Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Textile Technology (TT)
(Applicable from the academic session 2018-2019)

Semester-VI

Yarn Formation III (PC TT 601)

Name of the Course:	**Yarn Formation III**
Category :	**Professional Core Courses**
Course Code: PC TT 601	**Semester: VI**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester Exam.: 15 Marks
Tutorial: Nil	Assignment & Quiz: 10 (8+2) Marks
	Attendance: 5 Marks
Practical: hr./week	End Semester Exam.: 70 Marks
Credit Points: 3	

Course Objective:	
1	To impart knowledge of yarn doubling operation specific to different practical based problem.
2	To learn various category of unconventional yarn formation technology and to impart knowledge of various principles of these processes and working of related machineries along with technical specifications and end-uses.
3	To provide knowledge of various principles, mechanisms and technology involved for market dominant unconventional yarn formation processes (Open-end Rotor Spinning, Friction spinning and Air-jet Spinning) and respective machineries.
4	To learn the mathematical problem associated with day to day operations for various unconventional yarn formation technology
5	To provide overview of fancy, textured yarns & sewing threads and their manufacturing processes.
Pre-Requisite:	
1	PC TT 302 and PC TT 501

2	
3	

End Semester Examinations Scheme. Maximum Marks – 70. Time allotted – 3 hrs.

Groups	Units	Objective Questions (MCQ only with one correct answer)		Subjective Questions			
		No. of questions to be set	Total marks	No. of questions to be set	To answer`	Marks per question	Total marks
A	1 to 7	10	10				
B	1 to 7			6	3	5	15
C	1 to 7			6	3	15	45

- **Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.**
- **Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.**

Unit	Content	Hrs/Unit	Marks/Unit
1	**Technology of Yarn Doubling or Folding (Ply Twisting):** Aim and significance of Yarn Doubling; Twist balancing during ply twisting; Methodology of Yarn Doubling ; Ring-doubling technology and its limitations; emergence of Two-for One Twister (TFO) and its basic concept, Material flow inside a TFO, design and constructional features of TFO; Production and Twist calculation, Modern development. Application of yarn doubling in Sewing threads manufacturing Process.	3	4-6
2	**Introduction to Unconventional Spinning Technology:** Limitation of Conventional Ring Spinning; Emergence of	2	3-5

	unconventional yarn formation technologies – summary and classifications; Prospects and possibilities of uses of various unconventional spinning systems and their techno-economic feasibilities; Recent trends in unconventional spinning technologies; updates in modern technologies in yarn formation.		
3	**Open end Spinning Technology with detailing of Rotor Spinning:** (I) Introductory concept and principle of open end yarn formation process; Operating principles of various kinds of open-end spinning technologies (Such as rotor, friction, air-vortex, electrostatic, disc etc.) and their comparison; Advantages and Disadvantages of Open-end spinning. (II) Overview of Open-end Rotor Spinning technologies with preparatory requirements of raw materials and processes; Objectives, Task, and Material flow of rotor spinning machine; Design and constructional aspects of the Rotor Spinning machine along with in-depth study of machine elements such as Feed zone, Opening zone, transportation zone, yarn forming zone and withdrawal zone. Technological aspects of Rotor yarn formation in different zones such as fibre separation, fibre-flow speed, fibre transportation, Fibre deposition and back-doubling, formation of coherent fibre-ring, fibre twisting with false twist effect, wrapper fibres, Direction of withdrawal, winding requirements and packages etc. Rotor Specifications, Drive and Power consumption. Calculation related to production, twist, fibre speed, back-doubling etc. Rotor Yarn structural characteristics and properties alongwith comparison with Ring Spinning. Automation and Future scope of development;	12	22-28
4	**Friction Spinning Technology:**	8	8-12

	Introduction and classification of Friction spinning in terms of technology used such as Open-end and wrap-spun (False-twisted). Objectives and tasks of each class of friction spinning systems; Requirements of raw materials and preparatory processes, Evolution of Master-spinners, DREF spinning versions such as DREF-I, DREF-II, DREF-III, DREF-5, DREF-2000, DREF-3000 and DREF-5000 etc. and their operating principles; Technological aspects in brief such as influence of total draft, opening roller speed, delivery speed, Parameters of twisting drum and raw material properties on quality of friction spun yarn. Yarn characteristics of different classes of Friction spinning. Latest Developments of Friction spinning and their techno-commercial feasibilities. Yarn Application areas.		
5	**Air-Jet Spinning Technology:** Introductory concept of Air-jet spinning and its evolution; Operating principles of MJS, MTS and MVS; Mechanism of twisting and yarn formation; Requirements of raw materials and preparatory processes , Technological aspects in relation to draft, nozzle number and pressure, take-up ratio, delivery speed and raw material properties influencing yarn quality; Yarn structure and characteristics ; Techno-economics, development trends and end-uses.	8	8-12
6	**Other Less popular Unconventional Spinning Technologies:** (A) Self-twist Spinning – Principle of self-twisting; Yarn formation mechanism with importance phase shifting; Operating principle of REPCO Spinning; Yarn structure and properties, End-uses. (B) Wrap Spinning – Concept of wrap spun yarn manufacturing by Hollow Spindle spinning; Working principles, structure-	6	7-9

	property and end-uses. (C) Twist-less Spinning – Limitations of various twisted spinning and emergence of Twist-less spinning; Classification based on fibre adhesion; brief processes of different twist-less yarn preparation techniques such as Twilo, Pavena, Tek-ja, Bobtex etc. Yarn Structure and property; Pros and cons of processes and end-uses.		
7	**Overview on Fancy/Novelty yarn and Textured yarn manufacturing Processes :** Fancy/Novelty yarns and its Classification; A brief Concept of Mono-Fancy Yarns and Ply-based Fancy yarns and their profiles, basic production principles in various spinning methods such as ring, rotor, hollow-spindle spinning as well as fancy doubling method etc.; Application potential of mélange yarns in garments Textured yarns – basic concept and its classification; Different texturing methods such as false twist texturing, air-jet texturing etc. and their brief working principles; Comparative properties different textured yarns; Objectives and different methods of producing bulk yarns Principles of manufacturing high bulk yarn; Testing of textured yarns and their application areas.	6	7-9
	Total	45	100

Text and reference books:

1. 'New Spinning System' by W. Klein, *The Textile Institute Publication, Manual of Cotton Spinning, Short Staple Spinning Series (volume-5);*
2. 'Fundamentals of spun yarn technology' – Edited by Carl A. Lawrence; CRC Press, USA, 2003.
3. 'Advances in yarn spinning technology' – Edited by Carl A. Lawrence; The Woodhead Publishing Ltd. 2010.
4. Hand Book of Yarn Production by P. R. Lord;
5. Open End Spinning by R Nield;
6. 'Textile Yarns, Technology, Structure and Applications by Martinedale, Goswami & Scardino, Wiley Interscience publication, 1977,
7. 'Spun Yarn Technology' by Eric Oxtoby,
8. 'Open End Spinning' by Rohlena*;*
9. Fancy Yarns - Their Manufacture and Applications, Woodhead Publishing Limited Cambridge England 1st edition 2002
10. "Production of Synthetic Fibres" by Vaidya A A., 1st edition, Prentice Hall of India, New Delhi, 1988.
11. Air jet spinning – Textile Progress, Textile Institute Publication;
12. "Modern Yarn Production". By G R Wray.

