



KARNATAK UNIVERSITY, DHARWAD  
ACADEMIC (S&T) SECTION  
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ  
ವಿದ್ಯಾಮಂಡಲ (ಎಸ್&ಟಿ) ವಿಭಾಗ



Tele: 0836-2215224  
e-mail: academic.st@kud.ac.in  
Pavate Nagar, Dharwad-580003  
ಪಾವಟೆ ನಗರ, ಧಾರವಾಡ - 580003

NAAC Accredited  
'A' Grade 2014

website: kud.ac.in

No. KU/Aca(S&T)/SVB-09/BOS /Pulp&PapSci (UG) /20-21/ ೨೨೨

Date:

16 OCT 2020

NOTIFICATION

Sub: Regarding introduction of the syllabus of Pulp & Paper Science UG under C.B.C.S. w.e.f. the academic year 2020-21 & onwards.

- Ref: 1. UGC Letter DO No. 1-1/2016(SECY), dt. 10.08.2016.  
2. Special BOS Res. No. 01, dt. 07.08.2020.  
3. Special Faculty Res. No. 17, dt. 11.08.2020.  
3. Special Academic Council Res. No. 43, dt. 21.08.2020.  
4. Vice-Chancellor's order dated 07-10-2020

Adverting to the above, it is hereby notified to the Principals of all constituent and affiliated degree colleges coming under the jurisdiction of Karnatak University, Dharwad that the Pulp & Paper Science UG syllabus for I to VIII Semester which is annexed herewith in Annexure-A is introduced under C.B.C.S. from the academic year 2020-21 & onwards.

Hence, the contents of this notification may please be brought to the notice of the students and all the concerned. The prescribed C.B.C.S. syllabus may also be obtained through K.U.website ([www.kud.ac.in](http://www.kud.ac.in)).

(Dr. Hanumantappa K.T)  
REGISTRAR

To,

1. The Chairman, BOS Pulp & Paper Science (UG), Dept. of Pulp & Paper Science, K.U.Dharwad.
2. The Chairman, Dept. of Pulp & Paper Science, K.U.Dharwad.
3. The Principals of all the constituted and affiliated degree colleges under the jurisdiction of Karnatak University, Dharwad. (The same may be sent through e-mail)
4. The Registrar (Evaluation), K.U.Dharwad.

Copy fives to:

1. Dr. Ch.Ramesh, Dean, Faculty of Science & Tech., Dept. of Botany, K.U.Dharwad.
2. The Director, IT Section, Examination Section, K.U.Dharwad for information and to upload on K.U.Website ([www.kud.ac.in](http://www.kud.ac.in)).

Copy to:

1. PS to Vice-Chancellor, K.U.Dharwad.
2. S.A. to Registrar, K.U.Dharwad.
3. O.S., Exam UG / Confl / QP / GAD Section, K.U.Dharwad.
4. The System Analyst, Computer Unit Exam Section, K.U.Dharwad.



