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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Bachelor of Technology (Textile Engineering) (Credit Based)**  **Scheme of Studies/Examination (Modified)**  **Semester III (w.e.f. session 2019-2020)** | | | | | | | | | | | | | | | | | | | | | | |
| **Sr. No.** | | **Course No./Code** | | **Subject** | | **L:T:P** | | **Hours/Week** | | | **Credits** | | **Examination Schedule (Marks)** | | | | | | | | **Duration of Exam (Hrs)** | |
|
| **Major Test** | | **Minor Test** | | **Practical** | | **Total** | |
| 1 | | PCC-TEX-201A | | Textile Fibre – I | | 3:1:0 | | 4 | | | 4 | | 75 | | 25 | | 0 | | 100 | | 3 | |
| 2 | | PCC-TEX-203A | | Yarn Manufacturing-I | | 3:1:0 | | 4 | | | 4 | | 75 | | 25 | | 0 | | 100 | | 3 | |
| 3 | | PCC-TEX-205A | | Fabric Manufacturing-I | | 3:1:0 | | 4 | | | 4 | | 75 | | 25 | | 0 | | 100 | | 3 | |
| 4 | | PCC-TEX-207A | | Textile Chemical Processing-I | | 3:1:0 | | 4 | | | 4 | | 75 | | 25 | | 0 | | 100 | | 3 | |
| 5 | | PCC-TEX-209LA | | Textile Fibre - I Lab | | 0:0:2 | | 2 | | | 1 | | - | | 40 | | 60 | | 100 | | 3 | |
| 6 | | PCC-TEX-211LA | | Yarn Manufacturing-I Lab | | 0:0:2 | | 2 | | | 1 | | - | | 40 | | 60 | | 100 | | 3 | |
| 7 | | PCC-TEX-213LA | | Fabric Manufacturing-I Lab | | 0:0:2 | | 2 | | | 1 | | - | | 40 | | 60 | | 100 | | 3 | |
| 8 | | PCC-TEX-215LA | | Textile Chemical Processing-I Lab | | 0:0:2 | | 2 | | | 1 | | - | | 40 | | 60 | | 100 | | 3 | |
| **Total** | | | | | |  | | **24** | | | **20** | | **300** | | **260** | | **240** | | **800** | |  | |
| 9 | | \*MC-901A | | Environmental Sciences | | 3:0:0 | | 3 | | | - | | 75 | | 25 | | 0 | | 100 | | 3 | |
| \*MC-901A is a mandatory credit-less course in which the students will be required to get passing marks in the major test. | | | | | | | | | | | | | | | | | | | | | | |
| **Bachelor of Technology (Textile Engineering ) (Credit Based)**  **Scheme of Studies/Examination(Modified)**  **Semester IV (w.e.f. session 2019-2020 )** | | | | | | | | | | | | | | | | | | | | |
|  | |  | |  | |  | |  |  | |  | |  | |  | |  | |  | |
| **S. No.** | | **Course No./Code** | | **Subject** | | **L:T:P** | | **Hours/**  **Week** | **Credits** | | **Examination Schedule (Marks)** | | | | | | | | **Duration of Exam (Hrs)** | |
|
| **Major Test** | | **Minor Test** | | **Practical** | | **Total** | |
| 1 | | PCC-TEX-202A | | Textile Fibre – II | | 3:1:0 | | 4 | 4 | | 75 | | 25 | | 0 | | 100 | | 3 | |
| 2 | | PCC-TEX-204A | | Yarn Manufacturing-II | | 3:1:0 | | 4 | 4 | | 75 | | 25 | | 0 | | 100 | | 3 | |
| 3 | | PCC-TEX-206A | | Fabric Manufacturing-II | | 3:1:0 | | 4 | 4 | | 75 | | 25 | | 0 | | 100 | | 3 | |
| 4 | | PCC-TEX-208A | | Textile Chemical Processing-II | | 3:1:0 | | 4 | 4 | | 75 | | 25 | | 0 | | 100 | | 3 | |
| 5 | | PCC-TEX-210LA | | Yarn Manufacturing-II Lab | | 0:0:2 | | 2 | 1 | | - | | 40 | | 60 | | 100 | | 3 | |
| 6 | | PCC-TEX-212LA | | Fabric Manufacturing-II Lab | | 0:0:2 | | 2 | 1 | | - | | 40 | | 60 | | 100 | | 3 | |
| 7 | | PCC-TEX-214LA | | Textile Chemical Processing-II Lab | | 0:0:2 | | 2 | 1 | | - | | 40 | | 60 | | 100 | | 3 | |
| **Total** | | | | | |  | | **22** | **19** | | **300** | | **220** | | **180** | | **700** | |  | |
| 8 | | \*MC-902A | | Constitution of India | | 3:0:0 | | 3 | - | | 75 | | 25 | | 0 | | 100 | | 3 | |
| \*MC-902A is a mandatory credit-less course in which the students will be required to get passing marks in the major test. | | | | | | | | | | | | | | | | | | | | |

**Note: All the students have to undergo 4 to 6 weeks Industrial Training after 4th semester which will be evaluated in 5th semester.**

**PCC-TEX-201A**

**TEXTILE FIBRE – I**

**L T P Sessional: 25 Marks**

**3 1 - Exam: 75 Marks**

**Total 100 Marks**

**Time: 3 Hrs**

**Note:**

*Question no. 1 is objective type fifteen subparts covering all the four units. Eight more questions will be set in the question paper i.e. two from each unit. The students will be required to attempt Question no. 1 compulsorily and one question from each unit.*

**UNIT-I**

**Introduction:** Fibre, textile fibre, staple fibre, continuous filaments, classification of textile fibres, essential and desirable properties of textile fibres, comparision of natura and manmade fibers.

**Cotton** - cultivation and harvesting practices, concept of cotton varieties, ginning, grading, morphological structure of cotton, chemical composition of cotton, physical and chemical properties of cotton fibre.

**UNIT-II**

Cultivation, production, physical and chemical properties and end uses of: Jute, Flax, Hemp and Ramie.

**UNIT-III**

**Silk** - Production of silk (raw), morphological structure of silk, chemical composition, physical and chemical properties of silk, various varieties of silk, types of thrown silk , silk degummimg.

