Syllabus for the trade
of

RUBBER TECHNICIAN

(SEMESTER PATTERN)

under
CRAFTSMAN TRAINING SCHEME(CTS)

Designed in: 2013

By
Government of India
CENTRAL STAFF TRAINING AND RESEARCH INSTITUE
Directorate General of Employment & Training
Ministry of Labour & Employment
EN-81, SECTOR-V, SALT LAKE CITY
KOLKATA-700091

List of members of Trade Committee meeting for the Trade of Rubber Technician held on 12.08.2011 at Kolkata and 02.02.2011 at Agartala, Tripura.

S.J.Amalan, Director, Central Staff Training Research Institute, Kolkata.

SL.NO.	NAME & DESIGNATION S/SHRI	REPRESENTING ORGANIZATION	REMARKS
1.	V. George Jenner, Director	I&C, Tripura	Chairman
2.	B.Debbarma, M.D.	M.D.TRPC	Member
3.	Mohanam Nair, D.O.	D.O.Rubber Board	Member
4.	L.K.Mukherjee, Deputy Director	CSTARI, Kolkata	Member
5.	Alak Paul, Sr. Manager	TFDPC	Member
6.	Joy Joseph, Scientist		Member
7.	A.Datta, Joint Director	I&C	Member
8.	Tapan Das, Principal	ITI, Belonia	Member
9.	Debashish Das, Principal,	ITI, Indranagar	Member

List of members attended the Workshop to finalize the syllabi of existing CTS into Semester Pattern held from 6th to 10th May'2013 at CSTARI, Kolkata.

Sl. No.	Name & Designation	Organisation	Remarks
1.	R.N. Bandyopadhyaya, Director	CSTARI, Kolkata-91	Chairman
2.	K. L. Kuli, Joint Director of Training	CSTARI, Kolkata-91	Member
3.	K. Srinivasa Rao, Joint Director of Training	CSTARI, Kolkata-91	Member
4.	L.K. Muhkerjee, Deputy Director of Training	CSTARI, Kolkata-91	Member
5.	Ashoke Rarhi, Deputy Director of Training	ATI-EPI, Dehradun	Member
6.	N. Nath, Assistant Director of Training	CSTARI, Kolkata-91	Member
7.	S. Srinivasu, Assistant Director of Training	ATI-EPI, Hyderabad-13	Member
8.	Sharanappa, Assistant Director of Training	ATI-EPI, Hyderabad-13	Member
9.	Ramakrishne Gowda, Assistant Director of Training	FTI, Bangalore	Member
10.	Goutam Das Modak, Assistant Director of Trg./Principal	RVTI, Kolkata-91	Member
11.	Venketesh. Ch. , Principal	Govt. ITI, Dollygunj, Andaman & Nicobar Island	Member
12.	A.K. Ghate, Training Officer	ATI, Mumbai	Member
13.	V.B. Zumbre, Training Officer	ATI, Mumbai	Member
14.	P.M. Radhakrishna pillai, Training Officer	CTI, Chennai-32	Member
15.	A.Jayaraman, Training officer	CTI Chennai-32,	Member
16.	S. Bandyopadhyay, Training Officer	ATI, Kanpur	Member
17.	Suriya Kumari .K , Training Officer	RVTI, Kolkata-91	Member
18.	R.K. Bhattacharyya, Training Officer	RVTI, Trivandrum	Member
19.	Vijay Kumar, Training Officer	ATI, Ludhiana	Member
20.	Anil Kumar, Training Officer	ATI, Ludhiana	Member
21.	Sunil M.K. Training Officer	ATI, Kolkata	Member
22.	Devender, Training Officer	ATI, Kolkata	Member
23.	R. N. Manna, Training Officer	CSTARI, Kolkata-91	Member
24.	Mrs. S. Das, Training Officer	CSTARI, Kolkata-91	Member
25.	Jyoti Balwani, Training Officer	RVTI, Kolkata-91	Member
26.	Pragna H. Ravat, Training Officer	RVTI, Kolkata-91	Member
27.	Sarbojit Neogi, Vocational Instructor	RVTI, Kolkata-91	Member
28.	Nilotpal Saha, Vocational Instructor	I.T.I., Berhampore, Murshidabad, (W.B.)	Member
29.	Vijay Kumar, Data Entry Operator	RVTI, Kolkata-91	Member

