To compare the drape characteristics of skirts finished with different finishing agents, silicone, acrylic and DMDHEU finishes were applied on circular skirts. Finishes were applied on whole surface of skirts by dip and dry method. Finished skirts were draped on dress form, drape coefficient; shape and numbers of nodes were studied.

Figure 16
Finish application on waist length panel

Figure 17
Finish application on Mid Thigh length panel
Figure 18
Finish application on knee length panel

Figure 19
Finish application on whole skirt
4.8 Determination of aesthetic appeal of designed skirts and of these skirts after finishing

For judgment of aesthetic appeal, 20 judges were requested to observe the skirts and to give opinion on appeal. Photographs of designed skirts (without and with finish) were shown to judges and following questions were asked.

Ao = skirts (without finish) Af = skirts (with finish)
Is it the appealing? If yes, give your preference.
Do panels add decoration? Is it acceptable?
Do Af (with finish) change drape effect of Ao skirts? Which is more appealing- unfinished skirt/finished skirt/both equally. Scores were added and converted into percentage. Their opinions for each answer were taken.

4.9 Statistical analysis of data-

ANOVA was calculated to find out significance of the difference of different properties of knitted fabric.