**Wool** -Sheep rearing, wool shearing, wool classification by fleece, grading, morphological structure, chemical composition, physical and chemical properties of wool, wool felting.

**UNIT-IV**

**Regenerated fibers**– Introduction to regenerated fibres, degree of polymerization, polymer preperation and spinning process, physical and chemical properties of viscose rayon, acetate, triacetate fibers.

Discuss modified viscose rayon, cuprammonium rayon, a brief introduction of protein regenerated fibers: casein, corn fibre, groundnut fiber.

**Suggested Text Books & References:**

### Kozłowski R.M.,“Handbook of Natural Fibre”, 1st Edition,Wood Head Publication, 2012.

1. Jindal R., Jindal A.,“Textile Raw Material”,1st Edition, Abhishek Publications, Chandigarh, 2007.
2. Lewin M.,“Handbook of Fiber Science And Technology (International Fiber Science and Technology)”, CRC Press.
3. Gupta V. B. and Kothari V. K., “Manufactured Fiber Technology”, Chapman & Hall, London, 1997.
4. Kothari V.K.,“Textile Fibers: Developments and Innovations”, IAFL Publication, 2000.
5. Simpson W S., Crawshaw G., “Wool: Science and Technology”,Woodhead Textile Series, 2002.
6. Mishra S.P., “A text Book of Fiber Science and Technology”, New Age International (P) Ltd.
7. Moorthy S.H.V.,“Introduction to Textile Fibers”, Woodhead Textile Series, 2015.
8. Ghol E.P.G., Valensky., “Textile Science”, CBS Publishers & Distributors, 2nd Edn Reprint-(2005).
9. Bernard P C., “Textile Fiber to Fabric”, McGraw Hill Book Co.
10. Morton W.E & Hearle J.W.S., “Physical Properties of Textile Fibers”, Textile Institute, U.K.
11. Kothari V.K., “Progess in Textiles: Science & Technology” Vol-2, IAFL Publication New Delhi.
12. Cook G., “Hand Book of Textile Fibers”, Vol-1&2, Woodhead Publication.
13. [Eichhorn](https://www.amazon.in/s/ref=dp_byline_sr_book_1?ie=UTF8&field-author=Stephen+Eichhorn&search-alias=stripbooks) S., Hearle [J.W.S.,](https://www.amazon.in/s/ref=dp_byline_sr_book_2?ie=UTF8&field-author=J.+W.+S.+Hearle&search-alias=stripbooks)  Jaffe [M](https://www.amazon.in/s/ref=dp_byline_sr_book_3?ie=UTF8&field-author=M+Jaffe&search-alias=stripbooks) ., Kikutani [T](https://www.amazon.in/s/ref=dp_byline_sr_book_4?ie=UTF8&field-author=T+Kikutani&search-alias=stripbooks)., “Handbook of Textile Fibre Structure” , Vol. I., Wood Head Publication, 2009.
14. <https://nptel.ac.in/courses/116102026/24> (21st May, 2019).

**PCC-TEX-203A**

**YARN MANUFACTURING – I**

**L T P Sessional: 25 Marks**

**3 1 - Exam: 75 Marks**

**Total 100 Marks**

**Time: 3 Hrs**

**Note:**

*Question no. 1 is objective type fifteen subpartscovering all the four units.Eight more questions will be set in the question paper i.e. two from each unit. The students will be required to attempt Question no. 1 compulsorily and one question from each unit.*

# UNIT-I

# Mixing & Blending

Objectives of mixing and blending, Formulation of cotton mixing – scientific bale management, Different Blending methods with their advantages and disadvantages.

Tinting & Application of additional spin finish for manmade fibres.

# UNIT-II

# Opening and Cleaning

Need for opening and cleaning, Objective of blowroom, Various types of opener and cleaner – construction and working, Lap forming mechanism, Blow room accessories, Selection of blow room line for different cotton and man-made fibres, Production and cleaning efficiency level attainable in blowroom, Causes of lap defects and their remedies, Modern developments in blowroom.

# UNIT-III

# Carding

Objective, Comparison of lap feed and flock feed system. Principle of carding, stripping and brushing action, Design and construction of carding machine, Flexible and metallic card clothing, Processing of man-made fibres on carding, Optimization of process and machine parameters of carding, Autolevelling in card. Modern developments in carding, Calculations pertaining to draft and production.

# UNIT-IV

# Drafting

Objective, Fundamental concept of   Ideal  drafting, Actual drafting, Working principles of draw frame including constructional details, Weighting in draw frame, Draft distribution, Different types of drafting roller arrangements, Relation between drafting & doubling, Drafting irregularities, Autolevelling, modern  developments  in draw-frame, Calculations pertaining to draft and production.

# Suggested Text Books & References:

1. Klein, W., “Manual of Textile Technology: Vol. I. Technology of Short Staple Spinning”, – Textile Institute, Manchester, 1998.
2. Klein, W., “Manual of Textile Technology: Vol. II. A practical Guide to Blowroom & Carding”, – Textile Institute, Manchester, 2000.
3. Klein, W., “Manual of Textile Technology: Vol. III. A practical Guide to Combing & Drawing”, – Textile Institute, Manchester, 1995.
4. Klein, W., “Manual of Textile Technology: Vol. VI. Manmade Fibres and their Processing”, – Textile Institute, Manchester, 1994.
5. Oxtoby E, “Spun Yarn Technology”, Butterworths, London, 1987.
6. Salhotra, K.R.and Chattopadhayay (Eds.), R., “Course Material of Pilot Programme on Spinning : Blowroom and Card”, NCUTE Publication, 1998.
7. Salhotra K R, “Spinning of Man Made Fibres and Blends on Cotton Spinning System”,The Textile Association, Mumbai, 1989.
8. Foster G A R, “Manual of Cotton Spinning”, Vol. I –IV, The Textile Institute,Manchester, 1958.
9. Khare A R, “Elements of Blowroom, Carding and Drawframe”, Sai book Centre,Mumbai,1999.
10. Lawrence C A, “Fundamental of Spun Yarn Technology” CRC Press, USA,2003.
11. Booth J E, “Textile Mathematics”, Part II, Textile Institute, Manchester, 1978.