**KARNATAK UNIVERSITY**  
**DHARWAD**

\*\*\*

**Bachelor of Applied Science Program**

**B.A.Sc.**

**Pulp and Paper Science**

**(8 Semester Program)**

**SYLLABUS**

**AS DISCIPLINE SPECIFIC COURSE (DSC),**

**GENERIC ELECTIVE (GE) AND**

**SKILL ENHANCEMENT COURSE (SEC)**

**UNDER**

**CHOICE BASED CREDIT SYSTEM (CBCS)**

\*\*\*\*\*

**Effective from 2020-21**

## B. A. Sc Programmes structure under CBCS; Effective from 2020-21

### DSC, GE and SEC

<b>SEMESTER I</b>										
<i>Course</i>	<i>CODE</i>	<i>COURSE TITLE</i>	<i>L + T + P per week</i>	<i>CREDITS</i>	<i>TOTAL L CRED ITS</i>	<i>Lectures / semester</i>	<i>Sem. End Exam marks</i>	<i>IA marks</i>	<i>Total marks</i>	<i>Duration of Exam</i>
AECC	AECC-1A	English - 1	2 + 1 + 0	2 + 1 = 3	3	45 hrs	80	20	100	3 hrs
AECC	AECC-2A	MIL - 1	2 + 1 + 0	2 + 1 = 3	3	45 hrs	80	20	100	3 hrs
AECC	AECC-3A	Environmental science	2 + 0 + 0	2 + 0 = 2	2	30 hrs	40	10	50	1.5 hrs
DSC	BASC – 1A	Chemistry –I Practical	4 + 0 + 4	4 + 2 = 6	6	60hrs	80 40	20 10	100 50	3 hrs 4 hrs
DSC	BASC – 2A	Physics Practical	4 + 0 + 4	4 + 2 = 6	6	60hrs	80 40	20 10	100 50	3 hrs 4 hrs
DSC	BASC – 3A	Mathematics	5 + 1 + 0	5 + 1 = 6	6	60hrs	80	20	100	3 hrs
				<b>TOTAL</b>	26					
<b>SEMESTER II</b>										
AECC	AECC-1B	English – 2	2 + 1 + 0	2 + 1 = 3	3	45 hrs	80	20	100	3 hrs
AECC	AECC-2B	MIL - 2	2 + 1 + 0	2 + 1 = 3	3	45 hrs	80	20	100	3 hrs
AECC	AECC-3B	Constitution of India	2 + 0 + 0	2 + 0 = 2	2	30 hrs	40	10	50	1.5 hrs
DSC	BASC – 1B	Wood chemistry Practical	4 + 0 + 4	4 + 2 = 6	6	60hrs	80 40	20 10	100 50	3 hrs 4 hrs
DSC	BASC – 2B	Chemical Plant Utilities Practical	4 + 0 + 4	4 + 2 = 6	6	60hrs	80 40	20 10	100 50	3 hrs 4 hrs
DSC	BASC – 3B	Electrical Engineering basics	5 + 1 + 0	5 + 1 = 6	6	60hrs	80	20	100	3 hrs
				<b>TOTAL</b>	26					

<b>SEMESTER III</b>										
AECC	AECC-1C	English - 3	2 + 1 + 0	2 + 1 = 3	3	45 hrs	80	20	100	3 hrs
AECC	AECC-2C	MIL - 3	2 + 1 + 0	2 + 1 = 3	3	45 hrs	80	20	100	3 hrs
DSC	BASC – 1C	Pulp Manufacture Practical	4 + 0 + 4	4 + 2 = 6	6	60hrs	80 40	20 10	100 50	3 hrs 4 hrs
DSC	BASC – 2C	Chemistry - II Practical	4 + 0 + 4	4 + 2 = 6	6	60hrs	80 40	20 10	100 50	3 hrs 4 hrs
DSC	BASC – 3C	Mechanical Operation & Process Calculations	5 + 1 + 0	5 + 1 = 6	6	60hrs	80	20	100	3 hrs
				<b>TOTAL</b>	<b>24</b>					
<b>SEMESTER IV</b>										
AECC	AECC-1D	English - 4	2 + 1 + 0	2 + 1 = 3	3	45 hrs	80	20	100	3 hrs
AECC	AECC-2D	MIL - 4	2 + 1 + 0	2 + 1 = 3	3	45 hrs	80	20	100	3 hrs
DSC	BASC – 1D	Stock Preparation & Papermaking Practical	4 + 0 + 4	4 + 2 = 6	6	60hrs	80 40	20 10	100 50	3 hrs 4 hrs
DSC	BASC – 2D	Computer concepts & C Programming Practical	4 + 0 + 4	4 + 2 = 6	6	60hrs	80 40	20 10	100 50	3 hrs 4 hrs
DSC	BASC – 3D	Thermodynamics & Heat transfer	5 + 1 + 0	5 + 1 = 6	6	60hrs	80	20	100	3 hrs
				<b>TOTAL</b>	<b>24</b>					
<b>SEMESTER V</b>										
DSC	BASC – 1E	Pulp treatment and Bleaching Practical	4 + 0 + 4	4 + 2 = 6	6	60hrs	80 40	20 10	100 50	3 hrs 4 hrs
DSC	BASC – 2E	Chemistry –III Practical	4 + 0 + 4	4 + 2 = 6	6	60hrs	80 40	20 10	100 50	3 hrs 4 hrs
DSC	BASC – 3E	Mass Transfer & Fluid Mechanics	5 + 1 + 0	5 + 1 = 6	6	60hrs	80	20	100	3 hrs
GE	BASC – GE - 1E	Personality Development & Communication skills	0 + 0 + 2	0 + 2 = 2	2	30hrs	40	10	50	1.5hrs
SEC	BASC – SEC - 1E	Speciality paper	2 + 0 + 0	2 + 0 = 2	2	30hrs	40	10	50	1.5hrs
				<b>TOTAL</b>	<b>22</b>					

