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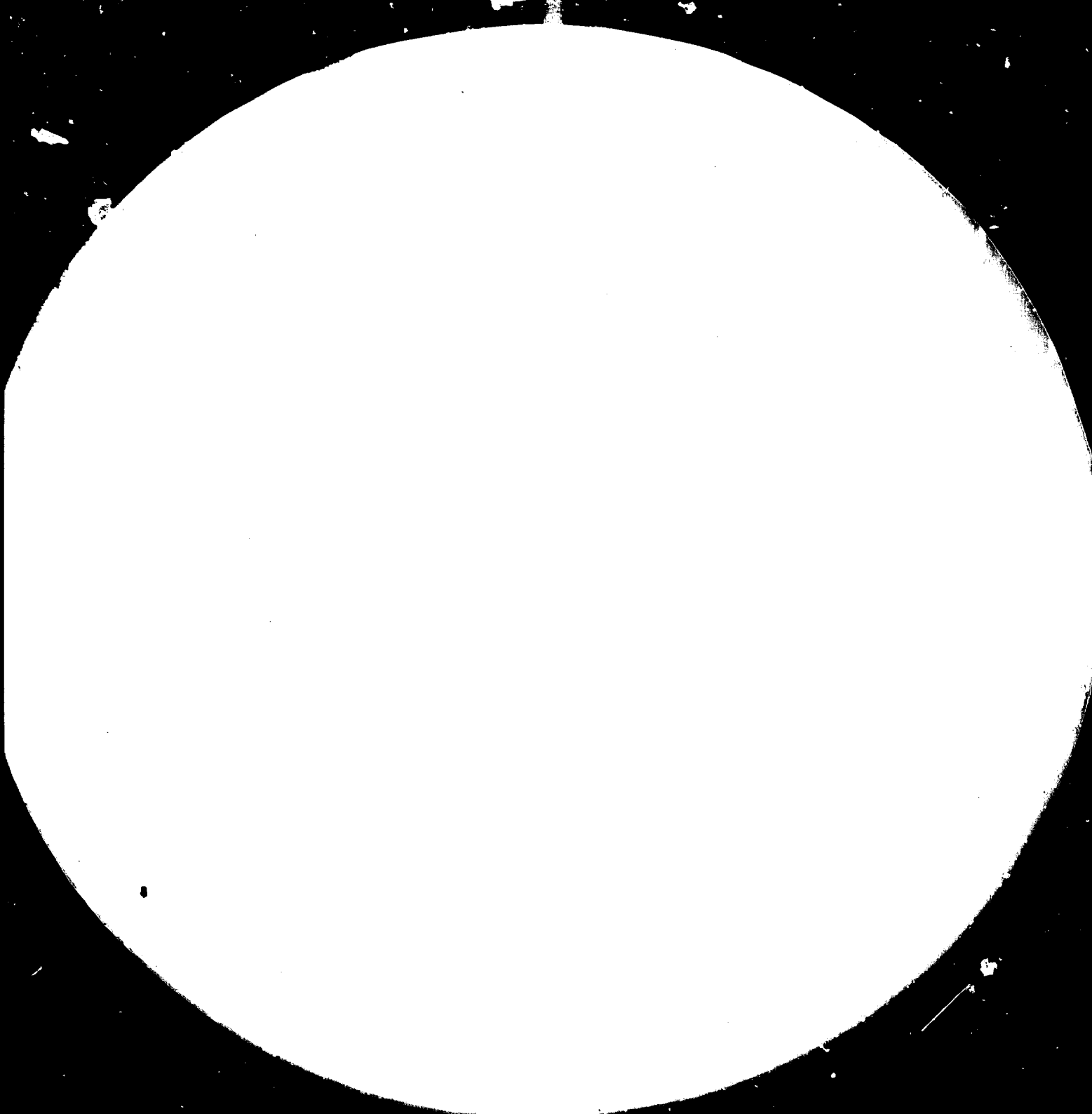
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11 March 1983
English

TEXTILE INDUSTRY DEVELOPMENT PROGRAMME

DP/BGD/82/006

BANGLADESH

Technical Report: Training of Technologists in the Weaving Sector *

Prepared for the Government of Bangladesh
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of D. S. W. Jayawardane,
Expert in Weaving (Training)

United Nations Industrial Development Organization

Vienna

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TEXTILE INDUSTRY DEVELOPMENT PROGRAMME

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Technical Report: Training of Technologists in the Weaving Sector

Corrigendum

Document DP/ID/SER.A/434, dated 11 March 1983 and titled as above,
should bear the symbol DP/ID/SER.A/437.