**PCC-TEX-205A**

**FABRIC MANUFACTURING – I**

**L T P Sessional : 25 Marks**

**3 1 - Exam: 75 Marks**

**Total 100 Marks**

**Time: 3 Hrs**

**Note:***Question no. 1 is objective type fifteen subpartscovering all the four units.Eight more questions will be set in the question paper i.e. two from each unit. The students will be required to attempt Question no. 1 compulsorily and one question from each unit.*

# UNIT-I

**Winding:** Objectives, types of packages, types of winding machines, Basic features of a winding machine, uniform build up of cones, Mechanical and electronic type yarn clearer. Yarn tensioners: Additive, multiplicative, combined and compensating type. Patterning: Reasons and remedies. Yarn fault classifying systems. Basic features of auto winders like Autoconer, Barbar colmman, Murata etc. Basic features of automatic winding machines, stop motions in winding machine, types of warp packages.

**Pirn winding:** Objectives, types of pirns, , basic feature of pirn winding, yarn path on pirn winding machine, yarn traversing system, different automation and standard winding parameters.

**UNIT-II**

**Warping:** Objectives, classification of warping, beam warping, sectional warping, conditions for warping, comparison of beam warping with sectional warping, basic features of warping machine, beaming, head stock, relation between section height and cone angle, drum storage capacity, different types of creels, leasing systems.

**Sizing:** Objectives, Classification and features of sizing methods and sizing machines, stresses on warp yarn during weaving, sizing parameters-size concentration, size percentage, size add-on, features of conventional slasher sizing machine, sizing ingredients, size preparation.Starch, modification of starch, polyvinyl alcohol, carboxyl methyl cellulose, acrylics, binders, lubricants and other additives, sizing of spun yarns, sizing of filament yarn, principle of different non conventional sizing techniques.

**UNIT-III**

**Drawing in:** Object of drawing in, importance, different types of heald wires, different types of drop wires, reed, reed count, drawing in order of plain weave, drawing in order of twill weave, drawing in order of satin weave, automation in drawing in, knotting and gaiting.

# Weaving: General loom elements, Classification of looms, Different motions of looms: Primary, secondary and auxiliary motions.

**Shedding:** Different types of shedding with advantage and disadvantages, geometry of shedding, heald reversing motion, shedding motion principles-open shed, closed shed, semi open shed, Loom timing diagram, early shedding, late shedding, split shedding or staggering of shed, asymmetric shedding, lease rods, back rest, effect of shed timing and back rest settings on properties of fabrics.

**UNIT-IV**

**Picking:** Types of conventional picking: over picking, under picking and parallel picking. Different type of picking accessories and their functions. Picking timing such as late picking and early picking, reasons of false picking and shuttle fly.

**Beating:** Function of beating. Kinematics of sley, sley eccentricity ratio, effects of sley eccentricity on beat up force and timing available for shuttle passage, accelerating force on sley, mechanics of beat up, bumping of loom, effect of yarn irregularity on pick spacing.

**Calculations:** Production, efficiency, Calculation**s** related to winding, warping and sizing.

### Suggested Text Books & References:

1. Talukdar, M.K., “An Introduction to Winding and Warping”, Textile Trade Press, Mumbai.
2. Ajgaonkar, D.B., “Sizing, Materials, Methods and Machines”, Textile Trade Press, Mumbai, 1982.
3. Banerjee, P.K., “Industrial Practices in Yarn winding”, NCUTE Publication, 1999.
4. Ramsbottom, “Warp Sizing Mechanisms”, Columbia Press, Manchester, 1965.
5. Ormerod, A., “Modern Preparation and Weaving Machinery”, Butterworths, 1983.
6. Aitken,”Automatic Weaving”, Columbia Press, Manchester, 1969.
7. Bennet, G.A., “An Introduction to Automatic Weaving”, Columbia Press, Manchester, 1958.
8. Gorder, V and Volkov, P., “Cotton Weaving”, Mir Publications, Moscow, 1987.
9. Sengupta, R., “Yarn Preparation Vol.-I & II”, Mahajan Publishers, Ahmedabad, 1970.
10. Singh, R.B.,”Modern Weaving Calculation, Vol-I Preparatory”, Mahajan Book Distributor, Ahmedabad, 1994.
11. SITRA Report on Work Methods of Conewinder Tenters.
12. BTRA Report on Winding.
13. BTRA Report on Warping and sizing.
14. Lord and Mohemad,”Conversion of Yarn to Fabric”.
15. Hougton,” Hand Book of Cotton Warp Sizing”.

**PCC-TEX-207A**

**TEXTILE CHEMICAL PROCESSING – I**

**L T P Sessional: 25 Marks**

**3 1 - Exam: 75 Marks**

**Total 100 Marks**

**Time: 3 Hrs**

**Note:**

*Question no. 1 is objective type fifteen subpartscovering all the four units.Eight more questions will be set in the question paper i.e. two from each unit. The students will be required to attempt Question no. 1 compulsorily and one question from each unit.*

**UNIT-I**

**Introduction:** Sequence of chemical processing of textiles. Natural and added impurities in textiles.

**Preparatory Processes:**

**Singeing:** Objective, types of singeing, details of various singeing methods with advantages and disadvantages. Evaluation method. Singeing machines.

**Desizing:** Objective, types, method details and mechanism of removal of starch in various methods. Efficiency of desizing.

**Scouring:** Objectives, mechanism of removal of impurities, recipe and controlling parameters involved. Scouring of natural, manmade and blended textiles. Evaluation of scouring efficiency. J-Box and kier machines.

**UNIT-II**

**Bleaching:** Objectives of bleaching. Hypochlorite and Hydrgen peroxide bleaching methods and their mechanism of action. Controlling parameter involved. Efficiency of bleaching.

**Mercerization:** Objectives, mechanism related to various physical and chemical changes in cotton during mercerisation. Process parameters involved in each method. Assessment of efficiency of mercerization: Barium activity number, its determination and interpretation. Different types of Mercerising machines.

**Heat setting:** Objectives and mechanism of heat setting. Different methods of heat setting and their effectiveness. Heat setting conditions and controls. Heat setting of polyester, nylon, acetate and their blends. Evaluation of degree of heat setting.

