SGGS INSTITUTE OF ENGINEERING & TECHNOLOGY, NANDED

(An Autonomous Institute of Government of Maharashtra)

Final Year B.Tech. (Textile Technology) Curriculum Structure: Academic year 2017-18 onwards
Structure A

Semester VII								
Course Code	Course Title	Lectures (L)	Tutorials (T)	Practical (P)	Credits			
					Th.	Pr.	TU	Total
TT401	Technical Textiles-I	04	00	02	04	01	00	05
TT403	Production Management	04	00	00	04	00	00	04
TT405	Knitting & Nonwovens	04	00	02	04	01	00	05
TT407	Mini Project	00	02	04	00	02	02	04
Elective IV (Any One)								
TT409A	Statistical Process Control in Spinning	03	00	02	03	01	00	04
TT409B	Advances in Finishing	03	00	02	03	01	00	04
TT409C	Merchandizing & Supply chain mgt.	04	00	00	04	00	00	04
TT409D	Smart Textiles	04	00	00	04	00	00	04
	Open Elective I	04	00	00	04	00	00	04
	Total	15/16	02	8/10	15/16	4/5	02	22
Total Credits of Sem VII					22			
Semester VIII								
Course Code	Course Title	Lectures (L)	Tutorials (T)	Practical (P)	Credits			
					Th.	Pr.	TU	Total
TT402	Project – A* (to be carried out in the Institute)	00	02	12	00	06	02	08
TT404	Seminar	00	02	00	00	00	02	02
TT406	In-Plant Training	00	00	04	00	02	00	02
Elective – V (Any Two)								
TT408A	Process Control in Weaving	03	00	02	03	01	00	04
TT408B	Technical Textiles-II	04	00	00	04	00	00	04
TT408C	Information Technology	04	00	00	04	00	00	04
TT408D	Indian Textile and Clothing Industry	04	00	00	04	00	00	04
	Open Elective II	04	00	00	04	00	00	04
	Total	7/8	04	16/18	7/8	8/9	4	20
Total Credits of Sem VIII					20			
Total Credits Sem VII & VIII					22+20 = 42			

Structure B

Semester VII								
Course Code	Course Title	Lectures (L)	Tutorials (T)	Practical (P)	Credits			
					Th.	Pr.	TU	Total
TT401	Technical Textiles-I	04	00	02	04	01	00	05
TT403	Production Management	04	00	00	04	00	00	04
TT405	Knitting & Nonwoven	04	00	02	04	01	00	05
TT407	Mini Project	00	02	04	00	02	02	04
Elective IV (Any Two)								
TT409A	Statistical Process Control in Spinning	03	00	02	03	01	00	04
TT409B	Advances in Finishing	03	00	02	03	01	00	04
TT409C	Merchandizing& Supply chain mgt.	04	00	00	04	00	00	04
TT409D	Smart Textiles	04	00	00	04	00	00	04
	Open Elective I	04	00	00	04	00	00	04
	Total	18/20	02	8/12	18-20	4-6	02	26
Total Credits of Sem VII					26			
Semester VIII								
Course Code	Course Title	Lectures (L)	Tutorials (T)	Practical (P)	Credits			
					Th.	Pr.	TU.	Total
TT410	Project – B* (To be carried out in the identified Industry / R & D Organization)	00	00	24	00	12	00	12
TT406	In-Plant Training	00	00	04	00	02	00	02
TT412	Case Study	00	00	04	00	02	00	02
	Total	00	00	32	00	16	00	16
Total credits Sem VII & VIII					26+16= 42			

Note:
'Structure – A' and 'Structure – B' be offered to the students of final semester (i.e. Sem. VIII). The students can opt for any one the structures. The student in scheme B should complete extra credits than scheme A; either in VI th or VII th semester.

SEMESTER VII

TT401: Technical Textiles-I

(L4-T0-P2): 5 Credits

Course Objectives:

1. To develop core knowledge of technical textiles to serve industry.
2. Develop research attitudes for innovation activities.
3. Develop skills in interdisciplinary areas.
4. Develop a lifelong learning attitude
5. Design of unconventional things which can help the society as per needs.

Course Outcomes:

1. Engineering of basic Technical Textiles, application areas, principles of functioning individual Technical Textiles.
2. Draw backs and advantages of different coating techniques and use appropriate method for desired results.
3. Design of different Technical Textiles such as type fabrics, air-bag, automotive textiles, Filter fabric, Geotextiles, Industrial Swing Threads considering safety factors.
4. Application of Technical Textile and safety of human life & society using air-bag, geotextile, coated fabrics etc.
5. Use of Technical textile in the form of geo-textile and its impact in environment control such as drainage, erosion control etc.

Course Contents:

1	What are Technical textiles? Application areas, Fibres that are used for Technical textiles, Use of Technical textiles globally
2	**Technical textile yarns:** Filament technical yarns such as glass fibres and yarns carbon fibres and yarn, ceramic fibres and yarns, HPPE fibres and yarns, Aramid fibres and yarns, Ultra-fine and Novelty fibres
3	**Finishing of technical textiles:** Finishing processes like mechanical processes, Calendering, Raising, Cropping, Compressive shrinkage, Heat setting.
4	**Coating of technical textiles:** Chemistry of coated textiles, PVC, PVDC, PTFE, Rubber- various type, Polyurethanes, Coating techniques: Knife coating, roller coating, nip coating, dip coating, cast coating, extrusion coating, spray coating, foam coating, U-V Cured coating, powder coating, Rotary screen coating, Hot melt coating, Transfer coating, fusible interlinings
5	**Belts:** Conveyer belts, Physical and mechanical properties, construction of belts, power transmission belts
6	**Hoses:**Construction, manufacturing of different hoses and their uses