1. Introduction:-

a. Purpose of Project:-

i. Development of Objectives:-

To increase the domestic production of cotton textiles in Bangladesh and to reduce the reliance upon imports of cotton cloth, by increasing the quality and reducing the production costs of cotton yarn. The project is also expected to contribute to an expansion of the handloom industry, thus increasing employment opportunities in the rural areas.

ii. Project's Immediate Objectives:-

1. To upgrade the levels of skill of selected Bangladesh Textile Mills Corporation managerial and supervisory staff and of skilled workers in a selected number of mills.
2. To establish central training and advisory services for BTMC Mills.

iii. Project Outputs:-

1. Training Programme

The textile industry under the BTMC is deficient in junior and middle management personnel to the amount of about 1300 people. This shortage is further aggravated when one considers replacement requirements, growth requirements and training of unqualified existing staff. Unless steps are taken to meet this very high demand the total figure could very easily reach nearly 2500 in five years time with corresponding drastic fall off in production and worsening of the quality of textiles produced.

Such persons should be the product of Universities, Polytechnics, Technical Colleges and the like with a lesser number moving into positions with technical responsibilities by virtue of their experience.

In Bangladesh, the College of Textile Technology does not meet the needs of industry because of its low output in comparison to the size of the industry and is not able to increase the output or offer sandwich courses, evening courses, etc. because of shortage of qualified staff. Even when fully staffed it would be impossible for the College of Textile Technology to meet the very high requirement.

At the Foreman/Supervisor level the shortage is not as critical but there is a very obvious need for training of the many unqualified staff at this level. The EMC Training Centre will be mainly concerned with training people at this level, but it can also play an important role in offering further training for junior and middle management people by offering courses, seminars, etc. from time to time on important and relevant aspects of textile processing and advanced technology.

The EMC Training Centre will offer training for key personnel in industry, i.e. starting with supervisors, foremen, and fitters but subsequently including jobbers and other craft-level employees. Furthermore, the courses should be designed to ensure that there is a rapid output and turnover of specialized personnel so that they become competent in their own fields of responsibility. From such people the industry should build up its staff structure for the future. The initial courses will first be offered in English to English speaking unqualified Foremen/Supervisors etc. but the same courses will be subsequently offered in Bengali to non-English speaking staff.

The Fitters undergoing fitting training will also take the appropriate textile module relevant to their area of responsibility. The Management Development Centre in Bangladesh can cope with any requirements as regards management oriented courses, but the EMC Training Centre will play its part in textile oriented management courses.

2. Training Implementation:-

The provision by in-service training and skill upgrading of skilled personnel and trained managerial staff by the end of the project about one third of whom will be management and accounting staff. The exact number and level of people to be trained will depend on the recommendations of the UNDP Training Centre Adviser concerning the design and duration of courses at the Centre.

iv. Duties:-

The expert will be a member of an international team and will be attached to the EMC. The team will be covering all aspects of cotton processing providing experts for all stages from spinning to dyeing/finishing. The expert will work in close co-operation with the weaving technologists, paying particular attention to the aspect of training, while the

weaving technologists will be mainly concerned with the technical production problems of the mills. The expert will specifically be expected to complement their activities by organising and conducting theoretical classes and giving practical demonstrations in the cotton weaving sector.

The expert will also be expected to prepare a final report, setting out the findings of his mission and his recommendations to the Government on further action which might be taken.

2. Work Programme

a. Course Preparation:-

Following are a list of courses shown in Mr. Jack Wealfenden's Report No. 2, titled, "The BMC Training Centre", to be used as a guide line by the weaving training staff.

- i. Course TC(SW)10 :- Mathematics
- ii. Course TC(W)18 :- Yarn Preparation for Weaving
- iii. Course TC(W)19 :- Weaving
- iv. Course TC(W)20 :- Fabric Structure(Woven)
- v. Course TC(W)21 :- Weaving Calculations
- vi. Course TC(W)22 :- Textile Testing(Yarn/Fabrics)
- vii. Course TC(W)23 :- Fabric Analysis
- viii. Course TC(W)24 :- General Textiles for Weaving Personnel
- ix. Course TC(W)25 :- Fabric Structure and Analysis
- x. Course TC(W)36 :- Advanced Weaving Knowledge

b. Counterpart Training:-

i. Senior Counterpart:-

Name :- Mr. Gulam Rahman Choudhury

Date Joined :- 22 January, 1980

Man Months Served :- 38

ii. Junior Counterparts:-

1. Mr. Nasiruddin Jahangir

Date Joined :- 7 January, 1980

Man Months Served :- 38

2. Mr. Rahim Uddin

Date Joined :- 8 June 1981

Man Months Served :- 20

c. Implementation:-

a. Scheduled Course:-

1. Adjustment and setting of the following motions of the

Sakamoto Automatic Loom - (In Bengali)

- i. Weft feeder motion
- ii. Weft fork motion
- iii. Weft replenishing mechanism