**UNIT-III**

Dyeing technology of natural and manmade textiles with Direct, Reactive, Vat, Insoluble Azoic, Sulphur, Solubilised vat, Acid, Metal-complex, Basic and Disperse dyes.

**Dyeing machineries:** Loose fibre, yarn and package dyeing machines. Jigger, winch, jet and HTHP beam dyeing m/cs. Padding mangles.

**UNIT-IV**

**Wool Processing:** Briefidea about wool setting and milling.

**Silk Processing:** Brief idea about Degumming.

**Suggested Text Books & References:**

1. Shenai, V.A. “Technology of Textile Processing, Technology of Bleaching and Mercerising”, Vol. 3,Sevak Publisher, Bombay,1996.
2. Shenai, V.A., “Technology of Textile Processing, Chemistry of Textile Auxillaries”, Vol. 5, Sevak Publisher, Bombay, 1976.
3. Shenai, V.A., “Technology of Textile Processing, Chemistry of Dyes and Principles of dyeing”, Vol. 2, Sevak Publisher, Bombay, 1977.
4. Koushik C.V and Jasico A. J., “Chemical Processing of Textile, Preparatory Process and Dyeing”, NCUTE.
5. Marsh, J.T., “Mercerising”, Chapman Publication, London, 1951.
6. Trotman, E.R.,”Textile Technology and Dyeing of Textile Fibres”, GriffinPublication, London, 1970.
7. Shenai, V.A.,”Principle and practice of Dyeing”, SevakPublisher,Bombay.
8. Shenai, V.A.,”Fundamentals of Principles of Textile Wet processing”, Sevak Publisher, Bombay.
9. Datye,K.V.andVaidya, A.A., “Chemical processing of Synthetic Fibres and Blends”, WileyPublication, New York, 1984.
10. Prayag.C.R.”Dyeing of silk and Manmade Fibre”.
11. Prayag, C.R.,”Bleaching, Mercerising and Dyeing of Cotton”.
12. Chakraborty J. N, “Fundamentals and Practices in Colouration of Textiles”, Woodhead Publishing India, 2009.
13. <https://nptel.ac.in/courses/116102016/> (31 May, 2019)

**PCC-TEX-209LA**

**TEXTILE FIBRE – I LAB**

**L T P Practical/Viva 60 Marks**

**- - 2 Sessional: 40 Marks**

**Total 100 Marks**

**Time: 3 Hrs.**

**At least 7 experiments are to be performed by each student.**

**List of Experiments:**

Physical and Chemical identification of following textile fibre(s)

1. Identification of cotton
2. Identification of wool
3. Identification of silk
4. Identification of viscose
5. Identification of bast fibers
6. Identification of polyester
7. Identification of nylon
8. Identification of acrylic
9. Identification of polypropylene
10. Identification of physical structure of fiber by XRD, SEM, NMR
11. Identification of chemical structure of fiber by

Identification of fibers in blend and % of fiber content in blend

1. Analysis of P/C blended fabric
2. Analysis of P/V blended fabric
3. Analysis of P/W blended fabric
4. Analysis of W/C blended fabric
5. Analysis of N/W blended fabric
6. Analysis of L/C blended fabric
7. Analysis of L/S blended fabric
8. Analysis of P/W blended fabric
9. Analysis of W/A blended fabric
10. Analysis of S/W blended fabric
11. Analysis of C/V blended fabric

**Note**: The above experiment should be conducted and shall be decided on factors like:

1. Facilities installed at Institute
2. Accessibility to industry & nearby institute like IIT Delhi, NITRA Ghaziabad, Textile Committee and NITRA Panipat.

3. Trend of technological developments in National & International perspective

**PCC-TEX-211LA**

**YARN MANUFACTURING – I LAB**

**L T P Practical/Viva 60 Marks**

**- - 2 Sessional: 40 Marks**

**Total 100 Marks**

**Time: 3 Hrs.**

**At least 7 experiments are to be performed by each student.**

**List of Experiments:**

# Mixing

* 1. To study the different techniques of Mixing and Blending.
  2. To study the application of spin finish and antistatic agents during mixing.

**Opening & Cleaning**

1. Study of general outline of opener and clearer machine employed in a modern Blowroom line.
2. Calculation of speeds of different machine parts for Cotton and Synthetic fibres, Blow/inch of Kirschner beater, Production calculation of blow room. Carding
3. To illustrate the working principle of carding machine.
4. To study the change places and speed of different parts of a carding machine for Cotton and Synthetic fibres.
5. Calculation of the speed, individual draft & total draft and production of carding machine.

# Drawframe

1. To study the working principle and important settings of drawframe machine.
2. Calculation of the total draft and its distribution in draw frame machine.
3. Study of drafting arrangement and top roller weighting system of draw frame machine.

**Note**: The above experiment should be conducted and shall be decided on factors like:

1. Facilities installed at Institute
2. Accessibility to industry & nearby institute like IIT Delhi, NITRA Ghaziabad, Textile Committee and NITRA Panipat.
3. Trend of technological developments in National & International perspective.

**PCC-TEX-213LA**

**FABRIC MANUFACTURING-I LAB**

**L T P Practical/Viva 60 Marks**

**- - 2 Sessional: 40 Marks**

**Total 100 Marks**

**Time: 3 Hrs.**

**At least 7 experiments are to be performed by each student.**

**List of Experiments:**

1. To study the motion transmission system in winding machine.

2. To study the Package stop motion in cone winding machine.

3. Study of precision winding machine.

4. Study of the direct warping machine.

5. Study of the sectional warping machine.

6. To study the passage of yarn on a sizing machine and the features of various parts/ mechanism of the sizing machine.

7. To Study the basic loom mechanism.

8. Study of shedding mechanism.

9. Study of picking mechanism.

10. Study of Beating up mechanism.

**Note**: The above experiment should be conducted and shall be decided on factors like:

1. Facilities installed at Institute
2. Accessibility to industry & nearby institute like IIT Delhi, NITRA Gaziabad, Textile Committee and NITRA Panipat.
3. Trend of technological developments in National & International perspective.