GENERAL INFORMATION

1.	Name of the Trade	: Rubber Technician
2.	N.C.O. Code No.	:
3.	Duration	: One year (Two Semester)
4.	Power Norms	: 5 KW
5.	Space requirements	: 60 sq. mtrs.
6.	Entry Qualification	: Passed 10th class examination under 10+2 system of education with Science and Mathematics or its equivalent.
7.	Unit size(No. of Students)	: 20
8 a.	Instructor's/Trainer's Qualification	: Three year Diploma in rubber technology from a recognized board/Institution.
8 b.	Desirable qualification	: Preference will be given to a candidate with Craft Instructor Certificate (CIC).

Note: At least one Instructor must have Degree/Diploma in relevant field.

TRADE: RUBBER TECHNICIAN

FIRST SEMESTER
(semester Code No.RUT-01)

Week No.	Trade Practical	Trade Theory	Engg. Drawing	Workshop calculation & Science
1.	Induction training. Familiarization with the Institute. Type of practical Training to be followed. Workshop safety. Introduction to the safety rules in the shop floor and the firefighting equipment Show different audio–visual aids, library, showroom	Importance of the trade in the industrial and commercial field. Theoretical subjects to be taught. Achievement to be made. Introduction to the general safety causes of the accident and the remedies. Give some instruction related with the duties of the trainees, discipline recreational, medical facilities and other extracurricular activities of the institute.	----------	----------
2.&3.	Testing of Field Latex for Dry rubber content and total solids. Visit to a Rubber plantation to understand the process of Sheet making.	Rubber Tree – Its propagation, Latex Harvesting, Collection, handling and Preservation of field latex. By products from the rubber plantations.	Importance of Engineering drawing and its knowledge, free hand sketches of Straight, oblique and perpendicular lines and plain figures like square, rectangle square, circle, polygons and triangles etc. Identification of simple geometrical solids from given models/ teaching aids, free hand sketches for simple solids like cube, cone pyramid, rectangle block etc.	Fundamental arithmetical operation addition, subtraction, multiplication and the division of whole numbers.
4. to 6.	Creaming of Field Latex by addition of creaming agents and DRC	Concentration of Latex - Creaming, Creaming Agents,	Importance of good printing of letters and numbers on	Properties and the uses of plain carbon steel and alloy.

	determination of Cream latex. Visit to a Latex centrifuging unit to understand the principles of centrifuging. Familiarize with the processing of skim rubber.	Efficiency of Creaming, Application of Creamed Latex, Centrifuging, Centrifuging Machine, Efficiency of Centrifuging, Skim Latex, Processing of Skim Latex.	drawing. Free hand practice of lettering and numbering style as per IS 696/ 1972. Standard line conversion and their meaning and their scope of application on Eng. Drawing as per IS 669/1972 ST symbols for simple eng, elements and materials used on drawing. As per I.S.I (hand out to be issued for.) Free hand sketches of hand tools and measuring tools, related to trades e.g. hammer, file, chisel drill, hacksaw tongs snips, solder-Iron mallets, Anvil, punch, harp, blow pipe, electrode holder, scale, caliper, try square, Bench vice etc. from supplied sketches or samples.	Fraction and decimals conversion, fraction to the decimal vice versa. Properties and uses of the copper, zinc, lead, tin and aluminum.
7. to 9.	Preparation of Sheet Rubber –Collection of Latex, Dilution, Coagulation, Sheeting and Drying, Grading of Sheet Rubber.	Processing of Latex into Dry Marketable forms, RSS, Crepe, TSR (ISNR) and Grading of Rubber.	-Do-	Simplification, application of fundamental arithmetical operation to shop problems. Properties and uses of brass, bronze, solder, bearing metal, timber, rubber. System of units- British Metric and S.I. units for length area, volume, capacity, weight, time, angle their conversion.