Batch No.	Duration of courses(days)	PERIOD Start - Finish	Level of Participants	Number called	Number attended	Percentage attended	Number of man days
1	2	3	4	5	6	7	8
1	12	26.5.80 - 23.6.80	Foremen, Fitters, Asstt. Fitters, & Jobbers	6	6	100%	72
2	12	2.7.80 - 15.7.80	"	12	10	83%	120
3	12	25.7.80 - 7.8.80	"	12	8	67%	96
4	12	18.8.80 - 30.8.80	"	12	9	75%	108
5	12	3.9.80 - 16.9.80	"	12	11	92%	132
6	12	20.9.80 - 3.10.80	"	12	10	83%	120
7	12	8.10.80 - 27.10.80	"	12	9	75%	108
8	12	29.10.80 - 13.11.80	"	12	10	83%	120
9	12	15.11.80 - 29.11.80	"	12	9	75%	108

Average 81% Total- 984

2. Adjustment and setting of following motions of Sakamoto Automatic Looms:-

- i. Shedding motion
- ii. Picking motion
- iii. Beating-up motion
- iv. Other auxiliary motion

1	2	3	4	5	6	7	8	9
1	11	1.12.81 - 12.12.81	Foremen, Fitters, Asstt. Fitters & Jobbers		11	11	100%	121
2	12	17.12.81 - 31.12.81	"		11	9	82%	108
3	11	4.1.82 - 15.1.82	"		11	11	100%	121
4	11	19.1.82 - 30.1.82	"		11	5	45%	55

Average 82% Total-405

3. Firm Winding and Warring

1	2	3	4	5	6	7	8	9
1	5	18.12.80	23.12.80	Shift-in-charge, and Supervisors	11	8	73%	40
2	5	26.12.80	3.1.81	"	11	9	82%	45
3	5	5.1.81	9.1.81	"	11	10	91%	50
4	5	13.1.81	17.1.81	"	11	9	82%	45
5	5	20.1.81	24.1.81	"	11	11	100%	55
6	5	27.1.81	31.1.81	"	9	9	100%	45
7	5	3.2.81	7.2.81	"	9	8	89%	40
8	5	10.2.81	14.2.81	"	10	6	60%	30
9	5	16.2.81	20.2.81	"	10	9	90%	45

Average 85% Total-395

4. Firm Winding, Warring and Sizing

1	2	3	4	5	6	7	8	9
1	11	16.3.81	- 28.3.81	Asst. Manager (Wvg.) Weaving Master, Asstt. Weaving Masters.	21	13	62%	143
2	11	31.3.81	- 11.4.81	"	20	12	60%	132
3	10	15.4.81	- 25.4.81	"	14	8	57%	80
4	10	28.4.81	- 9.5.81	"	15	9	60%	90
								Average 60% Total-445

5. Sizing

1	2	3	4	5	6	7	8	9
1	4	22.6.81	- 25.6.81	Shift-in-Charges and Supervisors	18	9	50%	36
2	4	29.6.81	- 2.7.81	"	18	13	72%	52
3	4	6.7.81	- 9.7.81	"	17	14	82%	56
4	4	13.7.81	- 16.7.81	"	16	15	94%	60
5	4	20.7.81	- 23.7.81	"	16	13	81%	52
								Average 76% Total-256

6. (i) Fabric defects, their causes and remedies
 (ii) Cloth inspection, grading and process control in the Weaving deptt.
 (iii) Selection of shuttles and their maintenance:

1	2	3	4	5	6	7	8	9
1	6	25.5.81	- 30.5.81	Asstt. Manager(Wvg.) Weaving Masters, Asstt. Weaving Masters.	23	10	43%	60
2	6	8.6.81	- 13.6.81	"	23	13	57%	78
Average							50%	Total-138

7. (i) Fabric defects, their causes and remedies
 (ii) Cloth inspection, grading and process control in the Weaving deptt.
 (iii) Selection of shuttles and their maintenance:

1	2	3	4	5	6	7	8	9
1	7	3.5.82	- 11.5.82	Asstt. Weaving Masters, Shift-in- Charges & Supervisors	21	12	57%	84
2	7	14.5.82	- 20.5.82	"	24	12	50%	84
3	7	24.5.82	- 31.5.82	"	22	10	45%	70
Average							51%	Total-238

8. (i) Fabric defects, their causes and remedies
 (ii) Cloth inspection, grading and process control in the Weaving deptt.
 (iii) Selection of shuttles and their maintenance:

1	2	3	4	5	6	7	8	9
1	7	28.11.82	- 5.12.82	Weaving Masters, Asstt. Weaving Masters	21	5	24%	35
Average							24%	Total-35

9. (i) Object of maintenance, safety devices on the loom
 (ii) General idea of measurement, Gauges etc.
 (iii) The different positions of the Crank Shaft
 (iv) Alignment between lease back plate and reed, alignment between race board and shuttle
 (v) Introductory notes on primary, secondary and auxiliary motions of the loom:

