Knitting Technology
Module - 5 : FAQ

Q1 What would happen to the property "P" of the knitted fabric if the change "C" is undertaken keeping other variables unchanged?

- C = An increase in yarn "tex" : P = Fabric width
- C = An increase in machine gauge : P = Fabric areal density in g/m^2
- C = An increase in stitch cam setting : P = Fabric length knitted per unit time

Ans.: An increase in yarn "tex" would only make the loop tighter and hence less porous. This would not affect the relaxed fabric width.

An increase in machine gauge, without disturbing the yarn count and machine setting would lead to a reduction in loop length. This would result in a rise in areal density.

An increase in stitch cam setting results in an increase in loop length which would lead to a rise in length of fabric knitted in unit time.

Q2 A 200 g/m^2 fabric, knitted from 30 Tex yarn to a loop length of 3 mm exhibits 180 courses /dm. If the fabric has been knitted on a 30" diameter 30-gauge machine, find out the fabric width in meters.

Ans.: GSM = 200 = $[l_{mm}/1000]$ x 10x courses /dm x10 x wales /dm x [Tex/1000]

Wales /dm = 124 $\implies$ Wales/ m = 1240

Fabric width = π x machine diameter x machine gauge / wales/ m = 2.28 m

Q3 Compile the values of shape factor of different types of yarns from the table in Appendix and critically evaluate their spread vis-à-vis Munden's proposition of unique loop shape and Chamberlane's value corresponding to a jammed loop.

Ans.:

Property	WOOL	WORSTED	COTTON(OE)	COTTON(RING)	SILK
Shape factor	1.3,	1.32	1.22,1.25	1.4, 1.27	1.29

Ignoring the two extreme values of 1.22 (Cotton OE) and 1.4 (Cotton Ring) the shape factor of loops in the relaxed state from all the five materials are fairly close, vindicating Munden's proposition. The great deviation from Chamberlane's model underlines the drawbacks of oversimplification in ignoring the elastic property of yarn as well as assuming a jammed condition.

Q4 Observing that larger value of K_S results in higher areal density while larger values of K_C and K_W result in shorter width and length of fabric, compile the values of these dimensional constants for different types of material from the Table in Appendix, and derive conclusions pertaining to the possible causes of the same as also to the resistance of the different materials to getting bent into the third dimension.

Ans.:

Material	K_C	K_W	K_S
WOOL	5.3, 5.54	4.1, 4.23	23.5
WORSTED	5.8	4.3	25.2
COTTON(OE)	5.76, 5.5	4.79, 4.6, 4.3	27.35, 23.7
COTTON(RING)	5.77,	4.15, 4.29	23.3, 23.9
SILK	5.2	4.0	21

The overall range of K values observed from this table is 5.3 « K_C« 5.8, 4.1« K_W«4.8 and 21« K_S«23.9 after ignoring the outlier value of 27.35 of K_S.

The cotton (OE) yarn exhibits highest K- values (dimensional parameters) while Silk yarn shows the lowest. This would tend to suggest a larger bending into the third dimension of the Cotton (OE) yarn and hence the thickest fabric for the same yarn count.

There is a considerable variation in the values reported for Cotton (OE) yarns and one may surmise that both ring spun and OE spun cotton yarns exhibit by and large similar mean K values. The values of Worsted yarns are nearly similar to that of cotton yarns while the wool yarns show values that are marginally lower. One may rank the experimental yarns with respect to bending rigidity in the order Silk yarn>Wool yarn> Cotton and Worsted yarn.

Q5   Consider the following table of constants corresponding to three different types of construction.

Type of construction	Shape factor	Commercial Tightness Factor
Plain Single Jersey	1.27	14.7
1 x 1 Rib	0.79	14.7
Interlock	0.59	13.7

Explain the reasons behind (a) the steady reduction in values of shape factor with change in construction from plain single jersey to Interlock and (b) the sudden change in the value of commercial tightness factor for Interlock.

Ans.: There are two major differences between Interlock and Single Jersey fabrics namely the number of layers of loops and the distortion of the sinker loop. Because of the first factor, namely a double layer of loops, the K_W-value of Interlock is almost twice that of the Single jersey construction and because of the second factor, there is a lateral compression

to the Interlock loops, causing a slight lowering of the K_C value. The result is a sharp drop in the effective value of the shape factor of the Interlock loop. The 1x1 rib has a K_W value intermediate between that of Interlock and Single jersey mainly owing to the lateral contraction of the structure, forcing the wale lines closer together than what would accrue with the Single jersey construction. The K_C-value of rib is similar to that of Interlock, for reasons already gone into. Thus the effective shape factor of 1x1 rib is an intermediate one between single jersey and interlock.

The Interlock construction is a meshing of two 1x1 rib constructions because of which the count of yarn chosen for Interlock construction is much finer than what would be needed if only one 1x1 rib were to be knitted. Moreover every Interlock loop gets stretched over two courses. As a result the "tex" value is relatively low and the "l" value is relatively high resulting in a sudden drop in the tightness factor of the individual Interlock loop.