10.to 12.	Visit to a Crepe factory and TSR factory; understand the process, Testing of TSR for the specification parameters like Dirt content, volatile matter, ash, nitrogen, plasticity (P0), Plasticity Retention Index (PRI).	Processing Machineries, Details regarding the machinery used to process different types of marketable forms of Natural Rubber. – A. Sheet Rollers & Sheeting Battery for Ribbed Smoked Sheet (RSS) B. Smoke House C. Creepers D. Initial Size reduction machines for rubber coagulum E. Hammer Mills. F. Shredders Drier –Different types.	Importance of putting dimension on the drawing as per IS 696/1972. How to measure the sizes of simple parts and the locations of the other operational surfaces, using simple measuring instruments and how to transfer the measurements or on the drawings of the features for dimension; Free hand sketches to study the techniques employed in dimensioning on the Drawing of features for size, location, hole arcs, angles, chamfer, taper etc. from given sample or sketches.	Effect of alloying elements of the property of C.I. and steel. Heat and temperature, thermometric scales their conversion temperature. Measuring instrument, quantity of heats, specific heat. Latent heat, Heat loss and heat gain-Simple problems.
13. & 14.	Qualitative tests on Synthetic rubbers. Identify the manufactures of Synthetic rubbers in India and overseas. List the applications of these rubbers as charts. Identify and collect rubber products made out of these rubbers.	General Purpose Synthetic Rubbers – SBR, Poly butadiene (BR), Butyl Rubber, grades, trade names, Manufacturing Process, properties, Comparison of properties with Natural Rubber and application of these rubbers in products.	Isometric and oblique. Drawing their methods of representation using simple solids like cube, rectangular block, stepped block cylindrical features, prisms	Rest and Motion, velocity, acceleration. Newton's law of motion.
15. & 16.	Qualitative tests for the Special purpose synthetic rubbers and prepare a chart illustrating the manufacturers and the properties of the Rubbers. Identify and collect rubber products made out of these rubbers.	Special purpose Synthetic Rubber- Poly chloroprene rubber (CR), Silicone Rubber, Nitrate Rubber (NBR), Ethylene Propylene Diane Rubber (EPDM), Poly Urethane Rubbers (PU).	-DO-	Moment and forces Simple problems on straight and bell cranked levers. Mass, Volume, Density, Weight C.G.S.M.K.S. and F.P.S. units of force weight etc. their conversion. Shop problems.

		Techniques of Vulcanization.		
17.	Collect different types of reclaimed rubber. Attempt a method to reclaim Waste rubber products by powdering and heating.	Reclaimed rubber, Process of Manufacture, Compounding, Types and Grades, Major uses.	-DO-	DO-
18. to 20.	Masticate Natural rubber to various extent on a two roll mixing mill (2 minutes, 5 min, 10 min, 20 min, 40 min), Observe the changes and find out the plasticity of these samples. Acquaint with the operation of the mixing mill and preparation of rubber filler mix.	Principles of Rubber compounding, Mastication, Compounding Ingredients, Definition and Objectives. Activators, Stearic Acid, Zinc oxide, Fillers, Black & Non-Black Fillers, Plasticizers.	Orthographic projection Std. systems (1st angle Orthographic projection& 3rd angle projection IS 696 as per 1972. Free hand sketches of simple objects like Vee blocks, stepped blocks simple brackets, black with holes and grooves to represent the views both in 1st and 3rd angle. Orthographic projection with dimensions.	Power and Roots-Factors, power base, exponent. Multiplication and division of power, root of a number. Square root by arithmetic's and problems related to trade.
21. to 23.	Mix full rubber compounds containing all the necessary ingredients.	Accelerators, Curing Agents and Special compounding Ingredients – Blowing Agents, Factice, Colours.	-DO-	Effect of force on materials in such application as extending, bend lug twisting, shearing etc. Meaning of stress and strain.
24.	Determine the cure time of different rubber compounds containing different cure systems on a Rheometer. Try to predict the cure behavior of the compound from the Rheograph.	Vulcanization – understanding the process. Cure time, Scorch time, and reversion. Vulcanization Methods.	-DO-	-DO-
25.	**Project work / Industrial visit (optional)**			
26.	**Examination**			

TRADE: RUBBER TECHNICIAN

SECOND SEMESTER
(Semester Code No. RUT-02)