<b>SEMESTER VI</b>										
DSC	BASC – 1F	Paper Drying & Finishing Practical	4 + 0 + 4	4 + 2 = 6	6	60hrs	80 40	20 10	100 50	3 hrs 4 hrs
DSC	BASC – 2F	Chemical Recovery Practical	4 + 0 + 4	4 + 2 = 6	6	60hrs	80 40	20 10	100 50	3 hrs 4 hrs
DSC	BASC – 3F	Process Control & Instrumentation	5 + 1 + 0	5 + 1 = 6	6	60hrs	80	20	100	3 hrs
GE	BASC – GE - 1F	Disaster Management	0 + 0 + 2	0 + 2 = 2	2	30hrs	40	10	50	1.5hrs
SEC	BASC – SEC – 1F	Engineering & CAD Drawing	2 + 0 + 0	2 + 0 = 2	2	30hrs	40	10	50	1.5hrs
				<b>TOTAL</b>	22					
<b>SEMESTER VII</b>										
*DSE	DSE- BASC – 1G	Paper Coating & Conversion <b>OR</b> Polymers used in Paper Industry	5 + 1 + 0	5 + 1 = 6	6	60 hrs	80	20	100	3 hrs
*DSE	DSE- BASC – 2G	Pollution abatement in Paper Industry <b>OR</b> Bio technology in Paper Industry	5 + 1 + 0	5 + 1 = 6	6	60 hrs	80	20	100	3 hrs
*DSE	DSE- BASC – 3G	Management and Costing <b>OR</b> Electronics and Communication Engineering	5 + 1 + 0	5 + 1 = 6	6	60 hrs	80	20	100	3 hrs
SEC	BASC – SEC – 1G	Industrial Training	2 + 0 + 0	2 + 0 = 2	2	30 hrs	40	10	50	Viva
				<b>TOTAL</b>	20					

<b>SEMESTER VIII</b>										
<i>*DSE</i>	<i>DSE- BASC – 1H</i>	<i>Printing and Packaging OR Paper evaluation, defects and control</i>	<i>5 + 1+ 0</i>	<i>5 + 1 = 6</i>	<i>6</i>	<i>60hrs</i>	<i>80</i>	<i>20</i>	<i>100</i>	<i>3 hrs</i>
<i>*DSE</i>	<i>DSE- BASC – 2H</i>	<i>Energy resources &amp; management OR Waste Management and recycle</i>	<i>5 + 1+ 0</i>	<i>5 + 1 = 6</i>	<i>6</i>	<i>60 hrs</i>	<i>80</i>	<i>20</i>	<i>100</i>	<i>3 hrs</i>
<i>*DSE</i>	<i>DSE- BASC – 3H</i>	<i>Process Designing OR Computer Applications in Paper Industry</i>	<i>5 + 1+ 0</i>	<i>5 + 1 = 6</i>	<i>6</i>	<i>60 hrs</i>	<i>80</i>	<i>20</i>	<i>100</i>	<i>3 hrs</i>
<i>SEC</i>	<i>BASC – SEC – 1H</i>	<i>Project work &amp; Dissertation</i>	<i>2 + 0 + 0</i>	<i>2 + 0 = 2</i>	<i>2</i>	<i>30 hrs</i>	<i>40</i>	<i>10</i>	<i>50</i>	<i>Viva</i>
				<i>TOTAL</i>	<i>20</i>					
		<b><i>Total Credits of the Programme</i></b>			<b><i>184</i></b>					

***\*Note: Each DSE shall have two papers in semesters VII and VIII. Student shall opt any one paper from each DSE in such cases.***

# Semester – I

Syllabi of B.Sc. Programme AECC is adopted for B.A. Sc. Programme

## Semester – I: Chemistry–I as DSC

Subject Code	BASC – 1A	Credits	4
Teaching Hours/Week	4	IA Marks	20
Tutorial Hours/Week	0	Exam Marks	80
Total hours / sem	60	Exam Hours	3

### UNIT – 1

**Titrimetric analysis:** Titrimetric analysis, Titration, types of titrations, equivalence point, Indicators, standard solution (Normality, Molality and ppm), primary and secondary standard.