Course Outcome:

At the end of the semester under this course, students should be able to

1. Summarize the basics of yarn doubling technologies and demonstrate its principle of operations. (Understanding)
2. Classify, compare and categorize various unconventional spinning technologies. (Understanding + Analyzing)
3. Illustrate basic principles and yarn forming mechanisms of market dominant unconventional spinning technologies such as Rotor, Air-jet and Friction spinning systems. (Applying)

4. Explain the basic know-how of Self-twist, Wrap and Twist-less spinning. (Understanding)
5. Solve important mathematical problems and deduce scientific theories of unconventional spinning technologies in relation to rotor/friction/air-jet/self-twist yarn production. (Applying + Analyzing))
6. Identify diversified forms of novelty yarns and their basic preparation principles and manufacturing technologies of textured yarns. (Knowledge/Remembering)

Special Remarks (If any):

Demonstration of machine may be needed

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Fabric Manufacturing III (PC TT 602)

Name of the Course:	**Fabric Manufacturing III**
Course Code: PC TT 602	**Semester: VI**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester Exam.: 15 Marks
Tutorial: Nil	Assignment & Quiz: =10(=8+2) Marks
	Attendance: 5 Marks
Practical: hr./week	End Semester Exam.: 70 Marks
Credit Points: 3	

Objective:	
1	Impart theoretical knowledge of woven fabric formation in shuttle less and multiphase loom.
2	Impart theoretical knowledge of knitted fabric formation.
3	Impart theoretical knowledge of nonwoven fabric formation.
Pre-Requisite:	
1	PC TT 401 and PC TT 502
2	
3	

End Semester Examinations Scheme. Maximum Marks – 70. Time allotted – 3 hrs.

Groups	**Units**	**Objective Questions (MCQ only with one correct answer)**		**Subjective Questions**			
		No. of questions to be set	**Total marks**	**No. of questions to be set**	**To answer`**	**Marks per question**	**Total marks**
A	**1 to 8**	**10**	**10**				

B	**1 to 8**			**6**	**3**	**5**	**15**
C	**1 to 8**			**6**	**3**	**15**	**45**

- **Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.**
- **Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.**

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction** Introduction to shuttleless looms. Principles of weft insertion, various picking elements.	1	5
2	**Projectile Loom** Working elements and weft insertion cycle in projectile loom-Torsion bar picking mechanism, power of picking, velocity and acceleration and energy consumed. Weft selection device, Loom timing diagram. Drive to sley and healds. Match Cam Beatup mechanism.	5	12
3	**Rapier Loom** Classification of rapier weaving machines: Flexible, Rigid rapiers; Single and double rapier. Negative and positive transfer in rapier. - Principles of tip and loop transfer-Weft insertion cycle- Rapier drives-Salient features.Power of picking, velocity and acceleration and energy consumed, timings, drive to sley and healds.Rapier heads for tip transfer and loop transfer. Function of ribbed guides.	5	12
4	**Jet Loom**	5	12

	• Air jet principle – Principle of air jet Weft insertion, types of nozzles, profile reed, Confuser guide, tendum nozzle. Air requirements. Loom timing diagram. Jetting sequence of relay nozzle. • Water jet principle – Weft insertion system – Nozzles and its design- Water requirements – Loom timing diagram		
5	Relative merits of the various weft insertion systems. Modifications required in the various shuttleless loom for filament yarns. Weft insertion rate and production calculation of various shuttleless loom. Various selvedges formation in shuttleless loom. Weft yarn accumulator (both rotary and loop storage types). Brief concept of stepper motor beatup meachism. Weft selection mechanism in multi-colour weft assemble. Fabric defects and remedies.	5	9
6	**Multiphase Loom** Introduction to multiphase weaving machine – Warp and weft direction shed wave principle. Principle and operation of circular weaving machines – sectional weaving machine. 3 D Weaving – Principle of Dual directional shedding: Linear-Linear, Linear-angular method.	5	10
7	**Introduction to Knitting** Definition of knitting. Concept of warp and weft knitting.	14	30

	Classification of weft knitting. Different knitting needles, its functions and different parts. Circular and flat-bed knitting machines: motion transmission, yarn path, fabrics formation. Role and function of sinker in knitting. Fundamental of knit, tuck and float stitches formation and loop formation sequence. Basic knitted structures and their production i.e. plain, rib, interlock, purl and their structure with notational represent, graphical represent and corresponding cam profiles. Concept of single track and multi-track cam assembly: design, needle set-out and cam set-out in multi-track cam. Different knitted design structure such as full cardigan, Half cardigan, double Pique, Milano rib, Swiss Pique, French pique, Pontedi roma, etc. Fabric GSM calculation; production calculation in circular knitting machine.		
8	**Introduction to Nonwoven** Definition as per INDA and EDANA, Fibres used in nonwovens. Comparison of woven, knitted and nonwoven structures- merits and demerits. Classification nonwoven based on route of formation, web laying and web bonding systems. • Web Laying Dry laid web , Air laid web formation, Wet-laid web formation • Bonding techniques Mechanical Bonding: Stitch bonding, Needle Punching: Hydro entanglements. Thermal Bonding, Chemical Bonding	5	10

	• Polymer to Nonwoven Spun bonding and Melt blown process: raw material		
	Total	45	100

Text and reference books:

1. Handbook of Weaving : Adanur Sabit.
2. Weaving Technology and Operations : A Ormerod and W S Sondhelm.
3. Principles of weaving: R Mark and T C Robinson
4. Weaving machine, mechanism and management: M K Talukdar and others
5. D.B. Ajgaonkar, "Knitting Technology", Universal Publication Corporation, Mumbai,1998.
6. P.K. Bannerjee, "Principle of fabric Formation", CRC Press Publication, Boca Raton,2015.
7. S.C. Ray, "Fundamentals and Advances in knitting Technology", Woodhead Publishing India Pvt. Ltd., New Delhi, 2012.
8. David J Spencer," Knitting Technology" Woodhead PublishingLimited,Cambridge, England.,2001.

Course Outcome:

After successful completion of this course, the students should be able to

1. Describe the functions of various components of shuttleless weaving machines
2. Describe weft insertion cycle of various shuttleless weaving machines
3. Explain the mechanism of multiphase weaving and 3-D weaving
4. Summerise the working principle of weft knitting machineries
5. Understand mechanism of different knitted loop formation
6. Interpretation knitted fabric design
7. Discuss the concept and mechanism of formation of nonwoven fabric

Special Remarks (If any): NIL

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Yarn Formation & Fabric Manufacturing Lab (PC TT 691)

Name of the Course:	**Yarn Formation & Fabric Manufacturing Lab**
Course Code: PC TT 691	**Semester: VI**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: /week	**Continuous Internal Assessment:**
Tutorial: Nil	**External Assessment: 60**
Practical: 3 hr./week	**Distribution of marks: 40**
Credit Points: 1.5	

Course Outcomes: After successful completion of this course, the students should be able to