Week No.	Trade Practical	Trade Theory	Engg. Drawing	Workshop Cal. & Science
1.&2.	Preparation of Blends of rubbers like NR/SBR, NR/PB etc. Prepare Tyre tread compounds using the blends.	Blends of Rubbers – Advantages & Dis-advantages, Thermo Plastic Elastomers. Simple methods of production. Advantages & Disadvantages.	Orthographic projection Std. systems (1st angle Orthographic projection& 3rd angle projection IS 696 as per 1972. Free hand sketches of simple objects like Vee blocks, stepped blocks simple brackets, black with holes and grooves to represent the views both in 1st and 3rd angle. Orthographic projection with dimensions.	Effect of force on materials in such application as extending, bend lug twisting, shearing etc. Meaning of stress and strain.
3.&4.	Cleaning of formers (Wood, Porcelain), Preparation of coagulants. Dipping the former in the latex compound for the required thickness. Drying.	Manufacture of Latex products – Dipping, Dipping Tanks, Formers, Coagulants, Ball Milling	Free hand sketches of standard rivet forms as per I.S.I. employed on drawings. Standard forms of key and cotters.	Problems on percentage related to trade. Meaning of stress strain modulus of elasticity. Algebraic symbols and fundamental algebraic operations. Sign and symbols used in algebra; co-efficient terms, like and unlike terms.
5. to 7.	Attempt the production of Balloons, Gloves, Rubber Bands and Finger Caps.	Compounding of Latex for various Dipped products. Typical Compound formulation for important dipped goods like: - Gloves, Balloons, Rubber bands, Condoms, Elastic thread.	-DO-	-DO-
8.&9.	Casting :– preparation of moulds using plaster of Paris. Compounding and molding process, finishing.	Casting process. Ex- Toys etc. Manufacture of Latex cements and adhesives, Latex paints and coatings.	-DO-	-DO-

10.&11.	Preparation of Latex foam compounding, frothing on the Hobart Mixer, transfer into the heated moulds, vulcanization, Washing and drying.	Manufacture of Latex foam. Process of manufacture :- 1. Dunlop process 2. Talalay process. Machinery details of process, Moulds, Autoclave, Vulcanization, testing and quality control.	-DO-	-DO-
12.&13.	Prepare maintenance protocol for the product manufacturing machines, understanding of the mechanism of working and safety aspects.	Rubber product manufacturing machineries:- A. Mixing Mills B. Internal Mixers C. Calenders D. Extruders E. Moulding Press F. Auto claves.	-DO-	Algebraic addition, subtraction, multiplication and division.
14.& 15.	Identify the tyre manufacturers in India, Understand the different types of tyres (2 wheelers, LCV, Truck, Earth Mover). Radial and Bias/belted tyres. Try to collect above used tyres. Measurements of Tyres in terms of its dimensions and hardness of tread.	Dry Rubber products :- Tyres – Tyre Industry in India, Manufacture of Automobile Tyres, tubes etc. Different types of Tyre. Manufacture of Cycle Tyre, tubes. Retreading of Tyres. Pre-cured retreads.	-DO-	-DO-
16.to18.	Mix proper compounds and prepare the following products: - Micro cellular rubber, Mat, extruded beading,	Non tyre products- Compounding and manufacturing methods. Mats, Hot water bags, micro cellular	-DO-	Power and exponent, Laws of exponent. Algebraic simplification problems. Electricity and its uses: - Electric current-positive and

	handmade hoses, paper weight, washers and Injection bottle caps, Gaskets and seals. Preparation of extruded products like tubes, channels using an extruder.	rubber, Play balls, Gaskets and seals, calendared sheets, rubber to metal products, rubber coated textile, rubber hoses, rubber beltings, rubber lining for chemical plants, rubber covered rollers, extruded products.		negative terminals use of fuses and switches conductor and insulators.
19.&20.	Testing of Gloves, Tensile properties, ageing tests, dimensions as per BIS. Acquaint with different types of Gloves, measurement on the dimensions, specification tests for different types of Gloves.	Testing of rubber products – Latex products -- physical & chemical properties of fresh latex. Specification tests for centrifuged latex & Technically Specified Rubber. Principles of testing of elastomervulcanizates, stress-strain properties, shear, compression set, flux resistance, abrasion, hardness, swelling insolvents, ageing tests.	-DO-	-DO-
21.&22.	Testing for Abrasion resistance, Hardness, Swelling index, Compression resistance. Heat buildup and flexing.	Standards and specifications, knowledge about Bureau of Indian Standards (BIS), BIS standards for few typical rubber products.	Screw thread forms as per I.S.I. conventional application of internal and external screw thread-free hand sketches of nut, bolts, Screw etc. Importance of blue print reading guide line how to read- Simple blue print	Factor and equations of algebraic formulae.

