



**INDIAN INSTITUTE OF HANDLOOM TECHNOLOGY, JODHPUR**  
(Approved by AICTE, New Delhi)



Curriculum for  
Three Year  
**Diploma in  
Handloom and  
Textile Technology  
(DHTT)  
R2021**





**Government Of India**  
Ministry of Textiles  
**INDIAN INSTITUTE OF HANDLOOM TECHNOLOGY**  
**JODHPUR**  
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**CURRICULUM FOR 3 YEAR**  
**DIPLOMA IN HANDLOOM AND TEXTILE TECHNOLOGY (DHTT)**  
**(R-2021)**

**INDIAN INSTITUTE OF HANDLOOM TECHNOLOGY**  
Bargarh/Fulia/Guwahati/Jodhpur/Salem/Varanasi/Champa/Kannur/KHTI-Gadag/SPKM-Venkatagiri  
**DIPLOMA IN HANDLOOM & TEXTILE TECHNOLOGY**

**REGULATION 2021 – CURRICULUM**

<b>SEMESTER - I</b>								
SI No	Category of Course	Code No	Course Title	Hours/week			Total credit Hrs/week	Credits
				L	T	P		
1	Basic Science	BS101	Mathematics - I	2	1	0	3	3
2	Basic Science	BS105	Applied Chemistry	2	1	0	3	3
3	Humanities & Social Science	HS101	Communication Skills in English	2	0	0	2	2
4	Engineering Science	ES101	Engineering Graphics	0	0	3	3	1.5
5	Engineering Science	ES103	Engineering Workshop Practice	0	0	3	3	1.5
6	Basic Science	BS109	Applied Chemistry Lab	0	0	2	2	1
7	Humanities & Social Science	HS103	Sports and Yoga	0	0	2	2	1
8	Humanities & Social Science	HS105	Communication Skills in English Lab	0	0	2	2	1
9	Audit	AU102	Environmental Science	2	0	0	2	0
<b>Total Credits</b>							<b>14</b>	
<b>SEMESTER - II</b>								
SI No	Category of Course	Code No	Course Title	Hours/week			Total credit Hrs/week	Credits
				L	T	P		
1	Basic Science	BS102	Mathematics - II	3	1	0	4	4
2	Basic Science	BS103	Applied Physics	2	1	0	3	3
3	Engineering Science	ES102	Introduction to IT System	3	0	0	3	3
4	Engineering Science	ES104	Fundamentals of Electrical, Electronics Engineering	2	1	0	3	3
5	Engineering Science	ES106	Engineering Mechanics	2	1	0	3	3
6	Basic Science	BS107	Applied Physics Lab	0	0	2	2	1
7	Engineering Science	ES108	Introduction to IT System Lab	0	0	2	2	1
8	Engineering Science	ES110	Fundamentals of Electrical, Electronics Engineering Lab	0	0	2	2	1
9	Engineering Science	ES112	Engineering Mechanics Lab	0	0	2	2	1
<b>Total Credits</b>							<b>20</b>	

SEMESTER - III								
Sl No	Category of Course	Code No	Course Title	Hours/week			Total credit Hrs/week	Credits
				L	T	P		
1	Programme Core	HTPC201	Textile Fibers	3	0	0	3	3
2	Programme Core	HTPC202	Yarn Manufacturing Technology	3	0	0	3	3
3	Programme Core	HTPC203	Handloom Weaving Technology	3	0	0	3	3
4	Programme Core	HTPC204	Fabric Structure – I	2	1	0	3	3
5	Programme Core	HTPC205	Chemical Processing of Textiles - I	3	0	0	3	3
6	Programme Core	HTPC206	Handloom Weaving Technology Lab	0	0	4	4	2
7	Programme Core	HTPC207	Fabric Analysis & Costing Lab - I	0	0	2	2	1
8	Programme Core	HTPC208	Chemical Processing of Textiles Lab - I	0	0	4	4	2
9	Internship	SI201*	Internship – I	0	0	0	0	2
				<b>Total Credits</b>				<b>22</b>
SEMESTER - IV								
Sl No	Category of Course	Code No	Course Title	Hours/week			Total credit Hrs/week	Credits
				L	T	P		
1	Programme Elective	HTPE2**	Programme Elective - I	3	0	0	3	3
2	Programme Core	HTPC209	Weaving Technology - I	3	0	0	3	3
3	Programme Core	HTPC210	Fabric Structure – II	2	1	0	3	3
4	Programme Core	HTPC211	Chemical Processing of Textiles –II	3	0	0	3	3
5	Programme Core	HTPC212	Textile Testing - I	3	0	0	3	3
6	Programme Core	HTPC213	Colour Concept and Textile Design Lab	0	0	2	2	1
7	Programme Core	HTPC214	Weaving Technology Lab	0	0	4	4	2
8	Programme Core	HTPC215	Chemical Processing of Textiles Lab - II	0	0	4	4	2
9	Programme Core	HTPC216	Textile Testing Lab – I	0	0	3	3	1.5
10	Audit	AU202	Essence of Indian Knowledge and Tradition	2	0	0	2	0
				<b>Total Credits</b>				<b>21.5</b>

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SEMESTER - V								
Sl No	Category of Course	Code No	Course Title	Hours/week			Total credit Hrs/week	Credits
				L	T	P		
1	Programme Elective	HTPE3**	Programme Elective - II	3	0	0	3	3
2	Programme Elective	HTPE3**	Programme Elective - III	3	0	0	3	3
3	Programme Core	HTPC301	Weaving Technology - II	3	0	0	3	3
4	Programme Core	HTPC302	Textile Testing - II	3	0	0	3	3
5	Open Elective	##	Open Elective - I	3	0	0	3	3
6	Programme Core	HTPC304	Jacquard Weaving & Computer Aided Textile Designing Lab	0	0	4	4	2
7	Programme Core	HTPC305	Textile Testing Lab - II	0	0	3	3	1.5
8	Projects	PR202	Minor Projects	0	0	4	4	2
9	Internship	SI301**	Internship – II	0	0	0	0	3
10	Audit	AU302	Indian Constitution	2	0	0	2	0
11	Humanities & Social Science	HS302	Seminar	0	0	3	3	1.5
				<b>Total Credits</b>				<b>25</b>
SEMESTER - VI								
Sl No	Category of Course	Code No	Course Title	Hours/week			Total credit Hrs/week	Credits
				L	T	P		
1	Humanities & Social Science	HS303	Entrepreneurship and Start-ups	3	1	0	4	4
2	Programme Elective	HTPE3**	Programme Elective - IV	3	0	0	3	3
3	Open Elective	##	Open Elective - II	3	0	0	3	3
4	Projects	PR302	Major Project	0	0	8	8	4
5	Programme Core	HTPC306	Fabric Analysis & Costing Lab - II	0	0	2	2	1
6	Programme Core	HTPC307	Handicraft Textiles & Handloom Tourism of India	3	0	0	3	3
				<b>Total Credits</b>				<b>18</b>

**DETAILS OF CREDIT DISTRIBUTION**

Category	Credits Allotted	Credit required as per AICTE Norms
Humanities and Social Sciences	9.5	8
Basic Sciences	15	19
Engineering Science	15	15
Programme Core	52	45-50
Programme Elective	12	12-16
Open Elective	6	9-12
Summer Internship - I	2	2
Summer Internship - II	3	3
Minor Project	2	2
Major Project	4	4
Audit Course	0	0
<b>Overall Credit</b>	<b>120.5</b>	<b>119</b>

**LIST OF PROGRAMME ELECTIVES (PE)**

Programme Elective-I		Programme Elective-II		Programme Elective-III		Programme Elective-IV	
Code no.	Course Title	Code no.	Course Title	Code no.	Course Title	Code no.	Course Title
HTPE201	Textile Costing	HTPE301	Knitting Technology	HTPE304	Technical Textiles	HTPE307	Technological Developments in Handlooms
HTPE202	Garment Manufacturing Technology	HTPE302	Advanced Fabric Structure	HTPE305	Apparel Marketing and Merchandising	HTPE308	Traditional Handloom Textiles of India
HTPE203	Non-Woven Technology	HTPE303	Fashion Designing	HTPE306	Advances in Textile Processing	HTPE309	Home Textiles

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### LIST OF OPEN ELECTIVES (OE)

Open Elective-I		Open Elective-II	
Code no.	Course Title	Code no.	Course Title
HTOE301	Product Design	HTOE305	Project Management
HTOE302	Introduction to E - Governance	HTOE306	Operations Research
HTOE303	Cyber Security laws, Standards and IPR	HTOE307	Internet of Things
HTOE304	Engineering Economics and Accountancy	HTOE308	Virtual Reality
HTOE309	Energy Conservations and Audit	HTOE311	Disaster Management
HTOE310	Renewable Energy Technologies	HTOE312	Marketing Management and Foreign Trade

#### **\*Internship — I (3-4 weeks)**

**2 Credits**

The internship with course code SI201 pertains to the 3<sup>rd</sup> semester. This shall be undertaken during the summer vacation at the end of 2<sup>nd</sup> semester. After completing the internship, the students shall submit the report to the faculty during the 3<sup>rd</sup> semester for assessment. This internship shall be undertaken in an industry/Govt. or Pvt. Certified Agencies which are in Social sector/ Govt. Skill Centers/Institutes/Schemes.

#### **\*\*Internship — II (4-6 weeks)**

**3 Credits**

The internship with course code SI301 pertains to the 5<sup>th</sup> semester. This shall be undertaken during the summer vacation at the end of 4<sup>th</sup> semester. After completing the internship, the students shall submit the report to the faculty during the 5<sup>th</sup> semester for assessment. This shall be undertaken in an industry only.

#### **Major Project**

**4 Credits**

PR302 Should be based on real/ live problems of the Industry/Govt./NGO/MSME/Rural sector or an innovative idea having the potential of a Start-up.



**INDIAN INSTITUTE OF HANDLOOM TECHNOLOGY**  
**DIPLOMA IN HANDLOOM & TEXTILE TECHNOLOGY**

**REGULATION 2021**

**SEMESTER I**

**BS101 : MATHEMATICS I**

L	T	P	C
2	1	0	3

**COURSE OBJECTIVES**

This course is designed to give a comprehensive coverage at an introductory level to the subject of Trigonometry, Differential Calculus, permutations, combinations and Basics of Probability and statistics.

**Unit 1 TRIGONOMETRY**

9

Concept of angles, measurement of angles in degrees, grades and radians and their conversions, T-Ratios of Allied angles (without proof), Sum, difference formulae and their applications (without proof). Product formulae (Transformation of product to sum, difference and vice versa). T- Ratios of multiple angles, sub-multiple angles (2A, 3A, A/2).

**Unit 2 DIFFERENTIAL CALCULUS**

9

Definition of function; Concept of limits. Four standard limits  $\lim_{x \rightarrow a} \left( \frac{x^n - a^n}{x - a} \right)$ ,  $\lim_{x \rightarrow 0} \left( \frac{\sin x}{x} \right)$ ,  $\lim_{x \rightarrow a} \left( \frac{a^x - 1}{x} \right)$ , and  $\lim_{x \rightarrow a} (1 + x)^{\frac{1}{x}}$ , Differentiation by definition of  $x^n$ ,  $\sin x$ ,  $\cos x$ ,  $\tan x$ ,  $e^x$  and  $\log_a x$ . Differentiation of sum, product quotient of functions. Differentiation of trigonometric and inverse trigonometric functions, Logarithmic differentiation, Exponential functions.

**Unit 3 PERMUTATIONS & COMBINATIONS**

9

Value of  ${}^n P_r$  and  ${}^n C_r$ . Binomial theorem: Binomial theorem (without proof) for positive integral index (expansion and general form); binomial theorem for any index (expansion without proof) first and second binomial approximation with applications to engineering problems.

**Unit 4 PROBABILITY & RANDOM VARIABLE**

9

Axioms of Probability - Conditional Probability - Total Probability - Baye's theorem - Definition of Random variable - and Types.

**Unit 5 STATISTICAL QUALITY CONTROL**

9

Concept of samples - types of samples - Control charts for measurements (X and R charts) - Control charts for attributes (p, c and np charts) - Tolerance limits - Acceptance sampling.





**Total: 45 Hour**

### **COURSE OUTCOMES**

At the end of the study of this course, the students will be able to

- CO1 Appreciate the importance of the geometric study as well as the calculation and the mathematical analysis, by applying trigonometric concepts.
- CO2 Find the effects of changing conditions on a system
- CO3 Solve simple counting problems using permutations and combination concept
- CO4 Apply the concept of probability and random variable in solving real life problems.
- CO5 Analyse the quality of samples by applying sampling technique

### **TEXT BOOK**

- 1 B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi, 40<sup>th</sup>Edition, 2007.
- 2 G. B. Thomas, R. L. Finney, Calculus and Analytic Geometry, Addison Wesley, 9<sup>th</sup>Edition, 1995.
- 3 Reena Garg, Engineering Mathematics, Khanna Publishing House, New Delhi (Revised Ed. 2018)

### **REFERENCE BOOK**

- 1 Sundaram, R. Balasubramanian, K. A. Lakshminarayanan, Engineering Mathematics, 6/e., Vi-kas Publishing House.
- 2 Reena Garg & Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishing House, New Delhi
- 3 Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
- 4 Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014

### **BS105: APPLIED CHEMISTRY**

	L	T	P	C
<b>COURSE OBJECTIVES</b>	2	1	0	3

To understand, ascertain and analyze and properties of natural raw materials require for producing economical and eco-friendly finished products.

- 1 Solve various engineering problems applying the basic knowledge of atomic structure and chemical bonding.
- 2 Use relevant water treatment method to solve domestic and industrial problems.
- 3 Solve the engineering problems using knowledge of engineering materials and properties.
- 4 Use relevant fuel and lubricants for domestic and industrial applications
- 5 Solve the engineering problems using concept of Electrochemistry and corrosion.

Unit 1 ATOMIC STRUCTURE, CHEMICAL BONDING & SOLUTIONS 9

Rutherford model of atom, Bohr's theory (expression of energy and radius to be omitted),



and hydrogen spectrum explanation based on Bohr's model of atom, Heisenberg uncertainty principle, Quantum numbers–orbital concept. Shapes of s,p and d orbitals, Pauli's exclusion principle, Hund's rule of maximum multiplicity Aufbau rule, electronic configuration. Concept of chemical bonding – cause of chemical bonding, types of bonds: ionic bonding (NaCl example), covalent bond (H<sub>2</sub>, F<sub>2</sub>, HF hybridization in BeCl<sub>2</sub>, BF<sub>3</sub>, CH<sub>4</sub>, NH<sub>3</sub>, H<sub>2</sub>O), coordination bond in NH<sub>4</sub><sup>+</sup>, and anomalous properties of NH<sub>3</sub>, H<sub>2</sub>O due to hydrogen bonding, and metallic bonding. Solution – idea of solute, solvent and solution, methods to express the concentration of solution molarity (*M*=mole per liter), ppm, mass percentage, volume percentage and mole fraction.

## Unit 2 WATER

9

Graphical presentation of water distribution on Earth (pie or bar diagram). Classification of soft and hard water based on soap test, salts causing water hardness, unit of hardness and simple numerical on water hardness.

Cause of poor lathering of soap in hard water, problems caused by the use of hard water in boiler (scale and sludge, foaming and priming, corrosion etc), and quantitative measurement of water hardness by ETDA method, total dissolved solids (TDS) alkalinity estimation.

- i). Water softening techniques – soda lime process, zeolite process and ion exchange process.
- ii). Municipal water treatment (in brief only) – sedimentation, coagulation, filtration, sterilization.

Water for human consumption for drinking and cooking purposes from any water sources and enlist Indian standard specification of drinking water (collect data and understand standards).

## Unit 3 ENGINEERING MATERIALS

9

Natural occurrence of metals – minerals, ores of iron, aluminium and copper, gangue (matrix), flux, slag, metallurgy – brief account of general principles of metallurgy. Extraction of - iron from haematite ore using blast furnace, aluminium from bauxite along with reactions. Alloys – definition, purposes of alloying, ferrous alloys and non-ferrous with suitable examples, properties and applications. General chemical composition, composition based applications (elementary idea only details omitted): Port land cement and hardening, Glasses Refractory and Composite materials. Polymers – monomer, homo and co polymers, degree of polymerization, simple reactions involved in preparation and their application of thermoplastics and thermosetting plastics (using PVC, PS, PTFE, nylon – 6, nylon-6,6 and Bakelite), rubber and vulcanization of rubber.

## Unit 4 CHEMISTRY OF FUELS AND LUBRICANTS

9

Definition of fuel and combustion of fuel, classification of fuels, calorific values (HCV and LCV), calculation of HCV and LCV using Dulong's formula. Proximate analysis of coal



solid fuel Petrol and diesel - fuel rating (octane and cetane numbers), Chemical composition, calorific values and applications of LPG, CNG, water gas, coal gas, producer gas and bio gas.

Lubrication – function and characteristic properties of good lubricant, classification with examples, lubrication mechanism – hydrodynamic and boundary lubrication, physical properties (viscosity and viscosity index, oiliness, flash and fire point, cloud and pour point only) and chemical properties (coke number, total acid numbers a pontification value) of lubricants.

## Unit 5 ELECTROCHEMISTRY

9

Electronic concept of oxidation, reduction and redox reactions.

Definition of terms: electrolytes, non-electrolytes with suitable examples, Faradays laws of electrolysis and simple numerical problems.

Industrial Application of Electrolysis

- Electrometallurgy
- Electroplating
- Electrolytic refining.

Application of redox reactions in electrochemical cells –

- Primary cells – dry cell,
- Secondary cell- commercially used lead storage battery, fuel and Solar cells.

Introduction to Corrosion of metals–

- Definition, types of corrosion (chemical and electrochemical), H<sub>2</sub> liberation and O<sub>2</sub> absorption mechanism of electrochemical corrosion, factors affecting rate of corrosion.

Internal corrosion preventive measures –

- Purification, alloying and heat treatment and External corrosion preventive measures:  
a) metal (anodic, cathodic) coatings, b) organic inhibitors.

**Total: 45 Hour**

### **COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Describe the classification and general properties of engineering materials such as metal, alloys, glasses, cement, refractory and composite materials using knowledge of chemical bonding.
- CO2 Assess the suitability of water source for domestic and industrial application, effluents and minimize water pollution.
- CO3 Qualitatively analyze the engineering materials and appreciate their properties and applications.
- CO4 Choose fuel and lubricants suitable for economical industrial processing to obtain eco-friendly finished products.
- CO5 a) Ascertain construction, mechanism efficiency of electrochemical cells, solar cell fuel cells  
b) Explain corrosion and develop economical prevention techniques.



### TEXT BOOK

- 1 Text Book of Chemistry for Class XI & XII (Part-I, Part-II); N.C.E.R.T., Delhi, 2017-18.
- 2 Agarwal, & Shikha, Engineering Chemistry, Cambridge University Press; New Delhi, 2015.
- 3 C.N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd., 2011.
- 4 Dara, S.S & Dr.S.S.Umare, Engineering Chemistry, S. Chand. Publication, New Delhi, 2015.
- 5 Jain & Jain, Engineering Chemistry, Dhanpat Rai and Sons; New Delhi, 2015.

### REFERENCE BOOK

- 1 Dr. Vairam, S., Engineering Chemistry, Wiley India Pvt. Ltd., New Delhi, 2013.
- 2 Dr. G. H. Hugar & Prof A. N. Pathak, Applied Chemistry Laboratory Practices, Vol. I and Vol. II, NITTTR, Chandigarh, Publications, 2013, 14.
- 3 Agnihotri, Rajesh, Chemistry for Engineers, Wiley India Pvt. Ltd., 2014.
- 4 [www.chemguide.co.uk/atommenu.html](http://www.chemguide.co.uk/atommenu.html) (Atomic structure and chemical bonding)
- 5 [www.visionlearning.com](http://www.visionlearning.com) (Atomic structure and chemical bonding)
- 6 [www.chem1.com](http://www.chem1.com) (Atomic structure and chemical bonding)
- 7 <https://www.wastewaterelearning.com/elearning/> (Water Treatment)
- 8 [www.capital-refractories.com](http://www.capital-refractories.com) (Metals, Alloys, Cement, and Refractory Materials)
- 9 [www.em-ea.org/guide%20books/book /2.1%20fuels%20and%20combustion.pdf](http://www.em-ea.org/guide%20books/book%20/2.1%20fuels%20and%20combustion.pdf) (Fuel and Combustion)
- 10 [www.chemcollective.org](http://www.chemcollective.org) (Metals, Alloys)
- 11 [www.wqa.org](http://www.wqa.org) (Water Treatment)

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### HS101: COMMUNICATION SKILLS IN ENGLISH

	L	T	P	C
<b>COURSE OBJECTIVES</b>	2	0	0	2

Communication skills play an important role in career development. This course aims at introducing basic concepts of communication skills with an emphasis on developing personality of the students. Thus, the main objectives of this course are:

- 1 To develop confidence in speaking English with correct pronunciation.
- 2 To develop communication skills of the students i.e. listening, speaking, reading and writing skills.  
To introduce the need for personality development- Focus will be on developing certain qualities which will aid students in handling personal and career challenges, leadership skills etc.
- 3

Unit 1 COMMUNICATION: THEORY AND PRACTICE 5

- Basics of communication: Introduction, meaning and definition, process of communication etc.
- Types of communication: formal and informal, verbal, non-verbal and written



Barriers to effective communication.

- 7 Cs for effective communication (considerate, concrete, concise, clear, complete, correct, courteous).
- Art of Effective communication,
  - Choosing words
  - Voice
  - Modulation
  - Clarity
  - Time
  - Simplification of words
  - Technical Communication.

Unit 2 SOFT SKILLS FOR PROFESSIONAL EXCELLENCE 5

- Introduction: Soft Skills and Hard Skills.
- Importance of soft skills.
- Life skills: Self-awareness and Self-analysis, adaptability, resilience, emotional intelligence and empathy etc.
- Applying soft skills across cultures.
- Case Studies.

Unit 3 READING COMPREHENSION 6

Comprehension, vocabulary enhancement and grammar exercises based on reading of the following texts:

**Section-1**

*Malgudi Days*: R.K. Narayan

*The Room on Roof*: Ruskin Bond “The Gift of the Magi” by O. Henry

“Uncle Podger Hangs a Picture” Jerome K. Jerome

**Section-2**

Night of the Scorpion by Nissim Ezekiel,

Stopping by Woods on a Snowy Evening by Robert

Frost, Where the Mind is Without Fear by

Rabindranath Tagore, Ode to Tomatoes by Pablo

Neruda,

Unit 4 PROFESSIONAL WRITING 7

The art of précis writing, Letters: business and personnel,

Drafting e-mail, notices, minutes of a meeting etc.

Filling- up different forms such as banks and on-line forms for placement etc.

Unit 5 VOCABULARY AND GRAMMAR 7



**Total: 30 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Develop basic speaking and writing skills including proper usage of language and vocabulary so that they can become highly confident and skilled speakers and writers.
- CO2 Communicate effectively in presentations, interviews and other forms of oral communication
- CO3 Draft emails and letters professionally
- CO4 Develop non-verbal communication such as proper use of body language and gestures.

**TEXT BOOK**

- 1 J.D.O'Connor. Better English Pronunciation. Cambridge: Cambridge University Press, 1980.
- 2 Lindley Murray, An English Grammar: Comprehending Principles and Rules. London: Wilson and Sons, 1908.
- 3 Kulbhushan Kumar, Effective Communication Skills, Khanna Publishing House, New Delhi (Re-vised Edition 2018)

**REFERENCE BOOK**

- 1 Margaret M. Maison. Examine your English. Orient Longman: New Delhi, 1964.
- 2 M. Ashraf Rizvi. Effective Technical Communication. Mc-Graw Hill: Delhi, 2002.
- 3 John Nielson. Effective Communication Skills. Xlibris, 2008.
- 4 Oxford Dictionary
- 5 Roget's Thesaurus of English Words and Phrases
- 6 Collin's English Dictionary

**ES101: ENGINEERING GRAPHICS**

<b>COURSE OBJECTIVES</b>	L	T	P	C
	0	0	3	1.5

- 1 To understand the language of graphics which is used to express ideas, convey instructions while carrying out engineering jobs.
- 2 To develop drafting and sketching skills, to know the applications of drawing equipment, and get familiarize with Indian Standards related to engineering drawings.
- 3 To develop skills to visualize actual object or a part of it, on the basis of drawings.
- 4 To develop skills to translate ideas into sketches and to draw and read various engineering curves, projections and dimensioning styles.
- 5 To understand the basic commands and develop basic skills related to computer aided drafting, of how to draw, modify, and edit basic shapes (2D), using AUTOCAD.



S. No.	Practical Exercises	Unit No.	Approx. Hrs
1	Draw horizontal, Vertical, 30 degree, 45 degree, 60 and 75 degrees lines, different types of lines, dimensioning styles using Tee and Set squares/ drafter. (do this exercise in sketch book)	I	02
2	Write alphabets and numerical (Vertical only) (do this exercise in sketch book)	I	02
3	Draw regular geometric constructions and redraw the given figure (do this exercise in sketch book) Part I	II	02
4	Draw regular geometric construction and redraw the given figure (do this exercise in sketch book) Part II	II	02
5	Draw a problem on orthographic projections using first angle method of projection having plain surfaces and slanting. Part I	III	02
6	Draw another problem on orthographic projections using first angle method of projection having slanting surfaces with slots. Part II	III	02
7	Draw two problems on orthographic projections using first angle method of projection having cylindrical surfaces, Part I	III	02
8	Draw two problems on Isometric view of simple objects having plain and slanting surface by using natural scale. Part I	IV	02
9	Draw some problems on Isometric projection of simple objects having cylindrical surface by using isometric scale. Part I	IV	02
10	Draw free hand sketches/ conventional representation of machine elements in sketch book such as, nuts, bolts, washers. Part I	V	02
11	Problem based Learning: Given the orthographic views of at least three objects with few missing lines, the student will try to imagine the corresponding objects, complete the views and draw these views in sketch book. Part I	III, II, V	02
12	Draw basic 2D entities like: Rectangle, Rhombus, Polygon using AutoCAD (Print out should be a part of progressive assessment). Part I	V	02
13	Draw basic 2D entities like: Circles, Arcs, circular using AutoCAD (Printout should be a part of progressive assessment). Part II	V	02
14	Draw basic 2D entities like: Circular and rectangular array using AutoCAD (Printout should be a part of progressive assessment). Part III	V	02
15	Draw blocks of 2D entities comprises of Rectangle, Rhombus, Polygon, Circles, Arcs, circular and rectangular array, blocks using AutoCAD (Print out should be a part of progressive assessment). Part IV	V	02

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16	Draw basic branch specific components in 2D using AutoCAD (Printout should be a part of term work). Part I	VI	02
17	Draw complex branch specific components in 2D using AutoCAD (Print should be a part of progressive assessment). Part I	VI	02
	Total		34

Unit 1 BASIC ELEMENTS OF DRAWING

8

Drawing Instruments and supporting materials: method to use them with applications. Convention of lines and their applications.