1	2	3	4	5	6	7	8	9	
1	5	17.8.81	-	22.8.81	Asstt. Weavings Masters, Supervisors & Fitters.	4	4	100%	20
2	5	25.8.81	-	31.8.81	"	4	4	100%	20
3	5	2.9.81	-	8.9.81	"	5	5	100%	25
4	6	10.9.81	-	17.9.81	"	5	5	100%	30
5	6	19.9.81	-	26.9.81	"	5	5	100%	30
6	5	28.9.81	-	3.10.81	"	5	5	100%	25
7	5	19.10.81	-	26.10.81	"	5	3	60%	15
								Average	94% Total-165

10. (i) Object of maintenance, safety devices on the loom
 (ii) General idea of measurement gauges etc.
 (iii) The different positions of the Crank Shaft
 (iv) Alignment between box back plate and reed, alignment between race board and shuttle
 (v) Introductory notes on primary, secondary and auxiliary motions of the loom:

1	2	3	4	5	6	7	8	9	
1	8	6.12.82	-	15.12.82	Fitters & Jobbers	18	8	44%	64
								Average	44% Total-64

11. Fabric Structures

1	2	3	4	5	6	7	8	9
1	13	7.12.81	- 22.12.81	Shift-in-Charge & Supervisors	18	14	78%	182
2	14	23.12.81	- 9.01.82	"	18	15	83%	210
3	13	11.01.82	- 25.01.82	"	17	14	82%	182
4	14	26.01.82	- 10.02.82	"	16	12	75%	168
5	15	11.02.82	- 27.02.82	"	16	10	63%	177

Average 76% Total-892

12. Fabric Structures

1	2	3	4	5	6	7	8	9
1	15	19.12.82	- 9.01.83	Weaving Masters, Asstt. Weaving Masters.	15	6	40%	90

13. Jacquard designing, Card cutting, lacing, yarn and cloth calculations:

1	2	3	4	5	6	7	8	9
1	8	3.3.82	- 11.3.82	Asstt. Weaving Masters, Shift-in- Charge & Supervisors	18	9	50%	72
2	7	13.3.82	- 20.3.82	"	18	9	50%	63
3	7	3.4.82	- 10.4.82	"	16	7	44%	49

Average 48% Total-184

14. Jacquard designing, Card cutting, lacing and yarn and cloth calculations:

1	2	3	4	5	6	7	8	9
1	7	1.9.82	- 8.9.82	Weaving Masters, Asstt. Weaving Masters.	19	7	37%	49
2	7	8.9.82	- 14.9.82	"	18	Cancelled due to poor attendance of the participants		
3	6	15.9.82	- 22.9.82	"	27	7	26%	42

Average 21% Total-91

15. Jacquard designing, Card cutting, lacing and yarn and cloth calculations:

1	2	3	4	5	6	7	8	9
1	7	10.1.83	-	20.1.83	Supervisors & Shift-in-Charges	Was cancelled due to peer attendance.		
2	7	23.1.83	-	3.2.83	"	Was cancelled due to peer attendance.		
							Average	CX Total-0

16. Fabric Structure

(ii) Jacquard designing, Card cutting, lacing and yarn and cloth calculations:-

1	2	3	4	5	6	7	8	9	
1	16	1.6.82	-	19.6.82	Weaving Masters, Asstt. Weaving Masters.	13	12	67%	192
2	14	22.6.82	-	8.7.82	"	17	6	35%	84
3	15	2.8.82	-	18.8.82	"	24	10	42%	150
							Average	48%	Total-426

b. Seminars:-

i. Training needs of the personnel in the BTMC

Number attended = 100 Date : June 1980

ii. Preparation and Weaving of Polyester/Cotton Blends

Number attended = 115 Date : November 1981

c. Other Work:-

Preparation of reports on Balancing, Modernisation and Rehabilitation of the following textile mills:

- i. Dacca Cotton Mills
- ii. Bangladesh Textile Mills
- iii. Gawsia Cotton Spinning Mills

3. Evaluation:-

a. Conditions Existing at the Start of the Project.

- i. An acute shortage of trained staff at all levels in the industry, particularly at the level of supervisory and middle management personnel as well as technical personnel responsible for maintenance and repair of machinery.

ii. Existing training programs of BMC only covered the training of surplus unskilled labour, while pre-service training of middle-level management and supervisory staff was provided at the Textile Institute under the Directorate of Technical Education of the Ministry of Education.

b. Evidence of Attainment of Objectives:-

- i. 538 personnel have received technical and factory management training and follow-up.
- ii. Provision of a comprehensive series of Textile Courses and counterparts capable of presenting a full training program.

c. Degree of Achievement:-

1. Total number of man-days	=	4808
Total number trained	=	538
Number of days taken for Course No. 1	=	12 days
" " " " " Course No. 2	=	11 "
" " " " " Course No. 3	=	11 "
" " " " " Course No. 6	=	6 "
" " " " " Course No. 9	=	5 "
" " " " " Course No. 16	=	<u>15 "</u>