**PCC-TEX-215LA**

**Textile ChemicalProcessing- I Lab**

**L T P Practical/Viva 60 Marks**

**- - 2 Sessional: 40 Marks**

**Total 100 Marks**

**Time: 3 Hrs.**

**At least 7 experiments are to be performed by each student.**

**List of Experiments:**

1. Desizing of cotton fabric using various types of desizing agents.
2. Scouring of Natural fibre in the form of yarn and fabric and find the scouring loss.
3. Scouring of Polyester/ Cotton /Blends and Wool.
4. Degumming of Silk and calculation of weight loss percentage.
5. Bleaching of Natural fibre namely Cotton, jute with
   1. Hyperchloride Bleaching
   2. Peroxide Bleaching
6. Bleaching of Polyester /Cotton Blend.
7. Determination of transmittance, absorbance and concentration of given dye liquor by visible spectrophotometer.
8. Dyeing of cotton yarn with direct dyes, reactive dyes and basic dyes
9. Dyeing of wool with direct dyes, basic dyes, and acid dyes.
10. Understand the color difference in AATCC grey scale (1-5) between standard and batches

(I) Manully with the comparison of grey scale, and

(II) by computer color matching machineand interpretation of color spectograph

1. To conduct practicals as per latest technology/material.

**Note**: The above experiment should be conducted and shall be decided on factors like:

1. Facilities installed at Institute
2. Accessibility to industry & nearby institute like IIT Delhi, NITRA Gaziabad, Textile Committee and NITRA Panipat.
3. Trend of technological developments in National & International perspective.

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **MC-901A** | **Environmental Sciences** | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **0** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | To learn the multidisciplinary nature, scope and importance of Environmental sciences. | | | | | | |
| **Course Outcomes (CO)** | | | | | | | |
| **CO1** | The students will be able to learn the importance of natural resources. | | | | | | |
| **CO2** | To learn the theoretical and practical aspects of eco system. | | | | | | |
| **CO3** | Will be able to learn the basic concepts of conservation of biodiversity. | | | | | | |
| **CO4** | The students will be able to understand the basic concept of sustainable development. | | | | | | |

**UNIT 1**

The multidisciplinary nature of environmental studies, Definition, Scope and Importance, Need for public awareness, Natural Resources: Renewable and Non-Renewable Resources: Natural resources and associated problems.

1. Forest Resources: Use and over-exploitation, deforestation, case studies. Timber eztraction, mining, dams and their effects on forests and tribal people.
2. Water Resources: Use & over-utilization of surface & ground water, floods, drought, conflicts over water, dams-benefits and problems.
3. Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
4. Food Resources: World Food Problems, changes caused by agriculture and overgazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
5. Energy Resources: Growing energy needs, renewable & non-renewable energy sources, use of alternate energy sources. Case studies.
6. Land Resources: Land as a resource, land, degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyle.

**UNIT II**

**Ecosystem-Concept of an ecosystem**. Sturcture and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological Succession, Food Chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: (a) Forest Ecosystem, (b) Grassland Ecosystem, (c) Desert Ecosystem and (d) Aquatic Ecosystems (ponds, streams, lakes, rivers, oceans, esturaries

Field Work: Visit to a local area to document Environment assets-river/forest/grassland/hill/mountain, Visit to a local polluted site-Urban /Rural Industrial/Agricultural, Study of common plants, insects and birds, Study of simple ecosystems-pond, river, hill, slopes etc. (Field work equal to 5 lecture hours).

**UNIT III**

**Biodiversity and its conservation:** Introduction, Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversityof global, National and local levels. India as a mega-diversity nation Hot spots of Biodiversity, Threats to biodiversity: Habitat loss, poaching of wild life, man-wildlife conflicts, Endangered and endemic species of India, Conservation of Biodiversity- In situ and Ex-Situ conservation of biodiversity.

**Environmental Pollution Definition:** Cause, effects and control measures of (a) Air Pollution (b) Water Pollution (c) Soil Pollution (d) Marine Pollution (e) Noise Pollution (f) Thermal Pollution (g) Nuclear Hazards

Solid waste management- cause, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides

**UNIT IV**

**Social Issues and the Environment**. From unsustainable to sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people: Its problems and concerns, Case Studies: Environmental ethics-issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies: Wasteland Reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public Awareness, Human population and the Environment, Population growth, variation among nations, Population explosion-Family Welfare Programme, Environment and human health. Human rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human Health, Case Studies, Drugs and their effects; Useful and harmful drugs, Use and abuse of drugs, Stimulant and depressan drugs, Concept of drug de-addiction, Legal position on drugs and laws related to drugs.

**Suggested Books**

* + - * Environmental Studies- Deswal and Deswal. Dhanpat Rai and Co.
      * Environmental Science and Engineering Anandan, P. and Kumaravelan, R. 2009. Scitech Publications (India) Pvt. Ltd., India.
      * Environmental Studies. Daniels Ranjit R. J. and Krishnaswamy. 2013. Wiley India.
      * Environmental Science- Botkin and Keller. 2012. Wiley , India

**Note: The Examiner will be given the question paper template to set the question paper.**

**PCC-TEX-202A**

**TEXTILE FIBRE – II**

**L T P Sessional: 25 Marks**

**3 1 - Exam: 75 Marks**

**Total 100 Marks**

**Time: 3 Hrs.**

**Note:**

*Question no. 1 is objective type fifteen subparts covering all the four units. Eight more questions will be set in the question paper i.e. two from each unit. The students will be required to attempt Question no. 1 compulsorily and one question from each unit.*

**UNIT-I**

**Introduction**: Basic concept of polymer, homopolymer, copolymer, thermoset, thermoplastic, elastomer, momomer, comonomer, oligomer, degree of polymerization, molecular weight and its practical significance, glass transition tenperature, melting point, factors affecting Tg , Tm, Criteria for fiber forming polymers.

Polymerization techniques w.r.t acrylic and polypropylene : bulk, solution, suspension, emulsion, gas phase polymerization, polymerization mechanism :( addition polymerization, condensation polymerization)

**UNIT-II**

Production of **polyethylene terephthalate** polymer, side reactions during PET synthesis, effect of DEG on polymer and fiber properties, methods to control DEF formation, advantages of TPA over DMT route.