Representative Fractions – reduced, enlarged and full size scales; Engineering Scales such as plain and diagonal scale.

Dimensioning techniques as per SP-46:2003 – types and applications of chain, parallel and coordinate dimensioning.

Geometrical and Tangency constructions. (Redraw the figure)

Unit 2 ORTHOGRAPHIC PROJECTIONS

8

Introduction of projections-orthographic, perspective, isometric and oblique: concept and applications. (No question to be asked in examination).

Introduction to orthographic projection, First angle and Third angle method, their symbols.

Conversion of pictorial view into Orthographic Views – object containing plain surfaces, slanting surfaces, cylindrical surfaces. (use First Angle Projection method only)

Unit 3 ISOMETRIC PROJECTIONS

8

Introduction to isometric projections. Isometric scale and Natural scale.

Isometric view and isometric projection.

Illustrative problems related to objects containing lines, circles and arcs shape only. Conversion of orthographic views into isometric view/projection.

Unit 4 FREE HAND SKETCHES OF ENGINEERING ELEMENTS

6

Free hand sketches of machine elements: nuts, bolts, washer, (For branches other than mechanical Engineering, the teacher should select branch specific elements for free hand sketching) Free hand sketches of orthographic view (on squared graph paper)



Unit 5 COMPUTER AIDED DRAFTING INTERFACE

7

Computer Aided Drafting: concept.

Hardware and various CAD software available.

System requirements and Understanding the interface.

Components of AutoCAD software window: Title bar, standard tool bar, menu bar, object properties tool bar, draw tool bar, modify tool bar, cursor cross hair. Command window, status bar, drawing area, UCS icon.

File features: New file, Saving the file, Opening an existing drawing file, Creating templates, Quit.

Setting up new drawing: Units, Limits, Grid, Snap. Undoing and redoing action.

Unit 6 COMPUTER AIDED DRAFTING

8

Draw basic entities like Line, Circle, Arc, Polygon, Ellipse, Rectangle, Multiline, Poly Line.

Method of Specifying points: Absolute coordinates, Relative Cartesian and Polar coordinates.

Modify and edit commands like trim, extend, delete, copy, offset, array, block, layers.

Dimensioning: Linear, Horizontal Vertical, Aligned, Rotated, Baseline, Continuous, Diameter, Radius, Angular Dimensions.

Dim scale variable. Editing dimensions.

Text: Single line Text, Multiline text.

Standard sizes of sheet. Selecting Various plotting parameters such as Paper size, paper units, Drawing orientation, plot scale, plot offset, plot area, print preview.

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Select and construct appropriate drawing scales, use drawing Equipment's with Indian Standards of engineering drawing.
- CO2 Draw views of given object and components.
- CO3 Sketch orthographic projections into isometric projections and vice versa.
- CO4 Apply computer aided drafting tools to create 2D engineering drawings.

**TEXT BOOK**

- 1 Bureau of Indian Standards. Engineering Drawing Practice for Schools and Colleges IS: Sp-46. BIS. Government of India
- 2 Bhatt, N. D. Engineering Drawing. Charotar Publishing House, Anand, Gujrat 2010; ISBN: 978-93- 80358-17-8



- 3 Jain & Gautam, Engineering Graphics & Design, Khanna Publishing House, New Delhi (ISBN: 978- 93-86173-478)
- 4 Jolhe, D. A. Engineering Drawing. Tata McGraw Hill Edu. New Delhi, 2010; ISBN: 978-0-07- 064837-
- 5 Dhawan, R. K. Engineering Drawing. S. Chand and Company, New Delhi; ISBN: 81-219-1431-0
- 6 Shah, P. J. Engineering Drawing. S. Chand and Company, New Delhi, 2008, ISBN:81-219-2964-4.
- 7 Kulkarni, D. M.; Rastogi, A. P.; Sarkar, A. K. Engineering Graphics with AutoCAD. PHI Learning Private Limited-New Delhi (2010); ISBN: 978-8120337831.
- Jeyapooan, T. Essentials of Engineering Drawing and Graphics using AutoCAD. Vikas Publishing House Pvt. Ltd, Noida, 2011; ISBN: 978-8125953005.
- 8 Autodesk. AutoCAD User Guide. Autodesk Press, USA, 2015.
- 9 Sham, Tickoo. AutoCAD 2016 for Engineers and Designers. Dreamtech Press; Galgotia Publication, New Delhi, 2015; ISBN 978-9351199113.

#### REFERENCE BOOK

- 1 <https://www.youtube.com/watch?v=TJ4jGyD-WCw>
- 2 [https://www.youtube.com/watch?v=dmt6\\_n7Sgcg](https://www.youtube.com/watch?v=dmt6_n7Sgcg)
- 3 [https://www.youtube.com/watch?v=\\_MQScnLXL0M](https://www.youtube.com/watch?v=_MQScnLXL0M)
- 4 <https://www.youtube.com/watch?v=3WXPanCq9LI>
- 5 <https://www.youtube.com/watch?v=fvjk7PlxAuo>
- 6 <http://www.me.umn.edu/coursesme2011/handouts/engg%20graphics.pdf>
- 7 <https://www.machinedesignonline.com>

#### ES103 ENGINEERING WORKSHOP PRACTICE

	L	T	P	C
<b>COURSE OBJECTIVES</b>	0	0	3	1.5
1 To understand basic engineering processes for manufacturing and assembly.				
2 To understand, identify, select and use various marking, measuring, and holding, striking and cutting tools and equipment's.				
3 To understand and interpret job drawings, produce jobs, and inspect the job for specified dimensions.				
4 To understand the various types of wiring systems and acquire skills in house wiring.				
5 To understand, operate, control different machines and equipment's adopting safety practices.				




- |        |                                                                                                                                |   |
|--------|--------------------------------------------------------------------------------------------------------------------------------|---|
| Unit 1 | CARPENTRY                                                                                                                      | 8 |
|        | i) Demonstration of different wood working tools/machines.                                                                     |   |
|        | ii) Demonstration of different wood working processes, like planing, marking, chiseling, grooving, turning of wood etc.        |   |
|        | iii) One simple job involving any one joint like mortise and tenon dovetail, bridle, half lap etc.                             |   |
| Unit 2 | FITTING                                                                                                                        | 9 |
|        | i) Demonstration of different fitting tools and drilling machines and power tools                                              |   |
|        | ii) Demonstration of different operations like chipping, filing, drilling, tapping, sawing, cutting etc.                       |   |
|        | iii) One simple fitting job involving practice of chipping, filing, drilling, tapping, cutting etc.                            |   |
| Unit 3 | WELDING                                                                                                                        | 8 |
|        | i) Demonstration of different welding tools / machines.                                                                        |   |
|        | ii) Demonstration on Arc Welding, Gas Welding, of broken parts with welding.                                                   |   |
|        | iii) One simple job involving butt and lap joint.                                                                              |   |
| Unit 4 | SHEET METAL WORKING                                                                                                            | 8 |
|        | i) Demonstration of different sheet metal tools / machines.                                                                    |   |
|        | ii) Demonstration of different sheet metal operations like sheet cutting, bending, edging, end curling, lancing, and riveting. |   |
|        | iii) One simple job involving sheet metal operations and riveting.                                                             |   |
| Unit 5 | ELECTRICAL HOUSE WIRING                                                                                                        | 8 |
|        | Practice on simple lamp circuits                                                                                               |   |
|        | i) one lamp controlled by one switch by surface conduit wiring,                                                                |   |
|        | ii) Lamp circuits- connection of lamp and socket by separate switches,                                                         |   |
|        | iii) Connection of Fluorescent lamp/tube light,                                                                                |   |
|        | iv) Simple lamp circuits-in- stall bedroom lighting. And                                                                       |   |
|        | v) Simple lamp circuits- install stair case wiring.                                                                            |   |
| Unit 6 | DEMONSTRATION                                                                                                                  | 4 |
|        | i) Demonstration of measurement of Current, Voltage, Power and Energy.                                                         |   |
|        | ii) Demonstration of advance power tools, pneumatic tools, electrical wiring tools and accessories.                            |   |
|        | iii) Tools for Cutting and drilling.                                                                                           |   |

**Total: 45 Hour**




## **COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Identify, select and use various marking, measuring, and holding, striking and cutting tools & equipment's and machines.
- CO2 Draw and complete jobs as per specifications in allotted time.
- CO3 Inspect the job for the desired dimensions and shape.
- CO4 Operate, control different machines and equipment's adopting safety practices.

## **REFERENCE BOOK**

- 1 S.K. Hajara Chaudhary, Workshop Technology, Media Promoters and Publishers, New Delhi, 2015.
- 2 B.S. Raghawanshi, Workshop Technology, Dhanpat Rai and sons, New Delhi 2014.
- 3 K. Venkat Reddy, Workshop Practice Manual, BS Publications, Hyderabad 2014.
- 4 Kents Mechanical Engineering Hand book, John Wiley and Sons, New York.

-

## **BS107: APPLIED CHEMISTRY LAB**

<b>COURSE OBJECTIVES</b>	L	T	P	C
	0	0	2	1

There are numerous number of materials used in fabricating and manufacturing devices for the comfort of life. The selection, characterization and suitability assessment of natural raw materials essentially requires principles and concepts of Applied Chemistry for technicians. The course aims to supplement the factual knowledge gained in the lectures by first hand manipulation of processes and apparatus. This will develop scientific temper and help to apply the basic concepts and principles in solving engineering problems.

## **LIST OF PRACTICALS:**

Perform any 12 (twelve) Laboratory Practicals

### **VOLUMETRIC AND GRAVIMETRIC ANALYSIS**

- 1. Preparation of standard solution of oxalic acid or potassium permanganate.
- 2. To determine strength of given sodium hydroxide solution by titrating against standard oxalic acid solution using phenolphthalein indicator.
- 3. Standardization of  $\text{KMnO}_4$  solution using standard oxalic acid and Determine the percentage of iron present in given Hematite ore by  $\text{KMnO}_4$  solution.
- 4. Iodometric estimation of copper in the copper pyrite ore.
- 5. Volumetric estimation of total acid number (TAN) of given oil.
- 6. Volumetric estimation of
  - a) Total hardness of given water sample using standard EDTA solution.
  - b) Alkalinity of given water sample using 0.01M sulphuric acid
- 7. Proximate analysis of coal
  - a) Gravimetric estimation moisture in given coal sample
  - b) Gravimetric estimation ash in given coal sample



## INSTRUMENTAL ANALYSIS

1. Determine the conductivity of given water sample.
2. Determination of the Iron content in given cement sample using colorimeter.
3. Determination of calorific value of solid or liquid fuel using bomb calorimeter.
4. Determination of viscosity of lubricating oil using Red wood viscometer.
5. Determination of flash and fire point of lubricating oil using Able's flash point apparatus.
6. To verify the first law of electrolysis of copper sulfate using copper electrode.
7. Construction and measurement of EMF of electro chemical cell (Daniel cell).
8. To study the effect of dissimilar metal combination.

**Total 45 Hour**

### COURSE OUTCOMES:

At the end of the study of this course, the students will be able to

- CO1 Differentiate different methods of quantitative analysis.
- CO2 Perform quantitative analysis using instruments.
- CO3 Use various apparatus for precise measurements.
- CO4 Construct different electrochemical cells used in developing batteries.
- CO5 Appreciate methods of corrosion abetments.

### TEXT BOOK

- 1 Text book of Chemistry for Class XI & XII (Part-I, Part-II); N.C.E.R.T., Delhi,2017-18.
- 2 Dr. G. H. Hugarand ProfA.N.Pathak, Applied Chemistry Laboratory Practices, Vol.I and Vol. II, NITTTR, Chandigarh, Publications, 2013-14.
- 3 Agnihotri, Rajesh, Chemistry for Engineers, Wiley India Pvt.Ltd.,2014.

### REFERENCE BOOK

- 1 Jain & Jain, Engineering Chemistry, Dhanpat Rai and Sons; New Delhi,2015.

## HS103: SPORTS AND YOGA

	L	T	P	C
<b>COURSE OBJECTIVES</b>	0	0	2	1

- 1 To make the students understand the importance of sound health and fitness principles as they relate to better health.
- 2 To expose the students to a variety of physical and yogic activities aimed at stimulating their continued inquiry about Yoga, physical education, health and fitness.
- 3 To create a safe, progressive, methodical and efficient activity based plan to enhance improvement and minimize risk of injury.
- 4 To develop among students an appreciation of physical activity as a lifetime pursuit and a means to better health.



- Unit 1 INTRODUCTION TO PHYSICAL EDUCATION
- Meaning & definition of Physical Education
  - Aims & Objectives of Physical Education
  - Changing trends in Physical Education
- Unit 2 OLYMPIC MOVEMENT
- Ancient & Modern Olympics (Summer & Winter)
  - Olympic Symbols, Ideals, Objectives & Values
  - Awards and Honours in the field of Sports in India (Dronacharya Award, Arjuna Award, Dhayan chand Award, Major Dhyan chand Khel Ratna Award etc.)
- Unit 3 PHYSICAL FITNESS, WELLNESS & LIFESTYLE
- Meaning & Importance of Physical Fitness & Wellness
  - Components of Physical fitness o Components of Health related fitness
  - Components of wellness o Preventing Health Threats through Lifestyle Change
  - Concept of Positive Lifestyle
- Unit 4 FUNDAMENTALS OF ANATOMY & PHYSIOLOGY IN PHYSICAL EDUCATION, SPORTS AND YOGA
- Define Anatomy, Physiology & Its Importance
  - Effect of exercise on the functioning of Various Body Systems. (Circulatory System, Respiratory System, Neuro-Muscular System etc.)
- Unit 5 KINESIOLOGY, BIOMECHANICS & SPORTS
- Meaning & Importance of Kinesiology & Biomechanics in Physical Edu. & Sports
  - Newton's Law of Motion & its application in sports.
  - Friction and its effects in Sports.
- Unit 6 POSTURES
- Meaning and Concept of Postures.
  - Causes of Bad Posture.
  - Advantages & disadvantages of weight training.
  - Concept & advantages of Correct Posture.
  - Common Postural Deformities – Knock Knee; Flat Foot; Round Shoulders; Lordosis, Kyphosis, Bow Legs and Scoliosis.
  - Corrective Measures for Postural Deformities
- Unit 7 YOGA
- Meaning & Importance of Yoga
  - Elements of Yoga
  - Introduction - Asanas, Pranayama, Meditation & Yogic Kriyas
  - Yoga for concentration & related Asanas (Sukhasana; Tadasana; Padmasana &



Shashankasana)

- Relaxation Techniques for improving concentration - Yog-nidra

#### Unit 8 YOGA & LIFESTYLE

- Asanas as preventive measures.
- Hypertension: Tadasana, Vajrasana, Pavanuktasana, Ardha Chakrasana, Bhujangasana, Shavasana.
- Obesity: Procedure, Benefits & contraindications for Vajrasana, Hastasana, Trikonasana, Ardha Matsyendrasana.
- Back Pain: Tadasana, Ardha Matsyendrasana, Vakrasana, Shalabhasana, Bhujangasana.
- Diabetes: Procedure, Benefits & contraindications for Bhujangasana, Paschimottasana, Pavanuktasana, Ardha Matsyendrasana.
- Asthma: Procedure, Benefits & contraindications for Sukhasana, Chakrasana, Gomukhasana, Parvatasana, Bhujangasana, Paschimottasana, Matsyasana.

#### Unit 9 TRAINING AND PLANNING IN SPORTS

- Meaning of Training
- Warming up and limbering down
- Skill, Technique & Style
- Meaning and Objectives of Planning.
- Tournament – Knock-Out, League/Round Robin & Combination

#### Unit 10 PSYCHOLOGY & SPORTS

- Definition & Importance of Psychology in Physical Edu. & Sports
- Define & Differentiate Between Growth & Development
- Adolescent Problems & Their Management
- Emotion: Concept, Type & Controlling of emotions
- Meaning, Concept & Types of Aggressions in Sports.
- Psychological benefits of exercise.
- Anxiety & Fear and its effects on Sports Performance.
- Motivation, its type & techniques.
- Understanding Stress & Coping Strategies.

#### Unit 11 DOPING

- Meaning and Concept of Doping
- Prohibited Substances & Methods
- Side Effects of Prohibited Substances

#### Unit 12 SPORTS MEDICINE

- First Aid – Definition, Aims & Objectives.
- Sports injuries: Classification, Causes & Prevention.



- Management of Injuries: Soft Tissue Injuries and Bone & Joint Injuries

### Unit 13 SPORTS / GAMES

Following sub topics related to any one Game/Sport of choice of student out of: Athletics, Badminton, Basketball, Chess, Cricket, Kabaddi, Lawn Tennis, Swimming, Table Tennis, Volleyball, Yoga etc.

- History of the Game/Sport.
- Latest General Rules of the Game/Sport.
- Specifications of Play Fields and Related Sports Equipment.
- Important Tournaments and Venues.
- Sports Personalities.
- Proper Sports Gear and its Importance.

**Total: 45 Hour**

### **COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Practice Physical activities and Hatha Yoga focusing on yoga for strength, flexibility, and relaxation.
- CO2 Learn techniques for increasing concentration and decreasing anxiety which leads to stronger academic performance.
- CO3 Learn breathing exercises and healthy fitness activities
- CO4 Understand basic skills associated with yoga and physical activities including strength and flexibility, balance and coordination.
- CO5 Perform yoga movements in various combination and forms.
- CO6 Assess current personal fitness levels.
- CO7 Identify opportunities for participation in yoga and sports activities.
- CO8 Develop understanding of health-related fitness components: cardiorespiratory endurance, flexibility and body composition etc.
- CO9 Improve personal fitness through participation in sports and yogic activities.
- CO10 Develop understanding of psychological problems associated with the age and lifestyle. First Year Curriculum Structure Common to All Branches 34
- CO11 Demonstrate an understanding of sound nutritional practices as related to health and physical performance.
- CO12 Assess yoga activities in terms of fitness value.
- CO13 Identify and apply injury prevention principles related to yoga and physical fitness activities.
- CO14 Understand and correctly apply biomechanical and physiological principles related to exercise and training.

### **REFERENCE BOOK**

- 1 Modern Trends and Physical Education by Prof. Ajmer Singh.
- 2 Light On Yoga By B.K.S. Iyengar.
- 3 Health and Physical Education – NCERT (11<sup>th</sup> and 12<sup>th</sup> Classes)






## HS105: COMMUNICATION SKILLS IN ENGLISH LAB

L	T	P	C
0	0	2	1

### COURSE OBJECTIVES

Communication skills play an important role in career development. This lab course aims at actively involving students in various activities to improve their communication skills with an emphasis on developing personality of the students. Thus, the objectives of this course are:

- 1 To develop listening skills for enhancing communication.
- 2 To develop speaking skills with a focus on correct pronunciation and fluency.
- 3 To introduce the need for Personality development-Focus will be on developing certain qualities which will aid students in handling personal and career challenges, leadership skills etc. for that purpose group discussion, extempore and other activities should be conducted during lab classes.

#### Unit 1 LISTENING SKILLS

7

Listening Process and Practice: Introduction to recorded lectures, poems, interviews and speeches, listening tests.

#### Unit 2 INTRODUCTION TO PHONETICS

8

Sounds: consonant, vowel, diphthongs, etc. transcription of words (IPA), weak forms, syllable division, word stress, intonation, voice etc.

#### Unit 3 SPEAKING SKILLS

8

Standard and formal speech: Group discussion, oral presentations, public speaking, business presentations etc. Conversation practice and role playing, mock interviews etc.

#### Unit 4 BUILDING VOCABULARY

7

Etymological study of words and construction of words, phrasal verbs, foreign phrases, idioms and phrases. Jargon/ Register related to organizational set up, word exercises and word games to enhance self-expression and vocabulary of participants.

**Total: 30 Hour**

### COURSE OUTCOMES:

At the end of the study of this course, the students will be able to

- CO1 Communicate effectively with an increase in their confidence to read, write and speak English fluently.
- CO2 Demonstrate a significant increase in word power.
- CO3 The variety of exercises and activities that will be conducted in the Language Lab will develop their skills needed to participate in a conversation like listening carefully and respectfully to others' view points; articulating their own ideas and questions clearly and overall students will be able to prepare, organize, and deliver an engaging oral presentation.



- CO4 Develop non-verbal communication such as proper use of body language and gestures.
- CO5 Communicate effectively with an increase in their confidence to read, write and speak English fluently.

### TEXTBOOK

- 1 Daniel Jones. *The Pronunciation of English*. Cambridge: Cambridge University Press 1956.
- 2 James Hartman & etal. Ed. *English Pronouncing Dictionary*. Cambridge: Cambridge University Press, 2006.
- 3 Kulbhushan Kumar, *Effective Communication Skills*, Khanna Publishing House, New Delhi (Revised Ed.2018)

### REFERENCE BOOK

- 1 J.D.O'Connor. *Better English Pronunciation*. Cambridge: Cambridge University Press, 1980.
- 2 Lindley Murray. *An English Grammar: Comprehending Principles and Rules*. London: Wilson and Sons, 1908.
- 3 Margaret M. Maison. *Examine your English*. Orient Longman: New Delhi: 1964.
- 4 J.Sethi & et al. *A Practice Course in English Pronunciation*. New Delhi: Prentice Hall, 2004.
- 5 Pfeiffer, William Sanborn and T.V.S Padmaja. *Technical Communication: A Practical Approach*. 6<sup>th</sup> ed. Delhi: Pearson,2007.

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### AU102: ENVIRONMENTAL SCIENCE

#### COURSE OBJECTIVES

L	T	P	C
2	0	0	0

Technicians working in industries or elsewhere essentially require the knowledge of environmental science so as to enable them to work and produce most efficient, economical and eco-friendly finished products.

- 1 Solve various engineering problems applying ecosystem to produce eco – friendly products.
- 2 Use relevant air and noise control method to solve domestic and industrial problems.
- 3 Use relevant water and soil control method to solve domestic and industrial problems.
- 4 To recognize relevant energy sources required for domestic and industrial applications.
- 5 Solve local solid and e-waste problems.

#### Unit 1 ECO SYSTEM

9

Structure of ecosystem, Biotic & Abiotic components Food chain and food web. Aquatic (Lentic and Lotic) and terrestrial ecosystem. Carbon, Nitrogen, Sulphur, Phosphorus cycle. Global warming -Causes, effects, process, Green House Effect, Ozone depletion




- Unit 2 AIR AND, NOISE POLLUTION 9  
Definition of pollution and pollutant, Natural and manmade sources of air pollution (Refrigerants, I.C., Boiler)  
Air Pollutants: Types, Particulate Pollutants: Effects and control (Bag filter, Cyclone separator, Electrostatic Precipitator)  
Gaseous Pollution Control: Absorber, Catalytic Converter, Effects of air pollution due to Refrigerants, I.C., Boiler  
Noise pollution: sources of pollution, measurement of pollution level, Effects of Noise pollution, Noise pollution (Regulation and Control) Rules, 2000
- Unit 3 WATER AND SOIL POLLUTION 9  
Sources of water pollution, Types of water pollutants, Characteristics of water pollutants  
Turbidity, pH, total suspended solids, total solids BOD and COD: Definition, calculation  
Waste Water Treatment: Primary methods: sedimentation, froth floatation, Secondary methods: Activated sludge treatment, Trickling filter, Bioreactor, Tertiary Method: Membrane separation technology, RO (reverse osmosis).  
Causes, Effects and Preventive measures of Soil Pollution: Causes-Excessive use of Fertilizers, Pesticides and Insecticides, Irrigation, E-Waste.
- Unit 4 RENEWABLE SOURCES OF ENERGY 9  
Solar Energy: Basics of Solar energy. Flat plate collector (Liquid & Air). Theory of flat plate collector. Importance of coating. Advanced collector. Solar pond. Solar water heater, solar dryer, Solar stills.  
Biomass: Overview of biomass as energy source. Thermal characteristics of biomass as fuel. Anaerobic digestion. Biogas production mechanism. Utilization and storage of biogas.  
Wind energy: Current status and future prospects of wind energy. Wind energy in India. Environmental benefits and problem of wind energy.  
New Energy Sources: Need of new sources. Different types new energy sources. Applications of (Hydrogen energy, Ocean energy resources, Tidal energy conversion.)  
Concept, origin and power plants of geothermal energy
- Unit 5 SOLID WASTE MANAGEMENT, ISO 14000 & ENVIRONMENTAL MANAGEMENT 9  
Solid waste generation- Sources and characteristics of Municipal solid waste, E- waste, biomedical waste.  
Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries.  
Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous waste  
Air quality act 2004, air pollution control act 1981 and water pollution and control act 1996.  
Structure and role of Central and state pollution control board.  
Concept of Carbon Credit, Carbon Footprint.  
Environmental management in fabrication industry.  
ISO14000: Implementation in industries, Benefits.



**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Understand the ecosystem and terminology and solve various engineering problems applying ecosystem knowledge to produce eco – friendly products.
- CO2 Understand the suitable air, extent of noise pollution, and control measures and acts.
- CO3 Understand the water and soil pollution, and control measures and acts.
- CO4 Understand different renewable energy resources and efficient process of harvesting.
- CO5 Understand solid Waste Management, ISO 14000 & Environmental Management.
- CO6 Different methods of teaching and media to be used to attain classroom attention.
- CO7 Massive open online courses (MOOCs) may be used to teach various topics/sub topics.
- CO8 15-20% of the topics which are relatively simpler of descriptive in nature should be given to the students for self-learning and assess the development of competency through classroom presentations.
- CO9 Micro-projects may be given to group of students for hand-on experiences
- C10 Encouraging students to visit to sites such as Railway station and research establishment around the institution.