Total number of days taken for a full course 60 days

$$\begin{aligned} \text{Total number trained in all the courses} &= \frac{\text{Total number of man-days}}{\text{Total number of days taken for a full course}} \\ &= \frac{4808}{60} = 80 \text{ Persons} \end{aligned}$$

Average percentage of attendance (See Figure 1) = 55%

$$\begin{aligned} \text{Total number that would have been trained if the attendance was 100\%} \\ &= \frac{80 \times 100}{55} = 145 \text{ Persons} \end{aligned}$$

- ii. All the courses mentioned in 2.A have been prepared except Course TC(SW) 10-Mathematics, as the counterparts are capable of preparing and presenting it.
- iii. The three counterparts have been fully trained and they are capable of presenting all courses.

4. Recommendations:-

a. Additional courses needed:

- i. Adjustment and Setting of Toyoda Shuttle changing automatic loom in English/Bengali.

ii. Adjustment and setting of Over Pick Loos.

iii. Training courses for operatives in the different sections of the weaving department for up-grading their skills, so that they become competent in their own field of responsibility.

b. Release of Trainees:-

For some courses attendance has been poor due to mills being unable to release the participants due to shortage of staff, certain courses had to be cancelled due to very poor attendance, See Fig. 1. The Mill Managements should try to solve this problem and send the requested personnel in order ease the current shortage of trained personnel.

c. Change in Venue:-

Since the Training Centre at Savar has not been completed, courses were conducted in mills and the facilities available were inadequate. The Training Centre should be started as soon as possible so as to conduct the courses more effectively.

d. Training in Management Aspects:-

The Management Development Centre in Bangladesh can cope with any requirements as regards management oriented courses, but the BTMC Training Centre should play its part in textile oriented management courses.

5. Acknowledgements:-

I wish to thank the Bangladesh Textile Mills Corporation, the College of Textile Technology, the UNDP and the Government of the People's Republic of Bangladesh for extending their co-operation in carrying out my duties.

6.1. Course Syllabi:-

Pirn Winding

1. Importance of pirn winding in relation with the other processes in the Weaving preparatory department.
2. Length of yarn on the pirn:-
 - a) Winding diameter
 - b) Winding position
 - c) Winding tension
3. Importance of Bunch and the Bunch length.
4. Importance of checking the length of empty pirn.
5. Importance of tying of broken ends.

6. Correct methods of pirn stripping.
7. Methods of twist setting of weft.
8. Training of operatives.
9. Cleanliness of the department.
10. Methods of calculation of the efficiency of the pirn winding machine.
11. Calculation of the weight of yarn produced on the pirn winding machine.

Warping:

1. Importance and the objective of warping.
2. Location of the warping machine.
3. Quality of the warper's beam.
4. Different methods of creeling cones and their merits and demerits:-
 - a) Changing one after another
 - b) Magazine creel
 - c) Changing all cones at once.
5. Duties of operative:
 - a) Use of scissors/Knetters
 - b) Location of broken ends
 - c) Use of beam reversing system
6. Adjustment and cleaning of the creel:
 - a) How to adjust the creel pegs
 - b) Cleanliness of the tension washers
 - c) Cleanliness of the porcelain guides
7. Importance of warp stop motion.
8. Importance of brake system.
9. Warping defects, their causes and results.
10. Study of yarn breakages in warping and calculation of breakage rate.

Sizing:

1. Reasons and objectives of sizing.
2. Appearance of yarn before and after sizing.
3. Theory of binding:
 - a) Van-der-Waals forces.

b) Forces due to Hydrogen bonding.

4. Properties of warp after sizing:-

- a) Tensile strength
- b) Protruding fibres
- c) Elongation of yarn:-
 - i. Elongation during sizing
 - ii. Elongation at break after sizing
- d) Smoothness of surface
- e) Softness of warp
- f) Moisture content

5. Choice of ingredients for sizing:-

- a) Cost of material
- b) Stability of viscosity
- c) Adhesive power
- d) Easy removal during desizing

6. Ingredients used in sizing:-

- a) Adhesives
- b) Softeners or lubricants
- c) Hygroscopic agents
- d) Antiseptics

7. Size mixing auxiliaries:-

- a) Antistatic agents
- b) Gums and glues
- c) Neutralizing agents
- d) Antifoam agents
- e) Tinting and colouring agents
- f) Fillers or weighting agents
- g) Water

8. Size recipes

9. Method of size preparation.

10. Types of size cooking equipment:-

- a) Ordinary open type tank
- b) Pressure cooker
- c) Jet cooker
- d) Heat exchanger

11. Sequence of adding various size ingredients
12. Handling and storage of starch
13. Boiling of starch
14. Methods of checking viscosity and starch percentage of size.
15. Sizing process:-
 - a) Temperature in the sew box
 - b) Supply of size to the sew box
 - c) Effect of temperature of size on the warp breakage rate during weaving
 - d) Effect of size take-up on the warp breakage rate during weaving
 - e) Effect of concentration of size on the size take-up
 - f) Effect of squeeze roller pressure
 - g) Effect of yarn speed
 - h) Drying of sized yarn
 - i) Beam flange space
16. Size take-up:
 - a) Factors influencing size take-up percentage
 - b) Establishing of operational standards
17. Methods of calculation of size take-up percentage
18. Testing of yarn after sizing:-
 - a) Single yarn strength and elongation
 - b) Resistance to abrasion.