7	**Filter fabrics:** Introduction, Dust collection theory and principles, Different filtration processes and textiles used therein. Finishing treatments used to filter, fabric test procedure
8	**Automotive textiles:** Introduction, Major fibres/ fabrics used, textiles used as Seating area, Headliners/ hood fabrics, Side panels, Carpets, Trunks, Door trim, Dash mat.
9	**Seat Belt:** Introduction, requirements, specifications, manufacturing of seat belt.
10	**Airbags:** Introduction, requirements of airbag fibres, fabric types, finishing of airbag fabric, garmenting of airbag.
11	**Tyre cords and fabrics:** Requirements of tyre cords, Textile components in a tyre, Tyre structure and design, cord processing and tyre manufacturing, good cord properties vstyre performance, physical and mechanical property requirements for tyre
12	**Filteration:** Introduction, Principle of filteration, dust collection theory, filterations and textiles, applications, yarn type and fabric construction, finishing treatments, water Purification by some specific fibres. Seperation of oil and water, air-purification.
13	**Film yarn:** Basic polymers required, manufacturing techniques, Their uses in fabrics, twines and ropes and Artificial turf.
14	**Geotextiles:** Introduction, important characteristics of geotextiles, fibres used, types of geotextiles, functions of geotextiles, geotextiles uses in seperation, filteration, drainage, reinforcement, sealing of roads, railway tracks etc.
15	**Sewing threads:** Introduction, apparel sewing threads, industrial sewing threads, structure of industrial thread, spun thread, core-spun thread, twisted multifilament thread, draw-textured thread, mono-cord thread, air-jet textured thread, monofilament thread, thread finishing, thread numbering, sizes of threads and fabrics, general properties of fibres used for sewing threads, threads for automated multi-directional sewing, very high temperature applications, PTFE fibre threads, ultra high modulas polyethylene threads, carbon fibre threads, threads for outdoor applications, thread for airbags, geo-textile

Practical:	
1	Determine the Tensile strength including grab test and strip test of geotextile.
2	Determine the Air-permeability of geotextile.
3	Determine the porosity of non woven/woven fabrics.
4	Determine the water permeability of a geotextile.
5	Determine the compressional and relaxation behaviour of geotextile.
6	Determine the Puncture Resistance of a geotextile.
7	Determine the Shear behaviour of soil using direct shear tester.
8	Determine the inter frictional properties of geotextile with soil.
9	Determine the Transmissivity of geotextile.
10	Determine the Grain size of soil using sieve shaker.
Reference Books:	
1	A. R. Horrocks & S. C. Anand, Handbook of technical textiles, The Textile Institute, Wood Head Publication Ltd., 2007
2	R. Alagiruswami and A. Das, Technical Textile yarns, The Textile Institute, Wood Head Publication Ltd., 2010
3	Geotextiles Handbook by T. S. Ingold & K. S. Miller
4	Wellington Sears Handbook of Industrial Textiles by Sabit Adanur, Technomic Publishing Co. INC, Lancaster, Basel,1995
5	Industrial Applications of Textile by R. S. Goy & J. A. Jenkins, Textile progress, 1970, March, Vol. II No. 1
6	Industrial Applications of Textiles by K. L. Floyd & H. M. Taylor, Textile progress, 1970, Vol.VI, No. 2
7	High performance fibres by P.Bajaj and A. K. Sengupta, The Textile Institute
8	Industrial Applications of Textiles: Textiles for Filtration and Coated Fabrics, P. Bajaj and A. K. Sengupta, The Textile Institute, Textile Progress, Vol 14, No.1
9	Automotive Textiles by S. K. Mukhopadhyay and J. F. Partridge, The Textile Institute, Textile Progress, Vol 29, No. 1/2

TT403: Production Management

(L4-T0-P0): 4 Credits

Course Objectives:

1. To know jobs/functions of Production and Operations Management, PPC & its implemer in textile industry
2. To learn the aspects of TQM, thoughts of quality management scientist and new management concepts like six sigma, five S, Kaizen & supply chain management
3. To study basic concepts of plant layout and material handling
4. To understand concept of productivity and machinery maintenance
5. To understand and use concepts of inventory management
6. To prepare practical production plans for spinning and weaving

Course Outcomes:

1. Perform functions of Production Engineer
2. Apply principles of production planning and control (PPC)
3. Install good layout and material handling system
4. Apply quality management tools and techniques
5. Solve sales forecasting and inventory management related problems
6. Prepare spinning and weaving production plans

Course Contents:

1.	Definitions of Production & Operations Managements, Functions of POM
2.	**Plant layout:** Features, Basic Principles, Costs, Basic Types of Layout, Their Merits and Demerits, Layouts & Buildings Used in Textile Industries
3.	**Material handling:** The Principles, Classification of Material Handling Equipments, Automation, Material Handling Equipments used in Ginning, Spinning, Weaving & Processing
4.	**Quality management:** Quality as a Corporate Strategy, What is Quality?, New Quality Concepts, Quality Circles, Kaizen, Contributions of Deming, Total Quality Management, Roadmap for TQM, Implementation of TQM, Six Sigma, Five 'S'
5.	**Pull Production System**: Justin Time**,** KANBANs, Small lots, transfer batch, Quick setups, SMED, TPS, Production Smoothening, Quality at the source, JIDOKA, ANDONs, Supplier networks. Kaizan, Poka Yoke, Zero defects, Benefits and drawbacks of JIT
6.	**Production planning and control:** Functions of PPC, Application of PPC in Textile Industry, Forecasting Purpose and Methods

7.	**Materials management:** Inventory, Relevant Cost, Economic Order Quantity, The management of supply chains, Distribution, Integration, supply chain and competitive advantage, marketing and logistics interface, principles of logistics costing, lead time management, Information Technology – A supply chain enablers, Suppliers, outsourcing, Measuring supply chain performances. Warehousing, VMI, Role of Internet in Supply chain and Outsourcing related to Textiles (B. P. O.)Theory of Constraints, Maynard's Operations Sequencing Technique (MOST)
8.	**Production planning in spinning and weaving:** Spin Plans for various Counts and Yarns, Production Rates, Waste, Efficiency level of Spinning Machines, Estimation of number of machines for the given production of yarn, Balancing of Machines, Production Rates, Efficiency etc. of Preparatory and Weaving Shed, Estimation of number of machines in Preparatory and Weaving, Preparation of Weaving Plan
9.	**Machinery maintenance:** Methods of machinery maintenance related to Preventive and Breakdown, Machinery Audit
10.	**Mill humidification:** Air Conditioning, Humidification and Ventilation for a Textile Mill, Different Systems of Humidification and their efficiency, Temperature, Relative Humidity and Ventilation requirement for different Sections of a Textile Mill, Dust extraction in Textile Mills, Methods and equipments used in dust extraction
11.	**Safety:** Personal protective equipments, Lighting requirements and fittings, illumination standards and measurements.