**TEXT BOOK**

- 1 S.C. Sharma & M.P. Poonia, Environmental Studies, Khanna Publishing House, NewDelhi
- 2 C.N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd., 2011. First Year Curriculum Structure Common to All Branches 52
- 3 Arceivala, Soli Asolekar, Shyam, Waste Water Treatment for Pollution Control and Reuse, Mc-Graw Hill Education India Pvt. Ltd., New York, 2007, ISBN:978-07-062099
- 4 Nazaroff, William, Cohen, Lisa, Environmental Engineering Science, Willy, New York, 2000, ISBN 10: 0471144940.
- 5 O.P. Gupta, Elements of Environmental Pollution Control, Khanna Publishing House, New Delhi
- 6 Rao, C. S., Environmental Pollution Control and Engineering, New Age International Publication, 2007, ISBN: 81-224-1835-X.
- 7 Rao, M. N.Rao, H.V.N, Air Pollution, Tata Mc-Graw Hill Publication, New delhi, 1988, ISBN: 0-07- 451871-8.
- 8 Frank Kreith, Jan F Kreider, Principles of Solar Engineering, McGraw-Hill, New York ; 1978, ISBN: 9780070354760.
- 9 Aldo Vieira, Da Rosa, Fundamentals of renewable energy processes, Academic Press Oxford, UK; 2013. ISBN: 9780123978257.
- 10 Patvardhan, A.D, Industrial Solid Waste, Teri Press, New Delhi, 2013, ISBN:978-81-7993-502-6
- 11 Metcalf & Eddy, Waste Water Engineering, Mc-Graw Hill, New York, 2013, ISBN: 077441206.



- 12 Keshav Kant, Air Pollution & Control, Khanna Publishing House, New Delhi (Edition 2018)
- 13 Open source software and website address:
- 1) [www.eco-prayer.org](http://www.eco-prayer.org)
  - 2) [www.teriin.org](http://www.teriin.org)
  - 3) [www.cpcp.nic.in](http://www.cpcp.nic.in)
  - 4) [www.cpcp.gov.in](http://www.cpcp.gov.in)
  - 5) [www.indiaenvironmentportal.org.in](http://www.indiaenvironmentportal.org.in)
  - 6) [www.whatis.techtarget.com](http://www.whatis.techtarget.com)
  - 7) [www.sustainabledevelopment.un.org](http://www.sustainabledevelopment.un.org)
  - 8) [www.conserve-energy-future.com](http://www.conserve-energy-future.com)

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## SEMESTER II

### BS102: MATHEMATICS - II

	L	T	P	C
<b>COURSE OBJECTIVES</b>	3	1	0	4

This course is designed to give a comprehensive coverage at an introductory level to the subject of matrices, Integral Calculus coordinate geometry, Basic elements of vector algebra and Testing of Hypothesis.

Unit 1 DETERMINANTS AND MATRICES 12

Elementary properties of determinants up to 3rd order, consistency of equations, Cramer's rule. Algebra of matrices, Inverse of a matrix, matrix inverse method to solve a system of linear equations in 3 variables.

Unit 2 INTEGRAL CALCULUS 12

Integration as inverse operation of differentiation. Simple integration by substitution, by parts and by partial fractions (for linear factors only). Use of formulas  $\int_0^{\pi} \sin^n x dx$ ,  $\int_0^{\pi} \cos^n x dx$  and  $\int_0^{\pi} \sin^m x \cos^n x dx$  for solving problems Where m and n are positive integers.

Unit 3 CO-ORDINATE GEOMETRY 12

Equation of straight line in various standard forms (without proof), intersection of two straight lines, angle between two lines. Parallel and perpendicular lines, perpendicular distance formula. General equation of a circle and its characteristics. To find the equation of a circle, given:

- i. Centre and radius,
- ii. Three points lying on it and




iii. Coordinates of end points of a diameter;

Definition of conics (Parabola, Ellipse, Hyperbola) their standard equations without proof. Problems on conics when their foci, directories or vertices are given.

Unit 4 VECTOR ALGEBRA

12

Definition notation and rectangular resolution of a vector. Addition and subtraction of vectors. Scalar and vector products of 2 vectors. Simple problems related to work, moment and angular velocity.

Unit 5 TESTING OF HYPOTHESIS

12

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean -Tests based on t for single mean, Chisquare and F distributions - Goodness of fit.

**Total: 60 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Appreciate the importance of the Determinants are the factors that scale different parameterizations so that they all produce same overall integrals, i.e. they are capable of encoding the inherent geometry of the original shape.
- CO2 Apply Integration for cumulative effect.
- CO3 Relate the connection between algebra and geometry through graphs of lines and curves.
- CO4 Apply the concept of testing of hypothesis for small and large samples in real life problems.

**TEXTBOOK**

- 1 B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi, 40th Edition, 2007.
- 2 G. B. Thomas, R. L. Finney, Calculus and Analytic Geometry, Addison Wesley, 9th Edition, 1995.
- 3 S.S. Sabharwal, Sunita Jain, Eagle Parkashan, Applied Mathematics, Vol. I & II, Jalandhar.

**REFERENCE BOOK**

- 1 Comprehensive Mathematics, Vol. I & II by Laxmi Publications, Delhi.
- 2 ReenaGarg & Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishing House, New Delhi
- 3 Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
- 4 Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014

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## BS103: APPLIED PHYSICS

L	T	P	C
2	1	0	3

### COURSE OBJECTIVES

The course will help the diploma engineers to apply the basic concepts and principles to solve broad-based engineering problems and to understand different technology based applications.

#### Unit 1 PHYSICAL QUANTITIES AND MEASUREMENTS

9

Physical quantities; fundamental and derived, Units and systems of units (FPS, CGS and SI units), Dimensions and dimensional formulae of physical quantities, Principle of homogeneity of dimensions, Dimensional equations and their applications, Limitations of dimensional analysis.

Measurements: Need, measuring instruments, least count, types of measurement (direct, indirect), Errors in measurements (systematic and random), absolute error, relative error, error estimation and significant figures.

#### Unit 2 PROPERTIES OF MATTER

9

Elasticity: definition of stress and strain, moduli of elasticity (definition only), Hooke's law, stress-strain curve and its significance.

Viscosity and coefficient of viscosity: Terminal velocity, Stoke's law and effect of temperature on viscosity, application in hydraulic systems.

Moment of inertia and its physical significance, Moment of inertia of rod, disc, ring and sphere (hollow and solid); (Formulae only).

Friction: concept, types, laws of limiting friction, coefficient of friction, and its engineering applications

#### Unit 3 HEAT

9

Concept of heat and temperature, modes of heat transfer (conduction, convection and radiation with examples), scales of temperature and their relationship, Expansion of solids, liquids and gases, coefficient of linear, surface and cubical expansions and relation amongst them, Coefficient of thermal conductivity, engineering applications.

#### Unit 4 WAVE MOTION AND OPTICS

9

Wave motion, transverse and longitudinal waves with examples, definitions of wave velocity, frequency and wave length and their relationship, amplitude, phase, phase difference, Free, damped and forced vibrations with examples, resonance.

Basic optical laws: reflection and refraction, refractive index, image formation by lenses, lens formula, magnification, Simple microscope and its uses, Total internal reflection, Critical angle and conditions for total internal reflection, Lasers: Energy levels, spontaneous and stimulated emission; population inversion, laser characteristics, applications of lasers.



Electric Current and its units, Resistance and its units, Conductance, Series and parallel combination of resistances. Ohm's law and its verification, Kirchhoff's laws, Wheatstone bridge and its applications, Capacitance and its units, Series and parallel combination of capacitors.

Insulator, semi-conductor, conductor, intrinsic and extrinsic semiconductors, p-n junction, junction diode, forward and reverse biased junction diodes, Transistor; description and three terminals, Working of PnP and NpN transistor.

**Total: 45 Hour**

### **COURSE OUTCOMES**

At the end of the study of this course, the students will be able to

- CO1 Identify physical quantities, select their units for use in engineering solutions, and make measurements with accuracy by minimizing different types of errors.
- CO2 A) Explain Hooke's law and its significance.  
B) Describe the viscosity of liquids, coefficient of viscosity and the various factors affecting its value and determine viscosity of an unknown fluid using Stokes' Law and the terminal velocity.  
C) Describe forms of friction and methods to minimize friction between different surfaces.
- CO3 A) Illustrate the terms; heat and temperature, measure temperature in various processes on different scales (Celsius, Fahrenheit, and Kelvin etc.).  
B) Distinguish between conduction, convection and radiation; identify different methods for reducing heat losses and mode of heat transfer between bodies at different temperatures
- CO4 Establish wave parameters: frequency, amplitude, wavelength, and velocity.
- CO5 A) Illustrate the conditions for light amplification in various LASER and laser based instruments and optical devices.  
B) Differentiate between insulators, conductors and semiconductors

### **TEXT BOOK**

- 1 Text Book of Physics for Class XI & XII (Part-I, Part-II); N.C.E.R.T., Delhi
- 2 Applied Physics, Vol. I and Vol. II, TTTI Publications, Tata McGraw Hill, Delhi.
- 3 Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi
- 4 A TEXT BOOK of Optics, N.Subramanyam, Brij Lal, MN Avahanulu, S Chand and Company Ltd.

### **REFERENCE BOOK**

- 1 Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi
- 2 Engineering Physics by DK Bhattacharya & Poonam Tandan; Oxford University Press, New Delhi.
- 3 Modern approach to Applied Physics-I and II, AS Vasudeva, Modern Publishers.





## ES102: INTRODUCTION TO IT SYSTEM

	L	T	P	C
<b>COURSE OBJECTIVES</b>	3	0	0	3

This course is intended to make new students comfortable with computing environment - Learning basic computer skills, learning basic application software tools, Understanding Computer Hardware, Cyber security awareness

Unit 1				9
Basic Internet skills: Understanding browser, efficient use of search engines, awareness about Digital India portals (state and national portals) and college portals. General understanding of various computer hardware components — CPU, Memory, Display, Keyboard, Mouse, HDD and other Peripheral Devices.				
Unit 2				9
OS Installation (Linux and MS Windows), Unix Shell and Commands,*				
Unit 3				9
Basics of HTML & CSS, Making Basic Personal Web-Page.				
Unit 4				9
Office Tools: OpenOffice Writer, OpenOffice Spreadsheet (Calc), OpenOffice Impress. (MS-office)				
Unit 5				9
Introduction of C language: History, Basic data type, Basic conditional statement, Simple program.				

**Total: 45 Hour**

### COURSE OUTCOMES:

At the end of the study of this course, the students will be able to

- Comfortably work on computer, install and configure OS, assemble a PC and connect it to external devices, write documents, create worksheets, prepare presentations, protect information and computers from basic abuses/ attacks.

## ES104: FUNDAMENTALS OF ELECTRICAL, ELECTRONICS ENGINEERING

	L	T	P	C
<b>COURSE OBJECTIVES</b>	2	1	0	3

To provide basic knowledge of the different elements and concepts of electrical engineering field and to learn basic concepts of various active and passive electronic components, Signals, Op-Amp and their applications, Digital Electronics and their applications to help students deal with electrical and electronics engineering principles and applications in industrial processes of different fields.



Unit 1	OVERVIEW OF DIGITAL ELECTRONICS, ELECTRONIC COMPONENTS & SIGNALS	9
	Passive & Active Components: Resistances, Capacitors, Inductors, Diodes, Transistors, FET, MOS and CMOS and their Applications. Signals: DC/AC, voltage/current, periodic/non-periodic signals, average, rms, peak values, different types of signal waveforms, Ideal/non-ideal voltage/current sources, independent/dependent voltage current sources. Boolean Algebra & Operations, Gates-Functional Block Approach, Storage elements-Flip Flops-A Functional block approach, Counters: Ripple, Up/down and decade, Introduction to digital IC Gates (of TTL Type).	
Unit 2	OVERVIEW OF ANALOG CIRCUITS	9
	Operational Amplifiers-Ideal Op-Amp, Practical op amp, Open loop and closed loop configurations, Application of Op-Amp as amplifier, adder, differentiator and integrator.	
Unit 3	ELECTRIC AND MAGNETIC CIRCUITS	9
	EMF, Current, Potential Difference, Power and Energy; M.M.F, magnetic force, permeability, hysteresis loop, reluctance, leakage factor and BH curve; Electromagnetic induction, Faraday's laws of electromagnetic induction, Lenz's law; Dynamically induced emf; Statically induced emf; Equations of self and mutual inductance; Analogy between electric and magnetic circuits.	
Unit 4	A.C. CIRCUITS	9
	Cycle, Frequency, Periodic time, Amplitude, Angular velocity, RMS value, Average value, Form Factor Peak Factor, impedance, phase angle, and power factor; Mathematical and phasor representation of alternating emf and current; Voltage and Current relationship in Star and Delta connections; A.C in resistors, inductors and capacitors; A.C in R-L series, R-C series, Power in A. C. Circuits, power triangle.	
Unit 5	TRANSFORMER AND MACHINES	9
	General construction and principle of different type of transformers; Emf equation and transformation ratio of transformers; Auto transformers; Construction and Working principle of motors; Basic equations and characteristic of motors.	

**Total: 45 Hour**

**REFERENCE BOOK**

- 1 Ritu Sahdev, Basic Electrical Engineering, Khanna Publishing House
- 2 Mittle and Mittal, Basic Electrical Engineering, McGraw Education, New Delhi, 2015, ISBN : 978-0-07-0088572-5
- 3 Saxena, S. B. Lal, Fundamentals of Electrical Engineering, Cambridge University Press, latest edition ISBN : 9781107464353
- 4 Theraja, B. L., Electrical Technology Vol – I, S. Chand Publications, New Delhi, 2015, ISBN: 9788121924405
- 5 Theraja, B. L., Electrical Technology Vol – II, S. Chand Publications, New Delhi,




- 2015, ISBN: 9788121924375
- 6 Jegathesan, V., Basic Electrical and Electronics Engineering, Wiley India, New Delhi, 2015, ISBN : 97881236529513
  - 7 Sedha, R.S., A TEXT BOOK of Applied Electronics, S.Chand, New Delhi, 2008, ISBN-13: 978- 8121927833
  - 8 Malvino, Albert Paul, David, Electronics Principles, McGraw Hill Education, New Delhi, 2015, ISBN-13:
  - 9 Mehta, V.K., Mehta, Rohit, Principles of Electronics, S. Chand and Company, New Delhi, 2014, ISBN-13-9788121924504
  - 10 Bell Devid, Fundamental of Electronic Devices and Circuits, Oxford University Press, New Delhi 2015 ISBN : 9780195425239

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### ES106: ENGINEERING MECHANICS

	L	T	P	C
<b>COURSE OBJECTIVES</b>	2	1	0	3

Following are the objectives of this course:

- 1 To obtain resultant of various forces.
- 2 To calculate support reactions through conditions of equilibrium for various structures.
- 3 To understand role of friction in equilibrium problems.
- 4 To know fundamental laws of machines and their applications to various engineering problems.

#### Unit 1 BASICS OF MECHANICS AND FORCE SYSTEM 9

Significance and relevance of Mechanics, Applied mechanics, Statics, Dynamics. Space, time, mass, particle, flexible body and rigid body. Scalar and vector quantity, Units of measurement (SI units) - Fundamental units and derived units. Force – unit, representation as a vector and by Bow’s notation, characteristics and effects of a force, Principle of transmissibility of force, Force system and its classification. Resolution of a force— Orthogonal components of a force, moment of a force, Varignon’s Theorem. Composition of forces – Resultant, analytical method for determination of resultant for concurrent, coplanar force systems – Law of triangle, parallelogram and polygon of forces.

#### Unit 2 EQUILIBRIUM 9

Equilibrium and, Free body and Free body diagram, Analytical and graphical methods of analyzing equilibrium. Lami’s Theorem – statement and explanation, Application for various engineering problems. Types of beam, supports (simple, roller and fixed) and loads acting on beam (vertical point load, uniformly distributed load). Beam reaction for cantilever, simply supported beam without overhang – subjected to combination of Point load and uniformly distributed load.

#### Unit 3 FRICTION 9

Friction and its relevance in engineering, types and laws of friction, limiting equilibrium,




limiting friction, co-efficient of friction, angle of friction, angle of repose, relation between co-efficient of friction and angle of friction. Equilibrium of bodies on level surface subjected to force parallel and inclined to plane.

Unit 4 CENTROID AND CENTRE OF GRAVITY

9

Centroid of geometrical plane figures (square, rectangle, triangle, circle, semi-circle, quarter circle). Centroid of composite figures composed of not more than three geometrical figures. Centre of Gravity of simple solids (Cube, cuboid, cone, and cylinder).

Unit 5 SIMPLE LIFTING MACHINE

9

Simple lifting machine, load, effort, mechanical advantage, applications and advantages. Velocity ratio, efficiency of machines, law of machine. Ideal machine, friction in machine, maximum Mechanical advantage and efficiency, reversible and non-reversible machines, conditions for reversibility. Velocity ratios of Simple axle and wheel, Differential axle and wheel, Worm and worm wheel, Simple screw jack.

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Identify the force systems for given conditions by applying the basics of mechanics.
- CO2 Determine unknown force(s) of different engineering systems.
- CO3 Apply the principles of friction in various conditions for useful purposes.
- CO4 Find the centroid and centre of gravity of various components in engineering systems.
- CO5 Select the relevant simple lifting machine(s) for given purposes.

**TEXTBOOK**

- 1 D.S. Bedi, Engineering Mechanics, Khanna Publications, New Delhi(2008)
- 2 Khurmi, R.S., Applied Mechanics, S. Chand & Co. New Delhi.
- 3 Bansal R K, A TEXT BOOK of Engineering Mechanics, Laxmi Publications
- 4 Ramamrutham, Engineering Mechanics, S. Chand & Co. New Delhi.

**REFERENCE BOOK**

- 1 Dhade, Jamadar & Walawelkar, Fundamental of Applied Mechanics, Pune VidhyarthiGruh.
- 2 Ram, H. D.; Chauhan, A. K., Foundations and Applications of Applied Mechanics, Cambridge University Press.
- 3 Meriam, J. L., Kraige, L.G., Engineering Mechanics- Statics, Vol. I, Wiley Publication, New Delhi.

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**BS107: APPLIED PHYSICS LAB**

**COURSE OBJECTIVES**

L	T	P	C
0	0	2	1

Study of Applied Physics aims to give an understanding of physical world by observations and predictions. Concrete use of physical principles and analysis in various fields of



engineering and technology is very prominent. The course aims to supplement the factual knowledge gained in the lecture by first hand manipulation of apparatus. This will develop scientific temper and help to apply the basic concepts and principles in solving engineering and technology based problems. In addition, students get necessary confidence in handling equipment and thus learn various skills in measurement.

**LIST OF PRACTICALS /ACTIVITIES (To perform minimum 10 practicals).**

1. To measure length, radius of a given cylindrical object (test tube and beaker) using a Vernier Caliper and find volume of each object.
2. To determine diameter of a wire and thickness of cardboard using a screw gauge.
3. To find the co-efficient of friction between wood and glass using a horizontal board.
4. To determine force constant of a spring using Hooke's Law.
5. To find the moment of inertia of a fly wheel.
6. To find the viscosity of a given liquid (Glycerine) by Stoke's law.
7. To measure room temperature and temperature of a hot bath using mercury thermometer and convert it into different scales.
8. To determine focal length and magnifying power of a convex lens.
9. To measure wavelength of a He-Ne/diode laser using a diffraction grating.
10. To verify Ohm's law by plotting graph between current and potential difference.
11. To verify laws of resistances in series and parallel combination.
12. To draw V-I characteristics of a semiconductor diode and determine its knee voltage.

**Total: 30 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Select right kind of measuring tools (Meter scale, Vernier caliper, Screw gauge, etc.) for determining dimensions of physical quantities and make measurements with accuracy and precision.
- CO2 Appreciate role of friction and measure co-efficient of friction between different surfaces.
- CO3 Describe and verify Hooke's law and determine force constant of spring body.
- CO4 Determine M.I. of a rotating body (flywheel)
- CO5 Determine viscosity of a given liquid by stoke's law
- CO6 Measure temperature under different conditions and different scales of temperature measurements.
- CO7 Apply knowledge of optics to determine focal length and magnifying power of optical lenses.
- CO8 Work with laboratory lasers and measure the wavelength of the light emitted from a laser.
- CO9 Verify Ohm's law for flow of current.
- CO10 Quantify resistances and verify laws of series and parallel combination of resistances.



## REFERENCE BOOK

- 1 Text Book of Physics for Class XI& XII (Part-I, Part-II); N.C.E.R.T., Delhi
- 2 Comprehensive Practical Physics, Vol, I & II, JN Jaiswal, Laxmi Publications(P)Ltd.,
- 3 Practical Physics by C. L. Arora, S. Chand Publication.
- 4 e-books/e-tools/ learning physics software/YouTube videos/websites etc.

## ES108: INTRODUCTION TO IT SYSTEMS LAB

### COURSE OBJECTIVES

L T P C  
0 0 2 1

This Lab course is intended to practice whatever is taught in theory class of ‘Introduction of IT Systems’ and become proficient in using computing environment basic computer skills, basic application software tools, Computer Hardware, cyber security features, etc.

S. No.	Topics for Practice
1	Browser features, browsing, using various search engines, writing search queries
2	Visit various e-governance/Digital India portals, understand their features, services offered
3	Read Wikipedia pages on computer hardware components, look at those components in lab, identify them, recognize various ports/interfaces and related cables, etc.
4	Install Linux and Windows operating system on identified lab machines, explore various options, do it multiple times
5	Connect various peripherals (printer, scanner, etc.) to computer, explore various features of peripheral and their device driver software.
6	Practice HTML commands, try them with various values, make your own Webpage
7	Explore features of Open Office tools, create documents using these features, do it multiple times
8	Explore security features of Operating Systems and Tools, try using them and see what happens.
This is a skill course. More you practice, better it will be.	

**Total: 30 Hour**

### COURSE OUTCOMES:

At the end of the study of this course, the students will be able to

- Comfortably work on computer, install and configure OS, assemble a PC and connect it to external devices, write documents, create worksheets, prepare presentations, protect information and computers from basic abuses/attacks

## REFERENCE BOOK

- 1 Online resources, Linux man pages, Wikipedia.
- 2 R.S. Salaria, Computer Fundamentals, Khanna Publishing House.
- 3 Ramesh Bangia, PC Software Made Easy – The PC Course Kit, Khanna Publishing



- House.
- 4 Mastering Linux Shell Scripting: A practical guide to Linux command-line, Bash scripting, and
  - 5 Shell programming, by Mokhtar Ebrahim, Andrew Mallett.
  - 6 IT Essentials PC Hardware and Software Companion Guide, Davis Anfinson and Ken Quamme,
  - 7 CISC Press, Pearson Education.
  - 8 PC Hardware and A+ Handbook, Kate J. Chase PHI (Microsoft).

**ES110: FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS  
ENGINEERING LAB**

L T P C  
0 0 2 1

**COURSE OBJECTIVES**

The practical in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No	Practical Outcomes (PrOs)	Approx. Hrs
1	Determine the permeability of magnetic material by plotting its B-H curve	02*
2	Measure voltage, current and power in 1-phase circuit with resistive load	02*
3	Measure voltage, current and power in R-L series circuit.	02*
4	Determine the transformation ratio (K) of 1-phase transformer	02
5	Connect single phase transformer and measure input and output quantities	02
6	Make Star and Delta connection in induction motor starters and measure the line and phase values.	02
7	Identify various passive electronic components in the given circuit	02
8	Connect resistors in series and parallel combination on bread board and measure its value using digital multimeter.	02
9	Connect capacitors in series and parallel combination on bread board and measure its value using multimeter	02*
10	Identify various active electronic components in the given circuit	02
11	Use multimeter to measure the value of given resistor	02
12	Use LCR-Q tester to measure the value of given capacitor and inductor	02
13	Determine the value of given resistor using digital multimeter to confirm with colour code.	02*
14	Test the PN-junction diodes using digital multimeter.	02*
15	Test the performance of PN-junction diode.	02
16	Test the performance of Zener diode	02

17	Test the performance of LED.	02
18	Identify three terminals of a transistor using digital multimeter	02
19	Test the performance of NPN transistor.	02*
20	Determine the current gain of CE transistor configuration	02
21	Test the performance of transistor switch circuit.	02
22	Test the performance of transistor amplifier circuit	02
23	Test Op-Amp as amplifier and Integrator	02
	Total	46

**Total 30 Hours**

### **COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Understand basic principle and operation of electric circuits and machines.
- CO2 Solve basic problems related to electrical circuits and machines. Explain the operation of different electrical technologies.
- CO3 Demonstrate an understanding of the control systems.
- CO4 Understand the basic circuit elements
- CO5 Understand different types of signal waveforms.
- CO6 Understand logic gates and apply them in various electronic circuits.
- CO7 Understand the basic concepts of op-amps, and their applications.
- CO8 Use relevant electric/electronic protective devices safely.