1	Compare the working of TFO Twister and Fancy doubling machine. (Understanding)
2	Identify machine components, forms of the materials, processes involved in technological processes of Unconventional spinning viz. Rotor spinning and/or Friction (DREF-II/III) spinning and/or Air-jet spinning and prepare flowchart in relation to material flow processing of above spinning system. (Knowledge + Applying)
3	Apply the know-how of theory of machines to study driving arrangement of Rotor and/or Friction and/or Air-jet spinning machine and calculate process and machine variables and production of the associated machines. (Applying + Analyzing)
4	Summarize the working principle of each element in unconventional weaving machines.
5	Illustrate the weft insertion cycle of different types of shuttle less looms
6	Calculate the WIR and production rate of the high speed weaving machines
7	Identify the different types of Nonwoven
8	Construct Stitches using various knitting machine
9	Identify the importance of various component of knitting machine

Pre-Requisite:

1	PC TT 392, PC TT 591
2	PC TT 491, PC TT 592

Practical:	
	1) Intellectual skills- 40%
	2) Motor skill- 60%

Laboratory Experiment:	
Yarn Formation Module	1. Study and sketch the working mechanism of a TFO yarn doubling machine with respect to flow of material, machine components and their dimensions, driving arrangement, special features etc.
	2. Determine the speed of various components such as Spindle, winding drum etc with the help of suitable gearing diagram and calculate its production
	3. Study and sketch the working mechanism of an open-end rotor spinning machine by identifying its different zone (such as Feeding, Opening, Fibre transportation, yarn formation inside Rotor, Yarn take-off and delivery etc.) with respect to flow of material, machine components and their dimensions, driving arrangement, features etc.
	4. Study the effect of rotor diameters of O.E. rotor spinning machine on rotor yarn production and its properties.
	5. Determination of speeds of various machine components of rotor spinning frame from its driving arrangement.
	6. Estimation of twist loss as well as minimum twist required to spin yarn continuously in a rotor spinning machine
	7. Studies on twist-strength relationship of rotor spun yarn.
	8. Zone wise study of Friction spinning machine (DREF-II/DREF-III etc.) by identifying its different zones (such as Feeding, Opening, Fibre transportation, yarn formation, Yarn take-off and delivery etc.) with respect to flow of material, machine components and their dimensions, tasks, driving arrangement, features etc.

	9. The working mechanism of Friction spinning machine (DREF-II/DREF-III etc.) to produce open-end/core-sheath friction spun yarn
	10. Study and sketch the working mechanism of Air-jet Spinning Machine together with its general study of machine elements, driving system etc.
	11. General Study of Fancy doubling machines to explore its potentiality for making various Ply based novelty yarns.
Fabric Manufacturing Module	1. Studyofweftreplenishmentmechanismanditstimingwithrespecttocranksh aftinautomaticloom.
	2. Study of driving system of a Rapier loom
	3. Study of weft insertion and transfer in Rapier loom
	4. Study of weft selection mechanism in a Rapier loom
	5. Study of torsion bar mechanism in projectile loom.
	6. Study of Weft insertion mechanism and Crank beat-up in projectile loom.
	7. Study the Weft transfer mechanism in Airjet loom
	8. Study of selvedge formation mechanism on a shuttleless loom
	9. Study of non-woven fabric formation (any type).
	10. Study of Flat bed and Circular knitting machine.
	11. Study and understand the loop formation sequence in weft knitting.
	12. Study the yarn path and fabric tech-up mechanism in flat bed knitting.
	13. Study the yarn path, yarn tension and fabric takeup in circular knitting.
	14. Observe and understand the gearing arrangement in circular knitting.
	15. Study and understand the needle set out and cam set out in multi track circular knitting machine.
	16. Study of Single Jersey circular knitting machine
The above list is not exhaustive. Additional laboratory work or experiments can be planned to consolidate the theoretical work and to emphasise the activities for doing rather than the knowing.	

Text and reference books:

1. Handbook of Weaving : Adanur Sabit.
2. Weaving Technology and Operations : A Ormerod and W S Sondhelm.
3. Principles of weaving: R Mark and T C Robinson
4. Weaving machine, mechanism and management: M K Talukdar.
5. D.B. Ajgaonkar, "Knitting Technology", Universal Publication Corporation, Mumbai, 1998.
6. P.K. Bannerjee, “Principle of fabric Formation”, CRC Press Publication, Boca Raton,2 015.
7. S.C. Ray, “Fundamentals and Advances in knitting Technology”, Woodhead Publishing India Pvt. Ltd., New Delhi, 2012.
8. David J Spencer,” Knitting Technology” Wood head Publishing Limited, Cambridge, England., 2001.
9. W. Klein, New Spinning System, ManualofTextile Technology–Vol-5, by The Textile Institute, Manchester ,UK.
10. Martinedale, Goswami & ScardinoTextileYarns,Technology, Structure and Applications, Wiley Interscience publication, 1977, U.S.A.
11. Eric Oxtoby, Spun Yarn Production, Butterworths London
12. Carl A. Lawrence “Fundamentals of Spun Yarn Technology” CRC Press USA 2003.
13. R H Gong and R M Wright, Fancy Yarns- Their Manufacture and Applications, Woodhead PublishingLimitedCambridgeEngland1st edition2002

Special Remarks (If any):

1. At least 12 number of experiments should be carried out by the students to cover the entire syllabus
2. At least 6 jobs per from each module must be completed

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Textile Chemical Processing III (PC TT 603)

Name of the Course:	**Textile Chemical Processing III**
Course Code: PC TT 603	**Semester: VI**
Duration: 6 months	**Maximum Marks:** 100
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester Exam.: 15 Marks
Tutorial: Nil	Assignment & Quiz: 10 (8+2) Marks
	Attendance: 5 Marks
Practical: hr./week	End Semester Exam.: 70 Marks
Credit Points: 3	

Objective:	
1	To introduce basic knowledge of printing and finishing of fabric
2	To impart knowledge of process sequence of printing and finishing
3	To impart knowledge of different dyes, pigments, chemicals and auxiliaries required for printing and finishing
4	To impart knowledge of various printing and finishing machines
5	To impart knowledge of quality assessment of printed and finished textiles
Pre-Requisite:	
1	PC TT 301
2	PC TT 402 and PC TT 492
3	PC TT 503 and PC TT 593

End Semester Examinations Scheme. Maximum Marks – 70. Time allotted – 3 hrs.