Reference Books:

1	Production and Operations Management – IInd Edition by S. N. Chary, published by Tata McGraw Hill
2	Production and Operation Management by N. G. Nair, published by Tata McGraw Hill
3	Production and Operation Management: Manufacturing and Services, VIIIth Edition by Chase, Aquilano and Jacobs, published by Irwin McGraw Hill
4	Operations Management: Strategy and Analysis, Vth Edition by Lee J Krajewski, Ritzman, P. Larry, published by Addison Wesley Publishing Co., Inc.
5	Humidification in Textile Mills, Textile Engineering Tablet II by S. P. Patel, published by ATIRA, Ahmedabad
6	Modern Textile Management by J. B. Rattan, Abhishek Publications, Chandigarh
7	Textile Manufacturing by M. G. Kulkarni

8	Production Planning & Inventory Control, Narasimhan, Mcleavey, Billingten, Prentice Hall of India, Edition 1997.
9	Theory and Problems in Production and Operation Management, Chary S.N., Tata McGraw Hill, Edition 1995.
10	Operations Management, Roberta S. Russell, Bernard W. Taylor III, Wiley India, Edition 2007.
11	Operations Management, Lee J. Krajewski, Larry P. Ritzman, Manoj K. Malhotra, 9/E Prentice Hall, Edition 2009.
12	Production and operation management, Everett E.Adam,Jr. Ronald J. Ebert, Prentice Hall of India, Edition 2008.
13	Production and operation management, Joseph S. Martinich, Wiley India, Edition 2008.
14	Operations Management, William J. V Stevenson, Tata McGraw Hill, Edition 2009.

TT405: Knitting & Nonwovens

(L4-T0-P2): 5 Credits

Course Objectives:

1. To learn the technology of weft and warp knitting.
2. To compare the properties of woven's and knitted fabrics.
3. Representation of knitted structures.
4. To practice knitting on different machines
5. To understand the technology of manufacturing non-woven's.
6. To know the different uses of knitting and non-woven fabrics.

Course Outcomes:

1. Learning knowledge about fabric manufacturing process other than weaving, knitting & nonwoven.
2. Apply knowledge nonwovens & knitted fabrics in end use application of knitting & nonwoven fabrics.
3. Learning different types of knitting & nonwoven machines and their manufacturing.
4. Explore a new idea for making knitted structures.
5. Ability to compare the properties of woven, knitted & nonwoven fabrics.
6. Analyze knitted fabrics from design point of view.

Course Contents:

Knitting	
1.	Introduction, history, growth of knitting industry in India, comparison of weaving & knitting, Classification, comparison between warp & weft knitting
2.	Weft knitting: types of needles, knitting elements, knitting actions, single and double jersey structures, machine, process and structures of plain, rib, interlock & purl knitting
3.	Circular weft knitting machine: creel, drive, tensioners, yarn feeding, stop motion, take up, settings & production calculations
4.	Design & elements: pattern wheel, pegged drum, multiple cam track, Jacquard
5.	Parameters of a knitted fabric, quality aspects, faults in knitted fabrics, products, market, machinery details
6.	Warp knitting: knitting elements, Raschel & Tricot knitting machines & their knitting cycle, principles of loop formation, warp knitted structures, developments in warp knitting, yarn selection, fabric defects, calculations, products, market, machinery details, quality aspects
Non-Wovens	
1.	Introduction, Definition, Basic nonwoven processes, raw material, fibre preparation processes, mixing & blending, Staple fibre web formation processes, carding process

2.	Web stacking processes, parallel-laid, cross-laid, perpendicular-laid, Wet-lay Process, fabric defects, Critical material characteristics and process factors, applications
3.	Web bonding processes, mechanical bonding, details of needle loom, factors affecting fabrics properties, major application of needled fabrics, thermal bonding processes, raw materials, calendar bonding process, critical process parameters, chemical bonding processes, chemical binders, methods of binder application
4.	Polymer-extrusion based technologies, spunbond technology, raw materials, process sequence, production systems, key process factors, applications, meltblown technology, spunbond versus meltblown
5.	Finishing Processes Mechanical finishing Chemical finishing Unconventional finishing
Braiding	
1	Introduction, types, production technology, products, properties & end uses,
Practical:	
1.	Study of different knitting machines like Circular Sinker Bed, Flat Bed hand knitting, V-Bed knitting, socks knitting, Interlock knitting & jacquard knitting machine:
2.	Study of knitting elements, stop motions, Knitting m/c speed, stitch length setting & fabric take-up,
3.	Running of knitting m/c. & problems encountered
4.	Preparation of few knitting samples on the above machines
5.	sample preparation on different machines
6.	Analysis of few knitted samples and reproduction of samples on the respective Machine, calculations
7.	Visit to non-woven industry
8.	Study & preparation of different knit braided structures
Reference Books:	
1.	http://nptel.ac.in/courses/116102014/
2.	Fundamentals &adnaces in knitting technology, S C Ray, Woodhead Publishing Ltd, 2016
3.	Knitting Technology by David J. Spencer – Pergarman Press, Oxford 1993
4.	Knitting Technology by D.B. Ajgoankar, Universal Publishing Corporation, Mumbai.
5.	Advances in Braiding Technology: Specialized Techniques and Applications, Yordan Kyosev, Woodhead Publishing

TT407: Mini Project

(L0-T2-P4): 4 Credits

Course Objectives:

1. To help students to work in a team for a common goal
2. To help students to start to think some research oriented work
3. To help students to find out a research problem
4. To help students to plan and execute literature survey for a definite problem

Course Outcomes:

1. Students should learn to work as an individual & in a team efficiently.
2. Students should learn to design & develop solutions for engineering problems.
3. Students should learn to use research based knowledge and methods for analyzing & synthesis of engineering problems.
4. Students should learn to manage a project by utilizing different tools and knowledge.

Every student will be allotted a project work (in a group) under a supervisor(s) at the beginning of 1st term of Final Year B. Tech. Every group is supposed to finalize the project in consultation with the project supervisor(s). They have to complete the review of literature, plan the experimental work and should start the actual project work in this semester. At the end of the semester, each student (in the group) should present his/her work along with hard bound copy before the panel of examiners as a part of examination. 50% marks will be given by the supervisor and remaining 50% by the other examiners. The evaluation will be done on the basis of completion of the above mentioned activities, presentation and viva-voce performance.