- Acid - base titrations: types, acid base indicators, Ostwald's theory, indicator constant and pH. Derivation of an expression for the relationship between pH and Indicator constant.
- Redox titrations: Dichromate and  $\text{KMnO}_4$  titrations, Redox indicators, Iodimetric and Iodometric titrations.
- Precipitation titrations: Adsorption Indicator, determination of Chloride.
- Complexometric titrations: Types EDTA titrations, metallochromic indicators types and applications.

10 Hours

### UNIT – 2

**Pulping chemicals:** Introduction to pulping chemicals, their significance and reactions involved in different types of pulping processes. Manufacturing processes of pulping chemicals - sodium hydroxide, sodium sulphide, sodium sulphate, sodium sulphite, sodium peroxide and sodium carbonate.

10 Hours

### UNIT – 3

**Alcohols:** Definition and classification. Reaction of alcoholic –OH groups with oxidizing agents such as HNO<sub>3</sub>, KMnO<sub>4</sub>, Cr<sub>2</sub>O<sub>3</sub>, K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>, and Reducing agents such as HIO<sub>4</sub>, Lithium aluminium hydride. OH group transformation by acylation, alkylation, xanthation, regenerated cellulose as viscose rayon, properties and applications.

10 Hours

#### UNIT – 4

**Carbohydrates:** Introduction, classification, ascending and descending of sugar series, Carbohydrates as a source for ethanol by fermentation, basics of fermentation, conversion of sugar in to alcohol, Study of molasses and Bagasse as fibrous materials and their applications.

10Hours

#### UNIT – 5

**Colloidal state:** Electrical Properties, charge, stability, Electro-phoresis, electro Coagulation, Peptization, Hardy-Schulze Rule protective colloids, Gold Number, Emulsions, micro emulsions and gels.  
6 Hours.

#### UNIT – 6

**Solutions:** Solutions of gas in liquid-Henry's law and its limitations. Solutions of solid in liquid-Rauolt's Law, Ideal and Non-ideal solutions. Osmosis and Osmotic pressure. Preparation of cupric ferrocyanide membrane, Measurement of osmotic pressure by Barkeley and Hartly method Theories of semi permeability. Applications, reverse osmosis and desalination of sea water, Laws of Osmotic pressure. Determination of molecular weight of a polymer.  
7 Hours

#### UNIT – 7

**Nernst distribution law:** Distribution law, Thermodynamic derivation of distribution law, calculation of partition coefficient, deviation from distribution law due to molecular complexity (association and dissociation), application of distribution law- in solvent extraction, use of various solvents in extraction wood, bark taking example of one polar solvent and a non-polar solvent, extraction of substance from solution with derivation and numerical problems.