Fabric Structure, Jacquard Designing, Card Cutting

Lacing, Yarn and Cloth Calculations:

1. Use of point paper
2. Plain weave, ornamentation of plain weave
3. Derivatives of plain weave:-
 - a) Warp rib weave
 - b) Weft rib weave
 - c) Mat weave
4. Denting of weft rib and mat weaves
5. Simple or ordinary Twill weaves
6. Large Twills or Diagonals

13. Head calculations

14. Darning

15. Bedford cords:-

- a) Plain-faced Bedford cord
- b) Wadded Bedford cords
- c) Bedford cords arranged with alternate picks
- d) Twill faced Bedford cords.

16. Velveteens:-

- a) All-over or plain velveteens
- b) Plain-back velveteens
- c) Front pile structures
- d) Corded velveteens

17. Terry pile structures:-

- a) Formation of pile
- b) Terry weaves

18. Construction and development of Jacquard designs:-

- a) Construction of squared paper design
- b) Process of drafting a sketch design

7. Satsum Weaves:

- a) Regular satsum weaves
- b) Irregular satsum weaves

8. Grope weaves:

- a) Grope weaves produced upon satsum bases
 - b) Grope weaves produced by combination of a floating weave with a plain weave
 - c) Grope weaves produced by reversing
 - d) Grope weaves produced by insertion of one weave over another.
9. Stripe and check weave combinations, and their relative firmness.

10. Weave repeat unit.

11. Construction of draft and lifting plan.

12. Systems of drafting:-

- a) Straight draft
- b) Sely draft
- c) Satsum draft
- d) Point draft

- c) Development of figures
- d) Prevention of long floats
- e) Bald and flat development
- f) Figure shading
- g) Insertion of ground weaves
- h) Joining of figure and ground
- i) Harness drawing-in card cutting and card lacing.

19. Specifications for certain fabrics.

20. Diameter of yarn and setting of simple structures:-

- a) Ashenkurst's Rule for diameter of yarn
- b) Setting of simple structures
- c) Derivation of Ashenkurst's formula

21. Direct and indirect systems of yarn numbering

22. Twist in yarns:-

- a) Balanced twist yarns
- b) Cable yarns
- c) Folded or doubled yarn

23. Calculations relating to warp, weft and cloth:-

- a) Contraction
- b) Crimp or regain
- c) Formulae to determine the weight of warp and weight of weft in cloth.

24. Balancing of warp plans.

25. Calculation of efficiency:-

- a) Loom efficiency
- b) Shed efficiency
- c) Overall efficiency

Fabric Defects, Their Causes and Remedies:-

Bar, box, mark, missing, end, broken pattern, broken pick, cut weft, cracks, defective selvages, floats, hang pick, harness skip or stitching, lashing-in, loose warp ends, hanging threads, reed marks, shuttle marks, slough off, stain, sticker, temple mark, uneven cloth.

Cloth Inspection and Process Control in the Weaving Department:-

1. Check to specification:-

- a) Cloth width
- b) Threads per inch
- c) Yarn count
- d) Warp crimp
- e) Weave
- f) Cloth faults
- g) Cloth appearance

2. Systematic fault tracing
3. Routine cloth inspection
4. Grey cloth inspection and collection of data.
5. Feed back of data to the preceding processes.
6. Cloth mending
7. Cloth grading:-
 - a) Continuous defects
 - b) Partial defects
8. Process control in sizing
9. Process control in warping
10. Process control in cone/cheese winding.
11. Process control in pirn winding
12. Waste control
13. Machine maintenance
14. Operative procedure
15. Economics of quality control

Selection of Shuttles and Their Maintenance

1. Selection of shuttles
2. Shuttle furnishings
3. Shuttle eyes
4. Shuttle maintenance.

Preparation and Weaving of Polyester/Cotton Blends:-

1. Introduction
2. Tear strength
3. Abrasion resistance

4. Crease recovery
5. Build up of static charges
6. Physical properties of Polyester and Cotton fibre.
7. Summary of textile properties of Polyester and Cotton.
8. Precautions to be taken.
9. Cone winding:-
 - a) Machinery requirements
 - b) Machine adjustments and process control
10. Firm winding:-
 - a) Steaming
 - b) Machinery requirements
 - c) Machinery adjustments and process control
11. Warping:-
 - a) Machinery requirements
 - b) Machine adjustments and process control
12. Sizing:-
 - a) Yarn stretch
 - b) Warp density in size box
 - c) Choice of ingredients