Scheme A: Elective IV (Any One)

Scheme B: Elective IV & V/ V (Any One/ Two)

TT409A: Statistical Process Control in Spinning

(L3-T0-P2): 4 Credits

Course Objectives:

1. Students will learn the fundamentals of Statistics, its application and the use of statistical tools for process control in general.
2. This course will make students learn particularly about the steps, methods and overall controlling of spinning process.
3. After completing this course students will have adequate theoretical and practical knowledge to be able to detect and solve problems (trouble-shooting)encountered during spinning process in a factory

Course Outcomes:

1. Students will learn the fundamentals of Statistics, the use of basic statistical tools for making inferences and its applications.
2. This course will highlight an in-depth and critical analysis of overall controlling of spun yarn manufacturing process.
3. This course will enable students to exercise controls over the process of yarn manufacturing and the quality aspects for spun yarns.
4. This course will enable students to conduct experiments, analyze and evaluate spun yarns.
5. After completing this course along with other prerequisites, students will be competent enough to handle the process of yarn manufacturing of a factory and to detect and solve problems related to it.

Course Contents:

1.	Collection of data, Representation of data, Frequency distribution, Mean and Standard Deviation
2.	Use of standard deviation, Random variable, Normal distribution- fundamental concepts and applications, Central Limit Theorem
3.	Confidence Level and confidence interval, Interval estimation, Hypothesis testing of mean(s), proportion and variances- both small and large samples, Applications in spinning and textiles
4.	Control Charts Importance and Applications
5.	Concept of process control in spinning, Need of it, Steps to implement process control in spinning, Fibre characteristics,
6.	Control of mixing cost and quality-Linear programming method
7.	Control of waste and cleaning in blowroom, carding and comber technological considerations and norms

8.	Snap study and end-breakage study in ring spinning
9.	Control of yarn quality, Causes and control of within and between bobbin variations, Methods of routine checking, Controlling count CV%
10.	Causes and control of yarn strength variation
11.	Causes and control of mass variations and imperfections in yarns, Uster spectrograph and periodic faults and their analysis & Uster diagram-analysis: application in spinning process
12.	Yarn realization and control, Productivity and means to improve it
13.	Yarn faults and package defects
14.	Machinery audit, Machine conditions and yarn quality, Instruments for machinery audit
Practical:	
1.	Prepare a yarn of given count with a given twist multiplier from a given roving hank. Make the necessary arrangements in the ring frame for the required draft and twist.
2.	Prepare another yarn sample of same count and twist multiplier but with only one change in process parameter (say different front top roller pressure or spacer) from a given roving hank. Test the single yarn strength of the above two samples. Take at least 30 readings for each type of yarns. Find the means and standard deviations of the two sets of readings. Perform the significance testing of the mean yarn strengths. Is there any significant difference between the yarn strengths at 5% significance level?
3.	Introduce a periodic fault in any one of the above-mentioned yarns/ Detect a periodic fault from a given yarn. Using Evenness tester, generate the spectrogram of the same yarn and find out the wave length of the fault. Also correlate it from the known source.
4.	Test the yarn CV%s in Evenness tester for the original yarn as well as the yarn with deliberately introduced periodic fault. Take 5 readings for each type of yarns. Find the means and standard deviations of the two sets of readings. Perform the significance testing of the mean yarn mass variation. Is there any significant mass variation between the two yarns at 5% significance level?
5.	Perform the snap study in a ring spinning shed. Find the snap efficiency.
6.	Perform the end-breakage study in a ring spinning shed. Find the end breakage rate.
7.	Find the within and between bobbin variations of yarn samples taken from a ring frame. Give your comments.
Reference Books:	
1.	Statistics for Engineers by Irwin R. Miller, John E. Friend and Richard Johnson, Prentice Hall of India Pvt. Ltd.
2.	Practical Statistics for the Textile Industry: Part I by GAV Leaf, The Textile Institute
3.	Practical Statistics for the Textile Industry: Part II by GAV Leaf, The Textile Institute
4.	Principles of Textile Testing by J. E. Booth, Butterworth Co.
5.	Process Control in Spinning by A. R. Garde and T. A. Subramanium, Ahmedabad Textile Research Association
6.	Handbook of Textile Testing and Quality Control by E. B. Grover and D. S. Hamby, Wiley Eastern Limited
7.	Evenness Testing in Yarn production Part I by R. Furter, The Textile Institute

TT409B: Advances in Finishing

(L3-T0-P2): 4 Credits

Course Objectives: At the beginning of the course, student will understand the concept of:

1. To educate basic knowledge of procedures, machinery & chemistry of different finishing of textile materials.
2. To educate basic science & technology of woolen fabric finishing.
3. To expose different machineries involved for finishing of textiles.

Course Outcomes:

1. Student developed understanding of engineering knowledge in different finishing operation & technology for textile fabrics.
2. Student developed understanding of problem analysis skills in identifying different types of finishes applied in textile & their quality evaluation.
3. Student developed understanding of modern tools & machines required for different finishes application in fabrics.
4. Students developed understanding to work as individual & team work through conducting different individual & group assignment & practical job work.
5. Students developed understanding in effective communication through repeated written and oral test & assignment of the subject

1.	**Finishing of cotton synthetics and blended fabrics:** Raising & Shearing, Sanforizing, Anticrease, Wash & Wear and Durable Press Finish, Perchmentising, Hand building, Softening and Stiffening, Delustering, Optical Whitening, Water repellent, Water Proofing, Flame Proofing finishes, Anti Pilling, Anti-Static and Soil Release Finish, U.V Protection finish, Antimicrobial Finishes, Denim Finishes, BioFinish, Fragrance Finish, Coated textiles.
2.	**Finishing of Woollen/Worsted fabrics:** Setting, Milling and Shrink Proofing of Wool, Mildew Proofing, Rot Proofing & Moth Proofing
3.	**Finishing machinery & developments:** Different kind of finishing machinery such as Drying Machines, Curing Machines, Other recent developments on finishes
Practical:	
1.	Fabric resin treatment
2.	Fabric starch/PVA treatment
3.	Coating of fabric with suitable materials
4.	Carbonisation/Perchmentisation of cotton fabrics
5.	Antipilling treatment of P/C blended fabric
6.	Fabric flame retardant treatment

Reference Books:	
1.	Chemical finishing of Textiles by Prof. Wolfgang D. Schindler & Prof. Peter J. Hauser,Woodhead Publishing Ltd. in association with The Textile Institute, England, 2004
2.	Textile Finishing by R. S. Prayag
3.	Technology of Textile Finishing, Vol. X, by Dr. V. A. Shenai, Sevak Publishers, Mumbai
4.	Chemistry & Technology of Fabric Preparation & Finishing, by Tomasino Charles, North Carolina State University, 1992
5.	Dyeing and Chemical Technology of Textile Fibres by E. R. Trotman

TT409C: Merchandizing & Supply chain mgt.