### **REFERENCE BOOK**

- 1 Ritu Sahdev, Basic Electrical Engineering, Khanna Publishing House, 2018
- 2 Mittal and Mittal, Basic Electrical Engineering, McGraw Education, New Delhi, 2015, ISBN : 978-0-07-0088572-5
- 3 Saxena, S. B. Lal, Fundamentals of Electrical Engineering, Cambridge University Press, latest edition ISBN : 9781107464353
- 4 Theraja, B. L., Electrical Technology Vol – I, S. Chand publications, New Delhi, 2015, ISBN: 9788121924405
- 5 Theraja, B. L., Electrical Technology Vol – II, S. Chand publications, New Delhi, 2015, ISBN: 9788121924375
- 6 Jegathesan, V., Basic Electrical and Electronics Engineering, Wiley India, New Delhi, 2015, ISBN : 97881236529513
- 7 Sedha, R.S., A TEXT BOOK of Applied Electronics, S.Chand ,New Delhi, 2008, ISBN-13: 978- 8121927833
- 8 Malvino, Albert Paul, David, Electronics Principles, McGraw Hill Education, New Delhi, 2015, ISBN-13: 0070634244-978
- 9 Mehta, V.K., Mehta, Rohit, Principles of Electronics, S. Chand and Company, New Delhi, 2014, ISBN-13-9788121924504
- 10 Bell Devid, Fundamental of Electronic Devices and Circuits, Oxford University Press, New Delhi 2015 ISBN : 9780195425239
- 11 [en.wikipedia.org/wiki/Transformer](http://en.wikipedia.org/wiki/Transformer)



- 12 [www.animations.physics.unsw.edu.au/~jw/AC.html](http://www.animations.physics.unsw.edu.au/~jw/AC.html)
- 13 [www.alpharubicon.com/altenergy/understandingAC.htm](http://www.alpharubicon.com/altenergy/understandingAC.htm)
- 14 [www.electronics-tutorials](http://www.electronics-tutorials)
- 15 [learn.sparkfun.com/tutorials/transistors](http://learn.sparkfun.com/tutorials/transistors)
- 16 [www.pitt.edu/~qiw4/Academic/ME2082/Transistor%20Basics.pdf](http://www.pitt.edu/~qiw4/Academic/ME2082/Transistor%20Basics.pdf)
- 17 [www.technologystudent.com/elec1/transisl.htm](http://www.technologystudent.com/elec1/transisl.htm)
- 18 [www.learningaboutelectronics.com](http://www.learningaboutelectronics.com)
- 19 [www.electrical4u.com](http://www.electrical4u.com)

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### ES112: ENGINEERING MECHANICSLAB

	L	T	P	C
<b>COURSE OBJECTIVES</b>	0	0	2	1
1 To obtain resultant of various forces.				
2 To calculate support reactions through conditions of equilibrium for various structures.				
3 To understand role of friction in equilibrium problems.				
4 To know fundamental laws of machines and their applications to various engineering problems.				

#### List of Practical to be performed:

- 1 To study various equipments related to Engineering Mechanics.
- 2 To find the M.A., V.R., Efficiency and law of machine for Differential Axle and Wheel.
- 3 To find the M.A., V.R., Efficiency and law of machine for Simple Screw Jack.
- 4 Derive Law of machine using Worm and worm wheel.
- 5 Derive Law of machine using Single purchase crab.
- 6 Derive Law of machine using double purchase crab.
- 7 Derive Law of machine using Weston's differential or wormed geared pulley block.
- 8 Determine resultant of concurrent force system applying Law of Polygon of forces using force table.
- 9 Determine resultant of concurrent force system graphically.
- 10 Determine resultant of parallel force system graphically.
- 11 Verify Lami's theorem.
- 12 Study forces in various members of Jib crane.
- 13 Determine support reactions for simply supported beam.
- 14 Obtain support reactions of beam using graphical method.
- 15 Determine coefficient of friction for motion on horizontal and inclined plane.
- 16 Determine centroid of geometrical plane figures.

**Total: 30 Hour**

#### COURSE OUTCOMES:

At the end of the study of this course, the students will be able to

- CO1 Identify the force systems for given conditions by applying the basics of mechanics.
- CO2 Determine unknown force(s) of different engineering systems.




- CO3 Apply the principles of friction in various conditions for useful purposes.  
 CO4 Find the centroid and centre of gravity of various components in engineering systems.  
 CO5 Select the relevant simple lifting machine(s) for given purposes.

**TEXT BOOK**

- 1 Bedi D.S., Engineering Mechanics, Khanna Publishing House
- 2 Khurmi, R.S., Applied Mechanics, S.Chand & Co. New Delhi.
- 3 Bansal R K, A TEXT BOOK of Engineering Mechanics, Laxmi Publications
- 4 Ramamrutham, Engineering Mechanics, S.,S Chand & Co. New Delhi.

**REFERENCE BOOK**

- 1 Dhade, Jamadar & Walawelkar, Fundamental of Applied Mechanics, Pune Vidhyarthi Gruh.
- 2 Ram, H. D.; Chauhan, A. K. Foundations and Applications of Applied Mechanics, Cambridge University Press.
- 3 Meriam, J. L., Kraige, L.G. , Engineering Mechanics- Statics, Vol. I, Wiley Publication, New Delhi.

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**SEMESTER III**

**HTPC201: TEXTILE FIBERS**

<b>COURSE OBJECTIVES</b>	L	T	P	C
	3	0	0	3

To enable the students to learn about

- 1 The fundamental concepts of polymerisation and fibre spinning techniques
- 2 The classification of fibres and fibre structure
- 3 The natural vegetable fibres, manufacture of regenerated fibres, properties and uses
- 4 The natural polyamide and manufacture of synthetic polyamide fibres, properties and uses
- 5 The manufacture of synthetic fibres, properties and uses

Unit 1 POLYMER TO FIBRE CONVERSION 9

Terminologies: repeat unit, mer-weight, polymerisation, degree of polymerisation, polymer molecular weight; Polymerization – Techniques; classification of polymers - Homo polymer, Co - polymer, Atactic, Syndotactic and Isotactic polymer, Man-made fibre spinning techniques – Melt and solution spinning techniques, Polymer selection and preparation. Post spinning operation - drawing, types of heat setting, influence of heat setting on fibre behaviour; Spin finish composition and application; Brief study of principles of Draw and Air – jet Texturising

Unit 2 BASICS OF TEXTILE FIBRE 9

Definition of Textile Fibres, Classification of fibres; study of morphological structures of fibres; Terminology related to Fibres: Introduction to common forms of textile fibres; staple




fibre, filament tow UDY, POY and FOY; Dope dyed and delustered fibres. Types of yarn – spun, continuous filament, mono filament, and multi filament, flat and textured yarn – single, ply and cabled yarns; Physical properties of fibres - Essential and desirable properties of Textile Fibres. Order and disorder of fibres - Concept of Crystallinity and Orientation

Unit 3 CELLULOSE FIBRES

9

Natural vegetable fibres – Cotton, linen, jute and hemp - chemical composition - physical and chemical properties - uses. Regenerated fibres – Viscose and, polynosic rayon fibres manufacturing process, physical and chemical properties uses.

Unit 4 POLYAMIDE FIBRE

9

Silk – Life cycle of silk worm, types of silk, rearing, reeling, spun silk producing techniques, throwing and weighting. chemical composition, physical and chemical properties and uses. Wool - Varieties, grading, fibre extraction, chemical composition, physical, chemical and properties and uses. Nylon6, Nylon 66 – manufacturing process, physical, chemical properties and uses

Unit 5 SYNTHETIC FIBRES

9

Polyester, polyethylene, polypropylene, acrylic - manufacturing process, physical, chemical properties and uses. Introduction to aromatic polyamides - manufacturing process, physical, chemical properties and uses

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Define terminologies related to polymerisation and explain different spinning techniques
- CO2 Categorize textile fibres and concept of fibre structure
- CO3 Explain the cultivation, properties, uses of natural cellulosic and manufacturing of regenerated cellulose fibres, properties and uses
- CO4 Describe the production process, properties and uses of polyamide fibres
- CO5 Discuss the manufacturing processes, properties, uses of synthetic fibres and principles of texturizing

**TEXT BOOK**

- 1 Gupta, V.B., Kothari, V.K., Manufactured Fibre Technology, Springer Netherlands, 1997
- 2 S P Mishra, Fibre Science and Technology, New-Age International Ltd...New Delhi, 199
- 3 Vaidya A A, Production of Synthetic Fibres, Prentice Hall of India, New Delhi, 1988



## REFERENCE BOOK

- 1 Cook Gordon J, Hand Book of Textile fibre, Vol.I and II, , WoodheadFibre Science series, UK, 1984
- 2 Ed. M Lewin and E M Pearce, Hand Book of Fibre Chemistry, Mercel Dekker Inc., 1998
- 3 Shenai V A, TextileFibre, Sevak Publications, Mumbai
- 4 R.W. Moncrieff, Manmade Fibres, , Butterworth, London
- 5 Gowariker V R, Viswanathan N V and Sridhar J, Polymer Science, , New Age International Ltd., New Delhi, 1996

## HTPC202: YARN MANUFACTURING TECHNOLOGY

	L	T	P	C
<b>COURSE OBJECTIVES</b>	3	0	0	3

To enable the students to learn about

- 1 Basic principles and method of working of various machinery involved in various fiber preparatory process involved in yarn manufacturing process.
- 2 Principles and method of working of ring spinning process and post spinning processes
- 3 Calculation of production, draft, twist and other particulars pertaining to yarn manufacturing process

### Unit 1 INTRODUCTION TO GINNING AND BLOWROOM PROCESSES 9

Process flow chart of carded and combed yarns; Objective, description and working of different types of Gins; Objectives, principles and description of opening, cleaning and blending machines used in blow room; Lap feed and chute feed systems; cleaning efficiency and production calculations in blow room.

### Unit 2 CARDING PROCESS 9

Objectives of carding - carding action - stripping action - passage of material through high production card; Description and functions of mote knives, under casing, back plate, front plate, flats, heel and toe arrangement; Web doffing systems; Coiler mechanism - functions - types of coilers; Auto levellers to enhance the quality of sliver – principles and working ; Carding machine production calculations.

### Unit 3 COMBING PROCESS 9

Objectives and advantages of combing process; Lap preparation techniques - Comber lap preparatory machines – Description and passage of material through sliver lap machine, ribbon lap machine and super lap formers; Passage of material through a modern comber - operations of combing cycle (Feeding, nipping, combing, detaching and top combing) - forward feed - backward feed –half lap – unicombe - piecing wave - Production calculation in preparatory to combing and combing machines



Unit 4 DRAW FRAME AND SPEED FRAME

9

Objectives of draw frame; Description of draw frame and passage of material through a high speed draw frame; drafting systems used in modern draw frames; auto-levelling - open loop and closed loop auto levellers; draft and production calculations in draw frame; Speed frame - Objectives - description and passage of material; Draft, Twist and Production calculations in speed frame

Unit 5 RING SPINNING, BUNDLING AND BALING PROCESSES

9

Ring spinning - Principle of yarn formation – description and passage of material through ring spinning machine - design features and functions of important elements of ring spinning machine; modern developments in ring spinning machines; draft, twist and production calculations in ring spinning machine; Reeling - Objectives description and working principle of the Reeling Objectives – Bundling and Baling - description and working principle of the bundling and baling presses

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Describe the function and mechanism of ginning machine and, opening and cleaning machines
- CO2 Explain the carding process, working of carding machine and functions of various parts
- CO3 Explain the importance of combing processes in enhancing the quality of yarn produced.
- CO4 Illustrate principle and working of draw frame and speed frame machines
- CO5 Illustrate principles and working of ring spinning process and post spinning machines.

**TEXT BOOK**

- 1 Oxtoby E., "Spun Yarn Technology ". Butterworth. London, 1987
- 2 Klein W., "The Technology of Short-staple Spinning ", The Textile Institute, Manchester. 1998
- 3 Klein W., "A Practical Guide to Opening and Carding ". The Textile Institute, Manchester, 1999.
- 4 Klein W., "A Practical Guide to Combing, Drawing and Roving Frame ", The Textile Institute, Manchester, 1999

**REFERENCE BOOK**

- 1 Peter R Lord, "Handbook of Yarn Production: Technology, Science and Economics ", The Textile Institute, Manchester, 1999. Woodhead Publishing Ltd. And CRC Press LLC 2003.
- 2 Salhotra K.R. and Chattopadhyay R., "Book of papers on Blowroom and Card ", Indian Institute of Technology, Delhi, 1998.



- 3 Iredale J., "Yarn Preparation: A Handbook ", Intermediate Technology, 1992.
- 4 Indhira Doraiswamy, Chellamani P. and Pavendhan A., "Cotton Ginning, Textile Progress", The Textile Institute. Manchester, 1993.
- 5 Wyme.A, Textiles, The Motivate series, Macmillan Texts for Industrial Vocational and Technical Education, Germany.
- 6 Hannelore Eberie et al., Clothing Technology – Fibre to Fabric, Verlag Europa-Lehrmittel, Nourney, Volmer GmbH & Co., Germany, 1996.
- 7 Sara J. Kadolph and Anna L. Langford, Textiles, Prentice Hall of India Limited, New Delhi, 2002

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### HTPC203 : HANDLOOM WEAVING TECHNOLOGY

	L	T	P	C
<b>COURSE OBJECTIVES</b>	3	0	0	3

To impart knowledge to students on

- 1 Identification of yarn packages and preparation of size recipe.
- 2 Basic terms, specifications and functions of weaving preparatory process and handloom machines
- 3 Basic mechanisms of handloom weaving process.
- 4 Count of yarns in different system of yarn numbering and conversion of one system to other.
- 5 Calculation of folded yarn count and various reed counts.

Unit 1 WEAVING PREPARATORY PROCESS 9

Different forms of yarn packages - hanks, cones, cheeses and spools - purpose and use; essential characteristic of warp and weft, yarn preparatory process; warping - peg warping, vertical warping and sectional warping; objective and importance of sizing of cotton yarn, ingredients used in size mixture and their functions, various forms of sizing- hank sizing and street warp sizing; illustrative size recipe for cotton, viscose and polyester - cotton blends; ideal sizing, common defects during sizing- causes and remedies.

Unit 2 HANDLOOMS AND SHED FORMATIONS 9

Evolution of handlooms - various parts of a handloom and their functions, types of handlooms - throw shuttle handloom, fly shuttle handloom, pit loom & frame loom; passage of warp in a fly shuttle handloom; motions of a handloom - primary, secondary & auxiliary motions; Different types of shed formations – centre closed shed, bottom closed shed, top closed shed, open shed and semi open shed; shedding mechanism of a handloom using treadles and heald reversing motions – roller system, pulley reversing system and jack and lam rod system.

Unit 3 PRIMARY AND SECONDARY MOTIONS OF HANDLOOMS 9

Handloom dobbies – lattice doobby, barrel doobby and bottom closed shed doobby – mechanism, working principles and suitability; design and essential features of a pit loom.






8 Lord.P.R and Mohamad, “Weaving: Conversion from yarn to Fabric”, 1982.

### REFERENCE BOOK

- 1 Hanton, WA, “Mechanics for Textiles Student an Introduction to the study of mechanics for Textiles student”, 1960.
- 2 Greenwood, Hony., “Hand book of weaving and manufacturing”, 2nd Edition, 1954.
- 3 Rama Verma, “Handloom weaving”, 1959.
- 4 David Ezakia, “Preparatory Process for weaving with calculation: including Development of the modern Power Loom”.
- 5 Z Grosicki, “Watsons Textile Design and Colour ”, 2<sup>nd</sup> Edition

### HTPC204 : FABRIC STRUCTURE- I

COURSE OBJECTIVES	L	T	P	C
	3	0	0	3

To impart knowledge to students about

- 1 The classification of woven fabrics
- 2 The concept of design elements and features of basic weaves.
- 3 The construction of different kinds of basic weave structures
- 4 Toweling, fancy fabric weaves and colour and weave effect

#### Unit 1 INTRODUCTION TO TEXTILE DESIGNING 9

Classification of textile fabrics; classification of woven fabrics - simple, compound and complex; fundamental aspects of woven fabrics-count of graph paper, Methods of representing design on graph paper; Principle of Design, draft, denting, lifting & tie-up plans. Types of draft - straight draft, skipped draft, pointed draft, herring bone draft, mixed draft etc. Plain weave - ornamentation of plain weaves; study of derivative structures of plain weave – regular and irregular warp rib, weft rib, hopsack and basket weaves. Catch-cord technique; design, draft, denting, peg/tie-up plan and thread interlacing diagram of above weaves

#### Unit 2 TWILL WEAVES AND ITS DERIVATIVES 9

Study of twill weaves up to 12 threads; classification of twills - warp faced twill, weft faced twill and equal faced twill, Left hand twill and Right hand twill; angle of inclination of twill diagonals- Steep twill and Flat twill; influence of the twist direction of yarn over prominence of twill lines; study of derivatives of twill weaves - wavy twill, herringbone, transposed twill, broken twill, elongated twill, combined twill, figured twill– Drafts, lifting plan & tie up, treadling plan for the above designs

#### Unit 3 DIAMOND AND SATIN WEAVES 9

Diamond weave, twill dice check, diaper; regular and irregular sateen and satin up to 12 threads, satin dice check weaves; design, draft, denting, peg/tie-up plan and thread interlacing diagram of above weaves. Difference between diamond and diaper, satin and sateen.





Unit 4 TOWELLING WEAVES

9

Study of honey comb weaves– ordinary honey comb, stitched honey comb and Brighton’s honey comb designs- cell formation; study of Huck-a-Back weave- Construction of Standard Huck- a - Back (10 X 10), Devon’s Huck– a– Back ;mock leno and corkscrew weaves. Design, draft, and peg/tie-up plan and thread interlacing diagram of above weaves

Unit 5 FANCY AND COLOUR AND WEAVE EFFECTS

9

Crepe weaves – construction upon sateen base, by combination of floating weaves with plain thread, by reversing and by insertion of one weave over another. Combination of weaves – twill and plain, mock-leno and plain, honey comb and plain, stripe and check effect by these combinations; Introduction to colour and weave effects- continuous line effect, hounds tooth patterns, bird’s eye and spot effects, hairline stripes, step patterns and all over effects. Distorted thread effects – salient feature, warp and weft distortion.

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Identify and construct plain weave and its derivatives
- CO2 Create different twill weave structures and its derivatives
- CO3 Draw the designs of Diamond and satin weaves
- CO4 Develop woven fabric designs suitable for towels
- CO5 Create fabric designs using different color and weave effects

**TEXT BOOK**

- 1 Grosicki Z. J., “Watson’s Textile Design and Colour”, Vol.1, Woodhead Publications, Cambridge England, 2004.
- 2 Grosicki Z. J., “Watson’s Advanced Textile Design and Colour”, Vol.II, Butterworths, London, 1989.
- 3 Grammar of Textile Design by H. NISBET, F.T.I.

**REFERENCE BOOK**

- 1 Wilson J., “Handbook of Textile Design”, Textile Institute, Manchester, 2001.
- 2 Horne C.E., “Geometric Symmetry in Patterns and Tilings”, Textile Institute, Manchester, 2000.
- 3 Seyam A. M., “Structural Design of Woven Fabrics, Theory and Practice”, Textile Institute, Manchester, 2002.
- 4 Georner D, “Woven Structure and Design, part 1: Single Cloth Construction”, WIRA, U.K., 1986.
- 5 Georner D, “Woven Structure and Design, Part 2: Compound Structures”, WIRA, U.K., 1989.

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## HTPC205 : CHEMICAL PROCESSING OF TEXTILES - I

L	T	P	C
3	0	0	3

### COURSE OBJECTIVES

To make the students understand the process of pretreatments and dyeing of cotton, wool and silk fibres using various dye classes and machineries suitable for the respective process.

#### Unit 1 PRETREATMENT OF COTTON

9

Need for preparation of grey goods & preparatory process sequence for different process of cotton material.

Singeing, objective & methods of singeing - Gas singeing machine description, working, precautions, merits & demerits. Desizing of cotton: objective, methods, special emphasis on Acid & enzyme desizing with merits & demerits. Scouring of cotton: objective, Chemistry, methods of scouring, Bleaching of Cotton: Objective, Chemistry, methods of bleaching, Hypochlorite & H<sub>2</sub>O<sub>2</sub> bleaching, OBA Treatment. Mercerization of Cotton: Objective, Chemistry, methods of mercerization, merits and demerits.

#### Unit 2 DYEING – TERMINOLOGIES AND MACHINES

9

Classification of dyes, Dyeing Terminologies, Dyeing machineries: Kier, J-Box, Jigger, Winch, Padding Mangles, Cabinet Hank dyeing machines, package dyeing machine, HTHP Beam, Jet Dyeing, Soft Flow, Over Flow dyeing machine, Hydro extractor, Vertical Can dryer and Hot Air Stentor.

#### Unit 3 DIRECT AND REACTIVE DYEING OF COTTON

9

Dyeing cotton with Direct Dyes: Classification, Mechanism, Recipe, Process conditions with procedure. After treatment of direct dyed cotton material: Methods and special emphasis on cationic dye fixing agents.

Dyeing of cotton with Reactive Dyes: Classification, Mechanism, Recipe, Process conditions with procedure for M, H and VS dyes

#### Unit 4 VAT, AZOIC AND SULPHUR DYEING OF COTTON

9

Dyeing of cotton with Vat Dyes: Classification Mechanism, Recipe, Process conditions with procedure and concepts of Solubilised Vat Dyes. Dyeing of cotton with Azoic Dyes: Mechanism, Recipe, Process conditions with procedure. Dyeing of cotton with Sulphur Dyes: Classification Mechanism, Recipe, Process conditions with procedure, and its common problems viz. Tendering & Bronziness, etc.

#### Unit 5 PRETREATMENT AND DYEING OF WOOL AND SILK

9

Pretreatment of Silk: Degumming and its methods, bleaching with H<sub>2</sub>O<sub>2</sub>.

Dyeing of Silk with Acid & Metal Complex: Classification, Mechanism, Recipe, Process conditions with procedure.

Pretreatment & Setting of wool: Scouring and its methods, Milling, Potting, Crabbing,



Decatising and Bleaching with H<sub>2</sub>O<sub>2</sub>.

Dyeing of Wool with Acid, Metal Complex, Chrome dyes: Mechanism, Recipe, Process conditions with procedure.

**Total: 45 Hour**

### **COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Explain the need and procedure for pre-treatments of cotton materials.
- CO2 Classify dyes, define the dyeing terms and select the appropriate machine for the process.
- CO3 Explain the process of dyeing cotton with direct and reactive dyes with suitable recipe and process conditions.
- CO4 Describe the process of dyeing cotton with vat, azoic and sulphur dyes with suitable recipe and conditions.
- CO5 Prepare the suitable recipe and procedure for the pre-treatment and dyeing of silk and wool materials.

### **TEXT BOOK**

- 1 Chemical Processing of Textiles by Dr. C.V. Kaushik and Mr. Antao Irwin Josico, NCUTE
- 2 Technology of Scouring and Bleaching, Trotman E.R., Griffin, London, 1968.
- 3 Technology of Textile processing Vol. II, III & VI by Dr. V AShenai
- 4 Technology of Dyeing by Dr. V AShenai
- 5 Guide to Wet Textile Processing Machines by J. N. Shah, Elsevier Science & Technology

### **REFERENCE BOOK**

- 1 Technology of Bleaching and Mercerizing, Shenai V.A., Sevak Publication, Bombay, Vol. - 3, 3rd edition, 2003
- 2 Textile Bleaching, Steven A.B., Pitman and Sons, London.
- 3 Textile Preparation and Dyeing, Asim Kumar Roy Choudhury, Oxford and IBH Publishing Co. Pvt. Ltd., 2006

### **HTPC 206 : HANDLOOM WEAVING TECHNOLOGY LAB**

	L	T	P	C
<b>COURSE OBJECTIVES</b>	0	0	4	2

To impart knowledge to students on

- 1 Different parts of handloom and weaving preparatory process
- 2 Development of design, draft, peg plan and tie up plan for handloom weaving
- 3 Various processes in weaving to develop the fabric sample

List of Experiments

- 1 Sketching and familiarizing of different functional parts of handloom.
- 2 Sketching and practice of various knots and piecing
- 3 Practice of bobbin and pirn winding



- 4 Practice of warping on peg warping frame and sectional warping machine
- 5 Study of preparation of design, draft, peg plan & tie –up plan and practice
- 6 Practice of drawing-in and denting
- 7 Practice of gaiting-up.
- 8 Practice of tie- up and handloom setting.
- 9 Practice of weaving.
- 10 Development of samples with Plain weave and its derivatives
- 11 Development of samples with Twill weave and its derivatives.
- 12 Preparation of lattice with pegs for handloom dobbies for various weaves

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Sketch and identify the different parts of handloom
- CO2 Perform various weaving preparatory processes.
- CO3 Draw a design, draft and peg-plan for the given fabric sample
- CO4 Adjust the settings of handloom to produce given fabric sample
- CO5 Prepare the lattices for various doobby designs

-  
**HTPC 207 : FABRIC ANALYSIS AND COSTING LAB – I**

	L	T	P	C
<b>COURSE OBJECTIVES</b>	0	0	2	1

To impart knowledge to students on analysis of weave and fabric particulars

**List of Experiments**

- 1 Analysis of weave, constructional details and weaving techniques of fabrics with plain weave
- 2 Analysis of weave, constructional details and weaving techniques of fabrics with plain weave derivatives for its production
- 3 Analysis of weave, constructional and weaving techniques of fabrics with different types of twill weaves for its production
- 4 Analysis of weave, constructional and weaving techniques of fabrics with satin and sateen weaves for its cloth production
- 5 Analysis of weave, constructional and weaving techniques of honey comb fabrics
- 6 Analysis of weave, constructional and weaving techniques of Huck a back fabrics

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Draw the structure of woven fabrics with different weaves
- CO2 Extract the weave from the given sample and draw the weave, draft and peg- plan for re-production




## HTPC 208 : CHEMICAL PROCESSING OF TEXTILES LAB - I

	L	T	P	C
<b>COURSE OBJECTIVES</b>	0	0	4	2

To enable the students to perform pre-treatment and dyeing of cotton, wool and silk materials

### List of Experiments

- 1 Desizing of cotton with Acid and Enzyme.
- 2 Scouring of cotton.
- 3 Bleaching of cotton with hydrogen peroxide and Hypochlorite
- 4 Dyeing of cotton with Direct dyes.
- 5 Dyeing of cotton with Reactive dyes.
- 6 Dyeing of cotton with Vat dyes.
- 7 Dyeing of cotton with Azoic dyes.
- 8 Dyeing of cotton with Sulphur dyes.
- 9 Study the effect of Liquor Ratio, Electrolytes & Temperature on any one class of dye.
- 10 Degumming & Bleaching of silk
- 11 Scouring & Bleaching of Wool
- 12 Dyeing of Silk & Wool with Acid dyes.
- 13 Dyeing of Silk & Wool with Metal Complex dyes

**Total: 45 Hour**

### COURSE OUTCOMES:

At the end of the study of this course, the students will be able to perform

- CO1 Pretreatments of cotton, wool and silk material.
- CO2 Dyeing of cotton with direct, reactive, vat, azoic and sulphur dyes using appropriate recipe for the given shade
- CO3 Dyeing of wool and silk with acid and metal complex dyes using appropriate recipe for the given shade
- CO4 The analysis of the effect of MLR, electrolyte and temperature on dyeing of cotton.