Groups	**Units**	**Objective Questions (MCQ only with one correct answer)**		**Subjective Questions**			
		No. of questions to be set	**Total marks**	**No. of questions to be set**	**To answer`**	**Marks per question**	**Total marks**

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A	**1 to 7**	**10**	**10**				
B	**1 to 7**			**6**	**3**	**5**	**15**
C	**1 to 7**			**6**	**3**	**15**	**45**

- **Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.**
- **Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.**

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction to Printing** Definition of printing, difference between dyeing and printing, Different steps involved in printing viz. preparation of material, preparation of printing paste, ingredients of printing paste, different thickeners, their chemical and rheological behaviour, drying and fixing of print, washing and drying of printed materials.	7	15
2	**Printing Machine** Principles of functions of different machines used in printing including roller, screen (flat bed and rotary), inkjet printer, curing machine, steamer, water removal by hydroextractor, hot air dryer, radio frequency dryer	4	10
3	**Styles and methods of printing** Direct, resist, discharge, flock printing, methods of printing-concept of hand block printing, roller printing and screen printing (flat bed and rotary) method, non conventional methods of printing like transfer printing (dry	8	25

	wet and melt transfer), making of screens for flat bed and rotary screen printing machines, storage and care of screens, faults and defects of screen and limitations, foam printing, ink jet printing.		
4	**Printing procedure of different fibres** Printing of cellulosic, wool, silk, polyester, polyamide, polyacrylic and their blends with various class of dyes like direct, acid, basic, mordant, azoic, vat solubilised vat, sulphur, reactive, disperse, pigment colours with relevant after treatments, faults of printing and their prevention	8	10
5	**Introduction to finishing** Objective of finishing, classification, temporary, semi permanent and permanent finishing and their significance	2	5
6	**Finishing equipments** Principles of functions of different machines used in finishing including padding units, sanforising machine, foam applicator	3	5
7	**Different finishing processes** Objective, classification of different finishing processes, principle, methods, advantages and disadvantages of different finishing processes including cross linking agents used for different substrates to impart crease recovery/easy care finish, antishrink finishing, flame retarding/proofing, water repelling, rot and mildew proofing of wool, carbonization of polyester/cellulosic materials, application	13	30

	of softeners, enzymatic softening, organdie finish, milling of wool, moth proofing of wool, antistatic finish, soil release finish, finishing of blends, foam application technology- objective, range of application, principle, ingredients of foam system, half life of foam, blow ratio, foam generator, foam applicator, merits and demerits		
	Total	45	100

Text and reference books:

1. Miles L. W. C. Textile Printing, Revised 2nd Edition, published by Society of Dyers and Colorists, UK, 2003.
2. Shenai V. A. Technology of Printing, Sevak Publication, 1985.
3. Roy Chowdhury A. K. Principles of Textile Finishing, 1st Edition, Woodhead Publishing, 2017.
4. Marsh J. T. An Introduction to Textile Finishing, Chapman and Hall Ltd., London, 1948.
5. Mark H., Wooding N. S. and Atlas S. H., Chemical Aftertreatments of Textiles, John Wiley and Sons Inc., New York, 1974.

Course Outcome:

After successful completion of this course, the students should be able to

1. Understand the objectives, tasks and basic principles behind textile printing and finishing processes.
2. Formulate the print and finish recipe for printing and finishing of various fabrics.
3. Perform printing and finishing operation with different styles of printing and different finishing agents coupled with various catalysts.
4. Evaluate the effect of different auxiliaries on printing and finishing.
5. Apply the knowledge of printing and finishing in relevant field.

Special Remarks (If any): NIL.

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Textile Chemical Processing Lab III (PC TT 692)

Name of the Course:	**Textile Chemical Processing Lab III**
Course Code: PC TT 692	**Semester: VI**
Duration: 6 months	**Maximum Marks:** 100
Teaching Scheme	**Examination Scheme**
Theory:	**Continuous Internal Assessment:**
Tutorial: Nil	**External Assessment: 60**
Practical: 3 hrs./week	**Distribution of marks: 40**
Credit Points: 1.5	

Course Outcomes: After successful completion of this course, the students should be able to	
1	Prepare print and finish recipe for printing and finishing of various fabrics.
2	Perform printing and finishing of pretreated fabric
3	Examine the effect of chemical auxiliary on printing and finishing
4	Examine the effect of steaming and curing on fixing of print and finish on to the substrate
5	Examine the colour fastness and durability of the printed and finished fabric
Pre-Requisite:	
1	PC TT 301
2	PC TT 402 and PC TT 492
3	PC TT 503 and PC TT 593

Practical: 13 numbers of experiments	
	3) Intellectual skills- 40%
	4) Motor skill- 60%

Laboratory Experiment:	
1	Direct style printing of cotton fabric using cold brand reactive colour
2	Direct style printing of cotton fabric using hot brand reactive colour
3	Direct style printing of cotton fabric using vat colour
4	Direct style printing of cotton fabric using solubilised vat colour
5	Direct style printing of cotton fabric using pigment colour
6	Direct style printing of silk fabric using acid colour
7	Discharge style printing of cotton fabric using reactive colour
8	Batik resist printing of cotton fabric
9	Batik resist printing of silk fabric
10	Application of functional finishes on cotton using crease recovery finish
11	Application of functional finishes on silk using crease recovery finish
12	Application of functional finishes on cotton using flame retardant finish
13	Application of functional finishes on cotton using water repellent finish
The above list is not exhaustive. Additional laboratory work or experiments can be planned to consolidate the theoretical work and to emphasize the activities for carrying out rather than knowing.	

Text and reference books:

1. Miles L. W. C. Textile Printing, Revised 2nd Edition, published by Society of Dyers and Colorists, UK, 2003.
2. Shenai V. A. Technology of Printing, Sevak Publication, 1985.
3. Roy Choudhury A. K. Principles of Textile Finishing, 1st Edition, Woodhead Publishing, 2017.
4. Marsh J. T. An Introduction to Textile Finishing, Chapman and Hall Ltd., London, 1948.
5. Mark H., Wooding N. S. and Atlas S. H., Chemical Aftertreatments of Textiles, John Wiley and Sons Inc., New York, 1974.

Special Remarks (If any):

At least 10 experiments should be conducted.

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Fabric Design (PC TT 604)

Name of the Course:	**Fabric Design**
Course Code: PC TT 604	**Semester: VI**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 2 hrs./week	Mid Semester Exam.: 15 Marks
Tutorial: Nil	Assignment & Quiz: =10(=8+2) Marks
	Attendance: 5 Marks
Practical: Nil hr./week	End Semester Exam.: 70 Marks
Credit Points: 2	

Objective:	
1	To impart basic weave design ,fancy design, compound weave design ,Advanced design , colour weave
2	To impart knowledge about implementation of weave design in weaving machine, basic weft knit design
3	To make student familiar with typical fabric construction details, also with 3D fabric and nonwoven design.

Pre-Requisite:	
1	PC TT 302, PC TT 501, PC TT 601
2	PC TT 401, PC TT 502 , PC TT 602

End Semester Examinations Scheme. Maximum Marks – 70. Time allotted – 3 hrs.

Groups	**Units**	**Objective Questions (MCQ only with one correct answer)**		**Subjective Questions**			
		No. of questions to be set	**Total marks**	**No. of questions to be set**	**To answer`**	**Marks per question**	**Total marks**

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(Applicable from the academic session 2018-2019)

A	**1 to 11**	**10**	**10**				
B	**1 to 11**			**6**	**3**	**5**	**15**
C	**1 to 11**			**6**	**3**	**15**	**45**

- **Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.**
- **Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.**