(L4-T0-P0): 4 Credits

Course Objectives: At the beginning of the course, student will understand the concept of:
1. To elucidate the management of the Garment business
2. To illustrate the fashion marketing and merchandising process.
3. To depict Retailing and Global Sourcing Strategies, Supply Chain and demand chain analysis
4. To make a distinction between principle and supplementary documents.

Course Outcomes: At the end of the course students will be able to
1. Give details of the organization of the Garment business
2. Illustrate the Fashion marketing and merchandising process.
3. Express retailing and Global Sourcing Strategies, Supply Chain and demand chain analysis
4. Decide between principle and supplementary documents.

Course Contents:

1.	Introduction to Garment industry: Apparel supply chain. The Garment manufacturing process- Apparel production process flow, order booking, pre-production meeting, production planning and control, cutting, sewing, finishing, quality control, printing process, embroidery process, sub-contracting work. Various sections of garment division- marketing, designing, merchandising, patternmaking, sampling, fabric & trim store, testing, cutting, sewing, finishing, industrial engineering, maintenance, quality control, account, human resource, electronic data processing.
2.	Promotion: Fashion marketing, size and structure of fashion market, marketing evolution, selling vs marketing, marketing environment, marketing research, marketing objectives and strategies, marketing mix, fashion marketing planning, fashion market sourcing, domestic, export manufacturing, retailers/wholesalers/co-operative, buying agencies/offices, direct exporting.
3.	Merchandising : Definition of Merchandising and role of Merchandiser: Definition and role of merchandiser, Buying indication, Market structure in export markets Design buying influences. Merchandising Plan: Market planning process, merchandising plan, merchandising calendar plan (ladder), Elements in a merchandise line and the planning process, Product Development, CAD for apparel
4.	Merchandising and Range Development: Fashion forecast for Europe and USA, elements of design, Interpretation of forecast for brands in color, silhouette and fabrics. General range development and specific buyer range developments, Colors: International interpretation of colors
5.	Apparel Fabrics: International textile and apparel trade, Global scenario. Technical and design specification to buy fabrics, fabric scouring for export markets, Trims and embellishment scouring
6.	Market Research: Buyer behaviour, apparel brand management, advertising & promotion, Retail management Pricing, Approaches for global markets: Effect on Global Economy Analysis of effect of international production and distribution of textiles and apparel goods on

	the global economy, Cost-plus and backward pricing, Elements of cost plus approach & cost sheet, Merchandise line pricing
7.	Out sourcing: Need, Resource Planning – Global Sourcing Strategies, Supply Chain and demand chain analysis, Supply chain management and its importance. JIT technology, Buying house –Its function and role in garment industry.
8.	Export records: Types of export papers, pre-shipment & post -shipment certification, Terms of sale, payment, shipment etc. Export incentives: Duty drawback, DEPB, I / E license - exchange control regulation – (FEMA) foreign exchange management acts - export management risk - export finance.
Reference Books	
1.	Fashion Buying ,Elain Stone.
2.	Principles of Fashion Merchandising, Sidney Packard
3.	Marketing Management by Philip Kotler. 15th edition Pearson Education. ISBN: 978-9332557185
4.	Cooklin's Garment Technology for Fashion Designers, 2nd Edition by Gerry Cooklin, Steven Hayes, John McLoughlin, Dorothy Fairclough, Blackwell Publications, ISBN: 978-1-4051-9974-2
5.	Garment Manufacturing: Processes, Practices and Technology by Prasanta Sarkar, Online Clothing Study. ISBN: 978-9383701759
	Fashion Buying by Elaine Stone. McGraw-Hill In publication ISBN: 978- 0070617469
	Apparel Merchandising by kumar .Abhishek Publications, ISBN: 978- 8182473010
	Fashion Marketing by Mike Easey .john Wiley & Sons publication. ISBN: 978- 0632034598

TT409D: Smart Textiles

(L4-T0-P0): 4 Credits

Course Objectives:

1. Differentiation between normal textiles and smart textiles
2. Use of heat storage materials for thermal clothing
3. Adoptive and responsive textile structures
4. Membranes for gas and vapor separations
5. Smart textiles for biomedical applications
6. Smart wear for special applications like snow clothing
7. Bioprocessing for smart textiles

Course outcomes:

1. Analyze requirements for smart clothing
2. Characterize materials used for smart textiles
3. Use interdisciplinary knowledge in making of a smart textiles
4. Attempt to design a smart textiles based on the requirements
5. Decide the various finishing process for smart textiles
6. Explore new materials as smart textiles

Course Contents:

1	Introduction: Need of smart textiles, difference between passive, smart and active smart textiles, human aspects, technology aspects, applications
2	Electrically active polymers: Polymer gel as actuators, non ionic polymer gel, applications, electroactive elastomer
3	Thermally sensitive textiles: Basics of heat storage, manufacture of thermally sensitive fibers and clothing by using phase change materials etc, properties
4	Polymeric membranes: PVA and PAAc network, polymers prepared by plasma and radiation grafting, polymers for gas separation
5	Fiber Bragg gratings: Fabrication of grating, mechanical properties of FBG, optical response under various deformations, polymeric optical fibers, integration of optical fibers in textiles, applications
6	Shape memory materials: Polymers and gel, effect of temperature, applications
7	Designing Technology for smart clothing: design process for smart clothing, wearable motherboard manufacture, properties and applications like snow clothing, army uniforms
8	Bioprocessing: drawback in conventional textile processing, enzyme technology, enzymes used for bioprocessing, Bioprocessing of natural fibers like wool, cotton and silk, Bioprocessing of synthetic fibers like polyesters and polyamides
9	Medical textiles: Polymers for biomedical applications, drug release textiles, textile sensors for healthcare, applications for children, patients,
10	Tissue engineering: Ideal scaffold system, scaffold materials, scaffold making, use of embroidery and its applications, nanofibers by electrospinning
11	Standardization for smart clothing technology: Methods, effects of standardization, evaluation for wearable computing