## SEMESTER IV

### HTPC 209: WEAVING TECHNOLOGY - I

	L	T	P	C
<b>COURSE OBJECTIVES</b>	3	0	0	3

To facilitate the students to learn about the

- 1 Principle and working of warp winding and pirn winding process.
- 2 Mechanism and principle of warping & sizing process and related calculations
- 3 Different primary motions in tappet loom and dobby loom.
- 4 Various secondary and auxiliary motions
- 5 Working principle of multiple box motions and production calculation in loom



Unit 1 WINDING

9

Objectives – Passage of yarn and Working principle of Precision winding machines and drum winding machines. Tensioning devices – Mechanical yarn clearer- slub catcher: fixed blade, adjustable blade, spring type. Electronic yarn clearer; photo-electric and capacitance type – Splicing; difference between knotting and splicing. Ribbon breaking devices. Objectives – Working principle of pirn winding machines - characteristics of pirn package. Yarn & Package faults. Yarn winding calculations – cone, cheese and pirn– efficiency, production and production planning.

Unit 2 WARPING AND SIZING

9

Modern high speed beam warping machine – mechanism and working principle, Sectional warping machine – mechanism and working principle. Working principle of Multi cylinder sizing machine. Mill warping calculations – efficiency, production, creel capacity, number of back beams, amount of yarn, wastage and production planning; Sectional warping calculation – creel capacity, no of sections, no of patterns per sections, width of warp and total no of ends; Sizing calculations – size pick up, efficiency, production and production planning

Unit 3 POWERLOOM WEAVING

9

Introduction to power loom – primary, secondary and auxiliary motions of a power loom; tappet shedding and reversing motions - early shedding, late shedding; designing of tappets for plain and 4 thread twill weaves; powerloom dobby – climax dobby, mechanism and working principle, lattices and pegging. Picking mechanism – scope of over-pick and under-pick mechanism, cone over-pick mechanism – mechanism and working principle; under-pick mechanism – mechanism and working principle, parallel motion, early picking and late picking.

Unit 4 BASIC AUTOMATION IN POWERLOOM

9

Beat-up mechanism – eccentricity of sley, timing and synchronization of primary motions; seven wheel take up motions; negative let-off motion. Warp protective motions – loose reed and fast reed motions, mechanism and working principle; weft detection motions – side weft fork and centre weft fork motions, mechanism and working principle. Temples – necessity and types of temples.

Unit 5 AUTOMATIC POWERLOOM

9

Multiple box motion; drop box – mechanism and working principle; automatic powerlooms – introduction; mechanical warp stop motion; weft replenishment mechanism - shuttle changing & cop changing mechanisms; Fabric production calculations of automatic powerlooms, preparation of lay-out for a loom shed.

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

CO1 Discuss the concept and mechanism of warp winding and weft pirn winding.



- CO2 Explain the mechanism and principle of warping & sizing process and estimate size pick up and production.
- CO3 Summarize the working mechanism of primary motions in tappet and dobby loom
- CO4 Elaborate the various secondary and auxiliary motions in power loom
- CO5 Demonstrate the drop box motion, stop motions and production calculations in power loom.

**TEXT BOOK**

- 1 Marks R. and Robinson T.C., “Principles of Weaving”, The Textile Institute, Manchester, 1989.
- 2 Sabit Adanur, “Handbook of Weaving”, Technomic Publishing Co. Inc., 2001
- 3 Ormerod A. and Sondhelm W.S., “Weaving: Technology and operations”, Textile Institute, 1995.

**REFERENCE BOOK**

- 1 Talukdar M.K., Sriramulu P.K. and Ajgaonkar D.B., “Weaving: Machines, Mechanisms Management”, Mahajan Publishers, Ahmedabad, 1998.
- 2 Booth J.E., “Textile Mathematics Volume 3”, The Textile Institute, Manchester, 1977.
- 3 Lord P.R. and Mohamed M.H., “Weaving: Conversion of Yarn to Fabric”, Merrow, 1992.
- 4 Vangheluwe L., “Air- Jet Weft Insertion”, Textile progress, Vol. 29, No. 4, Textile Institute Publication, 1999.

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**HTPC210 : FABRIC STRUCTURE- II**

<b>COURSE OBJECTIVES</b>	L	T	P	C
	2	1	0	3

To impart knowledge to students on

- 1 Multi-layer fabrics and their production.
- 2 Construction of weave, draft, peg plan for the production of compound and complex structures
- 3 Design preparation suitable for figured single cloth jacquard weaving

Unit 1    **CORDED AND RIB STRUCTURES** 9

Bedford cord weaves – salient features, plain faced Bedford cord (regular and alternate pick principle), twill faced bed ford cord, wadded bed ford cord, and crepon Bedford cords. Welt & Pique structures – salient features and manufacturing techniques, ordinary structure, wadded structure (loose back and fast back); Difference between welts and piques, Difference between Bedford cord and welt. Design, draft, denting, peg/tie-up plan and thread interlacing diagram of above weaves.

Unit 2    **DOUBLE LAYER CLOTH AND ITS TYPES** 9

Double cloth – classification, Step by step construction of self-stitched double cloth, reversible and non-reversible varieties using twill, sateen and satin; Centre stitched double cloth; double width plain cloth, plain Tubular cloth. Thread interchanging double cloth-




warp thread interchanging double cloth ,weft thread interchanging double cloth, Cloth interchanging double cloth using plain and twill weaves; Stripes and check effects using cloth interchanging principle; wadded double cloth – warp wadding and weft wadding. Design, draft, denting, peg/tie-up plan and thread interlacing diagram of above weaves.

Unit 3 TREBLE CLOTH AND BACKED CLOTH 9

Treble width plain cloth – interlacement diagram and its graphical representation; Treble cloth using twill, satin, and sateen. Backed cloths- warp & weft backed cloths-warp wadded and weft wadded backed cloth-Reversible and non-reversible using twill, sateen and satin - Imitation backed cloth, imitation warp and weft backed cloths. Design, draft, denting, peg/tie-up and thread interlacing diagram of above weaves.

Unit 4 COMPOUND WEAVE STRUCTURE- PILE WEAVE 9

Pile fabrics – Salient features, classification of pile fabrics- loop pile and cut pile; warp pile and weft pile. Terry piles – salient features, terry mechanism; classification of terry pile structures – 3 pick, 4 pick, 5 pick and 6 pick terry, graphical representation and thread interlacement diagram. Basic principles and weaves of warp pile fabrics produced with the aid of wires and face to face weaving. Construction of Weft pile designs - Construct Plain back, Twill back pile designs, Corded velveteen- design, draft, denting, peg plan, tie-up and thread interlacing diagram of above weaves.

Unit 5 INTRODUCTION TO COMPLEX WEAVES AND JACQUARD FIGURED DESIGN 9

Principles of Cross weaving-Variety types of sheds formed in cross weaving - Construction of plain gauze & leno – Drafting, lifting plan, thread diagram & graphical representation. Construction of extra warp and extra weft designs - Importance of extra warp and extra weft figuring in ornamentation of fabrics. Introduction of Construction and development of jacquard designs. Count of graph paper- Factors influencing the selection of appropriate count of graph paper. Study of Figured single cloth - structure of cloth with different weaves combination-Design development and punching process by using straight tie and straight draft

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Sketch corded and rib structures using basic weaves
- CO2 Create double cloth structures using different methods
- CO3 Construct treble cloth and backed cloth structures
- CO4 Select different weaves to produce compound fabric structures
- CO5 Develop the designs for complex fabric structures

**TEXT BOOK**

- 1 Grosicki Z. J., “Watson’s Textile Design and Colour”, Vol.1, Woodhead Publications, Cambridge England, 2004.
- 2 Grosicki Z. J., “Watson’s Advanced Textile Design and Colour”, Vol.II,





- Butterworths, London, 1989.
- 3 Grammar of Textile Design by H. NISBET, F.T.I.

### REFERENCE BOOK

- 1 Georner D. Woven Structure and Design Part I Single Cloth Construction WIRA UK 1986
- 2 Georner D, "Woven Structure and Design, Part 2: Compound Structures", WIRA,U.K., 1989.
- 3 X. Chen,M. Spola,J. Gisbert Paya &P. Mollst Sellabona1,Experimental Studies on the Structure and Mechanical Properties of Multi-layer and Angle-interlock Woven Structures, Pages 91-99

## HTPC211 : CHEMICAL PROCESSING OF TEXTILES – II

COURSE OBJECTIVES	L	T	P	C
	3	0	0	3

To facilitate the students to understand

- 1 the process of pretreatments and dyeing of polyester materials, dyeing defects and its remedies,
- 2 various methods and styles of printing
- 3 recipe and procedure for direct style printing on cotton ,silk and polyester various mechanical and chemical finishes

### Unit 1    PRETREATMENT AND DYEING OF POLYESTER 9

Pretreatment of Polyester: Scouring and bleaching with sodium chlorite. Heat Setting: Objective & Methods. Dyeing of Polyester with Disperse dyes: Mechanism, Recipe, Process conditions with procedure for Carrier, HTHP & Thermosol dyeing. Dyeing defects, damages and their remedies.

### Unit 2    INTRODUCTION TO PRINTING 9

Textile Printing: Differences in Dyeing and Printing, Printing paste ingredients and their functions. Methods of printing viz. Block Printing, Screen Printing, Rotary and Flatbed Screen Printing and Transfer Printing with their merits and demerits. Brief outlines of Styles of Printing viz. Direct, Resist and Discharge Printing. Traditional styles of Printing viz. Tie & dye, Kalamkari and Batik printing. After Treatments in printing: Steaming, Ageing and Curing.

### Unit 3    DIRECT STYLE OF PRINTING 9

Printing of cotton with Direct dyes, Reactive dyes in direct style: recipe & Procedure.  
 Printing of cotton with Pigments: recipe & Procedure  
 Printing of Silk with Acid dyes: recipe & Procedure  
 Printing of Polyester with Disperse dyes: recipe & Procedure




Unit 4 INTRODUCTION AND MECHANICAL FINISHES 9  
 Textile Finishing: Object & factors affecting selection of finishes.  
 Classification: Mechanical and Chemical Finishes, Temporary and Permanent Finishes.  
 Mechanical Finishing: Calendaring, Sanforizing, Raising or Napping, Shearing and Sueding.

Unit 5 CHEMICAL FINISHES 9  
 Chemical finishing: Wrinkle-resist finishing, Softening, Stiffening, Waterproof, water repellent, Soil repellency, soil release, Antistatic, flame retardant and flame resistant finish

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Explain the process of pre-treatment and dyeing of polyester fabrics.
- CO2 Describe various methods and styles of printing and select suitable print paste ingredients for the printing process.
- CO3 Explain the process of direct style of printing of various fabrics with suitable recipe and procedure.
- CO4 Classify textile finishes; explain the process of calendaring and sanforising
- CO5 Summarize the various chemical finishing treatments.

**TEXT BOOK**

- 1 Textile Dyeing by Dr. N. N. Mahapatra, Woodhead Publishing India in Textiles.
- 2 Chemical Processing of Textiles by Dr. C.V. Kaushik and Mr. Antao Irwin Josico, NCUTE
- 3 An Introduction to Textile printing by W Clarke.
- 4 Textile Finishing by R. S. Prayag
- 5 Technology of Textile Finishing by Dr. V.A. Shenai.

**REFERENCE BOOK**

- 1 Handbook of Textile processing machinery – R.S. Bhagwat1999
- 2 Dyeing and Chemical Technology of Textiles Fibres by E.R. Trotman
- 3 Chemical Finishing of Textiles by W.D. Schindler and P.J. Hauser.
- 4 A Handbook of Textile Finishing by A.J. Hall
- 5 Principles of Textile Finishing by Asim Kumar Roy choudhury

**HTPC212 : TEXTILE TESTING – I**

	L	T	P	C
<b>COURSE OBJECTIVES</b>	3	0	0	3

To enable the students to learn about

- 1 Sampling methods for testing of textile materials.
- 2 The moisture properties of textiles and its measurement.
- 3 The Determination of fibre length, fineness and maturity properties




- 4 The Determination of tensile properties of fiber and yarn.
- 5 The determination of Yarn count, Twist and mass evenness

Unit 1	SAMPLING	9
	Definition of quality- importance of quality assessment- selection of samples for quality assessment – random and biased samples – squaring technique and zoning technique for fibre Selection; Yarn sampling - use of random numbers - sampling for various types of yarn tests	
Unit 2	MOISTURE RELATED PROPERTIES OF TEXTILES	9
	Atmospheric conditions - absolute humidity, relative humidity, standard atmospheric testing conditions; Measurement of atmospheric conditions - Instruments used for determination of Relative Humidity – Wet and dry bulb hygrometer; Concept of Moisture Regain and Moisture Content – Relation between Regain and Content- Corrected yarn count in standard regain value; Effect of Moisture on fibre properties – Factors affecting Moisture Regain of textile materials – Standard regain value of textile fibres ; Methods of Measurement of Moisture Regain and Moisture Content -Moisture Testing Oven	
Unit 3	FIBER LENGTH, FINENESS AND MATURITY	9
	Fibre testing, the fibre quality index and spinnability; Fibre length and length uniformity measuring techniques. Fibre fineness – definition - its importance in yarn manufacture; measurement techniques. Cotton fibre maturity, estimation by microscopic method - maturity ratio and index, estimation by other methods – optical, air flow differential dyeing; its importance in spinning.	
Unit 4	TENSILE PROPERTIES OF FIBER AND YARN	9
	Tensile testing of Textiles – Introduction – Terminology and definitions; The Load and elongation curve – The stress and strain curve. Tensile strength testing modes – CRT, CRE and CRL; Factors affecting the test results obtained from testing instruments. Fibre strength measurement – stelometer; Pendulum lever principle (CRT) – single yarn strength tester, Inclined plane principle (CRL) - Scott IP Tester, Strain gauge principle (CRE) – Lea strength – CSP, merits & demerits.	
Unit 5	YARN COUNT, TWIST AND MASS EVENNESS	9
	Count measuring systems. Measurement of Yarn Count - weighing balance method, Knowles balance, Quadrant balance, Beasley’s balance. Significance of Yarn Twist - Twist direction - Twist factor and Twist Multiplier. Twist angle - function of twist in yarn structure – Twist and yarn strength – Effect of twist on fabric properties; Measurement of twist using Straightened fibre method, Twist contraction method. Yarn mass evenness parameters – measurement – electronic mass evenness determination – Yarn fault classification	

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to




- CO1 Use sampling methods for textile materials
- CO2 Describe moisture and its effect and relation with other properties of textile material.
- CO3 Analyse fibre length, fineness and maturity properties and their measurement
- CO4 Determine the tensile strength of fiber and yarn
- CO5 Explain significance of yarn count, twist and evenness and their measurement.

### TEXT BOOK

- 1 Booth J.E., “Principle of Textile Testing”, Butterworth Publications, London, 1989
- 2 Saville B.P., “Physical Testing of Textiles”, Textile Institute, Manchester, 1998
- 3 Kothari V. K., “Testing and Quality Management”, Progress in Textile Technology Vol.1, IAFL Publications, New Delhi, 1999
4. Amutha, K., A Practical Guide to Textile Testing. CRC Press, 2016.

### REFERENCE BOOK

- 1 Ruth Clock and Grace Kunz., “Apparel Manufacture – Sewn Product Analysis”, Upper Sadle River Publications, New York, 2000
- 2 Pradip V. Mehta., “Managing Quality in the Apparel Industry”, NIFT Publication, India, 1998
- 3 Sara J. Kadolph., “Quality Assurance for Textiles and Apparels”, Fair child Publications, New York,1998
- 4 Slater K., “Physical Testing and Quality Control”, The Textile Institute, Vol.23, No.1/2/3 Manchester, 1993
- 5 Textile testing web course content <https://nptel.ac.in/courses/116/102/116102029/#>

### HTPC 209 : COLOUR CONCEPTS AND TEXTILE DESIGN LAB

COURSE OBJECTIVES	L	T	P	C
	0	0	2	1

To impart knowledge to students on

Drawing small figures and motifs, Colour theory and its effect on weaves and Arrangement of motifs with different bases

#### List of Experiments

- 1 Practice on drawing types of Lines
- 2 Practice on drawing direction of Lines
- 3 Practice on Variation of Lines
- 4 Practice on foliage drawing like small plants, flowers and creepers
- 5 Practice on developing traditional motifs like birds, animals and flowers
- 6 Prepare Colour Wheel (Primary, Secondary and Tertiary Colours)
- 7 Practice chart for colour schemes
  - Monochromatic
  - Analogous
  - Achromatic
  - Complementary colour
    - Single Complementary

- Double Complementary
  - Split Complementary
  - Triadic
- 8 Create Simple colour & weave effects in design paper by applying colour schemes for the following
    - stripes
    - checks
    - step pattern
    - Hound's-tooth patterns
  - 9 Apply colour schemes for special colour and weave effects for rib and corkscrew weaves
  - 10 Apply colour schemes for figured colour and weave effects for the following
    - Simple and compound order of colouring
    - Distinct figured effects
  - 11 Arrange motifs or figures in different bases for drop device and drop reverse design
    - Diamond base, Ogee base, Diagonal wave line base and Rectangular base
  - 12 Arrange motifs or figures in different bases for Sateen system of distribution
    - Regular and irregular sateen arrangement
    - Layout preparation for shirting, Dothi, saree and chudidar

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Draw different lines and apply in designing motifs
- CO2 Apply the Light and pigment colour concepts in design development
- CO3 Create different colour and weave effects

-

**HTPC214: WEAVING TECHNOLOGY LAB**

<b>COURSE OBJECTIVES</b>	L	T	P	C
	0	0	4	2

To facilitate the students to learn about

- 1 Operation and working of various weaving preparatory machines.
- 2 Fabric samples development for basic weaves on handloom
- 3 Erection and setting of basic weaving mechanisms practically
- 4 Samples development for saree and dhoti borders using handloom doobby.

List of Experiments

- 1 Study the material passage, setting of tensioners, slub catchers and production calculation in cone winding machine.
- 2 Study the material passage and production calculation in pirn winding machine.
- 3 Study the material passage and production calculation in warping / sectional warping machine.
- 4 Development of samples with satin/ sateen weaves on handlooms
- 5 Development of samples with diamond, honey comb, diaper weaves on handlooms.




- 6 Development of samples with mock leno and huck-a-back weaves on handlooms.
- 7 Development of samples with distorted tread effect, backed cloth etc., on handlooms
- 8 Sketching and acquiring knowledge of different functional parts of Power loom.
- 9 Practice of erection and setting of tappet shedding mechanism
- 10 Practice of erection and setting of over-pick and under-pick mechanisms
- 11 Practice of erection and setting of beat-up mechanism and control of sley eccentricity.
- 12 Study of let-off mechanisms.
- 13 Practice of erection and setting of 5 and 7 wheel take-up mechanisms.
- 14 Study of weft fork and weft replenishment mechanisms in shuttle looms
- 15 Study of warp protector mechanism.
- 16 Creation of designs suitable for saree borders and dhoti borders using handloom dobbies.

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Predict slub catcher and tensioner settings for various linear density and calculate production in cone winding.
- CO2 Estimate and calculate production in pirn winding and warping machines
- CO3 Create fabric samples for various basic weaves on handloom using 5 to 8 shafts.
- CO4 Show and practice dismantling, assembling and setting of various primary, secondary and auxiliary motions in power loom.
- CO5 Develop sample for saree and dhoti borders using handloom doobby

-  
**HTPC 215 : CHEMICAL PROCESSING OF TEXTILES LAB - II**

<b>COURSE OBJECTIVES</b>	L	T	P	C
	0	0	4	2

To enable the students to

- 1 perform dyeing of polyester,
- 2 perform direct, discharge and resist style of printing
- 3 perform Identification of dyes in powder and dyed material
- 4 perform Stiffening and softening finish
- 5 Understand the computer colour matching process.

List of Experiments

- 1 Dyeing of polyester with disperse dyes.
- 2 Printing of Cotton in direct style with Direct & Reactive dyes using Blocks & Screens.
- 3 Printing of Polyester in direct style with Disperse dyes using Blocks & Screens.
- 4 Printing of Cotton & Polyester in direct style with Pigment Colours using Blocks & Screens.
- 5 Printing of Cotton in White Discharge Style on Direct & Reactive dye using Blocks & Screens.




- 6 Tie & Dye style of printing
- 7 Batik style of printing.
- 8 Identification of dyes in powder form.
- 9 Identification of dyes in dyed material
- 10 Application of stiffening agent.
- 11 Application of Reactive / Silicone Softeners
- 12 Demonstration on Computer Colour Matching.
- 13 Calibration, K/S Data generation & Evaluation of whiteness index.

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Conduct dyeing of polyester using disperse dye for the given shade with appropriate recipe.
- CO2 Conduct direct, discharge and resist style of printing using blocks and screen on cotton material.
- CO3 Identify dyes in powder form and in dyed materials.
- CO4 Apply stiffening and softening finish on cotton
- CO5 Analyse the shade using computer colour matching

-  
**HTPC216 : TEXTILE TESTING LAB – I**

<b>COURSE OBJECTIVES</b>	L	T	P	C
	0	0	3	1.5

To enable the students to learn about

- 1 Moisture in substrate /textile material and its measurement.
- 2 Determination of fibre length, fineness, maturity and trash properties
- 3 Determination of yarn count and twist.
- 4 Testing yarn evenness, imperfections and classification of yarn faults
- 5 Determination of tensile strength of yarn

List of Experiments

- 1 Determination of Moisture Regain and Moisture Content of the given material by drying and weighing method.
- 2 Determination of Atmospheric Conditions in the Testing Lab (Relative Humidity and Temperature) by Wet and Dry Bulb Hygrometer.
- 3 Determination of effective length, mean length, dispersion percentage and short fibre percentage for the given cotton sample using Baer Sorter
- 4 Determination of fineness of given cotton sample by Airflow method
- 5 Determination of maturity value of given cotton sample
- 6 Determination of yarn count by Length and Weight method.
- 7 Determination of yarn count by Knowles Balance
- 8 Determination of yarn count from the given fabric swatch by using Beasley's Balance
- 9 Determination of yarn count by Quadrant Balance




- 10 Determination of twist per inch in the given sample of yarn using twist contraction method (Untwist – Twist)
- 11 Determination of twist per inch in the given sample of yarn using Straightened Fibre Method.
- 12 Visual assessment of yarn evenness using ASTM Black Boards
- 13 Determination of single yarn and lea strength of yarn

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Determine moisture content in fibre and humidity.
- CO2 Assess fibre length, fineness and maturity
- CO3 Determine yarn count and twist.
- CO4 Analyse yarn evenness, imperfections and classify of yarn faults

**SEMESTER V**

**HTPC301 : WEAVING TECHNOLOGY – II**

**COURSE OBJECTIVES**

L	T	P	C
3	0	0	3

To facilitate the students to learn about the

- 1 Working mechanism of various jacquard looms and harness building.
- 2 Working principle of projectile and rapier looms.
- 3 Different jet loom and its working mechanisms.
- 4 Fabric parameters such as warp, weft and cloth cover factor, warp and weft yarn weight in linear meter and related calculations

**Unit 1 JACQUARDS**

9

Functions of Jacquard - Types of Jacquard - Jacquard mechanism - Figuring capacities of Jacquards - Types of sheds in Jacquard Shedding - SLSC Jacquard - DLSC Jacquard - DLDC Jacquard - Open shed Jacquards - Harness building - Harness Ties - Casting out - Card cutting - Card Lacing - High speed Jacquard – Introduction to electronic Jacquard - Special Jacquard mechanisms.

**Unit 2 SHUTTLELESS WEAVING MACHINES**

9

Techno economics of Shuttleless loom weft insertion systems; Importance of Shuttleless weaving, Installation of Shuttleless weaving machine - Minimum down time Supply Package - Accumulator - Measuring system - Cutters and automation in Shuttleless loom, selvedge in Shuttleless loom, Quick style change. Projectile looms - Basics - Weft insertion - Picking mechanism - Beat up mechanism - Rapier Loom - Classifications of Rapier weaving machines - Driving systems - Rapier Heads.



- Unit 3 JET LOOMS 9  
 Air Jet loom - Weft Insertion - Basic requirements - Merit and demerit - Water Jet loom - weft Insertion - Basic requirements - Merit and demerit - Multiphase looms - Various methods - Circular weaving. Loom monitoring and control Loom stoppages and efficiency; fabric defects and value loss; Filament weaving – Silk & Texturised yarns.
- Unit 4 YARN AND FABRIC CALCULATIONS 9  
 Pierce’s formula for estimation of diameter of yarns; relative diameter of yarns; calculation of cloth cover – warp cover, weft cover and cloth cover, derivation and calculations, fractional cover, percentage cover and cover factor.
- Unit 5 FABRIC CALCULATIONS 9  
 Determination of Ends per inch and Picks per inch while changing count, weave and both to maintain the same level compactness. Determination of count of Warp & Weft and Ends per inch and Picks per inch while increasing or decreasing the weight of fabric to maintain same level of compactness, Cloth calculation - Amount of Warp and Weft weight per linear meter, weight per square meter using Direct, Indirect and Universal systems of yarn count.

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Discuss the features of jacquard loom and its types.
- CO2 Explain the function of each element in projectile and rapier weaving machine.
- CO3 Summarise the working principle and weft insertion cycle of jet looms.
- CO4 Estimate the yarn diameter and cover factor of fabric sample.
- CO5 Analyse the fabric in-terms of warp and weft threads per unit length, weight per unit area and related calculations

**TEXT BOOK**

- 1 Marks R. and Robinson T.C., “Principles of Weaving”, The Textile Institute, Manchester, 1989.
- 2 Sabit Adanur, “Handbook of Weaving”, Technomic Publishing Co. Inc., 2001
- 3 Ormerod A. and Sondhelm W.S., “Weaving: Technology and operations”, Textile Institute, 1995.