13. Weaving

Adjustment and Setting of Sakamoto Cop-Changing Automatic Loom:-

1. Positions of the slay relative to the rotation of the crank shaft.
 - a) Front dead centre
 - b) Back dead centre
 - c) Top centre
 - d) Front centre
 - e) Bottom centre
 - f) Back centre
2. Weft feeler motion
3. Purpose of the bunch on the bobbin
4. Working principle of the weft feeler
5. Assembly and adjustment of weft feeler motion:-
 - a) How to fit the weft feeler box bracket

- b) How to adjust the weft feeler adjustable stud.
 - c) How to adjust the weft feeler box
 - d) How to adjust the weft feeler connecting rod and feeler motion knock.
 - e) How to adjust the feeler release adjustable piece.
6. How to adjust the shuttle feeler stud and starting rod spring.
7. Adjustment of weft stop motion:-
- a) How to fit the filling motion box
 - b) How to adjust the weft hammer lever bracket
 - c) How to adjust the fork holder
 - d) How to adjust the weft hammer
 - e) How to adjust the weft motion cam
 - f) How to adjust the weft hammer lever stud
8. How to adjust the starting rod
9. How to adjust the filling motion trip
10. How to adjust the taking-up finger.
11. How to adjust the lifting catch and the taking-up catch.
12. How to adjust the hepper stand
13. How to fit the bunter
14. Relation between the shuttle feeler and the hepper stand.
15. How to fit the shuttle feeler
16. How to fit the box front
17. How to fit the starting rod spring bracket.
18. How to fit the latch depressor:-
- a) SO-C and SO-D levers
 - b) SO-A and SO-B levers
19. How to fit the held back pawl
20. How to adjust the starting rod finger tip.
21. How to fit the feed pawl.
22. How to fit the transfer hammer
23. How to fit the transfer hammer spring
24. How to fit the latch

25. How to adjust the timing of the shedding motions:-

- a) Timing for plain weave
- b) Timing for twill weave

26. Adjustment of the picking motion:-

- a) How to fit the lever stick guide on hepper side
- b) How to adjust the picking stick spring.
- c) How to adjust the buffer holder and the bumper on hepper side
- d) How to adjust the buffer holder on the handle side.
- e) How to fit the side lever.
- f) How to determine the strength of picking
- g) Adjustment of picking timing.
- h) Adjustment of the side lever spring.

27. How to hang the heald frames

28. How to fit the reed cap and align the reed with the race board.

29. How to adjust the height of the temple case.

30. How to adjust the temple case in cross direction.

31. Adjustment of the warp stop motion:-

- a) How to fit the stop motion box
- b) How to adjust the eccentric cam.
- c) How to adjust the oscillating rod arm and feeler bar.
- d) How to fit the oscillating shaft to its end.
- e) How to join the warp stop swing lever to the connecting vertical rod.
- f) How to adjust the collar on the horizontal connecting rod.
- g) How to fit the lifting finger.
- h) How to adjust the knocking head.
- i) How to fit the knocking hammer.

32. Adjustment of the beating-up motion:-

- a) How to fit the alay sword and its brackets.
- b) How to fit the alay
- c) How to adjust the height of the alay
- d) How to fit the alay fly back.
- e) How to adjust the spider stop rod spring slot.
- f) How to adjust the knocking off lever.

- g) How to adjust the spider pulley lever.
- h) How to adjust the slay fly back.
- i) How to fit the spider pulley guide lever bracket.
- j) How to fit the spider stop finger bracket and duck bills

33. Assembly and adjustment of SNX type positive let-off motion:-

- a) How to fit the weight lever shaft
- b) How to fit the auto-let-off motion driving bracket.
- c) How to fit the beam presser shaft.
- d) How to fit the feed back shaft bracket.
- e) How to fit the beam bracket.
- f) How to fit the ratchet feeder bracket.
- g) How to adjust the beam presser.
- h) How to fix up the weight lever.
- i) How to fit the feed connecting rod.
- j) How to fit the indicator lever and regulator bracket.
- k) How to fit the feeling stud.
- l) How to fit the sector brake base.
- m) How to fit the sector lever.
- n) How to fit the sector brake cam lever.
- o) How to adjust the sector brake cam.
- p) How to adjust the sector brake stop collar.
- q) How to fit the feed back shaft shift lever.
- r) How to adjust the ratchet separator.
- s) How to adjust the weight lever stop.
- t) How to assemble the warp beam.
- u) How to determine weighing for positive let-off motion.
- v) How to adjust the indicator stop stud.