12	Solar textiles: Solar cells, photovoltaic textile construction and applications
13	Plasma technology: Basics of plasma, plasma applications for textile processing and altering surface characteristics
Reference Books:	
1	Smart fibers, fabrics and clothing, Edited by Xiaomiag Tao, The Textile Institute, published by Woodhead publishing Ltd.
2	Textiles for protection Edited by Richard A. Scott, The Textile Institute, published by Woodhead publishing Ltd.
3	Smart clothing technology and applications, Edited by Gilsoo Cho, published by CRC press
4	Intelligent textiles and clothing, Edited by H. R. Mattila, published by Woodhead publishing Ltd.
5	Smart textiles for medicine and healthcare Edited by L. Van Langenhove, published by Woodhead publishing Ltd.
6	Bioprocessing of textiles Edited by C. Vigneswaran M. Ananthasubramanian and P. Kandhavadivu, published by Woodhead publishing Ltd.
7	Medical textiles and biomaterials for healthcare Edited by S. C. Anand, J. F. Kennedy, M. Miraftab and S. Rajendran, published by Woodhead publishing Ltd.
8	Nanofibers and nanotechnology in textiles Edited by P. J. Brown and K. Stevens, published by Woodhead publishing Ltd.
9	Plasma technologies for textile and apparel, Edited by S. K. Nema and P. B. Jhala, published by Woodhead publishing Ltd.
10	Smart textiles and their applications, Edited by Vladan Koncar, published by Woodhead publishing Ltd.
11	Handbook of smart textiles, Edited by Xiaomiag Tao, published by Springer

SEMESTER VIII

TT402: Project – A* (to be carried out in the Institute)

(L0-T2-P12): 8 Credits

Course Objectives:

1. To help students to work in a team for a common goal
2. To help students to start to think some research oriented work
3. To help students to find out a research problem
4. To help students to plan and execute literature survey for a definite problem

Course Outcomes:

1. Students should learn to work as an individual & in a team efficiently.
2. Students should learn to design & develop solutions for engineering problems.
3. Students should learn to use research based knowledge and methods for analyzing & synthesis of engineering problems.
4. Students should learn to manage a project by utilizing different tools and knowledge.

Course Contents:

1	Project A is the continuation of the Mini Project. The project which was undertaken by a group of students should be completed within this semester. Every student (in a group) should present the work before the panel of examiners once internally as mid-term examination and next during the end-term examination and submit hard bound copy of the project report. The weight age of marks for the internal and external examinations will be 50:50. The evaluation of both internal and external examinations will be based on the presentation, viva-voice and actual work done by the student as an individual as well as a group.

TT404: Seminar

(L0-T2-P0): 2 Credits

Course Objectives:

1. To improve the managerial, communication and leadership skills.
2. To give exposure to students about latest technological updates.
3. To prepare for independent and life-long learning in the context of technological change.

Course Outcomes (COs):

1. Students will be efficient in communicating engineering problems.
2. Students should feel confident to work effectively as an individual, and as a leader in diverse teams, and in multidisciplinary settings.
3. Students will learn to review the literature of latest issues and prepare a report for presentation.

Course Contents	
1	Seminar should be based on the literature survey on any topic relevant to textile technology. Each student has to prepare a write up of about 20 pages of "A4" size sheets and submit it in duplicate as the term work. The student has to deliver a seminar talk in front of the faculty members of the department during mid semester & end term. The faculty members based on the quality of the work and preparation and understanding of the candidate, shall do an assessment of the seminar internally – jointly.

TT406: In-Plant Training

(L0-T0-P4): 2 Credits

Course Objectives:

1. To give a exposure to students about technological & managerial aspects
2. To enhance the analytical and logical skills based on basic textile engineering knowledge
3. To improve the managerial, communication and leadership skills.
4. To prepare the mindset of the students to work in the industry

Course Outcomes (COs):

1. Students will be efficient in communicating engineering problems.
2. Students will be able to correlate theory with practice
3. Students will be able to experiment with machines and process parameters.
4. Students will be gradually feel confident to handle the actual real life factory problems.

Course Contents	
1	**Industrial Training:** Every student need to take 2 weeks industrial training after Fifth Semester & before eighth Semester compulsorily. They need to present two to three seminars & submit bound copy of training report at the end of the eighth semester for the evaluation.

Elective – V

TT408A: Process Control in Weaving

(L3-T0-P2): 4 Credits

Course objectives:

1. To provide a complete knowledge on entire weaving preparatory and weaving process.
2. Motivate the students to learn about the actual industrial methods and control systems of weaving process.
3. To encounter a real problem with sufficient theoretical knowledge.

Course outcomes:

1. Student will able to apply knowledge to control weaving process.
2. Student will able to perform quality control studies independently.
3. Student will able to identify, formulate and solve process problems.
4. Student will able to use tools necessary for textile manufacturing practices.

Course Contents:

1.	**General:** Scopes of process control, approach to process control, setting norms and schedule of checks, machinery audit
2.	**Winding:** Scopes, approach, types and quality of knot, splicing, package faults and its causes, efficient removal of yarn faults, clearing efficiency, optimum clearing, knot factor, yarn clearer and settings, tension variations causes & remedies, control of tension in automatic winders, antipatterning devices, conditions of uniform build of a package, winding parameters & their effect on yarn quality, recording of yarn breaks in winding, approach to control of productivity, spindle allocation, production and efficiency calculations, production records, hard waste in winding & its resources
3.	**Warping:** Approach to process control, minimize end breaks in warping, uniformity of yarn tension across the warp sheet, quality of warping beam, control of productivity, production and efficiency calculations, control of hard waste
4.	**Sizing:** Scope, approach to process control, preparation of standard recipe, control of size pickup, control of yarn stretch, control of moisture in sized beam, quality of sized beam, improved fiber laying, devices for improving weavability, control of productivity, production and efficiency calculations, dead- loss and its calculations, control of waste in sizing