**REFERENCE BOOK**

- 1 Talukdar M.K., Sriramulu P.K. and Ajgaonkar D.B., “Weaving: Machines, Mechanisms, Management”, Mahajan Publishers, Ahmedabad, 1998
- 2 “Weaving: The knowledge in Technology”, Papers Presented at the Textile Institute WeavingConference, Textile Institute, 1998.
- 3 Booth J.E., “Textile Mathematics Volume 3”, The Textile Institute, Manchester, 1977.
- 4 Lord P.R. and Mohamed M.H., “Weaving: Conversion of Yarn to Fabric”, Merrow, 1992.

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## HTPC212 TEXTILE TESTING – II

	L	T	P	C
<b>COURSE OBJECTIVES</b>	3	0	0	3
To enable the students to learn about				
1	Construction characteristics of fabrics			
2	Determination of tensile, tear and bursting strength of fabric			
3	The principle and measurement of comfort and surface characteristics of fabric			
4	The standards and assessment procedure for fastness testing			
5	Fabric inspection and quality assessment of garments			
<b>Unit 1 CONSTRUCTION CHARACTERISTICS</b>				9
Basic fabric particulars – Measurement of ends and picks per inch, count of warp and weft, determination of the type of weave, measurement of length, width, thickness and Area density (GSM);warp and weft crimp measurements for spun and filament yarn fabrics, the cover factor calculations; Fabric sampling techniques.				
<b>Unit 2 FABRIC STRENGTH RELATED PROPERTIES</b>				9
Tensile strength measurement – ravelled strip test and grab test – mechanical and electronic measuring systems. Tear strength – importance – measuring systems. Bursting strength and its measurement. Ballistic impact strength. Universal tensile tester - principle and operation				
<b>Unit 3 COMFORT AND SURFACE CHARACTERISTICS</b>				9
Fabric stiffness – principle of measurement of flexural rigidity; Drapeability – measurement of drape coefficient; Crease recovery measurement techniques. Wrinkle recovery assessment using standard grades; Principle and functioning of air permeability testers, water repellency, fabric shrinkage testing; Fabric abrasion resistance – measuring technique; Fabric pilling resistance – methods of determination.				
<b>Unit 4 FASTNESS PROPERTIES OF TEXTILES</b>				9
Objectives of various fastness testing of textile materials. Various standards and procedure to assess washing fastness, rubbing fastness, light fastness and perspiration fastness property of a textile material.				
<b>Unit 5 FABRIC INSPECTION AND GARMENT QUALITY EVALUATION</b>				9
Fabric inspection – Manual, semi-automatic and Automatic Inspection systems, and classification of fabric defects, Method of Grading– 4 point system and 10 point system. Acceptable quality level (AQL), MIL standards and final inspection. Quality assessment of Garments - cutting, sewing, pressing, finishing and packaging defects.				
				<b>Total: 45 Hour</b>

### COURSE OUTCOMES:

At the end of the study of this course, the students will be able to



- CO1 Explain various constructional characteristics of a fabric
- CO2 Determine fabric tensile characteristics of a fabric
- CO3 Assess the comfort and surface characteristics of fabric
- CO4 Explain the fastness characteristics of a textile material
- CO5 Explain the fabric inspection and garment quality evaluation methods

**TEXT BOOK**

- 1 Booth J.E., “Principle of Textile Testing”, Butterworth Publications, London, 1989
- 2 Saville B.P., “Physical Testing of Textiles”, Textile Institute, Manchester, 1998
- 3 Kothari V. K., “Testing and Quality Management”, Progress in Textile Technology Vol.1, IAFL Publications, New Delhi, 1999
- 4 Amutha, K. , A Practical Guide to Textile Testing, CRC Press, (2016).

**REFERENCE BOOK**

- 1 Dolez, P. I., Vermeersch, O., & Izquierdo, V. (Eds.),Advanced characterization and testing of textiles. Woodhead Publishing, (2017).  
Ruth Clock and Grace Kunz., “Apparel Manufacture – Sewn Product Analysis”, Upper Sadle River Publications, New York, 2000
- 2 Pradip V. Mehta., “Managing Quality in the Apparel Industry”, NIFT Publication, India, 1998
- 3 Sara J. Kadolph., “Quality Assurance for Textiles and Apparels”, Fair child Publications, New York,1998
- 4 Slater K., “Physical Testing and Quality Control”, The Textile Institute, Vol.23, No.1/2/3 Manchester, 1993
- 5 Textile testing web course content <https://nptel.ac.in/courses/116/102/116102029/#>

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**HTPC 304 : JACQUARD WEAVING AND COMPUTER AIDED TEXTILE DESIGNING LAB**

<b>COURSE OBJECTIVES</b>	L	T	P	C
	2	1	0	3

To impart knowledge to students on

- 1 Development of graph for simple and compound fabric structures and designs
- 2 Computer Aided Textile designing using different software
- 3 Card Punching procedure for Jacquards

List of Experiments

- 1 Design development on graph paper and card punching procedures for production of figured single cloth.
- 2 Design development on graph paper and card punching procedures for production of damask fabrics.
- 3 Design development on graph paper and card punching procedures for production of figured double cloth with 2 colour and 4 colour effects.
- 4 Design development on graph paper and card punching procedures for production of




- figured warp/weft backed cloth.
- 5 Design development on graph paper and card - punching procedures for production of figured extra warp and extra weft fabrics.
  - 6 Design development on graph paper and card and punching procedures for production of figured terry structures.
  - 7 Study of figured pique structures, graph design development and card cutting procedures for these structures.
  - 8 Study of patent satin structures, graph design development and card punching procedures for these structures.
  - 9 Study of tapestry structures, graph design development and card cutting procedures for these structures.
  - 10 Creation of design using paint shop pro /Adobe Photoshop /Corel draw
  - 11 Conversation of vector image into Raster image.
  - 12 Creation of dobby designs using CATD software.
  - 13 Creation of Jacquard designs using CATD software.

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Develop graphical design for simple and compound fabrics
- CO2 Develop Textile designs by using designing software
- CO3 Modify vector image to raster image using designing software
- CO4 Create dobby and jacquard designs by using CATD software

**HTPC 305 : TEXTILE TESTIN LAB - II**

	L	T	P	C
<b>COURSE OBJECTIVES</b>	0	0	3	1.5

To enable the students to learn about

- 1 The Determination of crimp, shrinkage and GSM of fabric
- 2 The Determination of fastness properties of dyed textile materials
- 3 Determination of tensile, ballistic and bursting strength of fabric
- 4 Determination of crease recovery, stiffness and drape characteristics of fabric
- 5 Determination of pilling and abrasion resistance characteristics of fabric

List of Experiments

- 1 Determination of warp and weft yarn Crimp in the given fabric swatch.
- 2 Determination of shrinkage in the given fabric swatch
- 3 Determination of thickness and weight of given fabric sample in terms of weight / square yard and GSM.
- 4 Determination of Washing fastness of dyed material by following ISO and AATCC standards
- 5 Determination of Wet & Dry Rubbing fastness of dyed material using Crock meter.
- 6 Determination of Light fastness of dyed material
- 7 Determination of Ballistic Strength of the given fabric




- 8 Determination of Tensile Strength of the given fabric
- 9 Determination of Fabric Tearing Strength using Elmendorf Tear Tester
- 10 Determination of Crease recovery of the given fabric
- 11 Determination of Bursting strength testing of the given fabric
- 12 Assessment of Pilling characteristics of the given fabric
- 13 Determination of bending length of the given fabric using Shirley Stiffness Tester and Assessment of Drapability of the given fabric
- 14 Assessment of Abrasion resistance of fabrics using Martindale Abrasion Tester

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Determine the crimp, shrinkage and GSM of the fabric
- CO2 Assess the quality of fabrics in terms of fastness properties
- CO3 Analyse tensile, ballistic and bursting strength of fabric
- CO4 Determine crease recovery, stiffness and drape characteristics of fabric
- CO5 Analyse pilling and abrasion resistance characteristics of fabric

-  
**HS302 ENTREPRENEURSHIP AND START-UPS**

<b>COURSE OBJECTIVES</b>	L	T	P	C
	3	1	0	4

- 1 Acquiring Entrepreneurial spirit and resourcefulness.
- 2 Familiarization with various uses of human resource for earning dignified means of living.
- 3 Understanding the concept and process of entrepreneurship - its contribution and role in the growth and development of individual and the nation.
- 4 Acquiring entrepreneurial quality, competency, and motivation.
- 5 Learning the process and skills of creation and management of entrepreneurial venture.

Unit 1 INTRODUCTION TO ENTREPRENEURSHIP AND START – UPS

- Definitions, Traits of an entrepreneur, Intrapreneurship, Motivation
- Types of Business Structures, Similarities/differences between entrepreneurs and managers  
Government Schemes for Textile Entrepreneurs
- Handloom Promotion programs, schemes available MSME, NABCONS, Textile Clusters successful entrepreneur and expos, producer companies, GEM on boarding, craft village and Design Resource Centres

Unit 2 BUSINESS IDEAS AND THEIR IMPLEMENTATION

- Discovering ideas and visualizing the business
- Activity map




- Business Plan
- Unit 3 IDEA TO START-UP
- Market Analysis – Identifying the target market,
  - Competition evaluation and Strategy Development,
  - Marketing and accounting,
  - Risk analysis
- Unit 4 MANAGEMENT
- Company’s Organization Structure,
  - Recruitment and management of talent.
  - Financial organization and management
- Unit 5 FINANCING AND PROTECTION OF IDEAS
- Financing methods available for start-ups in India
  - Communication of Ideas to potential investors – Investor Pitch
  - Patenting and Licenses
- Unit 6
- Exit strategies for entrepreneurs, bankruptcy, and succession and harvesting strategy

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Explain the dynamic role of entrepreneurship and small business
- CO2 Discuss the role of Government schemes for entrepreneurship
- CO3 Financial Planning and Control
- CO4 Forms of Ownership for Small Business
- CO5 Strategic Marketing Planning
- CO6 New Product or Service Development
- CO7 Business Plan Creation

**REFERENCE BOOK**

- 1 Steve Blank and Bob Dorf, The Startup Owner’s Manual: The Step-by-Step Guide for Building a Great Company, K & S Ranch ISBN – 978-0984999392
- 2 Eric Ries, The Lean Startup: How Today’s Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Penguin UK ISBN – 978-0670921607
- 3 Adrian J. Slywotzky with Karl Weber, Demand: Creating What People Love Before They Know They Want It, Headline Book Publishing ISBN – 978-0755388974
- 4 Clayton M. Christensen, The Innovator’s Dilemma: The Revolutionary Book That Will Change the Way You Do Business, Harvard business ISBN: 978-142219602
- 5 <https://www.fundable.com/learn/resources/guides/startup>
- 6 <https://corporatefinanceinstitute.com/resources/knowledge/finance/corporatestructure/>
- 7 <https://www.finder.com/small-business-finance-tips>
- 8 <https://www.profitbooks.net/funding-options-to-raise-startup-capital-for-your-business/>

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## HTPC306 : FABRIC ANALYSIS AND COSTING LAB -II

L	T	P	C
2	1	0	3

### COURSE OBJECTIVES

To enable the students to learn about

- 1 Analysis of cloth particulars and weave
- 2 Factors involved in fabric costing

### List of Experiments

- 1 Analysis of weave, constructional details, weaving techniques and costing of at least two traditional handloom sarees
- 2 Extracting the production particulars of given plain fabric sample and furnishing the production and cost details.
- 3 Extracting the production particulars of given handloom multi treadle design fabric sample and furnishing the production and cost detail
- 4 Extracting the production particulars of given handloom extra warp and weft sample and furnishing the production and cost detail
- 5 Extracting the production particulars of given double cloth sample and furnishing the production and cost detail
- 6 Extracting the production particulars of given handloom jacquard design fabrics and furnishing the production and cost detail

**Total: 45 Hour**

### COURSE OUTCOMES:

At the end of the study of this course, the students will be able to

- CO1 Analyse and extract the construction particulars of woven fabric sample for reproduction
- CO2 Estimate the cost of fabric.

-

## HTPC307: HANDICRAFT TEXTILES & HANDLOOM TOURISM OF INDIA

L	T	P	C
3	0	0	3

To be framed.

-



## PROGRAMME ELECTIVES

### HTPE201 : TEXTILE COSTING

	L	T	P	C
<b>COURSE OBJECTIVES</b>	3	0	0	3
To enable to learn about				
1	Elements of cost accounting			
2	Costing of yarns and fabrics in spinning and weaving mills			
3	Wet process cost			
4	Costing of apparels in a garment unit			
5	Working capital management			
<b>Unit 1</b>	<b>ELEMENTS OF COST ACCOUNTING</b>			<b>9</b>
Introduction to cost accounting, - Cost ledgers: Reconciliation between cost and financial accounting, Costing methods, Product Costing, Job, order, Batch, Contract costing and Cost Sheet.				
Elements of cost & classification of cost elements – examples from spinning and weaving mill; standard costing, analysis of variance; breakeven analysis, cost volume profit analysis				
<b>Unit 2</b>	<b>YARN AND WET PROCESS COST</b>			<b>9</b>
Costing of yarn – material, labor, power and overhead expenses; allocation of costs to yarns in spinning mill running with different counts- balancing of machinery.				
<b>Unit 3</b>	<b>FABRIC COSTING</b>			<b>9</b>
Woven Fabric costing: Yarn cost, warp weight, Weft weight, preparation charge cost, Sizing cost, Warping cost, weaving cost, other cost, miscellanies cost, profit & cost sheet.				
Knitting Fabric Costing: Yarn cost, knitting cost, post knitting charge, miscellanies cost, profit & cost sheet.				
<b>Unit 4</b>	<b>GARMENT COSTING</b>			<b>9</b>
Fabric and accessories Cost Estimation at Garment Factory for cutting, stitching, checking, packing, forwarding, shipping, insurance etc.				
<b>Unit 5</b>	<b>WORKING CAPITAL MANAGEMENT</b>			<b>9</b>
Project cost- Working capital management in spinning, weaving and chemical processing unit – determination, sources, cost; Budget, types of budgets, budgeting and control in textile unit.				

**Total: 45 Hour**

### COURSE OUTCOMES:

At the end of the study of this course, the students will be able to

- CO1 Summarize broadly about Costing, accounting elements of cost in textile industries
- CO2 Compare the process costs for yarn & wet processing of textiles
- CO3 Estimate the cost of Woven and knitted fabrics
- CO4 Decide the cost of various garment products





CO5 Justify the concept of working capital management and execute financial planning of various textile sectors and profitability to achieve the organization goal.

### TEXT BOOK

- 1 Johnson Maurice, E. Moore, "Apparel Product Development", Om Book Service, 2001.
- 2 Katherin McKelvy, "Fashion Source Book", Om Book Service, 2001.
- 3 M. Krishna Kumar, Apparel Costing, Publisher: Abhishek Publications, 2015
- 4 Hardman Arthur H, Productive Costs in Cotton Spinning Mills, Publisher: Nabu Press, October 2010.
- 5 Principles of Cost Accounting: Managerial Applications by Richard D Irwin Management Accounting, Sultan Chand and Sons.

### REFERENCE BOOK

- 1 M.N.Arora, Cost Accounting: Principles and practice, New Delhi: Vikas publishing Pvt. Ltd., 2011.
- 2 Horngreen, Foster & Datar, Cost Accounting-A Managerial Emphasis, New Delhi: Prentice Hall India, 2010.
- 3 Dr. Ashish K. Bhattacharyya, Principles and Practice of Cost Accounting, New Delhi: Prentice Hall (PHI), 201
- 4 I.M.Pandey, Financial Management, New Delhi: Vikas Publishing House Pvt. Ltd., 2012
- 5 Brigham and Houston, Fundamentals of Financial Management, New Delhi: Thomson Learning,
- 6 Prasanna Chandra, Financial Management-Theory and Practice, New Delhi: Tata McGraw- Hill Publishing Company Ltd, 2012
- 7 Aswat Damodaran., "Corporate Finance Theory and Practice", John Wiley & Sons, 2001,
- 8 James C., Van Home., "Financial Management and Policy", 12th Edition Prentice Hall of India Pvt. Ltd., New Delhi, 2001
- 9 Thukaram Rao M.E., "Cost and Management Accounting" New Age International, Bangalore, 2004.
- 10 Khan., and Jain, "Basic financial Management & Practice", 7th Edition, Tata McGraw Hill, New Delhi, 2014.

### HTPE 202 : GARMENT MANUFACTURING TECHNOLOGY

	L	T	P	C
<b>COURSE OBJECTIVES</b>	3	0	0	3

To impart knowledge to students on

- 1 Basics of garment making process like spreading
- 2 Garment components

Unit 1 INTRODUCTION AND CLASSIFICATION

9

Introduction to Apparel Industry: Apparel industry in India - Domestic industry: Various



departments in the Garment industry; Classification of garments; Type of fabric – season – events – application – manufacturing – sources – gender and age – style and shape – length of the garment. Process flow chart for the production of basic garments.

Unit 2 MEASUREMENTS AND PATTERN MAKING 9

Anthropometry – 8 head theory - The sequence of taking body measurements. Concepts of basic pattern making - types of pattern making - principles for pattern drafting with examples – pattern making tools and its applications - concepts of pattern grading.

Unit 3 SPREADING AND CUTTING 9

Introduction to fabric spreading, marker planning and marker efficiency. Types and functions of cutting machines – straight knife, round knife and band knife cutting machines. Introduction to computerised cutting machines. Common defects in spreading, cutting and their remedies.

Unit 4 SEAMS, STITCHES, ACCESSORIES AND TRIMS 9

Types of Stitches and Federal classifications - Types of seams and Federal classifications. Defects in stitches and seams. Basic parts of sewing machines and their functions. Sewing thread – construction, material, thread size and packages. Introduction to Trims and accessories – Labels, linings, interlinings, waddings, lace, braids, elastics, shoulder pads, Fastener - hook and loop (Velcro), Hook and eye, button and Zip

Unit 5 SEWING MACHINES 9

Basic parts of sewing machines and their functions. Classification of the sewing machine and its applications: Single Needle Lock Stitch Machines (SNLS), Double Needle Lock Stitch Machines (DNLS), Overlock and Flatlock. Sewing machine bed types and their applications. Introduction to Sewing Needles, its types, size and their application. Introduction to different special-purpose sewing machines: Feed of arm, button hole sewing, button sewing, Bartack, blind stitch machines and embroidery sewing machines. Fusing and Pressing-

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Explain domestic apparel industry and classification of garments.
- CO2 Apply standard measurements for garments and concepts of pattern making.
- CO3 Discuss about spreading, marker planning and cutting operations in garment industry
- CO4 Describe different types of seams, stitches, Trims and accessories used in garment construction
- CO5 Identify various sewing machines used for different processes of garment manufacturing

**TEXT BOOK**

- 1 T P Karthik, T Ganesan & D Gopala Krishnan, AMT, CRC press.
- 2 Jacob Solinger, Apparel Manufacturing Handbook, Van Nostrand Reinhold



Company, 1980

- 3 Harold Carr & Barbara Latham, The Technology of Clothing Manufacture, Blackwell Sciences, 1996

#### REFERENCE BOOK

- 1 Ruth E. Glock & Grace I. Kunz, Apparel Manufacturing Sewn Product Analysis, Pearson Prentice Hall, 2005
- 2 Shaeffer Claire, "Sewing for the Apparel Industry", Prentice-Hall, New Jersey, 2001
- 3 Mary Mathews, "Practical Clothing Construction" Part I & II, Cosmic Press, Madras
- 4 Gerry Cooklin, Garment Technology for Fashion Designers, Blackwell Science Ltd, 2001
- 5 Zarapkar, System of Cutting, Bombay publications, 2006

#### HTPE203: NONWOVEN TECHNOLOGY

	L	T	P	C
<b>COURSE OBJECTIVES</b>	3	0	0	3

To enable the students to learn about the

- Concepts of nonwovens, fibre preparation and characteristics
- Different techniques involved in web formation
- Various web bonding processes
- Polymer-extrusion based technologies for nonwovens manufacture
- Testing of nonwoven fabrics and applications

#### Unit 1 FUNDAMENTALS OF NONWOVEN FABRICS 9

Introduction to nonwovens – Definitions and classification of nonwovens-fibre preparations and their characteristics for the production of nonwovens and Applications of nonwovens methods of nonwoven fabric production.

#### Unit 2 WEB FORMATION WITH STAPLE FIBRES 9

Production of staple fiber web: Dry laid – card, air; wet laid; web layering techniques – parallel, cross and perpendicular. Influence of web laying methods on fabric properties; quality control of web.

#### Unit 3 MECHANICAL, CHEMICAL AND THERMAL BONDING 9

Web Bonding Processes: mechanical bonding-needling, stitching, water jet consolidation; Thermal Bonding technologies; Chemical bonding-Binder polymers and bonding technologies

#### Unit 4 POLYMER-LAID WEB AND FABRIC FORMATION 9

Polymer-extrusion based technologies - Manufacture of Spun bonded fabrics; Manufacture of Melt blown fabrics – fibre formation and its attenuation; Effect of processing parameters on fabric characteristics

#### Unit 5 FINISHING AND TESTING OF NONWOVENS 9



Introduction – Mechanical and chemical finishing of nonwoven; Testing – standards for nonwovens; Stages of testing – fibre preparation and nonwovens stages; testing based on applications

**Total: 45 Hour**

### **COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Classify nonwovens and explain the basics of fibre preparation and fabric manufacturing methods for nonwovens
- CO2 Describe different web forming techniques for nonwovens manufacturing
- CO3 Summarize and compare different bonding methods used in nonwovens manufacturing
- CO4 Explain polymer laid web formation techniques and manufacture of spun bonded and melt blown fabrics
- CO5 Evaluate the performance of nonwovens from fibre preparation to nonwoven manufacturing stages with different standards.

### **TEXT BOOK**

- 1 Lunenschloss J., Albrecht W. and David Sharp., “Nonwoven Bonded Fabrics”, Ellis Horwood Ltd., New York, 1985.
- 2 Nonwovens: Process, structure, properties and applications, by T.Karthik, R.Rathinamoorthy, C. Praba Karan, Woodhead Publishing India Pvt Ltd. New Delhi.
- 3 Russell S., “Hand Book of Nonwovens”, Textile Institute, Manchester, 2004.
- 4 Chapman R., “Applications of Nonwovens in Technical Textiles”, Textile Institute, Manchester, 2010.

### **REFERENCE BOOK**

- 1 Mrstina V. and FeigF., “Needle Punching Textile Technology”, Elsevier, New York, 1990.
- 2 Dharmadhikary R. K., Gilmore T. F., Davis H. A. and Batra S. K., “Thermal Bonding of Nonwoven Fabrics”, Textile Progress, Vol.26, No.2, Textile Institute Manchester, 1995.
- 3 Jirsak O. and Wadsworth L. C., “Nonwoven Textiles”, Textile Institute, Manchester, 1999.
- 4 NPTEL on Nonwoven Technology  
(<https://nptel.ac.in/courses/116/102/116102014/>)
- 5 O. Irsak, Nonwoven Textiles, Textile Institute, Manchester, 1999

### **HTPE301 : KNITTING TECHNOLOGY**

#### **COURSE OBJECTIVES**

- To enable the students to know about fundamentals of weft and warp knitting and classifications of knitted fabrics

L	T	P	C
3	0	0	3



- To enable the students to know about the fabric structures and their derivatives
- To illustrate the students about the mechanism of loop formation in weft and warp knitting.

Unit 1	INTRODUCTION TO KNITTING	9
	Introduction to knitting; Comparison of fabric properties - woven, knits and nonwoven fabrics; classification of knitting processes – weft knit & warp knit; yarn quality requirements for knitting. Preparation of staple yarns for weft and warp knitting. Basic terminologies such as course, wales, technical face, technical back, course length, stitch length, WPI, CPI, stitch density, GSM, Tightness Factor etc.,	
Unit 2	FUNDAMENTALS OF KNITTING	9
	Needles – types, merits and demerits, Loop forming sequence of latch, bearded & compound needles. Passage of material through weft knitting machines. Functional Elements: Sinkers, Cylinder, Dial, Cams, Creels, Feeder, Fabric Spreader, Take down and winding Mechanism. Elements of knitted loop structures.	
Unit 3	WEFT KNIT STRUCTURES	9
	Basic weft knitted structures, production and properties - plain, rib, interlock and purl; Line, Symbolic and diagrammatic notations of basic weft knitted structures, Factors affecting the formation of loop; effect of loop length and shape on fabric properties; Fundamentals of formation of knit, tuck and float stitches	
Unit 4	FLAT KNITTING AND DERIVATIVES	9
	Basic principles and elements of flat knitting machines; different types of flat knitting machines - manual, mechanical and computer controlled; production of various weft knitted structures using flat knitting machines	
Unit 5	WARP KNITTED STRUCTURES	9
	Basic principles; elements of warp knitted loop – open loop, closed loop; warp knitting elements chain link, chain links for simple patterns, guide bar movement mechanism. Tricot and Rachel warp knitting machines. Let-off system; take-up system; Uses of warp knitted fabrics in technical applications	

**Total: 45 Hour**

### **COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Explain the basic knitting terminology, specifications and functions of weft knitting machines
- CO2 Explain the sequence of loop formation, passage of material and role of functional elements of knitting
- CO3 Identify different structures of the basic weft knitted structures
- CO4 Explain the basic terminology in flat ~~warp~~ knitting, specifications and functions of flat knitting machines




CO5 Demonstrate the loop formation in warp knitting

**TEXT BOOK**

- 1 Anbumani N., Knitting-Fundamentals, Machines, Structures and Developments, New Age International Publishers, 2007.
- 2 Ray, S. C. (Ed.). Fundamentals and advances in knitting technology. CRC Press. 2012.