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction** Idea of cloth formation on loom; classification of fabrics; idea of fabric structure; methods of fabric representation; repeat of weave; drafts; requirements of drawing in; weaving plan; lifting plan relationship between weave; draft and lifting plan; construction of weaving plan from a given weave; construction of weave from a given draft and lifting plan; construction of draft from a given lifting plan and weave.	1	2
2	**Basic weave** General characteristics; Method of construction, features and uses of plain weave and its derivatives, twill weave and its derivatives, Satin and sateen weaves and their derivatives, simple colour and weave effects; idea of compound colour and weave effects . Diamond and Diaper, huckaback ,mockleno ,honeycomb, brighton honeycomb; Construction of cork screw weaves; features of crepe weave method of preparation of crepe weave and derivatives; features of Bedford cord, construction of bed ford cords - idea of	4	12

	different types ;		
3	**Backed cloth** Warp backed cloth; weft backed cloth; backed cloth with wadding threads; warp and weft wadded cloths; reversible backed cloths.	3	10
4	**Figuring with extra threads** Principles of figuring with extra materials; extra warp figuring-concept of simple techniques; extra weft figuring-concept of simple techniques;	2	8
5	**Welts and piques** Ordinary ,wadded, fast back welts; piques; idea of loose back, half fast back and fast back fabrics.	2	8
6	**Double and multilayer cloths** Classifications of double cloth construction; concept of self stitched; stitched by thread interchange; stitch by cloth interchange; centre stitched; alternate single-ply and double ply construction; idea of wadded double cloths; idea of treble cloth and multiply belting structure.	4	12
7	**Gauze and Leno structure** Principles of leno structures; methods of producing leno and idea of simple constructions ; idea of Gauge with reference to Madras Muslin structures	3	10
8	**Pile structures**	4	12

	weft-pile introduction; concept of simple constructions; Terry pile introduction; formation of pile; simple terry weaves; idea of a terry pile forming mechanism ; velveteen; all over or plain plushes; corded and figured velveteens; velvets ;idea of carpet design		
9	**Standard procedure of fabric calculation** Fabric characteristics; dimension of fabric; density of warp and threads in grey fabrics; warp and weft characteristics; take up and crimp of yarn in fabrics; calculation of number of warp and weft threads in fabrics; selecting the selvedges; type of weave and weaving plan; calculation of reed; calculation of harness and healds; calculation of yarn mass per unit area of fabric. Standard woven fabrics specification	3	10
10	**Advance fabric manufacturing** Basic 3D weave in 2D weaving Braiding design, Design of nonwoven fabrics	2	8
11	**Design of standard weft knit fabrics** Plain knit, double cross tuck, lacoste, crepe, birds eye, mock rib, twill, swiss double pique, full cardigan, half cardigan, single pique, Ponte-di-Roma	2	8
	Total	30	100

Text and reference books:

1. Groscicki Z J, "Watsons Textile Design and Colour", Newnes Buttersworth, 1988.
2. Groscicki Z J, "Watsons Advanced Textile Design", Newnes Buttersworth, 1989.
3. Klibbe J W, "Structural Fabric Design", Revised edition, 1965, North Carolina State University.
4. Nisbeth H, "Grammer of Textile Design", 3rd edition, D B Tarapore Wala sons and Co., 1994.
5. Gokarneshan N, "Fabric Structure and Design", New Age Inernational, New Delhi,
6. P.K.Banerjee .'Principle of fabric Formation ' CRC Press 2014

Course Outcome

After successful completion of this course, the students should be able to

1. Design various weave structures
2. Analyze colour and weave effects
3. Illustrate special weaves
4. Understand principle of development of 3D fabric design in 2D weaving machine
5. Learn to create new structures

Special Remarks (If any): NIL

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Theory of Elasticity (PE TT 601 A)

Name of the Course:	**Theory of Elasticity**
Course Code: PE TT 601 A	**Semester: VI**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester Exam.: 15 Marks
Tutorial: Nil	Assignment & Quiz: =10(8+2) Marks
	Attendance: 5 Marks
Practical: hr./week	End Semester Exam.: 70 Marks
Credit Points: 3	

Objective:	
1	To make students understand the principles of elasticity.
2	To familiarize students with basic equations of elasticity
3	To provide basic knowledge of Analysis of stress and strain
4	To expose students to two dimensional problems in Cartesian and polar coordinates.
5	To make students understand the principle of torsion of prismatic bars.

Pre-Requisite:	
1	BS-PH101
2	BS-PH201

End Semester Examinations Scheme. Maximum Marks – 70. Time allotted – 3 hrs.

Groups	**Units**	**Objective Questions (MCQ only with one correct answer)**		**Subjective Questions**			
		No. of questions to be set	**Total marks**	**No. of questions to be set**	**To answer`**	**Marks per question**	**Total marks**
A	**1 to 14**	**10**	**10**				
B	**1 to 14**			**6**	**3**	**5**	**15**

C	**1 to 14**			**6**	**3**	**15**	**45**

- **Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.**
- **Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.**

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction** Introduction and Historic Overview	1	2
2	**Introduction to Tensor Algebra** Summation Convention, b. Kronecker's Delta and the permutation Tensor, c. Coordinates and Tensors Transformation, d. Derivatives Convention	4	8
3	**Stress** a. Notion of Stress, b. Stress in Cartesian Coordinates, c. Shear Stresses, d. Stress at a Point, e. Principal Stresses and Principal Coordinates, f. Maximum Shearing stresses, g. Stress Ellipsoid, h. Hydrostatic and Deviatoric Stress Tensors, i. Equilibrium Equations and Boundary Conditions	6	14
4	**Strain** a. Displacements and Strains,b. Strain at a Point, c. Principal Strains and Principal Coordinates, d. Local Rotation, e. Hydrostatic and Deviatoric Strain Tensors, f. Compatibility Equations,	4	10

5	**Constitutive Equations** a. Generalized Hooke's Law, b. Relationships between Elastic Moduli	3	6
6	**General Formulation of Elastic Problem** a. Boundary-Value Problems in Elasticity, b. Navier's Equations, c. Beltrami-Michell's Equations, d. Principle of Superposition, e. Saint-Venant's Principle, f. Uniqueness of Solution	4	10
7	**Three-Dimensional Problems** a. Bar Stretched by its Own Weight, b. Torsion of a Circular Shaft, c. Bending of a Prismatic Bar	4	10
8	**Two Dimensional Elasticity** a. Plane Strain, b. Plane Stress, c. Airy's Stress Function	2	4
9	**Plane Problem in Cartesian Coordinates** Solution by Polynomials	2	4
10	**Plane Problem in Polar Coordinates** a. General Solution, b. Thick-Walled Cylindrical Pressure Vessel (Lamé's problem), c. Pure Bending of a Curved Beam, d. Stress Concentration around Circular Hole (Kirsch's problem), e. rotating Disks, f. Concentrated Line- Force on a Plane, (Flamant's problem), g. Force Acting at the End of a Wedge, h. Shrink Fit	5	12

11	**Torsion** a. Torsion of a uniform circular shaft, b. Torsion of non circular cylindrical Bars, c. Torsion of Hollow Bars, d. Membrane Analogy	3	6
12	**Strain Energy** a. Strain Energy Density, b. Strain Energy Density Function, c. Betti-Maxwell Reciprocal Theorem	3	6
13	**Thermo elasticity** a. General Approach, b. Plane Thermoelastic Problem in Polar Coordinates	2	4
14	Application of principles of theory of elasticity in textile machines and materials	2	4
	Total	45	100

Text and reference books:

1. Timoshenko, S.P., and Goodier, J.N., Theory of Elasticity, McGraw-Hill (1970).
2. Sokolnikoff, I.S., Mathematical Theory of Elasticity, Krieger Publishing Company (1983).
3. Shames, I.H., Mechanics of Deformable Solids, Krieger Publishing Company (1983).