5.	**Weft winding:** Minimizing end breaks, productivity, hard waste, production calculations
6.	**Loom shed:** Scopes, control of loom speed, control of loom efficiency, factors affecting loom efficiency, stops due to end breaks & their control, Stops due to weft breaks, end breakage study, snap study, productions calculations, control of waste in weaving
7.	**Fabric defects:** Grading of fabrics, value loss, various fabric defects & their causes and control
8.	**Management of loom shed:** organization in weaving department, duties of weaver, shift Incharge, optimum loom assignment
9.	**Some Special weaving processes:** Introduction, properties of PC yarn, control of PC blend yarn starting from winding to weaving, conditioning of yarn
Practical:	
1.	Measurement of winding tension on different winding machine
2.	Warp breakage study on winding machine
3.	Calculation of the machine efficiency and operative efficiency of a given winding machine
4.	Warp breakage study on warping machine
5.	Calculation of machine efficiency and operative efficiency on warping machine
6.	Preparation of a good quality pirn with different package characteristics
7.	Study of end breaks and stops in loomshed
8.	Snap study for determination of loom efficiency
9.	Preparation of a project report of a loomshed
Reference Books:	
1.	Process Control in Weaving by ATIRA
2.	BTRA Monograph series in Warping Winding & Sizing, Bombay Textile Research Association, Edited by S. M. Betrabet, 1986
3.	Weaving machines, mechanisms, management by M. K. Talukdar, P. K. Sriramulu and D. B. Ajgaonkar

TT408B: Technical Textiles-II

(L4-T0-P0): 4 Credits

Course Objectives:

1. To develop core knowledge of technical textiles to serve industry.
2. Develop research attitudes for innovation activities.
3. Develop skills in interdisciplinary areas.
4. Develop a lifelong learning attitude
5. Design of unconventional things which can help the society as per needs.

Course Outcomes:

1. Fundamental of science of Technical Textiles.
2. The subject requires collection of information from journals, net and understands the complex problem deeply to design different protective clothing such as EMI protective clothing, radiation protective clothing and other mechanical protective clothing..
3. Design of different Technical Textiles such as flame retardant fabrics, chemical protective clothing, sports textiles, medical textiles.
4. Application of Technical Textile and safety of human life & society using mechanical protective clothing, bullet proof cloth for military uses etc.
5. Designing of water proof breathable cloth considers the comfort property of human being and make individual students to be a professional engg. In his/her field.

Course Contents:

1	**Heat and flame protection:** Introduction, What constitutes flammability? Thermal behavior of fibres, Different high temperature fibres including inorganic fibres like Ceramic, Basalt and Glass fibre. Fire protection, general considerations, LOI, Flame resistance fibres and fabrics in detail, fire retardant finishes for cellulose, polyester, wool and their blends. Fire fighter's protective clothing, Military flame-retardant, heat protective textiles, military flame and heat threat, criteria for protection of individual, toxic fumes and smoke, thermoplastic melt hazard, flame retardant textiles in military use.
2	**Chemical protective clothing:** Introduction, what is chemical hazards? Different types of protective materials,components of chemical protective garments, levels of protection, chemical protective clothing materials, protection from liquid, toxic fumes and gases, Performance evaluation of chemical protective clothing, chemical, biological and radiation hazards and their prevention.
3	**Mechanical protective clothing:** Introduction, materials used, gloves, chain saw clothing, electrostatic protection, clean room textiles, radiation protection, protection from cold, High visibility textiles, metalized fabrics, Physical requirements for military textiles, underwear materials, thermal insulation, water vapour permeable/waterproof materials, military combat clothing systems, camouflage concealment and deception, ultraviolet wave band, visible waveband, visual decoys, Near

	infrared camouflage, dyes for NIR camouflage, Far infrared wave band and design of military equipments/vehicle for the same, Bullet proof fabrics principles, mechanics of ballistic impact, textile materials for ballistic protection, design of ballistic vests and helmets, ballistic testing and evaluation, Clean room fabric, radiation protection, Protective clothing for space.
4	**Medical textiles:** Introduction, textile materials used-category wise, fibre used, wound care, bandages, extracorporeal devices, implantable materials, sutures, soft tissue implants, orthopaedic implants, cardiovascular implants, healthcare and hygiene products.
5	**Textiles in sports:** Introduction, Current sportswear market, key trends in sportswear design, fibres and fabrics, technical sportswear for women, trends, styles, fashion, garment development, the design development process, functional need of the end-user, emerging trends, commercial reality, biomimicry, environmental issues, application in performance sportswear
6	**Sports footwear:** Functional design of sportswear, functional fit of sport footwear, biomechanics of the foot, functional materials and components in sport footwear
7	**Comfort properties of textiles:** What are waterproof breathable fabrics? Types of W.P.B fabrics, coatings, biomimetics, assessment techniques, performance of water proof breathable fabrics.
Reference Books:	
1	A. R. Horrocks& S. C. Anand, Handbook of technical textiles, The Textile Institute, Wood Head Publication Ltd., 2007
2	R. Alagiruswami and A. Das, Technical Textile yarns, The Textile Institute, Wood Head Publication Ltd., 2010
3	Handbook of Industrial Textiles by SabitAdanur, Technomic Publishing Co. INC, Wellington Sears Lancaster, Basel,1995
4	Industrial Applications of Textile by R. S. Goy & J. A. Jenkins, Textile progress , 1970, March Vol. II No.1
5	Industrial Applications of Textiles by K. L. Floyd & H. M. Taylor, Textile progress, 1970, Vol.VI, No.2
6	High performance fibres by P. Bajaj and A. K. Sengupta, The Textile Institute
7	Textiles in sports by R. Shishoo, Wood Head Publication, The Textile Institute, 2005

TT408C: Information Technology

(L4-T0-P0): 4 Credits

Course Objectives:

1. To prepare students to be part of team that imagine, specify, design, justify, build, implement, manage and use information systems.
2. To educate students use of information technology, including hardware, software, and telecommunications, as a conduit for the value-added information content of formal organizational systems.

Course Outcomes:

1. Students should learn to use information systems to design & implement engineering solutions.
2. Students should learn to use IT in the textile industry to improve efficiency & productivity.
3. Students should learn to manage a project by utilizing IT tools and knowledge.