**Melt Spinning:** polymer feed, melting device, extruder, static mixer, pre filtration, manifold, spin pack, spinneret parameters, quenching chambers parameters, take up & winding. High speed spinning and properties of polyester, Physical & chemical properties of polyester.

**UNIT-III**

**Nylon:** Nylon 6 polymer production, parameter in water catalyzed system in caprolactum polymerization,, effect of different parameters on polymerization of nylon 6, continuous polymerization in VK tube, Polymer production of nylon 6,6, fibre formation by melt spinning, Physical and chemical properties, application of nylon fiber.

**Acrylic:** Polymer production, fiber formation by wet and dry spinning, fiber formation and coagulation variables. Comparitive study of wet and dry spinning process, dry jet wet spinning.

**UNIT-IV**

**Polyolefin:** physical and chemical properties of polyethylene and polypropylene fibers, types of polypropylene fiber and their applications.

**Drawing & Texturing:** Drawing condition, phenomenon of necking, Continuous filament drawing machine, texturising methods, draw texturing process, heat setting.

**Suggested Text Books & References:**

1. Lewin M., “Handbook of Fiber Science and Technology (International Fiber Science and Technology)”, CRC Press.
2. Gupta V B and Kothari V. K., “Manufactured Fiber Technology”, Chapman & Hall, London, 1997.

# Mclntyre J. E., “Synthetic Fibres”, 1st Edition, Wood Head Publishing.

# Deopura B.L., Alagirusamy R., Joshi M.,Gupta B., “Polyesters and Polyamides”, Woodhead Publishing in Textiles, CRC, 2008.

1. Kothari V.K., “Textile Fibers: Developments and Innovations”, IAFL Publication 2000.
2. Mishra S.P., “A text Book of Fiber Science and Technology”, New Age International (P) Ltd.
3. Moorthy, S.H.V., “Introduction to Textile Fibers”, Woodhead Textile Series, 2015.
4. Bernard P C., “Textile Fiber to Fabric”, McGraw Hill Book Co.
5. Morton W.E & Hearle J.W.S., “Physical Properties of Textile Fibers”, Textile Institute, U.K.
6. Kothari V.K., “Progess in Textiles: Science & Technology” Vol-2, IAFL Publication New Delhi.
7. Cook G., “Hand Book of Textile Fibers”, Vol-1&2, Woodhead Publication.
8. Vaidya A.A., “Production of Synthetic Fibers” Prentice-Hall of India Pvt Limited.
9. Moncrieff R. W., “Manmade Fibres”, Lliffe Publication, The University of California, 1996.
10. Billmeyer F.W., “Textbook of Polymer Science”, 3rd edition, Wiley-Blackwell, 1984.
11. Gowarikar V.R., Viswanathan N.V., Sreedhar J., “Polrmer Science”, Halsted Press New York, 1986.

TT-204A

**YARN MANUFACTURING-II**

**L T P Sessional: 25 Marks**

**3 1 - Exam: 75 Marks**

**Total 100 Marks**

**Time: 3 Hrs.**

**Note:***Question no. 1 is objective type fifteen subparts covering all the four units.Eight more questions will be set in the question paper i.e. two from each unit. The students will be required to attempt Question no. 1 compulsorily and one question from each unit.*

# UNIT-I

# Combing

Objective, Different combing preparatory process for lap preparation – Sliver lap, Ribbon lap and Unilap machine, Different types of comber, Combing cycle of rectilinear cotton comber, Timing diagram for combing operation, Configuration of fibre feed and its effect on quality of product, noil percentage and fractionation efficiency of comber, Influence of type of feed on noil extraction and cleanliness of sliver, Calculation pertaining to draft, production and noil percentage.

# UNIT-II

# Speed frame

Objective, Working principle of speed frame, Construction and working of important parts, Mechanism of drafting, twisting and winding, Basic principle of designing of cone drum, Differential motions & Building  motions, Common defects in roving packages, their causes and remedies, Processing of man-made fibres on speed  frame , Recent development in speed frame. Calculations pertaining to draft, TPI and production, twist multiplier and roving twist.

# UNIT-III

# Ring frame

Objective, Principle and mechanism involved in drafting, twisting and winding, Ordinary and high draft systems, Rising and falling lappets, balloon control rings, Design and types of spindle, ring and traveler, Concept of twist multiplier and yarn contraction due to twisting, types of builds, Mechanism of package formation, Causes and remedies to control end breaks, Recent developments in ring frame, Concept of average mill count and 20’s conversion.

# UNIT-IV

# Doubling

Objective and terminology, Requirement of feed package for yarn plying, Systems of doubling (dry &wet) study of ring doublers, Two for one twister (TFO)- objective & working principle, Calculation of draft, TPI and production of ring frame & doubling frame.

# Suggested Text Books and References:

1. Klein, W., “Manual of Textile Technology: Vol. I. Technology of Short StapleSpinning”, – Textile Institute, Manchester, 1998.
2. Klein, W., “Manual of Textile Technology: Vol. III. A practical Guide to Combing & Drawing”, – Textile Institute, Manchester, 1995.
3. Klein, W., “Manual of Textile Technology: Vol. IV. A practical Guide to Ring Spinning”, – Textile Institute, Manchester, 1995.
4. Klein, W., “Manual of Textile Technology: Vol. VI. Manmade Fibres and their Processing”, – Textile Institute, Manchester, 1994.
5. Salhotra K R, “Spinning of Man Made Fibres and Blends on Cotton Spinning System”,The Textile Association, Mumbai, 1989.
6. Salhotra, K.R., Alagirusamy, R. and Chattopadhayay R.(Eds.), “Course Material of Pilot Programme on Spinning: Ring Spinning, Doubling and Twisting”, NCUTE Publication, 2000.
7. Chattopadhyay, R., and Rengasamy (Eds.), “Course Pilot Programme on Spinning: Drawing Combing and Roving”, NCUTE Publication, 1999.
8. Oxtoby, E. “Spun Yarn Technology”. Butterworths, London.
9. Khare A R, “Elements of Combing”, Sai book center, Mumbai, 1999.
10. Khare A R “Elements of Ring Frame and Doubling”, Sai book Centre, Mumbai, 1999.
11. Lawrence C A, “Fundamental of Spun Yarn Technology” CRC Press, USA,2003.
12. Booth J E, “Textile Mathematics”, Part II, Textile Institute, Manchester, 1978.
13. <https://nptel.ac.in/courses/116102038/> (31st May, 2019)

**PCC-TEX-206A**

**FABRIC MANUFACTURING-II**

**L T P Sessional: 25 Marks**

**3 1 - Exam: 75 Marks**

**Total 100 Marks**

**Time: 3 Hrs.**

**Note:**

*Question no. 1 is objective type fifteen subparts covering all the four units.Eight more questions will be set in the question paper i.e. two from each unit. The students will be required to attempt Question no. 1 compulsorily and one question from each unit.*

# UNIT-I

**Secondary motion**

**Take up motion:** Negative take up, positive take up, five wheel take up motion, seven wheel take up motion, electronic take up.