7 Hours.

## Reference Books:

1. Advanced Inorganic chemistry by R.D. Madan, S Chand & Co Ltd., New Delhi, 1987
2. Theoretical Inorganic chemistry by J.D. Lee, Blackwell Science Ltd., 5th Edition 2014
3. Inorganic Quantitative analysis by A.I. Vogel, E L B S & Londman, London, 1979
4. Pulp and paper chemistry and chemical technology by James P. Casey- Volume I, Pulp and Paper Industry Canada, 1985
5. Instrumental methods of analysis by Willard, merit and Dean., CBS P & D Delhi 1986
6. Organic chemistry by Morrison and Boyd - 5th edition, Pearson Education, Delhi, 2012.
7. Organic chemistry by I.L. Finar Vol I & II - 6th edition., Pearson Education, Delhi, 2001
8. Basic principles of organic chemistry by Roberts and Caserio, Wabenzaman, London, 1976
9. Organic Quantitative analysis by Vogel, 4th edition, E L B S & Londman, London, 1979
10. Principles of physical chemistry by Prutton and Murrion, 4th edition, Oxford & IBH Publication New Delhi-1980
11. Physical chemistry by Deniels and Alberty, 1st Edition, John Weley & Co Ltd., Newyork 1995
12. Physical chemistry by Barrow, 5th edition, M C Graw hill book, Singapore -1988
13. Text book of physical chemistry by Glasstone. 2nd edition, M.C. Millan, India Ltd., Delhi.- 1989
14. Text book of practicals in physical chemistry by B.D. Khosla, R, Chand & Co. Delhi - 1980
15. Text book of physical chemistry by B.D. Khosla, 3rd Edition, R Chand & Co. Delhi- 1982
16. A text Book of Organic Chemistry, Arun Bahl and Bahl B,S, 15th Edition S. Chand and Company, New Delhi, 1998.



## Semester – I: Chemistry -I Lab

Subject Code	DSC – 1A	Credits	2
Teaching Hours/Week	4	IA Marks	10
Tutorial Hours/Week	0	Exam Marks	40
Total hours	52	Exam Hours	4

### INORGANIC VOLUMETRIC ANALYSIS:

1. Standardisation of HCl using Standard  $\text{Na}_2\text{CO}_3$  Solution.
2. Titration of mixture of ( $\text{NaOH} + \text{Na}_2\text{CO}_3$ ) using HCl
3. Titration of mixture of ( $\text{NaOH} + \text{NaHCO}_3$ ) using HCl
4. Titration of mixture of ( $\text{Na}_2\text{CO}_3 + \text{NaHCO}_3$ ) using HCl
5. Standardization of  $\text{KMnO}_4$  using oxalic acid
6. Titration of mixture of oxalic acid + sodium oxalate with  $\text{KMnO}_4$
7. Determination of Chloride in water / effluent using standard  $\text{AgNO}_3$  solution.
8. Determination of Iron (II) using  $\text{K}_2\text{Cr}_2\text{O}_7$  solution.
9. Iodimetric titration: Volumetric determination of Iodine using Standard  $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$  Solution.
10. Iodometric titration: Estimation of  $\text{Cu}^{+2}$  in  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  solution using standard  $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$  solution.
11. Complexometric titration of  $\text{Zn}^{+2}$  using EDTA

**Note: There shall be instructions / training for the students about laboratory etiquettes, handling of reagents, laboratory safety measures, use of apparatus / instruments pertaining to the semester before commencement of the regular practicals. The same shall be recorded in the Journal.**

### Examination

In a batch of ten students, at least five different volumes may be given in the practical examination. Viva questions may be asked on any of the experiments prescribed in the practical syllabus.

**Distribution of Marks:**

Accuracy 20 marks, Reactions and calculations – 5marks, Technique and Presentation-5marks, Journal-5 marks, Viva-Voce-5 marks, Total=40 marks.

**Deduction of Marks for accuracy:**

**Titration:**  $\pm 0.2$  CC -20 marks,  $\pm 0.4$  CC- 16 marks,  $\pm 0.6$  CC- 12 marks,  $\pm 0.8$  CC- 08 marks,  $\pm 0.9$  CC- 05 marks, above  $\pm 0.9$  – zero marks

**Semester – I: Physics as DSC**

Subject Code	BASC – 2A	Credits	4
Teaching Hours/Week	4	IA Marks	20
Tutorial Hours/Week	0	Exam Marks	80
Total hours	60	Exam Hours	3

**UNIT – 1**

**Moment of Inertia:** Kinetic energy of rotating body (derivation), laws of rotational motion, general theorem of parallel and perpendicular axis. Derivation of expressions of MI of Lamina, Cylindrical rods, Solid and Hollow cylinders about standard axis, Sphere and Disc, MI of a fly wheel experiment and theory. Related problems are to be solved.