Course Contents:	
1	**Introduction to IT System:** Information concepts, System and modeling concept, What is an information system? Business information system, System developments, Why study information systems?
2	**Information system in organisations:** Organisation and information system. Competitive advantage, Performance based information system Errors in information system.
3	**Hardware Input Processing and Output Devises** : Computer systems, Integrating the power of tech., Processing and memory devices, Power speed and capacity, Secondary storage, Input output devices, The gate way to computer system, Computer system types, Standards, selecting and upgrading.
4	**System Software and Application Software**: An overview of software, System software, Application software. Programming languages, Software issues and trends.
5	**Organising Data and Informations :** Data management, Data modeling and data base, models. Database management systems, database development.
6	**Telecommunications and Networks:** An overview of communication system. Telecommunication, Network and distribution processing. Telecommunication applications.
7	**The Internet Intranet and Extra net**: Use and functioning of internet. Internet services, The world wide web, Intranet and extranet, Net issues.
8	**Electronic Commerce :** An introduction to electronic commerce, E commerce applications, Technology infrastructure, Electronic payment systems, Threats to E commerce, Strategies to successful e-commerce.
Reference Books :	
1	Principles of Information systems (Fifth ed.)- By Ralph M. Stair, George W. Reynolds. Cengage Learning, 13 Ed. (TEXTBOOK)
2	Electronic Commerce, By – Laudon and Traver
3	Data and Computer Communications By – Behrouz A Forouzan, TMH, India

TT408D: Indian Textile & Clothing Industry

(L4-T0-P0): 4 Credits

Course Objective: At the beginning of the course, student will understand the concept of:

1. Concept of Structure of Textiles and Clothing Industries
2. Understanding about raw material, production and import & export of the material
3. Information about machines and their manufacturers
4. Concept of Industrial Relations, and labour laws
5. Concept of different schemes & investments

Course Outcomes: At end of the course, student will be able to:

1. Study Structure and SWOT analysis of Indian textile industry
2. Updating knowledge related to machine manufactures, raw material, production, import & export
3. Write Concept of Industrial Relations, and Labour laws
4. Apply Concepts of related to schemes & policies

Course Contents:

1	**The Structure of Textiles and Clothing Industries,** mill sector, spinning sector, weaving sector, made-ups, processing activity, knitted and crocheted products, technical textile, embroidery work, manufacture of wearing apparel, textile machine manufacturers, synthetic industry, wool, silk, jute, power loom, handloom
2	**Raw material production:** natural and synthetic fibres, yarn, fabrics, made ups, varieties, cost, availability,
3	**Production of textiles & clothing in industry sector:** production trends in all sectors, installed capacity, capacity utilization
4	**Machine manufacturing:** machine manufactures for above activities in India & abroad, cost and technical machine details, technological trends and latest developments,
5	**Exports and Import of Textiles and Clothing** exports and import of fibre, yarn, fabric, garments, made up, technical textiles from India to the rest of the world, import of all above products by India from world, trends in import & export
6	**Domestic Demand Pattern of Textiles and Clothing:** trends in consumption, expenditure and price, retailing, value chain analysis
7	**Schemes & investments:** investment pattern, foreign direct investment, different government policies, SWOT analysis of India's textile & clothing industry, Textiles Research Associations (TRAs), educational institutes, job opportunities in government & private sector
8	**Industrial relations &labour laws:** Definitions & objectives of industrial relation, charge procedure, punishment & appeal, collective bargaining, employee grievances -nature, grievance handling procedure, workers participation in management, Industrial Disputes Act 1947, The Factories Act 1948,The Wages Act 1956, The Minimum Wages Act 1948, Workmen's Compensation Act 1923, The Gratuity Act 1972

References Books	
1	Bedi, D. S. (2009), "Assessing the Prospectus of India's Textile and Clothing Sector", Ministry of Textiles, Government of India, available at: http://texmin.nic.in
2	Ministry of Textiles, Annual Reports, Government of India, available at: http:// texmin.nic.in
3	Compendium of Schemes, Ministry Of Textiles, Government Of India, http:// texmin.nic.inz
4	Labour& Industrial Law by S. K. Mishra
6	Industrial & Business Management by Martand T. Telsang

Structure - B

TT410: Project – B* (to be carried out in the identified Industry / R & D Organization)
12 Credits

Course Objectives:

1. To help students to work in a team for a common goal
2. To help students to start to think some research oriented work
3. To help students to find out a research problem
4. To help students to plan and execute literature survey for a definite problem

Course Outcomes:

1. Students should learn to work as an individual & in a team efficiently.
2. Students should learn to design & develop solutions for engineering problems.
3. Students should learn to use research based knowledge and methods for analyzing & synthesis of engineering problems.
4. Students should learn to manage a project by utilizing different tools and knowledge.

Course Contents:

1	**Project B** is totally industry oriented online practical problem based project. The project which is undertaken by single/group of students, should be completed within this semester. Student(s) should suggest one senior officer of Industry/R&D Lab, willing to guide & monitor progress of the undertaken project . Concerned officer will be officially appointed by our Institute as online (External Guide) along with one appointed faculty(Internal Guide) from the parent department. Every student (in a group) should present the work before the panel of examiners once internally as mid-term examination and next during the end-term examination and submit hard bound copy of the project report. The weight age of marks for the internal and external examinations will be 50:50. The evaluation of both internal and external examinations will be based on the presentation, viva-voice and actual work done by the student as an individual as well as a group.

TT406: In-Plant Training Evaluation

(L0-T0-P4) 2 Credits

Course Objectives:

1. To give a exposure to students about technological & managerial aspects
2. To enhance the analytical and logical skills based on basic textile engineering knowledge
3. To improve the managerial, communication and leadership skills.
4. To prepare the mindset of the students to work in the industry

Course Outcomes (COs):

1. Students will be efficient in communicating engineering problems.
2. Students will be able to correlate theory with practice
3. Students will be able to experiment with machines and process parameters.
4. Students will be gradually feel confident to handle the actual real life factory problems.

Course Contents	
1	**Industrial Training:** Every student need to take 2 weeks industrial training after Fifth Semester & before eighth Semester compulsorily. They need to present one seminars & submit bound copy of training report at the end of the eighth semester for the evaluation.

TT 412 : Case Study
(L--T—P 04): 02 Credits

Course Objectives:

1. To improve the managerial, communication and leadership skills.
2. To give exposure to students about latest technological updates.
3. To prepare for independent and life-long learning in the context of technological change.

Course Outcomes (COs):

1. Students should experience investigations for real problems using research-based tools & knowledge.
2. Students will understand the impact of the professional engineering solutions in societal and environmental contexts.

Course Contents	
1	Case Study should be based on the topics relevant to textile technology in the field of fiber, yarn, fabric, garment technology and management related to area of their convenience. Product development, trouble suiting problems, best practices of the organization can be studied as a case study. The case study shall be framed in consultation with subject co-coordinator & industry expert and finally take the approval from the department. Each student has to prepare a write up 25-30 pages on "A4" size sheets and submit it in duplicate as the term work. The faculty members based on the quality of the work and preparation and understanding of the candidate, shall do an assessment of the case study internally – jointly.