**Let Off Motion:** Objective, negative let off motion, positive let off motion- basic requirements, tension control mechanism, electrical let off motion, warp tension variation.

**Unit-II**

**Auxilliary motion**: Objective, classification.

**Weft Stop motion:** objective, side weft fork motion, centre weft fork motion.

**Warp Stop motion:**  objective, mechanical warp stop motion, electrical warp stop motion.

**Warp Protecting motion**: objective, loose reed warp protecting motion, fast reed warp protecting motion, electromagnetic warp protecting motion.

Weft mixing motion, Mutiple box motion, 4×1 drop box motion, preparation of pattern cards, pick at will motion.

**Unit-III**

**Automatic looms:** basic features, advantages over plain looms, classification of automatic looms, weft feeling mechanism, mechanical weft feeler, electronic weft feeler, optical weft feeler, pirn changing mechanism, shuttle changing mechanism, bobbin loader mechanism.

**Dobby Shedding:** Main parts of dobby loom, types of Dobby, negative dobby, single, double lift single jack dobby, double lift double jack dobby, design and peg plan for dobbies, positive dobby, electronic dobby, types of shed formed in dobby

**Unit-IV**

**Jacquard Shedding:** Principle parts of jacquard machine, types of jacquard, types of shed formed in jacquard, single lift single cylinder jacquard, double lift single cylinder jacquard, double lift double cylinder jacquard, harness building, harness ties, design ties, card cutting, card lacing

**Calculations:** Production, efficiency, Calculation**s** related to weaving.

# Suggested Text Books & References

1. Marks and Robinson,”Principles of Weaving”.Textile Institute,Manchester,1986.
2. Thomas fox,”Mechanism of Weaving”,Bombay Universal Publishing Co,1993.
3. Lord and Mohemad,”Conversion of Yarn to Fabric”,Merrow Publishing Co.Ltd, England,1988.
4. Aswani,K.T.,”Plain Weaving Mechanism”,Mahajan Publishers,Ahmedabad,1996.
5. Aswani,K.T.,”Fancy Weaving Mechanism”,Mahajan Publisher,Ahmedabad,1990.
6. Sengupta,R.,”Weaving Calculations”,Taraporwala Sons,Bombay 1990.
7. Banerjee,N.N.,”Weaving Mechanism Vol,-I & Vol.II”,West Bengal,1994.
8. Rai,Hasmukh,”Fabric Forming”,S.S.M.Institute,Kuomarapalyam Tamil Nadu,1996.
9. Talukdar,M.K.,”Modern Weaving Technology”,NICTAS,Ahmedabad,1998.
10. Rapier Looms,WIRA Research & Technical Service Manual for industry.
11. Kharwani,P.A.,”Weaving I shuttle looms”,NCUTE Publication,1999.
12. Khatwani,P.A.,”Weaving II Shuttleless Looms”,NCUTE Publication,1999.
13. Khatwani,P.A.”Filament Weaving”, NCUTE Publication,2000.

**PCC-TEX-208A**

**Textile Chemical Processing - II**

**L T P**

**3 1 - Sessional: 25 marks**

**Exam: 75 marks**

**Total: 100 marks**

**Time: 3Hrs**

**Note:**

*Question no. 1 is objective type fifteen subparts covering all the four units.Eight more questions will be set in the question paper i.e. two from each unit. The students will be required to attempt Question no. 1 compulsorily and one question from each unit.*

**UNIT-1**

**Printing:** Introduction to printing methods block, screen and roller printing. Advantages and disadvantages of each method. Various styles of printing like Direct, Discharge and Resist styles on natural, man-made and blended textiles.Ingredients of print paste with their details. Classification and mechanism of working of thickeners.

**Transfer Printing:** Types, mechanism of transfer printing and machineries.

**Pigment Printing:** Mechanism and recipe details of pigment printing.

**UNIT-II**

**Finishing:**

**Mechanical Finishes:** Calendaring - its types, construction and function of various calendaring m/cs. Sanforizing - method, mechanism and machineries involved. Sueding /raising, Napping and Shearing finishes, Foam finishing technology.

**Chemical Finishes:** Problem of creasing, anti-crease finish on cotton. Drawback and advantages associated with use of various anti-crease chemicals. Water repellency and water repellent finishes on cotton. Evaluation of water repellency. Flame proofing and its evaluation. Softeners and their application.Silk Finishing: Weighting of silk and Scroop finish.

**UNIT-III**

**Developments in preparatory and dyeing:** Continuous pre-treatment and Continuous dyeing. Mass coloration principle, technology and different methods, Tie and dye, Batik printing.

**UNIT-IV**

Ecofriendly processing and Effluent generated from textile processing and its treatment.

**Fastness properties:** Light fastness, rubbing fastness, Sublimation fastness, Perspiration fastness, Washing fastness properties evaluation.