Course Outcome:

After successful completion of this course, the students should be able to

1. Understand stress and deformation and their relationship
2. Understand the structural sections subjected to torsion
3. Understand the torsion developed in circular/non-circular/hollow-shaft
4. Solve strategies of various plane (Cartesian and polar**)** problems.
5. Understand the theory of stress and deformation in field of textile material

Special Remarks (If any): NIL

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Theory of Elasticity Lab (PE TT 691 A)

Name of the Course:	**Theory of Elasticity Lab**
Course Code: PE TT 691 A	**Semester: VI**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: hrs./week	**Continuous Internal Assessment:**
Tutorial: Nil	**External Assessment: 60**
Practical: 3 hr./week	**Distribution of marks: 40**
Credit Points: 1.5	

Course Outcomes: After successful completion of this course, the students should be able to

1	Analyse of stress and deformation and their relationship
2	Analyse the structural sections subjected to torsion
3	Analyse the torsion developed in circular/non-circular/hollowshaft
4	Formulate and solve strategies of various plane (Cartesian and polar**)** problems.
5	Analyse of stress and deformation and their relationship

Pre-Requisite:

1	BS-PH101
2	BS-PH201

Practical:	
	5) Intellectual skills-70%
	6) Motor skill-30%

Laboratory Experiment:	
1	Determination of load-elongation of solid (thin filament like materials)
2	Analysis of the load elongation diagram for finding out young's modulus, yield

	point, yield strain, yield stress ,breaking load, breaking strain, energy to break the specimen, toughness, true stress
3	Study of plastic deformation of solid
4	Determination of Poisson's ratio
5	Determination of bending deformation under three point load of a rod
6	Analysis of bending deflection and load curve and calculation of bending rigidity and modulus of the material
7	Determination of torque –angular displacement diagram of thin filament like material and analysis of the diagram to calculate torsional rigidity and shear modulus of the material
8	Determination of moment of inertia of known cross-section of thin rod like material (circular, elliptical, square, rectangular, hollow circular)
9	Determination of compressive load –deformation of a solid
10	Determination of buckling load –deformation of clamped rod and shell
11	Determination of load – deformation of ring
12	Study of failure of rod due to tensile loading
The above list is not exhaustive. Additional laboratory work or experiments can be planned to consolidate the theoretical work and to emphasis the activities for doing rather than the knowing.	

Text and reference books:

1. Timoshenko, S.P., and Goodier, J.N., Theory of Elasticity, McGraw-Hill (1970).
2. Sokolnikoff, I.S., Mathematical Theory of Elasticity, Krieger Publishing Company (1983).
3. Shames, I.H., Mechanics of Deformable Solids, Krieger Publishing Company (1983).

Special Remarks (If any):

At least 10 experiments should be conducted

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Theory of Textile Structure (PE TT 601 B)

Name of the Course:	**Theory of Textile Structure**
Course Code: PE TT 601 B	**Semester: VI**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester Exam.: 15 Marks
Tutorial: Nil	Assignment & Quiz: =10(8+2) Marks
	Attendance: 5 Marks
Practical: hr./week	End Semester Exam.: 70 Marks
Credit Points: 3	

Objective:	
1	To enable the students to understand the fundamentals of the yarn structure, measures of structural parameters and factors influencing them.
2	To enable the students to learn about geometry of woven, knitted and nonwoven fabrics and understand the deformation of fabric under stress

Pre-Requisite:	
1	PC TT 303, PC TT 504
2	PC TT 302, PC TT 401, PC TT 501, PC TT 502, PC TT 601, PC TT 602
3	

End Semester Examinations Scheme. Maximum Marks – 70. Time allotted – 3 hrs.

Groups	**Units**	**Objective Questions (MCQ only with one correct answer)**		**Subjective Questions**			
		No. of questions to be set	**Total marks**	**No. of questions to be set**	**To answer`**	**Marks per question**	**Total marks**
A	**1 to 9**	**10**	**10**				

B	**1 to 9**			**6**	**3**	**5**	**15**
C	**1 to 9**			**6**	**3**	**15**	**45**

- **Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.**
- **Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.**

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction** Basic concepts of yarn and fabric structure.	1	2
2	**Yarn structure** Types of yarn, the idealized helical yarn structure, yarn count and twist factors, twist contraction and retraction, packing of fibres in yarn, effect of fibre properties on the diameter and density of yarn, measurement of yarn diameter, density and specific volume, empirical formulas for the determination of yarn diameter	7	14
3	**Morphology of single yarn** The arrangement of fibres in a unitary yarn, ideal migration, characterization of migration behaviour, techniques of determining the position of fibre in a yarn, migration in blended yarns, mechanisms of migration, effect of various parameters on migration behaviour. Idea of migration of rotor, airjet, dref ,compact yarns	5	12
4	Analysis of tensile behaviour, effect of traverse force and lateral components of continuous filament yarns. extension & breakage of spun yarn. Energy method to calculate load	5	10

	elongation of filament yarn		
5	Study of fibre obliquity and slippage, influence of fibre length, fibre fineness and friction. migration	3	8
6	Composition of fibres in cross section of blended yarns, blend irregularity, distribution of blend components, strength of blended yarns, introduction of Hamburger's model. Migration index	3	8
7	**Cloth setting theory** Study of Peirce's model and its applicable formula; limiting structures,; modifications due to deviation from circular cross-section of yarn, cover and crimp interchange in woven fabrics with respect to simple geometry, shrinkage analysis,.	8	18
8	**Geometry of weft Knitted structures** Relationship with loop for plain knitted fabric. Areal density of plain knitted fabric., Geometrical property of nonwoven structure ,Tensile properties of Knitted fabric. Nonwoven structures. Tensile behaviour of non-woven fabric.	7	16
9	Introduction to tensile, buckling, bending, shear, compression and drape behaviour of fabric., flow property, heat and vapour transmission through fabric structure	6	12
	Total	45	100

Text and reference books:

1. Hearle J W S, Grosberg P and Backer S, "Structural Mechanics of Fibres Yarns and Fabrics", Wiley Interscience, New York, 1969.
2. Goswami B C, Martindale J G and Scardino F, "Textured yarn technology, structure and applications", Wiley Interscience Publisher, New york, 1995.

3. Peirce F T and Womersley J R, "Cloth Geometry", reprint, The Textile Institute, Manchester
4. 1978.
5. Hearle J W S, Thwaites J J and Amirbayat, "Mechanics of Flexible Fibre Assemblies", Sijthff and Noordhoff International Publishers BV, Alphen aan den
6. Rijn, Netherlands 1980.
7. Journals: Textile Research Journal, Princeton, USA and Journal of Textile Institute, Manchester, UK
8. Newton A (1993), Fabric Manufacture: A Hand book, Intermediate Technology Publications, London.
9. Grosicki Z (1988), Watson's Textile Design and Colour, Newnes Butterworths.
10. Weiner L (1971), Textile Fabric Design Tables, Technomic, Stamford, USA.
11. Seyam, A M (2002), Textile Progress, The Textile Institute, Vol. 31, No. 3. Jinlian HU, Structure and Mechanics of Woven Fabric, Woodhead Publication.
12. Kemp A (1958), J. Text. Inst., 49, T 44.
13. Love L (1954), Text. Res. J., 24, 1073.
14. P. Schwartz Structure and mechanics of textile fibre assemblies
15. Structure and mechanics of woven fabrics J.Hu.
16. Thermal and moisture transport in fibrous materials Edited by N. Pan and P. Gibson

Course Outcome:

After successful completion of this course, the students should be able to

1. Understand relations between geometrical parameters of twisted yarn, woven and knit nonwoven fabrics.
2. Apply the relations in real cases and engineer product of required properties
3. Understand relations basic mechanical properties of the textile product and structural parameters of textile yarn, fabric and apply in real problems.
4. Relate the internal geometry of fibre to yarn and its influence on physical property.
5. Relate the structural parameters with production parameters and engineer new products with desired property.