Q6   It is desired to knit a plain single jersey fabric of 65" stable width & areal density of 100 g/m^2 from 40^s N$_e$ Cotton yarn. Calculate the loop length (mm) and its Tightness factor as also the cam setting (mm) & diameter (inches) of the required knitting machine.

Ans.: The machine gauge is $\sqrt{[20 \times 40]} \approx 28$

Areal density $= 100 = [K_S / l_{inch}] . [39.37] . tex . 10^{-3} \implies$ l = 0.343 cm= 0.135"

T.F. $= \sqrt{[tex]} / l_{cm} = 11.3$

From the values of machine gauge and loop length $\implies$ cam setting = 1.65 mm

Wales/inch $= K_W / l_{inch} = 31.8$

Fabric width $= 65" = \pi .$ Machine diameter. Gauge/ [Wales/inch]

Machine diameter $= 23.5" = 24"$

Q7 Find out the value of cam setting in mm on a circular single jersey-knitting machine of gauge 30 and diameter 20 inches, which converts yarn of 10 Tex into loops of tightness factor 14.7. Find out the areal density of the resultant 1 m wide knitted fabric in flat form, if the machine running at 40 rpm with 60 feeders produces 50 m/hour at 95% efficiency.

Ans.: TF = 14.7 = $\sqrt{10} / l_{cm}$ $\implies$ l = 0.215 cm

Cam setting h = 0.5 $\sqrt{[l_{mm}^2 - a_{mm}^2]}$ where a = [1/Gauge] = 0.8466 mm

Cam setting h = 0.988 mm

Number of wale lines = π. Machine diameter. Machine gauge = 1885

Hence in 1 m width of fabric there are 1885 wale lines

Length of fabric produced/ hour = 50 m = [60. 40. 60. 0.95] x No. of courses/m

Courses/ m in fabric = 2736

Hence number of loops per m^2 of fabric = 1885 x 2736 = 5,15,7360

Hence length of yarn in m^2 of fabric = 5,15,7360 x 2.15 x 10^{-3} m = 11, 088 m

Hence fabric GSM = 11, 088 x 10 x 10^{-3} = 111

Q8 Calculate the fabric width (cm), loop length (mm) & areal density (g/m²) of a 1x1 rib fabric knitted from cotton yarn to a course density of 150 per dm on a 24 gauge, 28 inch diameter machine, if it is assumed that the tightness factor of each loop is 10.0 & the ratio of wale to course spacing on the surface in the final fabric is 0.8.

Ans.: Courses per mm = 150/100 = 1.5; hence course spacing c = 1/1.5 mm

Accordingly wale spacing is w = 0.8/1.5 = 0.533 mm

Hence wales per dm = W = 188

Fabric width in m = π x machine diameter x machine gauge x 0.533/1000 = 1.126

Yarn count in N_e = gauge^2/6 = 24^2/6 = 96 = 6.166 tex.

Loop length = l = [$\sqrt{tex}$] / tightness factor = 0.24 cm = 2.4 mm

Areal density = 10C x 10W x 2 x [l/1000] x [tex/1000] = 83.4

Q9 What would be the diameter of a machine of gauge 20 that would knit a single jersey tube of diameter equal to 26" from a cotton yarn of 20^s N_e knitted to a tightness factor of 14.7. Calculate the weight in grams per liner meter of the fabric.

Ans.: TF = 14.7 = $\sqrt{tex}$/loop length $_{cm}$ $\Longrightarrow$ Loop length $_{inches}$ = l = 0.146

Wales/inch = K_W / l = 4.29/0.146 = 29.38

Machine gauge for yarn of 20^s N_e = 20

Open width of tube of diameter 26" = 81.68"

Number of wale lines in fabric = Number of needles in machine = 29.38 x 81.68"

$\qquad\qquad\qquad$ = 2400 = π x machine diameter x machine gauge

Hence machine diameter = 38"

Courses per inch of fabric = K_C / l = 5.46 / 0.146 = 37.4

Courses per meter of fabric = 37.4 x 39.37 = 1472

No. of loops per liner meter of cloth = 1472 x 2400 = 3533592

Length of yarn consumed in making 1 m cloth = 3533592x0.146/39.37 = 13,104 m

Hence the weight of 1m cloth = [592/20] x 13.104 g = 388g.

Q10 What should be value of cam setting in mm if a single jersey fabric of commercially acceptable tightness factor is to be knitted on a 20 gauge circular knitting machine?

Ans.: For a 20 gauge circular single jersey machine the English cotton count is 20^s N_e which is equal to 29.6 tex.

For the TF value of 14.7 and tex-value of 29.6, the loop length in cm is 0.37 which is equal to 0.146".

Applying the formula, $l^2 = a^2 + 4h^2$, where $l = 0.146$ and $a = 1/20$ ", the value of h comes out to be equal to 1.74 cm.