12

Hours

**UNIT – 2**

**Acceleration due to Gravity:** Theory of compound pendulum, Interchangeability of centres of suspension and oscillation, Four points collinear with the C.G. about which the time period is same conditions for maximum and minimum time periods, Bar pendulum, Experimental determination of "g" using Bar pendulum, Bifilar suspension with parallel threads. Related problems are to be solved

12 hours

**UNIT – 3**

**Elasticity:** Stress, Strain, Hooke's law, Elastic limit, Elastic constants and relation between them. 'Y' by Searle's method, torsion of a cylinder, Maxwell's needle, bending of beams, cantilever, 'Y' by bending, Rigidity modulus by dynamical method. Related problems are to be solved

12 Hours

**UNIT – 4**

**Simple Harmonic Motion (SHM):** Definition of SHM, Expressions for displacement, velocity and acceleration of a particle executing SHM, Differential

equation of linear SHM, Total energy of a particle executing SHM (Derivation), Expressions for the period of oscillation of flat spiral spring (Derivation) composition of two linear SHM's of equal periods acting at right angles to each other, Lissajous figures. Related problems are to be solved

12 Hours

#### **UNIT – 5**

**Interference:** Division of wavelength, fresnel biprism method of determining wavelength with theory. Division of amplitude method, stoke's treatment of reflection and refraction at an interface. Thin films condition for maximum and minimum (both reflected and transmitted), colour of thin films, expression for path difference, Newton's rings - theory and experiment to determine wavelength of light. Lip Mann process of colour photography. Related problems are to be solved

12 Hours

#### **Reference Books:**

1. General Properties of matter, D. S. Mathur - S. Chand and Co. New Delhi (2010)
2. General Properties of matter, Khanna and Gulati - R. Chand and Co. New Delhi (1978)
3. Text Book of Light, D.N. Vasudev Atmaram and Sons, Delhi (1987)
4. Optics, Khanna and Gulati - R. Chand and Co. New Delhi (1989)
5. Modern Physics, R. Murugesan - S. Chand and Co. New Delhi (1994)
6. Practical Physics, C. L. Arora - S., Chand and Co. New Delhi (2004)
7. Practical Physics, Warsnop and Flint — Asia Publishing House, New Delhi (1971)
8. Practical Physics, M.A. Hipparagi — Uday Publication, Belgaum (1989)
9. Elements of Properties of Matter, D. S. Mathur

## Semester – I: Physics Lab

Subject Code	DSC – 2A	Credits	2
Teaching Hours/Week	4	IA Marks	10
Tutorial Hours/Week	0	Exam Marks	40
Total hours	52	Exam Hours	4

1. Bar Pendulum (L-V)
2. Bar Pendulum ( $L^2-Lt^2$ )
3. Fly Wheel
4. Maxwell's Needle
5. Volume Resonator
6. Moment Of Inertia By Disc
7. Parallel Axes Theorem
8. Perpendicular Axes Theorem
9. Torsion Pendulum
10. Viscosity By Stokes Method
11. Y-Bending Of Beam
12. Y-By Searle's Method
13. Frequency of AC Sonometer

## Semester – I: Mathematics as DSC

Subject Code	BASC – 3A	Credits	6
Teaching Hours/Week	5	IA Marks	20
Tutorial Hours/Week	1	Exam Marks	80
Total hours	60	Exam Hours	3

### UNIT – 1

Successive Differentiation, Taylor's and Maclaurin's Theorem (statement only). Leibnitz's rule for  $n^{\text{th}}$  derivative of the product of two functions and related problems.

10 Hours

### UNIT – 2

Differential Equations. Formation of differential Equations. Equations of the first order and first degree. Variable separable form and Homogeneous equations.

10 Hours

### UNIT – 3

Methods of solving linear differential equations of  $n^{\text{th}}$  order with constant coefficients. Complementary function and particular integral and general solution.

10 Hours

### UNIT – 4

Functions of two or more variables. Partial Differentiation. Formation of PDEs by elimination of arbitrary constants / functions. Jacobians.

10 Hours

### UNIT – 5

Reduction formulae. Evaluation of integrals. Beta and Gamma functions. Relation between Beta and Gamma functions. Simple examples and problems to be solved.

10 Hours

### UNIT – 6

Laplace transforms of some standard functions. Basic properties of Laplace transform of Derivatives and Integrals of function.