Special Remarks (If any): NIL.

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Theory of Textile Structure Lab (PE TT 691 B)

Name of the Course:	**Theory of Textile Structure Lab**
Course Code: PE TT 691 B	**Semester: VI**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: hrs./week	**Continuous Internal Assessment:**
Tutorial: Nil	**External Assessment: 60**
Practical: 3 hr./week	**Distribution of marks: 40**
Credit Points: 1.5	

Course Outcomes: After successful completion of this course, the students should be able to

1	Apply structural relationships in the practical problems
2	Measure the structural parameters in textile product
3	Describe machines and instruments used in measuring the parameters

Pre-Requisite:

1	PC TT 303, PC TT 504
2	PC TT 302, PC TT 401, PC TT 501, PC TT 502, PC TT 601, PC TT 602
3	PC TT 393

Practical:	
	1) Intellectual skills- 60 %
	Students Apply therotical knowledge of structure and analysing the experimental data
	2) Motor skill- 40%
	Students develop skill to handle the testing instruments

Laboratory Experiment:	
1	Determination of packing fraction and specific volume of a yarn
2	Determination of twist to break of spun/filament yarn
3	Determination of contraction due to twist
4	Determination of migration parameters of spun yarn
5	Determination of load elongation curve of yarn and its analysis by using theoretical relationship .
6	Test for limiting conditions of geometry of woven fabric of simple weave (plain, twill, sateen, matt) and their prediction of maximum sett
7	Determination of the weave value of woven fabric of simple weave (plain, twill, sateen, matt) and its prediction of sett of square fabric by using cloth setting theory
8	Determination of Poisson ratio of yarn
9	Determination of porosity and density of fabric
10	Study of crimp interchange of woven fabric.
11	Study of nature of load elongation property of woven, knitted and nonwoven fabric
12	Study of relationship between course, wales per inch and loop length, tightness factor, weight of weft knitted fabric and analysis by using geometrical relationships .
13	Study of nature of air flow property of woven, knitted and nonwoven fabric
14	Analysis of shrinkage plain woven fabric.
15	Study of fabric shear and bending.
16	Study of orientation distribution function of fibre in nonwoven fabric
The above list is not exhaustive. Additional laboratory work or experiments can be planned to consolidate the theoretical work and to emphasis the activities for doing rather than the knowing.	

Text and reference books:

1. Hearle J W S, Grosberg P and Backer S, "Structural Mechanics of Fibres Yarns and Fabrics", Wiley Interscience, New York, 1969.

2. Goswami B C, Martindale J G and Scardino F, "Textured yarn technology, structure and applications", Wiley Interscience Publisher, New york, 1995.

3. Peirce F T and Womersley J R, "Cloth Geometry", reprint, The Textile Institute, Manchester 1978.

4. Structure and mechanics of woven fabrics J.Hu

5. Textile Testing J.E.Booth

6. Physical testing of textiles B. P. Saville

Special Remarks (If any):

At least 10 experiments should be conducted

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Introduction to Java (OE TT 601 A)

Name of the Course:	**Introduction to Java**
Course Code: OE TT 601 A	**Semester: VI**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 2 hrs./week	Mid Semester Exam:15Marks
Tutorial: Nil	Assignment & Quiz: 10 (=8+2)Marks
	Attendance: 5Marks
Practical:	End Semester Exam.: 70 Marks
Credit Points:2	

Objective:	
1	To impart knowledge about the engineering aspects of Java Programming and their application.
2	
Pre-Requisite:	
1	ES-CS201, ES-CS291

End Semester Examinations Scheme. Maximum Marks – 70. Time allotted – 3 hrs.

Groups	**Units**	**Objective Questions (MCQ only with one correct answer)**		**Subjective Questions**			
		No. of questions to be set	**Total marks**	**No. of questions to be set**	**To answer`**	**Marks per question**	**Total marks**
A	**1 to 4**	**10**	**10**				
B	**1 to 4**			**6**	**3**	**5**	**15**
C	**1 to 4**			**6**	**3**	**15**	**45**

- **Only multiple choice type questions (MCQ) with one correct answer are to be set in**

the objective part.

- **Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.**

Unit	Content	Hrs/Unit	Marks/Unit
1.	**JAVA Basics** Introduction to Programming Languages and algorithms, The Evolution of Java, Object-Oriented Programming Concepts and Java, Differences between C++ and Java, The Primary Characteristics of Java, The Architecture, Programming with Java, Tokens, Identifiers, Keywords, Literals, Separators, Comments and Whitespaces, Operators; Expressions; Using Data Types, Primitive Data Types, Reference Data Types; Declarations; Control Flow, Blocks and Statements, Conditional Statements, Looping Statements	6	20
2.	**JAVA Classes, Packages , Interfaces and Streams** Introduction, Classes-Defining simple class, Class Variables, Class Methods, Return Types, Method Modifiers, Declaring Method Security and Accessibility, Overloading Methods; Working with Objects, Creating Objects, Destroying Objects, Constructor; Packages, Declaring a Package, Accessing Other Packages, Package-Naming Conventions, The CLASSPATH Environment Variable, Overview of the Standard Packages; Inheritance, Sub-classing, Method	10	33

	Overriding; Interfaces, Declaring an Interface, Implementing Interfaces, Modifiers, Using an Interface Data Flow with Java Streams, Input Streams, Output Streams,		
3.	**Exception Handling in JAVA** Introduction, Exception Methods, java language Exceptions.	3	10
4.	**JAVA Threads, Applets and AWT** Introduction; Creating Threads; The Life Cycle of a Thread; Thread Methods; Using Threads, Declaring Threads, Creating and Starting the Thread Object new and the Instantiation of Threads, Stopping the Thread, Destroying a Thread, Naming a Thread; Synchronization of Threads, Producer/Consumer Example, Locking an Object, Synchronized Blocks, Using the notify All and wait Methods, Deadlocks Introduction, Applet Examples, The java. Applet. Applet Class, The Five Stages of an Applet's Life Cycle, Methods for Adding UI Components, Methods for Drawing and Event Handling, Introduction, Control Classes-component, layout and menu classes.	11	37
	Total	30	100

Text and reference books:

1. Introduction to Java Programming, 6th Edition, Y.Daniel Liang (2007), Pearson Prentice Hall,
2. Schaum's Outlines of Programming with Java,J. R. Hubbard, Schaums
3. Thinking in Java 3rd ed- Bruce Eckel, Publisher: PrenticeHall
4. Java Gently, 3rd Edition:by Judith Bishop
5. Sams Teach YourselfJ ava 1.1 in 24 Hours: Rogers Cadenhead, Laura Lemay, and Charles Perkins
6. LEARNING JAVA by Rich Raposa, Wiley Publications
7. Who's Afraid of Java?, by Steve Heller,Publisher: AP Professional
8. Java:How to Program with an Introduction to Visual J++, by Harvey M.Deitel, Paul J. Deitel ,Publisher: Prentice Hall
9. Java by Example, 2nd Edition, by Jerry Jackson, Alan L. McClellan, Publisher: Sunsoft Press/Prentice Hall
10. Java for Dummies ,2nd Edition, by Aaron E. Walsh, Publisher :Dummies Press/IDG Books

Course Outcome:

After successful completion of this course, the students should be able to

1. Explain object oriented programming concept.
2. Analyze fundamentals concept of JAVA.
3. Demonstrate basic application of package and interfaces.
4. Illustrate basic application of exception handling.
5. Create various programming in JAVA.