			exercise reading related to missing lines, missing views, missing dimension, Missing section, identification of surface symbols etc.	
23.to 24.	Acquaint with the formulation for common rubber products and build up the capability for designing formulation for common rubber products. Attempt the production of the above products and assess the quality of the same.	Design and development of rubber products, Basic understanding on the formulation of rubber products, Dosages and criteria for selection.	-DO-	-DO-
25.	**Revision**			
26.	**Examination**			

TRADE : RUBBER TECHNICIAN
LIST OF TOOLS AND EQUIPMENTS

A. TRAINEES TOOL KIT FOR 20 TRAINEES +1 INSTRUCTOR

Sl. No.	Name of the items	Specification	Qty.
1.	Weighing Balance - Electronic	Capacity : 1000g Readability : 0.01 g Repeatability ± 0.01 g Linearity ± 0.02 g Pan size (mm) : 125	5 Nos.
2.	Common Balance	With weights in the ratio 1:2:2:5 measurable up to 10KG	2 Nos.
3.	Platform Balance	Capacity : 60kg Accuracy : 5gm Platters Size : 500 × 500mm Display : LED	1 No.
4.	Water Bath –Lab size	6 holes with digital temperature control, thermostatic control with an accuracy of ± 5ºC.	2 Nos.
3.	Hot Air Oven – 0 to 200^0 C	Size in Inch : 18" X 18"X18" Temp. : Ambient to 200° CInner SS Outer powder coated Digital Temperature Control, Thermostatically Temperature Control	2 Nos.
5.	Wallace Plastimeter	Plastimeter dimensions: 306mm (w) x 353mm (d) x 306mm (w) Specimen cutter dimensions: 380mm (d) x 80mm (w) Weight of Plastimeter: 34kg Platen sizes: 10mm, 7.3 and 14mm Diameter Standards: BS 903: Pt A59 :section A59.1 : 1997 ISO 2007: 1991 Platen temperature P14/1,2,3: 100°C Platen temperature P14/VT: 60°C - 180°C	1 No.
6.	Infra Red Heater	BTU Output: 5,200 Heating: 1,000	2 Nos.

		Capability (sq. ft.)	
		Volts	120
		Amps	12.5
		Watts	1,500
		Blower Included	Yes
		Heat Settings	Variable
		Thermostat Included	Yes
		Power Cord (ft.)	6
		Plug Type	3-prong
		Receptacle Type Required	Standard
		Remote Included	Yes
		Thermal Cut off Safety Device	Yes
		Tip-Over Safety Switch	Yes
		Dimensions W x D x H (in.)	14 3/8 x 19 3/4 x 17 3/4
		Manufacturer Warranty	3 year limited warranty
		Ship Weight	49.76 lbs
7.	Sheeting Rollers and batteries	With 1hp single motor, Roller with 610mm, 4 pairs, Dimension in meter 1.4Lx1.07wx0.96H	2 Nos.
8.	Latex Creaming Tank	Standard	1 No.
9.	Ball Mill	Speed of bucket- 24rpm, Speed of opening >25mm, Size of outputting feed 0.075-.1mm, Power 100Kw	1 No.
10.	Ball Milling jar	Small size/ steel	4 Nos.
11.	Latex Dipping Tank (Steel)	Small size/ steel	1 No.
12.	Coagulant Tank	Small size/ steel	1 No.
13.	Formers for Household Gloves	Wood or Porcelain	12 Pairs
14.	Formers for Electricians Gloves	Wood or Porcelain	12 Pairs
15.	Formers for Surgical Gloves	Wood or Porcelain	12 pairs
16.	Formers for Balloons	Wood or Porcelain	12 Nos.
17.	Formers for Rubber Band	Wood or Porcelain	12 nos.
18.	Formers for Finger Caps	Wood or Porcelain	12 Nos.
19.	Casting Moulds	Plaster of Paris or Aluminum	10 Nos.
20.	Hobart Mixer	N-50, 5 quart mixer, 1/6-H.P. Hobart-designed fixed-speed motor	1 No.