**REFERENCE BOOK**

- 1 Henry Johnson, Introduction to Knitting Technology, Abhishek Publications, Chandigarh, 2006.
- 2 Ajgaonkar D.B., Knitted Technology, Universal Publishing Corporation, Mumbai, 1998.
- 3 Spencer D.J., Knitting Technology: A Comprehensive Handbook, Woodhead Publishing Limited, England, 3<sup>rd</sup> Edition, 2001.
- 4 Maity, S., et. al., (Ed.). Advanced Knitting Technology, Woodhead Publishing, UK. 2021

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**HTPE302 : ADVANCED FABRIC STRUCTURE**

**COURSE OBJECTIVES**

L	T	P	C
3	0	0	3

To impart knowledge to student on

- 1 Graph preparation for Jacquard looms,
- 2 Card punching procedure for figured fabric
- 3 Types of harness building and construction of harness

Unit 1 JACQUARD CARD PUNCHING AND EXTRA WARP AND WEFT DESIGNS 9

Study of the jacquard graph development and card punching technique for straight tie-straight draft, straight tie- sectional draft, sectional tie- sectional draft arrangements. Introduction of traditional loom mountings- heald and harness mountings, Pressure harness, Bannister harness, working comber boards in various designs. Damask – Salient features – Structure of cloth – Designing, enlargement and punching techniques for jacquards. Figured extra warp and extra weft designs using jacquard and jacquard with healds.

Unit 2 FIGURED PATENT SATIN AND PIQUES 9

Figured Patent satin – structure of cloth – Use of straight tie with healds- use of working comber for saving of punched cards-Designing, simplified enlargement and punching technique. Figured piques – Structure of cloth – Use of Straight tie with healds – use of working comber board in fast back structures to save punched cards-designing and Simplified enlargement technique.

Unit 3 FIGURED BACKED CLOTH 9

Figured warp backed cloth – Structure of cloth – Use of sectional harness in simplification



of graph development process and punching technique. Figured weft backed cloth – Structure of cloth – Separation of two series of weft for simplifying graph development process and punching technique. Tapestry – Traditional and modern Tapestries – Simple weft faced tapestries; two coloured weft faced reversible structures; three colour and four colour weft faced reversible and non-reversible structures. Modern Tapestry–3 pick & 4 picks tapestry using jacquard and heald method. Designing, simplified enlargement and punching techniques

Unit 4 FIGURED DOUBLE CLOTH AND TERRY

9

Study on Figured double cloth and Figured Terry (3 and 4 pick terry weave) –Design development and punching process for straight harnessing with straight draft , straight harnessing with sectional draft ,sectional harnessing with sectional draft – Structure of cloth.

Unit 5 GAUZE AND FIGURED LENO

9

Figured Leno and gauze fabrics – Salient features-Bottom douping and top douping. Stripe and Check effect; plain, twill and leno combination; Cord effect, Net leno. Indication of leno structures, drafting plan and lifting plan of straight and pointed draft structures. Chenille Axminister pile fabrics manufactured using handlooms - technique of fabric manufacture and designing

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Develop the figured single cloth design and understand the working of traditional handloom mountings.
- CO2 Construct weave, draft, peg-plan for the production of figured Patent satin and piques
- CO3 Describe Figured warp backed cloth, figured weft backed cloth and Tapestry fabrics
- CO4 Develop the figured double cloth and Terry fabric
- CO5 Construct gauze and figured Leno fabrics

**TEXT BOOK**

- 1 Grosicki Z. J., “Watson’s Textile Design and Colour”, Vol.1, Woodhead Publications, Cambridge England, 2004
- 2 Grosicki Z. J., “Watson’s Advanced Textile Design and Colour”, Vol.II, Butterworths, London, 1989..
- 3 Grammar of Textile Design by H. NISBET, F.T.I.

**REFERENCE BOOK**

- 1 Geormar D. Woven Structure and Design Part I Single Cloth Construction WIRA UK 1986
- 2 Georner D, “Woven Structure and Design, Part 2: Compound Structures”, WIRA,U.K., 1989.
- 3 X. Chen,M. Spola,J. Gisbert Paya &P. Mollst Sellabona1,Experimental Studies on



the Structure and Mechanical Properties of Multi-layer and Angle-interlock Woven Structures, Pages 91-99

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**HTPE 303 : FASHION DESIGNING**

	L	T	P	C
<b>COURSE OBJECTIVES</b>	3	0	0	3

- 1 To enable the students know about the basics of fashion terms, fashion cycle and fashion designing
- 2 To elaborate the students about the colour theory and principles of design.
- 3 To teach the students about the design and portfolio development.

Unit 1 9  
Definition and origin - terms & definitions - reasons for change in fashion - classification of fashion – Style, classic, FAD, Trend - fashion cycle. Fashion designing - designers’ role in styling and production of costumes.

Unit 2 9  
Design aesthetics – Definition, Types - Structural and decorative design. Elements of design – line, shape, form, colour & texture. Lines – varieties and their application in a design. Shapes - Types – Natural, stylized, geometrical, and abstract.  
Colour – Definition and origin – Characteristics (hue, value and intensity) - Prang colour chart - color harmony and colour schemes. Psychology of colour and its application in apparel market. Texture – types of texture and its application in clothing.

Unit 3 9  
Balance, proportion, rhythm, harmony & emphasis. Balance - asymmetrical and symmetrical. Types – Formal, Informal and radial. Proportion or scale – planning the shapes and space.  
Rhythm – through repetition, alternation, progression and gradation. Emphasis using contrast colours and background. Harmony of lines, shapes, colour and textures.

Unit 4 9  
Skirts - Basic concepts in designing the variety of skirts. Trousers – Basic concepts in designing the variety of trousers. Introduction to neck lines, waistlines, hemlines, collars, sleeves, cuffs, plackets and pockets. Fullness applied in apparel –tucks, pleats, gathers, shirring, frills or ruffles, flounces.

Unit 5 9  
Market research - method of fashion Trend forecast. Silhouettes – Types and their application in everyday use. Wardrobe planning –Portfolio development.

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to





- CO1 Explain basic fashion terminology, theories involved in fashion cycle and role of fashion designer.
- CO2 Apply elements of design and color theories on clothings.
- CO3 Explain various principles of design used in apparel.
- CO4 Explain basic concepts in designing of various garments and its components.
- CO5 Describe methods of trend forecast and develop design portfolio

**TEXT BOOK**

- 1 Parul Bhatnagar, “Traditional Indian Costumes and Textiles”, Abhishek Publications, Chandigarh,2004.
- 2 Elaine Stone, “The Dynamics of Fashion”, Fairchild Publications, New York, 2001.

**REFERENCE BOOK**

- 1 Peacock J., “Fashion Source Books”, Thames and Hudson, 1997-98.
- 2 Gini Stephen Frings, “Fashion Concept to Consumer”, Prentice Hall, New Jersey, 2004.

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**HTPE304 : TECHNICAL TEXTILES**

<b>COURSE OBJECTIVES</b>	L	T	P	C
	3	0	0	3

To enable the students to learn about

- 1 Classification of technical textiles, overview of properties of high performance fibres and applications of technical textiles
- 2 Requirements and manufacture of tyre cords
- 3 Properties and manufacture of belts and hoses
- 4 Textiles in filtration and protective garments
- 5 Various technological aspects of geo and medical textiles

Unit 1 INTRODUCTION TO TECHNICAL TEXTILES 9

Introduction: Definition – scope – milestones in the development, textile process, applications of technical textiles - twelve sectors of technical textiles - raw materials used in technical textiles;

High performance fibres: Glass, carbon, aramid and ultra high modulus fibres – properties, structure and applications.

Unit 2 TYRECORDS AND BELTS 9

Requirements of tyre cord - suitability of various fibres - polyester and nylon tyre cords – manufacture of tyre records. Conveyor Belts - physical and mechanical properties- construction, manufacture of conveyor belts, requirements of Seat belt and air bags

Unit 3 TEXTILES IN FILTRATION 9

Filter fabrics: Introduction- principles of filtration - types of filtration, Textiles in liquid




filtration - Textiles in dry filtration – Dust collection theory – cleaning mechanism of filters

Unit 4 PROTECTIVE TEXTILES

9

Protective clothing: requirements of protective clothing. Principle, Fiber and fabric requirements for Ballistic protection, Flame resistant protective clothing. Chemical protective textiles.

Unit 5 MEDICAL TEXTILES AND GEO TEXTILES

9

Medical Textiles: Introduction – Materials used in bio textiles - Classification - implantable, and non-implantable materials- sutures

Geo-textiles: Definition- functions - raw materials - woven, nonwoven and knitted Geo-textiles-Applications of geo-textiles for drainage, separation, soil reinforcement, and filtration and erosion control.

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Define, classify technical textiles sectors and describe the properties and applications of high performance fibres used for technical textiles
- CO2 Elucidate requirements, manufacture and properties of tyre-cord fabrics and belts
- CO3 Explain the filtration mechanism and different types of filters
- CO4 Illustrate the materials and properties of different protective textiles
- CO5 Implement the role of textile materials in geo textiles and medical textiles product development.

**TEXT BOOK**

- 1 Handbook of Technical Textiles, Ed. A R Horrocks and S C Anand, Woodhead Publication Ltd., Cambridge (2000)
- 2 Handbook of technical textiles, Volume 1: Technical Textile Processes by A Richard Horrocks, Subhash C. Anand, The Textile Institute, Woodhead Publication Ltd., Cambridge (2016).
- 3 Handbook of technical textiles, Volume 2: Technical Textile Applications by A Richard Horrocks, Subhash C. Anand, The Textile Institute, Wood head Publication Ltd., Cambridge (2016).
- 4 Adanur S., “Handbook of Industrial Textiles”, Technomic Publication, Lancaster, 2001

**REFERENCE BOOK**

- 1 Kanna M.C., Hearle, O Hearle, Design and manufacture of Textile Composites, Textile progress, Textile Institute, Manchester, April 2004.
- 2 Scott, Textile for production, Textile progress, Textile Institute, Manchester, Oct. 2005.
- 3 Shishoo, Textileinspot, Textileprogress, TextileInstitute, Manchester, Aug. 2005
- 4 Kennady, Anand Miraftab, Rajandran, Medical Textile & Biomaterials for Health care, Woodhead publishing Ltd., UK, 2005



- 5 Medical Textiles-International Conference on Medical Textiles, Bolton, Woodhead Publication,Cambridge,1997 Geo textile by John, N.W.M, Blackie publication, Glasgow, 1987

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**HTPE305 : APPAREL MARKETING AND MERCHANDISING**

	L	T	P	C
<b>COURSE OBJECTIVES</b>	3	0	0	3
1 To enable the students to learn about the marketing strategies and functions in apparel merchandising.				
2 To explain the students about sourcing strategies, supply chain management and time management.				
3 To elaborate the students about various documents meant for apparel exports.				
 Unit 1 <b>MARKETING</b>				<b>9</b>
Apparel marketing: Definition, scope, functions and strategies of marketing.				
Market Research: International market, retail and wholesale market and domestic market.				
Advertising: Purpose, methods, types of advertising media, sales promotion methods.				
 Unit 2 <b>MERCHANDISING</b>				<b>9</b>
Apparel Merchandising: Definition, functions of merchandising division, roles and Responsibilities of merchandiser.				
Types of Merchandising: Principles and techniques of apparel merchandising, retail merchandising, visual merchandising, interfacing merchandising with production.				
 Unit 3 <b>SOURCING</b>				<b>9</b>
Sourcing: Definition, need and important factors in sourcing, methods of sourcing raw materials, sourcing of accessories, manufacturing resource planning, principles of MRP, Overseas sourcing - sourcing strategies. Supply chain and demand chain analysis, Materials management for quick response, Buying houses.				
 Unit 4 <b>DOCUMENTATION</b>				<b>9</b>
Order confirmation, various types of export documents, pre-shipment post-shipment documentation -terms of sale - payment - shipment				
 Unit 5 <b>TIME MANAGEMENT</b>				<b>9</b>
Time management in merchandising, production scheduling, route card format, accessories follow-up, practical check points, computer applications in marketing and merchandising.				

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to




- CO1 Explain various types of apparel market and advertising techniques involved in merchandising.
- CO2 Discuss the types and functions of merchandising.
- CO3 Explain the factors involved in sourcing, supply chain and material management systems.
- CO4 Classify various types of documents used for export of apparels.
- CO5 Develop production scheduling and manage time in marketing and merchandising

**TEXT BOOK**

- 1 V. R. Sampath, P. Perumalraj and M. Vijayan, “Apparel Marketing and Merchandising”, Kalaiselvam Pathippakam, Coimbatore, 2007.
- 2 Vijay Barotia, “Marketing Management”, Mangal Deep Publication, New Delhi, 2001.

**REFERENCE BOOK**

- 1 Moore Evelyn C., “Path for Merchandising- A Step by Step Approach”, Thames and Hudson Ltd., London, 2001.
- 2 Jarnow J. and Dickerson K. G., “Inside the Fashion Business”, Prentice Hall, New Delhi, 1997
- 3 Laine Stone and Jean Samples, “Fashion Merchandising”, McGraw Hill Books, Singapore, 1985
- 4 Ruth E Glock, Grace I Kunz, “Apparel Manufacturing”, Sewn Product Analysis - 3rd Edition, Prentice Hall Inc., 2000
- 5 J. A. Jarnow, M. Guerreiro and B. Judelle, “Inside the Fashion Business”, Macmillan Publishing Company, 1990.
- 6 Grace I. Kunz, “Merchandising: Theory, Principles and Practice”, Fairchild Books, 2005
- 7 Elaine Stone and A. Jean, “Fashion Merchandising - An Introduction”, McGraw-Hill Book Company, 1990.

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**HTPE306 : ADVANCES IN TEXTILE PROCESSING**

<b>COURSE OBJECTIVES</b>	L	T	P	C
	3	0	0	3

To enable the students to understand

- 1 The concept of biotechnology in textile processing,
- 2 The process of combined, continuous and blend processing.
- 3 Special prints and concept of digital printing
- 4 The advancement in finishing and garment processing
- 5 The concept of eco-friendly processing and effluent treatment.

**Unit 1 BIO-TECHNOLOGY IN TEXTILE PROCESSING**

9

Introduction – Enzymes-mechanism of enzyme action, Process conditions for activating enzymes and Factors affecting efficiency of enzyme treatment. Pretreatments –




Enzymatic desizing, enzymatic degumming, enzyme scouring, enzymatic bleaching. Finishing – Bio-finishing and Use of enzymes in Denim washing .Merits and Demerits of enzyme processing.

Unit 2 COMBINED, CONTINUOUS AND BLENDS PROCESSING 9

Introduction, combined scouring and desizing, combined scouring and bleaching, combined desizing, scouring and bleaching. Continuous process – need, machines used. Pretreatment and dyeing of Polyester/Wool, Polyester/Cotton and Polyester/Viscose, cotton/spandex.

Unit 3 SPECIAL PRINTS AND DIGITAL PRINTING 9

Special Printing Effects – Brasso, Kadi, Metallic, high density print, crepon style, Flock printing and Foam printing.

Digital Printing – Introduction, principle, methods, pretreatment, ink types and substrate, advantages and disadvantages.

Unit 4 FINISHING AND GARMENT PROCESSING 9

Introduction, Definition, concept and applications of nanotechnology, plasma technology, micro-encapsulation, ultrasonic, UV protection, antimicrobial finishes.

Garment processing - Introduction, factors to be considered, machineries used, advantages and disadvantages.

Unit 5 ECO-FRIENDLY PROCESSING AND EFFLUENT TREATMENT 9

Pollution in textiles-Introduction, textile pollutants, banned dyes, harmful chemicals, alternatives to banned dyes and chemicals. Characteristics of waste water, Effluent treatment – methods, design and working of ETP and tolerance level of effluent.

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Describe the application of enzyme in textile wet processing.
- CO2 Explain the combined processing and processing of blends.
- CO3 Appraise on various special prints and concept of digital printing.
- CO4 Discuss on advancement in textile finishing and garment processing.
- CO5 Explain the concept of eco-friendly processing and ETP.

**TEXT BOOK**

- 1 Chemical technology in the pre-treatment processes of textiles – S.R.Karmakar, Elsevier, 1999.
- 2 Textile Printing – R.S.Prayag.



- 3 Digital Printing of Textiles, Ujji. H. Woodhead publishing,2006.
- 4 Technology of Dyeing – V.A.Shenai
- 5 Garment Finishing & Care Labelling by S.S.Satsangi, Usha Publishers, 53-B/AC-IV, Shalimar Bagh, New Delhi.

**REFERENCE BOOK**

- 1 Handbook of Textile processing machinery – R.S. Bhagwat1999.
- 2 Eco-friendly wet processing, NCUTE.

-

**HTPE 307 : TECHNOLOGICAL DEVELOPMENTS IN HANDLOOMS**

	L	T	P	C
<b>COURSE OBJECTIVES</b>	3	0	0	3

To impart knowledge to students on

- 1 Developments in preparatory and handloom weaving processes
- 2 Working principles of various elements in handlooms.

Unit 1 DEVELOPMENTS IN HANDLOOM WEAVING PREPARATORY MACHINES 9

Objectives of Technological developments in handlooms- the layout of placing the looms in systematic / organized way and its merits and demerits – Limitations of Hand operated pirn, cheese and bobbin winding charkas used in preparatory processes. Advantages of single spindle and multi spindle winding machines over hand operated charkas.

Unit 2 DEVELOPMENTS IN STRUCTURE OF HANDLOOM 9

Importance of Angle iron pillars and cross bars used in place of wooden pillars and cross bars in pit looms - Power operated in-house beaming machine for long length of warp and its advantages- Improved Frame loom and its advantages.

Unit 3 DEVELOPMENTS IN TAKE UP AND HANDLOOM DOBBIES 9

5 wheel take up motion and worm & worm wheel take up motions used in handlooms - Drop box or vibrating box attachments on handlooms - Vertical Handloom doobby - Its merits and demerits. Plunger mechanism used in Durry weaving and its advantages

Unit 4 SOLID BORDER WEAVING AND TWIN CLOTH 9

Weaving on handlooms with multiple jacquards - Solid border weaving with catch cord technique – Solid border weaving sley - Multiple butta weaving sley - Advantages and disadvantages of these mechanisms. Twin cloth weaving sley. Improved pit loom.

Unit 5 SEMI AUTOMATIC HANDLOOM AND ITS ATTACHMENTS 9

Semi-automatic looms – Nepali pedal loom, Chittaranjan loom, banaras semi-automatic loom, itchalkaranchi loom – Electric motor operated jacquard lifting mechanism, Pneumatic lifting mechanism for jacquard. Electromagnetic lifting mechanism for heald

shaft – Merits and demerits of these mechanisms.

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Express various advanced preparatory processes in handloom weaving
- CO2 Describe the various developments in structure of handloom
- CO3 Explain various developments in take-up mechanisms and handloom dobbies
- CO4 Express the solid border weaving and twin cloth
- CO5 Demonstrate various handlooms and its advanced mechanisms

**REFERENCE BOOK**

- 1 Mamidipudi, Annapurna & Bijker, Wiebe. (2018). Innovation in Indian Handloom Weaving. Technology and Culture. 59. 509-545. 10.1353/tech.2018.0058.
- 2 <http://textilescommittee.nic.in/sites/default/files/coursecontent/Dobby%20Handloom%20Weaver.pdf>
- 3 <http://textilescommittee.nic.in/sites/default/files/course-content/Dobby%20Handloom%20Weaver.pdf>

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**HTPE308 : TRADITIONAL HANDLOOM TEXTILES OF INDIA**

	L	T	P	C
<b>COURSE OBJECTIVES</b>	3	0	0	3

To impart knowledge to students on

- 1 Product specifications and production techniques of traditional handloom products
- 2 Organisations and Government Acts related to handlooms

Unit 1 9

Product specifications, production techniques, raw material and unique characteristics of Banaras Brocade Silk Saree, Baluchari Silk Saree, Bomkai Saree, Chanderi Saree, Chettinad Cotton Saree, Gadwal Saree, Ilkal Saree, Jamdani Cotton Saree.

Unit 2 9

Product specifications, production techniques, raw material and unique characteristics of Kota Doria Saree, Khandua Saree, Kani Pashmina Shawl, Kancheepuram Silk Saree, Maheswari Saree, Mangalgiri Saree, Paithani Saree, Pochhampally Ikat Saree, Siddipet Gollabama Saree,

Unit 3 9

Product specifications, production techniques, raw material and unique characteristics of Shantipuri Cotton Saree, Tangail Cotton Saree, Tancoi Silk saree, Uppada Jamdani Silk Saree, Venkatgiri Cotton Saree, balaramapuram cotton saree

Unit 4 9

India Handloom Brand (IHB) - Objectives – benefits – standard operating procedure – Detailed procedure on surveillance – certificate of registered trade mark. Role of Office of DCH, Weaver’s service centres and Textile Committee on IHB. Handloom mark –



Objectives, details of schemes, Silk mark – Objectives, details of scheme. Introduction to Global Organic Textile standard (GOTS)

Unit 5

9

The Handloom (Reservation of articles for Production) Act, 1985; Terms and definitions. Range reserved for exclusive production by handlooms. Power to specify articles for exclusive production by handlooms. Constitution of advisory committee. Prohibition of production of articles reserved exclusive production by handlooms- power to call information, inspection, search and seize – penalty for contravention

**Total: 45 Hour**

### **COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Describe the specifications and production techniques of traditional sarees
- CO2 Explain the specifications and production techniques of shawls and sarees
- CO3 Describe the unique characteristics of traditional sarees
- CO4 Explain the importance of handloom certification process
- CO5 Describe the Handloom reservation act and its importance

### **REFERENCE BOOK**

- 1 <https://www.indiahandloombrand.gov.in/>
- 2 [http://cbseacademic.nic.in/web\\_material/Curriculum/Vocational/2015/Traditional\\_India\\_Textile\\_and\\_Basic\\_Pattern\\_Dev\\_XII/CBSE\\_Traditional\\_Indian\\_Textiles%20XII.pdf](http://cbseacademic.nic.in/web_material/Curriculum/Vocational/2015/Traditional_India_Textile_and_Basic_Pattern_Dev_XII/CBSE_Traditional_Indian_Textiles%20XII.pdf)
- 3 The Handloom (Reservation of articles for Production) Act, 1985, no 22 of 1985.
- 4 John Gillow, Nicholas Barnard, “Traditional Indian Textiles”
- 5 Anjali karolia, “**Traditional Indian Handcrafted Textiles**” History, Techniques, Processes, and Designs Vol. I & II

### **HTPE309 : HOME TEXTILES**

	L	T	P	C
<b>COURSE OBJECTIVES</b>	3	0	0	3

To enable the students to learn about

- 1 Fundamentals of home textile, materials used for home textile products and factors affecting their selection of home textile.
- 2 Kitchen textiles, draperies, bed linen and towels.
- 3 Manufacture and properties of floor coverings.
- 4 Care of home textiles and testing of home textile products.

Unit 1 FUNDAMENTALS OF HOME TEXTILES

9

Home Textiles: Definition, different types of home textiles, selection of fibers, Colors, Designs, factors affecting selection of home textiles, woven & Nonwoven; Upholstery: Materials - Fixed upholstery, Non-stretch loose covers, Stretch covers - Cushion covers; Table Textiles - Definitions, Different types, table mats, table cloth and hand towels, selection of material, use and care labeling; Living Room Furnishing - Sofa covers, wall



hangers, cushion, cushion covers, upholsteries, bolster and bolster covers

Unit 2 KITCHEN TEXTILES AND DRAPERIES 9

Kitchen Textiles: Definition, Types- apron-dish cloth, bread bag, pot holders, hand towels, fridge cover, fridge handle covers, mixer cover, grinder covers their use and care labeling; Wall coverings- use and care labeling; Draperies and curtains- choices of fabrics, calculating the amount of material needed, hints on making curtains, hang wall; Methods of furnishing draperies at the top with tucks or pleats; Use of drapery rods, hooks, tapes, rings and pins.

Unit 3 BED LINENS AND TOWELS 9

Bed Linen -Definitions, different types of bed linens, sheets, blankets, blanket covers, comforters, comforter covers and bed spreads; Mattress - Mattress covers, pads, pillows; Made-ups in hospitals; Textiles care labeling; Towels: Types, bath robes, beach towels, napkins; Construction of towels- weave, pile height - pattern - dyeing and finishing, Absorption tests; Velour - Types of velvet and construction.

Unit 4 FLOOR COVERINGS 9

Floor covering: hard floor coverings, resilient floor coverings, soft floor coverings, Rugs, cushions pads and care labeling; Carpet Manufacture methods & Types: Tufted, Hand tufted, Needle felt, Woven & Knotted. Wilton & Administer - Knitted, Stitch bonding and & Flocking; Carpet fibers and &yarns: Wool, wool blend, nylon, polypropylene, polyester and & acrylic

Unit 5 CARE AND TESTING OF HOME TEXTILES 9

Care of Home Textiles - Vacuum cleaning of Rugs and carpets, washing of curtains, draperies, bed linens and kitchen linen, Drying and &pressing; Washing Methods: Kneading and squeezing, Suction washing, Use of washing Machine; Stain Removal: Identification of stain, general procedure for stain removal, Bleaches for stain removal, optical brighteners and blues; Testing of home textiles - color fastness, shrinkage, abrasion and flammability tests.

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Summarize types of home textiles and materials used for home textiles
- CO2 Assess suitability of upholstery, table textiles, living room furnishing, kitchen textiles, curtains and draperies according to customer needs.
- CO3 Analyse bed linen and &towels requirements in technical terms
- CO4 Select floor coverings according to specific needs
- CO5 Discuss about care of home textiles, washing methods, stain removal and testing of home textiles

**TEXT BOOK**

- 1 Subrata Das., Performance of Home Textiles, Wood head Publishing India PVT. LTD, 2010
- 2 Fundamentals of Textiles and their care, Susheela Dantiyagi. Orient Longman Ltd., New Delhi



- 3 Household Textiles and Laundry work, DurgaDuelkar, Athma Ram and Sons, New Delhi
- 4 Soft furnishing book by Kartin Cargill, Reed consumer books Limited, London

**REFERENCE BOOK**

- 1 Simplicity's (1993). Simply the best home decoration book, A fire side book as published by Simon and Schulster (New York), London. The simplicity Pattern company inc
- 2 Soft furnishing by Saarah Campbell and Hilary More, Mac Donald Books, QED Publishers Limited, London
- 3 Wingate I.B., & Mohler J.E., Textile Fabrics & Their Selection, Prentice Hall Inc, New York
- 4 Alexander N.G., Designing Interior Environment, Mass Court Brace Covanorich, New York, 1972

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OPEN ELECTIVE

**HTOE301 PRODUCT DESIGN**

<b>COURSE OBJECTIVES</b>	L	T	P	C
	3	0	0	3

- 1 To acquire the basic concepts of product design and development process
- 2 To understand the engineering and scientific process in executing a design from concept to finished product
- 3 To study the key reasons for design or redesign.