Special Remarks (If any): NIL

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Introduction to Python (OE TT 601 B)

Name of the Course:	**Introduction to Python**
Course Code: OE TT 601 B	**Semester: VI**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 2 hrs./week	Mid Semester Exam.:15Marks
Tutorial: Nil	Assignment & Quiz: 10 (=8+2)Marks
	Attendance: 5Marks
Practical:	End Semester Exam.: 70 Marks
Credit Points:2	

Objective:	
1	To impart knowledge basics of algorithmic problem solving
2	To impart basic knowledge of Python programs with conditionals and loops.
3	To make student understand Python functions and use function calls.
4	To offer knowledge of Python data structures.

Pre-Requisite:	
1	ES-CS201, ES-CS291

End Semester Examinations Scheme. Maximum Marks – 70. Time allotted – 3 hrs.

Groups	**Units**	**Objective Questions (MCQ only with one correct answer)**		**Subjective Questions**			
		No. of questions to be set	**Total marks**	**No. of questions to be set**	**To answer`**	**Marks per question**	**Total marks**
A	**1 to 5**	**10**	**10**				
B	**1 to 5**			**6**	**3**	**5**	**15**
C	**1 to 5**			**6**	**3**	**15**	**45**

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- **Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.**
- **Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.**

Unit	Content	Hrs/Unit	Marks/Unit
1.	**Introduction to Python** Features of Python - Python interpreter - interactive and non-interactive mode	2	7
2.	**Conditionals and Functions** Operators – Boolean Values – Operator Precedence – Expression – Conditionals: If-Else Constructs – Loop Structures/Iterative Statements – While Loop – For Loop – Break Statement – Function Call and Returning Values – Parameter Passing – Local and Global Scope – Recursive Functions.	6	20
3.	**Object and Classes** Classes in Python - Principles of Object Orientation - Creating Classes - Instance Methods - File Organization - Special Methods - Class Variables - Inheritance - Polymorphism - Type Identification - Custom Exception Classes	7	23
4.	**String, Dictionaries and Modules** Strings: Introduction, Indexing, Traversing, Concatenating,	8	27

	Appending, Multiplying, Formatting, Slicing, Comparing, Iterating – Basic Built-In String Functions – Dictionary: Creating, Accessing, Adding Items, Modifying, Deleting, Sorting, Looping, Nested Dictionaries Built-in Dictionary Function – Finding Key and Value in a Dictionary – Modules – Module Loading and Execution – Packages – Python Standard Libraries.		
5.	**File handling and Exception handling** Introduction to Files – File Path – Opening and Closing Files – Reading and Writing Files – File Position – Exception: Errors and Exceptions, Exception Handling, Multiple Exceptions.	7	23
	Total	30	100

Text and reference books:

1. Reema Thareja, "Python Programming using Problem Solving Approach", Oxford University Press, 2017.
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", Second Edition, Shroff/ O'Reilly Publishers, 2016. (http://greenteapress.com/wp/thinkpython/).
3. Dive into Python, Mike
4. Learning Python, 4th Edition by Mark Lutz
5. Programming Python, 4th Edition by Mark Lutz

Course Outcome:

After successful completion of this course, the students should be able to

1. Develop algorithmic solutions to simple computational problems.
2. Develop and execute simple Python programs.

3. Write simple Python programs for solving problems and decompose a Python program into functions.
4. Represent compound data using Python lists, tuples, dictionaries etc.
5. Read and write data from/to files in Python programs.
6. Implementing database using SQ Lite.
7. Access database using python programming.
8. Develop web applications using python programming.
9. Develop and use Web Services using python.

Special Remarks (If any): NIL

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Syllabus for B. Tech in Textile Technology (TT)
(Applicable from the academic session 2018-2019)

Internet of Things (OE TT 601 C)

Name of the Course:	**Internet of Things**
Course Code: OE TT 601 C	**Semester: VI**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 2 hrs./week	Mid Semester Exam.:15Marks
Tutorial: Nil	Assignment & Quiz: 10 (=8+2)Marks
	Attendance: 5Marks
Practical:	End Semester Exam.: 70 Marks
Credit Points:2	

Objective:	
1	To impart necessary and practical knowledge of components of Internet of Things.
2	To support for development of skills required to build real-life IoT based projects.

Pre-Requisite:	
1	ES-CS201, ES-CS291

End Semester Examinations Scheme. Maximum Marks – 70. Time allotted – 3 hrs.

Groups	**Units**	**Objective Questions (MCQ only with one correct answer)**		**Subjective Questions**			
		No. of questions to be set	**Total marks**	**No. of questions to be set**	**To answer`**	**Marks per question**	**Total marks**
A	**1 to 4**	**10**	**10**				
B	**1 to 4**			**6**	**3**	**5**	**15**
C	**1 to 4**			**6**	**3**	**15**	**45**

- **Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.**

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- **Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.**

Unit	Content	Hrs/Unit	Marks/Unit
1.	**Introduction to IoT** Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Everything as a Service (XaaS), Role of Cloud in IoT, Security aspects in IoT.	6	20
2.	**Elements of IoT** Hardware Components- Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces. Software Components- Programming API's (using Python/ Node.js/ Arduino) for Communication Protocols- MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP.	8	27
3.	**IoT Application Development** Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices.	11	37
4.	**IoT Case Studies** IoT case study and mini project based on Industrial automation/ Transportation/ Agriculture/ Healthcare/ Home	5	16

	Automation		
	Total	30	100

Text and reference books:

1. V. Madisetti and A. Bahga, Ïnternet of Things, A Hands on Approach, University Press, 2015.
2. S.R.N. Reddy, R. Thukral and M. Mishra, Introduction to Internet of Things: A Practical Approach, ETI Labs, 2017.
3. P. Raj and A.C. Raman, The Internet of Things: Enabling Technologies, Platforms and Use Cases, CRC Press, 2017.
4. J. Jose, Internet of Things, Khanna Publishing House, New Delhi, 2018. 5
5. A. McEwen, Designing the Internet of Things, Wiley, 2013. 6
6. R. Kamal, Internet of Things: Architecture and Design, McGraw Hill, 2017.
7. C. Pfister, Getting Started with the Internet of Things, O Reilly Media, 2011.

Course Outcome:

After successful completion of this course, the students should be able to

1. Understand internet of Things and its hardware and software components.
2. Interface I/O devices, sensors & communication modules.
3. Remotely monitor data and control devices, and develop real life IoT based projects.

Special Remarks (If any):NIL