21.	Foam Mould	Small size, For Small cushion	2 Nos.
22.	Autoclave	AUTOCLAVE VERTICAL DIA X HEIGHT : 300x500 mm. (12'X20") LOAD : 2.0 KW I) OUTER M.S. DELUXE S.S.	1 No.
23.	Rubber Band Cutting Machine	Manually Operated I) Hydraulic Operated II) Screw type with Hand Wheel Toggle type	1 No.
24.	Calendar	3 roll, roll with 8", with antifriction bushing, fail safe system with Special accessories such as, strip cutting knife, roll temperature control system, hinged or motorized side shields .	1 No.
25.	Extruder – Lab size	Size 1", L/D Ratio.1:4.5 Worm R.P.M. 40, Capacity (app.)5 K.G./H.R, Electric Motor 2 H.P.	1 No.
26.	Rheometer	System should measure Rheological properties Torque Range: 0.05µNm to 200mNm	1 No.
27.	Two Roll Mill –Size (6 x 12 inch)	Roll dia-250mm, Barrel length 600mm, Batch cap-8-9KG, 15HP, Gear 10:1/50:1	1 No.
28.	Moulds for Cellular Sheet	For small size specimen/standard	1 No.
29.	Moulds for Play Ball (Multi Cavity)	For small size specimen/standard	2 Nos.
30.	Moulds for Table Mat (Multi Cavity)	For small size specimen/standard	1 No.
31.	Metal Moulds for Injection Bottle Caps (Multi cavity)	For small size specimen/standard	1 No.
32.	Hydraulic Press (Moulding Press)	Capacity-1ton, Platen size-250x250mm,Ram dia 150mm, Ram stroke-100mm, Electric heating	1 No.

B. RAW AND STATIONERY MATERIALS REQUIRED

Sl. No.	Name of the items	Specification	Quantity
1.	Aluminum Pans	4 ltr capacity	12 Nos.
2.	Glass Beaker	1000 ml capacity	5 Nos.
3.	Glass Beaker	500 ml capacity	16 Nos.
4.	Glass Beaker	250 ml capacity	16 Nos.
5.	Glass beaker	100 ml capacity	25 nos.
6.	Glass Beaker	50 ml capacity	16 nos.
7.	Conical Flask	250 ml	20 nos.
8.	Conical Flask	100 ml	16 nos.
9.	Funnels	Small, Medium and Big size	16 nos.
10.	Burette	50 ml	16 nos.

11.	Burette	100 ml	16 nos.
12.	Pipette	20 ml	16 nos.
13.	Pipette	10 ml	16 nos.
14.	Burette Stand	---	16 nos.
15.	Glass rods for stirring	long and short	20 nos. each
16.	Hot plate	Plate size 6x6” Overall size 8x8” 1ph, 240 volt	3 nos.
17.	Formic Acid	-----	5 liters
18.	Acetic Acid	-----	5 liters
19.	Natural rubber	-----	25 kg
20.	SBR	-----	25 kg
21.	PBR	-----	25 kg
22.	IIR	-----	25 kg
23.	Silicone Rubber	-----	25 kg
24.	Nitrile Rubber	-----	25 kg
25.	EPDM	-----	25 kg
26.	Sulphur	-----	25 kg
27.	Zinc Oxide (Activators)	-----	10 kg
28 .	Stearic Acid (Activators)	-----	10 kg
29.	CBS (Accelerator)	-----	2 kg
20.	TMT (Accelerator)	-----	2 kg
21.	MBTS (Accelerator)	-----	2 kg
22.	Clay	-----	25 kg
23.	Carbon black	-----	25 kg
24.	MC crump	-----	100 kg
25 .	Reclaimed Rubber	-----	50 kg