34. Assembly and adjustment of the brake and take-up motion:-

- a) How to fit the brake lever.
- b) How to fit the cloth roller lever bracket.
- c) How to fit the cloth roller lever bracket stay.
- d) How to fit the return motion lever and intermediate wheel stud bracket.
- e) How to fit the cannon bracket.
- f) How to fit the taking up lever and bumper shim bracket.
- g) How to fit the spring handle.
- h) How to adjust the clutch.
- i) How to fit the inclined lever and the brake hoop.

j) How to fit the slip catch bracket and adjust the slip catch.

35. How to adjust the shuttle box.

Weaving Mechanism:-

Hand loom and power loom, Tappets under the heald centre, driving for tappets, advantages of tappet shedding and timing, early shedding, late shedding, picking, shuttle, defects of shuttles and shuttle cap, defects of negative picking, essential features of a good pick, over pick motion, upright shaft and cone, intensity of picking, length of shuttle box and picking tappet, construction of picking tappet, hollow race beard and bowed reed, under pick motion, intensity of force in underpick, notes on picker, picking band etc., swell spring or box swell, buffer, check strap, shuttle guard, early and late picking, shuttle flying out of the loom, shuttle trapping in the shed, weak and harsh pick, beating-up, construction of going part, mechanism of going part, eccentricity of slay's motion, crank, position of crank shaft in relation to connecting pin, sweep of slay and reed, timing of primary motions in tappet loom, method of driving the loom, maximum speed of a loom, setting the slay, shedding and picking, take-up motion, positive take-up motion, five wheel take-up motion, change wheel, dividend of a loom, calculated dividend and practical dividend, seven wheel take-up motion, let-off-motion, types of let-off-motion, conditions of good let-off motion, negative let-off motions and their characteristics, chain, lever and weight let-off motion, weft fork motion, its objectives, types of weft fork, side weft fork motion, and its defects, braking motion, timing of the side weft fork motion, fast and loose reed motions and their timing, shuttle trapping, dobby, scope of dobby, use of dobby, construction of dobby, single lift dobby, double lift dobby, types of double lift dobbies, Hattersley or Keighley dobby, positive Hattersley dobby, climax dobby, single lift Jacquard, details of single lift Jacquard, driving for single lift Jacquard, rotation of card cylinder, swing lever principle, double lift double cylinder Jacquard, its advantages, details of double lift double cylinder Jacquard, its advantages and defects, automatic loom and its features, automatic loom versus non-automatic loom, types of automatic looms, warp stop motion and its functions, types of warp stop motions such as electric and mechanical warp stop motions, drop wires, alider bars, automatic cap changing mechanism, Northrop cap changing loom, self threading shuttle, weft feeler motion, wicket motion, electric weft feeler motion, weft fork motion, cap changing mechanism, shuttle protector, shuttle protector cutter, weft cutter, three miss thread motion, Northrop Reper let-off motion, Bartlett let-off motion, Ruti cap changing loom, double pick in cap changing loom, shuttle changing automatic loom, its characteristics, type of shuttle changing looms, temples and their construction, necessity of temples, types of temples, their uses, setting of temple, defects caused by temples;

Modern Developments in Weaving:-

Introduction, the bobbin leader, weft winding at the loom, the Rapier system of weft insertion, Sulzer shuttleless weaving machine, air jet weft insertion, weft insertion by water jet.

Non-Weave Fabrics:-

Adhesives and bonding, introduction, adhesion, classification of Bonds, bonding procedure, factors influencing bonding process, adhesives for non-woven textiles, adhesive properties, applicability of adhesives in non-wovens, raw materials, principles of production of non-woven fabrics, classification of non-woven fabrics, basic technologies of non-woven fabrics, mechanically bonded non-woven fabrics, chemically bonded fabrics, production technology of non-woven fabrics.

2. List of Mills:-

- | | |
|---------------------------------|--------------------------|
| a. Gassia Cotton Spinning Mills | v. Khulna Textile Mills |
| b. Olympia Textile Mills | w. Meghna Textile Mills |
| c. Zeevat Textile Mills | x. Mahini Cotton Mills |
| d. Dasca Cotton Mills | y. National Cotton Mills |
| e. Bangladesh Textile Mills | z. Karilán Silk Mills |
| f. Maslin Cotton Mills | |
| g. Ahmed Bawany Textile Mills | |
| h. Chittaranjan Cotton Mills | |
| i. Dhakswari Cotton Mills No. 1 | |
| j. Dhakswari Cotton Mills No. 2 | |
| k. Izaminarayan Cotton Mills | |
| l. Adarsha Cotton Mills | |
| m. Al-Haj Textile Mills | |
| n. Asiatic Cotton Mills | |
| o. Begra Cotton Mills | |
| p. Chand Textile Mills | |
| q. Chittagong Textile Mills | |
| r. Pahartali Textile Mills | |
| s. Halima Textile Mills | |
| t. Ibrahim Cotton Mills | |
| u. Jalil Textile Mills. | |

(D. S. W. JAYAWARDANE)
Weaving Adviser(Training)

P.R. No. 1

Average Attendance = 55%