**Suggested Text Books and References**

1. Shenai, V.A., “Technology of Textile Processing Vol. 2,3,4,6, and 10”, Sevak Publisher, Bombay.
2. Koushik C.V and Jasico A. J., Chemical Processing of Textile, Preparatory Process and Dyeing, NCUTE.
3. R.S.Prayag, “Technology of Textile Printing”, Shree J.Printers, 1999.
4. Marsh, J.T., “An Introduction to Textile Finishing”, Chapman Publication, London, 1948.
5. Trotman, E.R. “Textile Technology and Dyeing of Textile Fibres”. Griffin Publication, London, 1970.
6. Shenai, V.A. “Principle and Practice of Dyeing”, Sevak Publisher, Bombay.
7. Datye, K.V. and Vaidya, A.A., “Chemical Processing of Synthetic Fibres and Blends”, Wiley Publication, New York
8. Prayag, C.R., “Bleaching, Mercerising and Dyeing of Cotton”, Dharwar, Karnataka, India, 1990.
9. Vankar, Padma, “Textile Effluents”, NCUTE Publication, 2001.
10. Prayag R.S, “Textile Finishing’’, 1994.
11. V.A.Shenai, “Technology of Finishing”, Sevak Publication, 1996.
12. V. A Shenai, “Technology of Printing”, Sevak Publications, Mumbai, 1990.

**PCC-TEX-210LA**

###### YARN MANUFACTURING-II LAB

**L T P Practical/Viva 60 Marks**

**- - 2 Sessional: 40 Marks**

**Total 100 Marks**

**Time: 3 Hrs.**

**At least 7 experiments are to be performed by each student.**

**List of Experiments:**

**Combing**

1. To the study the different methods of lap formation in combing preparatory.
2. To study the combing cycle of a rectilinear cotton comber.

**Speedframe**

1. To study the drafting, twisting and winding zone of speed frame.
2. To study the building motion in speed frame.
3. Calculation of break draft constant, draft constant and twist constant and productionof speed frame.

# Ringframe

1. To demonstrate the working principle of a ringframe.
2. To study the different components of drafting system and twisting system.
3. Calculation pertaining to gearing, speed, constant, draft and production.

# Doubling

1. To show the passage of yarn in doubling machine and demonstrate the working principle.

**Note**: The above experiment should be conducted and shall be decided on factors like:

1. Facilities installed at Institute
2. Accessibility to industry & nearby institute like IIT Delhi, NITRA Gaziabad, Textile Committee and NITRA Panipat.
3. Trend of technological developments in National & International perspective.

**PCC-TEX-212LA**

###### **FABRIC MANUFACTURING-II LAB**

**L T P Practical/Viva 60 Marks**

**- - 2 Sessional: 40 Marks**

**Total 100 Marks**

**Time: 3 Hrs.**

**At least 7 experiments are to be performed by each student.**

**List of Experiments:**

1. Study of take up motion.

2. Study of negative let-off system

3. Study of positive let-off system.

4. Study of Warp protection motion (both loose reed and fast reed).

5. Study of warp stop motion.

6. Study of weft stop motion.

7. Study of pirn changing mechanism.

8. Study of multiple box motion.

9. Study of dobby mechanism.

10. Study of jacquard mechanism.

**Note**: The above experiment should be conducted and shall be decided on factors like:

1. Facilities installed at Institute
2. Accessibility to industry & nearby institute like IIT Delhi, NITRA Gaziabad, Textile Committee and NITRA Panipat.
3. Trend of technological developments in National & International perspective.

**PCC-TEX-214LA**

###### TEXTILE CHEMICAL PROCESSING-II LAB

**L T P Practical/Viva 60 Marks**

**- - 2 Sessional: 40 Marks**

**Total 100 Marks**

**Time: 3 Hrs.**

**At least 7 experiments are to be performed by each student.**

**List of Experiments:**

1. Conduct practicals on Conventional and latest machines (Preparatory / dyeing / Finishing).
2. Conduct practicals on Recent developed methods of dyeing using different type of dyes
   1. Natural
   2. Synthetic
   3. Blends
3. Dyeing of cotton yarn with vat, reactive and sulphur in a sample pot dyeing machine.
4. Dyeing of cotton fabric with vat, reactive and sulphur dyes in laboratory jigger machine.
5. Calibration of dyeing and recipe prediction with the help of CCM.
6. Study of fastness to washing and rubbing with the help of CCM.
7. Reproduction of shade with the aid of computer as well as visual methods.
8. Printing with kerosene and synthetic based thickeners. Evaluate the printing with qualitative and quantitative methods on different materials.
9. Conduct practical with transfer printing technique on different materials.
10. Quantitative analysis of different textile blends in fibre, yarn and fabric form.

**Note**: The above experiment should be conducted and shall be decided on factors like:

1. Facilities installed at Institute
2. Accessibility to industry & nearby institute like IIT Delhi, NITRA Gaziabad, Textile Committee and NITRA Panipat.
3. Trend of technological developments in National & International perspective.

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| --- | --- | --- | --- | --- | --- | --- |
| **MC-902A** | **Constitution of India** | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **-** | **-** | **75** | **25** | **100** | **3 Hrs.** |
| **Purpose** | **To know the basic features of Constitution of India** | | | | | |
| **Course Outcomes** | | | | | | |
| **CO1** | **The students will be able to know about salient features of the Constitution of India.** | | | | | |
| **CO2** | **To know about fundamental duties and federal structure of Constitution of India.** | | | | | |
| **CO3** | **To know about emergency provisions in Constitution of India.** | | | | | |
| **CO4** | **To know about fundamental rights under constitution of India.** | | | | | |

**UNIT-I**

1. Meaning of the constitution law and constitutionalism, Historical perspective of the Constitution of India. Salient features and characteristics of the Constitution of India.
2. Scheme of the fundamental rights

**UNIT - II**

1. The scheme of the Fundamental Duties and its legal status. The Directive Principles of State Policy – Its importance and implementation. Federal structure and distribution of legislative and financial powers between the Union and the States.
2. Parliamentary Form of Government in India – The constitution powers and status of the President of India

**UNIT - III**

1. Amendment of the Constitutional Powers and Procedure. The historical perspectives of the constitutional amendments in India.
2. Emergency Provisions: National Emergency, President Rule, Financial Emergency. Local Self Government – Constitutional Scheme in India.

**UNIT-IV**

7. Scheme of the Fundamental Right to Equality. Scheme of the Fundamental Right to certain Freedom under Article 19.

8. Scope of the Right to Life and Personal Liberty under Article 21.

**Text Books**

1. Constitution of India. Prof.Narender Kumar (2008) 8th edition. Allahabad Law Agency**.**

**Reference Books:**

1. The constitution of India. P.M. Bakshi (2016) 15th edition. Universal law Publishing.