Unit 1 9  
 Definition of a product; Types of product; Levels of product; Product-market mix; New product development (NPD) process; Idea generation methods; Creativity; Creative attitude; Creative design process; Morphological analysis; Analysis of interconnected decision areas; Brain storming.

Unit 2 9  
 Product life cycle; The challenges of Product development; Product analysis; Product characteristics; Economic considerations; Production and Marketing aspects; Characteristics of successful Product development; Phases of a generic product development process; Customer need identification; Product development practices and industry-product strategies

Unit 3 9  
 Product design; Design by evolution; Design by innovation; Design by imitation; Factors affecting product design; Standards of performance and environmental factors; Decision making and iteration; Morphology of design (different phases); Role of aesthetics in design.

Unit 4 9  
 Introduction to optimization in design; Economic factors in design; Design for safety and reliability; Role of computers in design; Modeling and Simulation; The role of models in




engineering design; Mathematical modeling; Similitude and scale models; Concurrent design; Six sigma and design for six sigma; Introduction to optimization in design; Economic factors and financial feasibility in design; Design for manufacturing; Rapid Prototyping (RP); Application of RP in product design; Product Development versus Design.

Unit 5

9

Design of simple products dealing with various aspects of product development; Design starting from need till the manufacture of the product,

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Understand the basic concepts of product design and development process.
- CO2 Illustrate the methods to define the customer needs.
- CO3 Describe an engineering design and development process.
- CO4 Understand the intuitive and advanced methods used to develop and evaluate a concept.
- CO5 Apply modelling and embodiment principles in product design and development process.

**REFERENCE BOOK**

- 1 Product Design and Development, Karl T. Ulrich and Steven D. Eppinger, Tata McGraw–Hill edition.
- 2 Engineering Design –George E. Dieter.
- 3 An Introduction to Engineering Design methods Vijay Gupta.
- 4 Merie Crawford : New Product management, McGraw-Hill Irwin.
- 5 Chitale A K and Gupta R C, “Product Design and Manufacturing”, Prentice Hall of India, 2005.
- 6 Kevin Otto and Kristin Wood, Product Design, Techniques in Reverse Engineering and New Product Development, Pearson education.

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**HTOE202 INTRODUCTION TO E-GOVERNANCE**

	L	T	P	C
<b>COURSE OBJECTIVES</b>	3	0	0	3

To cover the concepts of e-Governance and to understand how technologies and business models shape the contours of government for improving citizen services and bringing in transparency.

Unit 1

9

Exposure to emerging trends in ICT for development; Understanding of design and implementation of e-Government projects, e-governance lifecycle.

Unit 2

9

Need for Government Process Re-engineering (GPR); National e-Governancelan (NeGP) for India; SMART Governments & Thumb Rules

- Unit 3 9  
 Architecture and models of e-Governance, including Public Private Partnership (PPP);  
 Need for Innovation and Change Management in e-Governance; Critical Success Factors;  
 Major issue including corruption, resistance for change, e-Security and Cyber laws
- Unit 4 9  
 Focusing on Indian initiatives and their impact on citizens; Sharing of case studies to  
 highlight best practices in managing e-Governance projects in Indian context. Visits to local  
 e-governance sites (CSC, eSeva, Post Office, Passport Seva Kendra, etc) as part of  
 Tutorials.
- Unit 5 9  
 Mini Projects by students in groups – primarily evaluation of various e-governance  
 projects.

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

Through exposure to introductory ideas and practices followed in a selected number of e-Governance initiatives in India, the course will help students to understand and appreciate the essence of e-Governance.

**REFERENCE BOOK**

- 1 Managing Transformation –Objectives to Outcomes. J Satyanarayana, Prentice Hall India
- 2 The State, IT and Development. Kenneth Kenniston, RK Bagga and Rohit Raj Mathur, Sage Publications India Pvt Ltd.
- 3 e-Government -The Science of the Possible. J Satyanarayana, Prentice Hall, India
- 4 <http://www.csi-sigegov.org/publications.php>
- 5 <https://negd.gov.in>
- 6 <https://www.nisg.org/case-studies-on-e-governance-in-india>

**HTOE304 ENGINEERING ECONOMICS & ACCOUNTANCY**

<b>COURSE OBJECTIVES</b>	L	T	P	C
	3	0	0	3

- 1 To acquire knowledge of basic economics to facilitate the process of economic decision making
- 2 To acquire knowledge on basic financial management aspects.
- 3 To develop the basic skills to analyze financial statements.

- Unit 1 INTRODUCTION 9  
 Managerial Economics; Relationship with other disciplines; Firms: Types, objectives and goals; Managerial decisions; Decision analysis.




Unit 2	DEMAND & SUPPLY ANALYSIS	9
	Demand; Types of demand; Determinants of demand; Demand function; Demand elasticity; Demand forecasting; Supply; Determinants of supply; Supply function; Supply elasticity.	
Unit 3	PRODUCTION AND COST ANALYSIS	9
	Production function; Returns to scale; Production optimization; Least cost input; Isoquants; Managerial uses of production function; Cost Concepts; Cost function; Types of Cost; Determinants of cost; Short run and Long run cost curves; Cost Output Decision; Estimation of Cost.	
Unit 4	PRICING	9
	Determinants of Price; Pricing under different objectives and different market structures; Price discrimination; Pricing methods in practice; Role of Government in pricing control.	
Unit 5	FINANCIAL ACCOUNTING (ELEMENTARY TREATMENT)	9
	Balance sheet and related concepts; Profit & Loss Statement and related concepts; Financial Ratio Analysis; Cash flow analysis; Funds flow analysis; Comparative financial statements; Analysis & Interpretation of financial statements; Investments; Risks and return evaluation of investment decision; Average rate of return; Payback Period; Net Present Value; Internal rate of return,	

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Understand the macro-economic environment of the business and its impact on enterprise
- CO2 Understand cost elements of the product and its effect on decision making
- CO3 Prepare accounting records and summarize and interpret the accounting data for managerial decisions
- CO4 Understand accounting systems and analyze financial statements using ratio analysis
- CO5 Understand the concepts of financial management and investment

**REFERENCE BOOK**

- 1 Premvir Kapoor, Sociology & Economics for Engineers, Khanna Publishing House, New Delhi, 2018
- 2 McGuigan, Moyer and Harris, 'Managerial Economics; Applications, Strategy and Tactics', Thomson South Western, 10th Edition, 2005.
- 3 Prasanna Chandra. 'Fundamentals of Financial Management', Tata Mcgraw Hill Publishing Ltd., 4th edition, 2005.
- 4 Samuelson. Paul A and Nordhaus W.D., 'Economics', Tata Mcgraw Hill Publishing Company Limited, New Delhi, 2004.
- 5 Paresh Shah, 'Basic Financial Accounting for Management', Oxford University Press, New Delhi, 2007. 3. Salvatore Dominick, 'Managerial Economics in a global economy'. Thomson South Western, 4th Edition, 2001

## HTOE309 ENERGY CONSERVATION AND AUDIT

	L	T	P	C
<b>COURSE OBJECTIVES</b>	3	0	0	3

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- 1 Undertake energy conservation and energy audit.

### Unit 1 ENERGY CONSERVATION BASICS ENERGY SCENARIO 9

Primary and Secondary Energy, Energy demand and supply, National scenario. Energy conservation and Energy audit; concepts and difference Indian Electricity Act 2001; relevant clauses of energy conservation BEE and its Roles MEDA and its Roles Star Labelling: Need and its benefits.

### Unit 2 ENERGY CONSERVATION IN ELECTRICAL MACHINES 9

Need for energy conservation in induction motor and transformer. Energy conservation techniques in induction motor by: Improving Power quality. Motor survey Matching motor with loading. Minimizing the idle and redundant running of motor. Operating in star mode. Rewinding of motor. Replacement by energy efficient motor Periodic maintenance Energy conservation techniques in Transformer. Loading sharing Parallel operation Isolating techniques. Replacement by energy efficient transformers. Periodic maintenance. Energy Conservation Equipment: Soft starters, Automatic star delta convertor, Variable Frequency Drives, Automatic p. f. controller (APFC), Intelligent p. f. controller (IPFC) Energy efficient motor; significant features, advantages, applications and limitations. Energy efficient transformers, amorphous transformers; epoxy Resin cast transformer / Dry type of transformer.

### Unit 3 ENERGY CONSERVATION IN ELECTRICAL INSTALLATION SYSTEMS 9

Aggregated Technical and commercial losses (ATC); Power system at state, regional, national and global level.

Technical losses; causes and measures to reduce by.

- a) Controlling I<sup>2</sup> R losses.
- b) Optimizing distribution voltage
- c) Balancing phase currents
- d) Compensating reactive power flow

Commercial losses: pilferage, causes and remedies

Energy conservation equipment: Maximum Demand Controller , kVAR Controller, Automatic Power Factor controller(APFC)

Energy Conservation in Lighting System

- a) Replacing Lamp sources.
- b) Using energy efficient luminaries.



- c) Using light controlled gears.
  - d) Installation of separate transformer / servo stabilizer for lighting.
  - e) Periodic survey and adequate maintenance programs.
- Energy Conservation techniques in fans, Electronic regulators.

Unit 4 ENERGY CONSERVATION THROUGH COGENERATION AND TARIFF 9

Co-generation and Tariff; concept, significance for energy conservation Co-generation Types of cogeneration on basis of sequence of energy use (Topping cycle, Bottoming cycle) Types of cogeneration basis of technology (Steam turbine cogeneration, Gas turbine cogeneration, Reciprocating engine cogeneration). Factors governing the selection of cogeneration system. Advantages of cogeneration. Tariff: Types of tariff structure: Special tariffs; Time-off-day tariff, Peak-off-day tariff, Power factor tariff, Maximum Demand tariff, Load factor tariff. Application of tariff system to reduce energy bill.

Unit 5 ENERGY AUDIT OF ELECTRICAL SYSTEM 9

Energy audit (definition as per Energy Conservation Act) Energy audit instruments and their use. Questionnaire for energy audit projects. Energy flow diagram (Sankey diagram) Simple payback period, Energy Audit procedure (walk through audit and detailed audit). Energy Audit report format.

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Interpret energy conservation policies in India.
- CO2 Implement energy conservation techniques in electrical machines.
- CO3 Apply energy conservation techniques in electrical installations.
- CO4 Use Co-generation and relevant tariff for reducing losses in facilities.
- CO5 Undertake energy audit for electrical system

**REFERENCE BOOK**

- 1 Guide Books No. 1 and 3 for National Certification Examination for Energy Managers and Energy Auditors, Bureau of Energy Efficiency (BEE), Bureau of Energy Efficiency (A Statutory body under Ministry of Power, Government of India) (Fourth Edition 2015).
- 2 O.P. Gupta, Energy Technology, Khanna Publishing House, New Delhi
- 3 Henderson, P. D., India - The Energy Sector, University Press, Delhi, 2016. ISBN: 978- 0195606539
- 4 Turner, W. C., Energy Management Handbook, Fairmount Press, 2012, ISBN 9781304520708
- 5 Sharma, K. V., Venkateshaiah; P., Energy Management and Conservation, I K International Publishing House Pvt. Ltd; 2011 ISBN 9789381141298
- 6 Mehta ,V. K., Principles of Power System, S. Chand &Co.New Delhi, 2016, ISBN 9788121905947

- 7 Singh, Sanjeev; Rathore, Umesh, Energy Management, S K Kataria&Sons,New Delhi ISBN-13: 9789350141014
- 8 Desai, B. G.; Rana, J. S.; A. Dinesh, V.; Paraman, R., Efficient Use and Management of Electricity in Industry, Devki Energy Consultancy Pvt. Ltd.
- 9 Chakrabarti, Aman, Energy Engineering And Management, e-books Kindle Edition

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### HTOE310 RENEWABLE ENERGY TECHNOLOGIES

	L	T	P	C
<b>COURSE OBJECTIVES</b>	3	0	0	3

- 1 To understand present and future scenario of world energy use.
- 2 To understand fundamentals of solar energy systems.
- 3 To understand basics of wind energy. 445 Open Elective Courses
- 4 To understand bio energy and its usage in different ways.
- 5 To identify different available non-conventional energy sources.

Unit 1	INTRODUCTION	9
	World Energy Use; Reserves of Energy Resources; Environmental Aspects of Energy Utilisation; Renewable Energy Scenario in India and around the World; Potentials; Achievements / Applications; Economics of renewable energy systems.	
Unit 2	SOLAR ENERGY	9
	Solar Radiation; Measurements of Solar Radiation; Flat Plate and Concentrating Collectors; Solar direct Thermal Applications; Solar thermal Power Generation Fundamentals of Solar Photo Voltaic Conversion; Solar Cells; Solar PV Power Generation; Solar PV Applications.	
Unit 3	WIND ENERGY	9
	Wind Data and Energy Estimation; Types of Wind Energy Systems; Performance; Site Selection; Details of Wind Turbine Generator; Safety and Environmental Aspects.	
Unit 4	BIO-ENERGY	9
	Biomass direct combustion; Biomass gasifiers; Biogas plants; Digesters; Ethanol production; Bio diesel; Cogeneration; Biomass Applications.	
Unit 5	OTHER RENEWABLE ENERGY SOURCES	9
	Tidal energy; Wave Energy; Open and Closed OTEC Cycles; Small Hydro-Geothermal Energy; Hydrogen and Storage; Fuel Cell Systems; Hybrid Systems.	

**Total: 45 Hour**

#### COURSE OUTCOMES:

At the end of the study of this course, the students will be able to

- CO1 Understand present and future energy scenario of the world.
- CO2 Understand various methods of solar energy harvesting.
- CO3 Identify various wind energy systems.






- CO4 Evaluate appropriate methods for Bio energy generations from various Bio wastes.  
 CO5 Identify suitable energy sources for a location.

**REFERENCE BOOK**

- 1 O.P. Gupta, Energy Technology, Khanna Publishing House, Delhi (ed. 2018)
- 2 Renewable Energy Sources, Twidell, J.W. & Weir, A., EFN Spon Ltd., UK, 2006.
- 3 Solar Energy, Sukhatme. S.P., Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
- 4 Renewable Energy, Power for a Sustainable Future, Godfrey Boyle, Oxford University Press, U.K., 1996
- 5 Fundamental of Renewable Energy Sources, GN Tiwari and MK Ghoshal, Narosa, New Delhi, 2007.
- 6 Renewable Energy and Environment-A Policy Analysis for India, NH Ravindranath, UK Rao, B Natarajan, P Monga, Tata McGraw Hill.
- 7 Energy and The Environment, RA Ristinen and J J Kraushaar, Second Edition, John Willey & Sons, New York, 2006.
- 8 Renewable Energy Resources, JW Twidell and AD Weir, ELBS, 2006.

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**OPEN ELECTIVE – II**

**HTOE305 PROJECT MANAGEMENT**

<b>COURSE OBJECTIVES</b>	L	T	P	C
	3	0	0	3

- 1 To develop the idea of project plan, from defining and confirming the project goals and objectives, identifying tasks and how goals will be achieved.
- 2 To develop an understanding of key project management skills and strategies.

Unit 1 CONCEPT OF A PROJECT	9
Classification of projects- importance of project management- The project life cycle- establishing project priorities (scope-cost-time) project priority matrix- work break down structure.	
Unit 2 CAPITAL BUDGETING PROCESS	9
Planning- Analysis-Selection-Financing-Implementation-Review. Generation and screening of project ideas- market and demand analysis- Demand forecasting techniques. Market planning and marketing research process- Technical analysis	
Unit 3 FINANCIAL ESTIMATES AND PROJECTIONS	9
Cost of projects-means of financing-estimates of sales and production-cost of production-working capital requirement and its financing-profitability projected cash flow statement and balance sheet. Break even analysis.	




Unit 4 BASIC TECHNIQUES IN CAPITAL BUDGETING 9  
 Non discounting and discounting methods- payback period- Accounting rate of return-net present value-Benefit cost ratio-internal rate of return. Project risk. Social cost benefit analysis and economic rate of return. Non-financial justification of projects.

Unit 5 PROJECT ADMINISTRATION 9  
 Progress payments, expenditure planning, project scheduling and network planning, use of Critical Path Method (CPM), schedule of payments and physical progress, time-cost trade off.  
 Concepts and uses of PERT cost as a function of time, Project Evaluation and Review Techniques/cost mechanisms. Determination of least cost duration. Post project evaluation. Introduction to various Project management software's.

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Understand the importance of projects and its phases.
- CO2 Analyze projects from marketing, operational and financial perspectives.
- CO3 Evaluate projects based on discount and non-discount methods.
- CO4 Develop network diagrams for planning and execution of a given project.
- CO5 Apply crashing procedures for time and cost optimization.

**REFERENCE BOOK**

- 1 Project planning, analysis, selection, implementation and review – Prasanna chandra – Tata McGraw Hill
- 2 Project Management – the Managerial Process – Clifford F. Gray & Erik W. Larson - McGraw Hill
- 3 Project management - David I Cleland - Mcgraw Hill International Edition, 1999
- 4 Project Management – Gopala krishnan – Mcmillan India Ltd.
- 5 Project Management-Harry-Maylor-Pearson Publication

**HTOE306 OPERATIONS RESEARCH**

**COURSE OBJECTIVES** L T P C  
3 0 0 3  
 To provide a broad and in depth knowledge of a range of operation research models and techniques, which can be applied to a variety of industrial applications.

Unit 1 9  
 Development, Definition, Characteristics and phase of Scientific Method, Types of models; General methods for solving operations research models.

Unit 2 9




Allocation: Introduction to linear programming formulation, graphical solution, Simplex Method, artificial variable technique, Duality principle. Sensitivity analysis.

Unit 3 9  
Transportation Problem Formulation optimal solution. Unbalanced transportation problems, Degeneracy. Assignment problem, Formulation optimal solution

Unit 4 9  
Sequencing: Introduction, Terminology, notations and assumptions, problems with n-jobs and two machines, optimal sequence algorithm, problems with n-jobs and three machines.

Unit 5 9  
Theory of games: introduction, Two-person zero-sum games, The Maximum –Minimax principle, Games without saddle points – Mixed Strategies,  $2 \times n$  and  $m \times 2$  Games – Graphical solutions, Dominance property, Use of L.P. to games.

**Total: 45 Hour**

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Understand the formulation of Linear Programming
- CO2 Analyze and Convert the problem into a mathematical model.
- CO3 Understand and implement the transportation problems at workplace
- CO4 Understand sequencing to optimize the process time for n- job and m-machine
- CO5 Identify and select suitable methods for various games and apply the LP

**REFERENCE BOOK**

- 1 Operations Research: an introduction, Hamdy A. Taha, Pearson Education.
- 2 Operations. Research: theory and application, J.K. Sharma, Macmillan Publishers.
- 3 Introduction to Operations Research: concept and cases, Frederick S. Hillier and Gerald J. Lieberman, Tata McGraw-Hill

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**HTOE307 INTERNET OF THINGS**

**COURSE OBJECTIVES**

L	T	P	C
2	1	0	3

Internet of Things (IoT) is presently an important technology with wide ranging interest from Government, academia and industry. IoT cuts across different application domain verticals ranging from civilian to defence sectors which includes agriculture, space, health care, manufacturing, construction, water, mining, etc. Today it is possible to build different IoT solutions such as shopping system, infrastructure management in both urban and rural areas, remote health monitoring and emergency notification systems, and transportation systems. Therefore, it is very important to learn the fundamentals of this emerging technology



Unit 1	9
Introduction to IoT; Sensing; Actuation	
Unit 2	9
Basics of IoT Networking, Communication Protocols, Sensor networks	
Unit 3	9
Introduction to Arduino programming, Integration of Sensors/Actuators to Arduino	
Unit 4	9
Implementation of IoT with Raspberry Pi; Data Handling Analytics	
Unit 5	9
Case Studies: Agriculture, Healthcare, Activity Monitoring	
<b>Total: 45 Hour</b>	

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- Understanding of various aspect of IoT, know some tools and have basic implementation skills.

**REFERENCE BOOK**

- 1 [https://nptel.ac.in/noc/individual\\_course.php?id=noc17-cs22](https://nptel.ac.in/noc/individual_course.php?id=noc17-cs22)
- 2 “The Internet of Things: Enabling Technologies, Platforms, and Use Cases”, by Pethuru Raj and Anupama C. Raman (CRC Press)
- 3 Internet of Things by Dr. Jeeva Jose, Khanna Publishing House (Edition 2017)
- 4 “Internet of Things: A Hands-on Approach”, by Arshdeep Bahga and Vijay Madisetti (Universities Press)
- 5 Internet of Things: Architecture and Design Principles, Raj Kamal, McGraw Hill
- 6 Research papers

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**HTOE311 DISASTER MANAGEMENT**

<b>COURSE OBJECTIVES</b>	L	T	P	C
	3	0	0	3

Following are the objectives of this course:

- 1 To learn about various types of natural and man-made disasters.
- 2 To know pre- and post-disaster management for some of the disasters.
- 3 To know about various information and organisations in disaster management in India.
- 4 To get exposed to technological tools and their role in disaster management.

Unit 1	UNDERSTANDING DISASTER	9
Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, Capacity – Disaster and Development, and disaster management.		




Unit 2	TYPES, TRENDS, CAUSES, CONSEQUENCES AND CONTROL OF DISASTERS	9
	Geological Disasters (earthquakes, landslides, tsunami, mining); Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves) Biological Disasters (epidemics, pest attacks, forest fire); Technological Disasters (chemical, industrial, radiological, nuclear) and Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters) Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters.	
Unit 3	DISASTER MANAGEMENT CYCLE AND FRAMEWORK	9
	Disaster Management Cycle – Paradigm Shift in Disaster Management. Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Microzonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Awareness. During Disaster – Evacuation – Disaster Communication – Search and Rescue – Emergency Operation Centre – Incident Command System – Relief and Rehabilitation – Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment; IDNDR, Yokohama Strategy, Hyogo Framework of Action.	
Unit 4	DISASTER MANAGEMENT IN INDIA	9
	Disaster Profile of India – Mega Disasters of India and Lessons Learnt. Disaster Management Act 2005 – Institutional and Financial Mechanism, National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national), Non-Government and Inter Governmental Agencies	
Unit 5	APPLICATIONS OF SCIENCE AND TECHNOLOGY FOR DISASTER MANAGEMENT	9
	Geo-informatics in Disaster Management (RS, GIS, GPS and RS). Disaster Communication System (Early Warning and Its Dissemination). Land Use Planning and Development Regulations, Disaster Safe Designs and Constructions, Structural and Non Structural Mitigation of Disasters S&T Institutions for Disaster Management in India	
		<b>Total: 45 Hour</b>

**COURSE OUTCOMES:**

At the end of the study of this course, the students will be able to

- CO1 Acquainted with basic information on various types of disasters
- CO2 Knowing the precautions and awareness regarding various disasters
- CO3 Decide first action to be taken under various disasters
- CO4 Familiarised with organisation in India which are dealing with disasters
- CO5 Able to select IT tools to help in disaster management




## REFERENCE BOOK

- 1 Publications of National Disaster Management Authority (NDMA) on Various Templates and Guidelines for Disaster Management
- 2 Bhandani, R. K., An overview on natural & man-made disasters and their reduction, CSIR, New Delhi
- 3 Srivastava, H. N., and Gupta G. D., Management of Natural Disasters in developing countries, Daya Publishers, Delhi
- 4 Alexander, David, Natural Disasters, Kluwer Academic London
- 5 Ghosh, G. K., Disaster Management, A P H Publishing Corporation
- 6 . Murthy, D. B. N., Disaster Management: Text & Case Studies, Deep & Deep Pvt. Ltd

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## HTOE312 MARKETING MANAGEMENT AND FOREIGN TRADE

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## COURSE OBJECTIVES

To impart knowledge to students on,

- Marketing strategies, consumer behavior and market research, Foreign trade, agreements, documentation procedures and policies of Import / Export market.

Unit 1	MARKETING	9
	Introduction to Marketing - marketing in a developing economy – Marketing of services – planning marketing mix – market segmentation – Marketing research and its applications.	
Unit 2	CONSUMER BEHAVIOUR	9
	Understanding Consumers - Determinants of Consumer behaviour – models of Consumer Behaviour – Indian Consumer Environment.	
Unit 3	ELEMENTS OF MARKETING MIX	9
	PRODUCT - PRICING - Marketing channels, Wholesaling, Retailing. PROMOTION –Advertising, Sales promotion, Personnel selling, Publicity. Market Research. Definition, Methods of research, Steps, Need and Importance.	
Unit 4	FOREIGN TRADE	9
	Definition, Importance, Types – Import, Export, Re-export; Features of foreign trade. Functions and objectives of WTO-Concepts of GATT and MFA.	
Unit 5	EXPORT DOCUMENTATION	9
	Order confirmation, various types of export documents, pre-shipment and post-shipment documentation, terms of sale, payment and shipment. Duty drawback, DEPB, I/E licenseexchange control regulation-foreign exchange regulation acts-export management risk-export finance.	

**Total: 45 Hour**

## COURSE OUTCOMES:

At the end of the study of this course, the students will be able to



- CO1 Identify the market and segments of marketing.
- CO2 Describe the concepts of consumer behaviour.
- CO3 Explain the various elements involved in marketing and market research.
- CO4 Define foreign trade and discuss in detail the functions of WTO.
- CO5 Prepare various documents required for exports

**TEXT BOOK**

- 1 Philip Kotler, "Marketing Management", PHI publications, 2004.
- 2 Raj Agarwal, "Indian Foreign Trade", Excel books, 2002

**REFERENCE BOOK**

- 1 Evans. J. R. "Marketing: Marketing In The 21st Century", 8th edition, 2003.
- 2 S. Shivaramu, "Export Marketing – A practical Guide to Exporters", McGraw-Hill Book Company, 1985.
- 3 D. Sinha, "Export Planning and Promotion", IIM, Calcutta, 1981.
- 4 S. Shivaramu. "Export Marketing" – A Practical Guide to Exporters", Wheeler Publishing, ISBN: 81-7544-166-6, 1996.

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