10 Hours

### Reference Books:

1. Engineering Mathematics, H.K. Dass - S. Chand and Co. New Delhi (1995)
2. Statistical Methods, S.P. Gupta - S. Chand and Co. New Delhi (1987)
3. Business Statistics, R. Dhareshwar - S. Chand and Co. New Delhi (1987)
4. Practical Statistics, S.P. Gupta - S. Chand and Co. New Delhi (1990)
5. Differential Calculus, Shanti Narayan - S. Chand and Co. New Delhi (2009)
6. Integral Calculus, Shanti Narayan - S. Chand and Co. New Delhi (2009)
7. Differential Equations, M.D. Raisinghania - S. Chand and Co. New Delhi (2009)

## Semester – II

Syllabi of B.Sc. Programme AECC is adopted for B.A. Sc. Programme



## Semester – II: Wood Chemistry as DSC

Subject Code	BASC – 1B	Credits	4
Teaching Hours/Week	4	IA Marks	20
Tutorial Hours/Week	0	Exam Marks	80
Total hours	60	Exam Hours	3

### UNIT – 1

**Introduction:** Raw materials required for Paper Industry and their requirements and procurement. General structure of coniferous and broad leaf wood, structural elements of wood and bark, anatomical and chemical differences of softwood, hardwood and grasses

6 Hours

### UNIT – 2

**Structure of wood:** Microscopic and submicroscopic structure of cell wall structural elements and organisation. Arrangement of micro fibril, structures of micro fibrils.

6 Hours

### UNIT – 3

**Fiber morphology and proximate analysis:** Fiber morphology, fiber length, diameter, lumen width, cell wall, thickness, slenderness ratio, flexibility coefficient and their significance from papermaking point of view., principle involved in the proximate analysis of fibrous raw materials with respect to paper industry.

8 Hours

### UNIT – 4

**Non-woody fibers:** Scope and utilization of non-wood fibers in paper making, Physical and chemical characteristics of baggase, bamboo, straw, kenaf, jute, hemp, cotton linters and agave. Their distribution, occurrence and availability.

8 Hours

### UNIT – 5

**Cellulose and Hemicellulose:** Chemical components of wood occurrence, distribution, isolation and chemical structure of cellulose, cellulose reactions with cooking liquor - cellulose derivatives used in paper industry- solutions of cellulose and their applications. Structure of xylans, galactomannasglucomannas and arabinogalactans. Reactions of hemicellulose with cooking liquor.

12 Hours

#### **UNIT – 6**

**Lignin and Wood extractives:** Introduction, structure of lignin, physical properties, reactions of lignin with sulfite and sulphate pulping liquor, laboratory and commercial separations of lignin, biosynthesis of lignin. Types of wood extractives . Effect of wood extractives on pulp quality.

8Hours

#### **UNIT – 7**

**Storage and handling of fibrous raw materials at mill sites:** Measurement of wood, storage of raw materials and stacking, protection against fire and decayhandling and conveying of raw material.

6Hours

#### **UNIT – 8**

**Preparation of fibrous raw material for cooking:** Debarking, depithing, chipping, chopping, chip analysis washing, screening, types of storage - chip conveying to digesters.

6Hours

#### **Reference Books:**

1. Text book of wood technology Volume I – AJ Oanshin and CdeZeeuw, McGraw Hill Book Company
2. The Chemical Technology of Wood - H. F. B. Wenzl Academic Press, New York
3. Pulp and Paper Manufacture Volume III, Secondary Fibers and Non – Wood Pulping - Edited by F Hamilton and B. Leopold Published by the Technical Section Canadian Pulp and paper Association
4. Hand Book of Pulp Volume I – Edited by Herbert Sixta Published by Wiley-VCH VerlagGmbH and Company KGaA, Weinheim
5. Wood and Cellulose Chemistry Edited by David N.S. Hon Nobuo Shiraishi – 1998, Library of Congress, New York.

## Semester-II: Wood Chemistry LAB

Subject Code	DSC – 1B	Credits	2
Teaching Hours/Week	4	IA Marks	10
Tutorial Hours/Week	0	Exam Marks	40
Total hours	52	Exam Hours	4

1. Determination of following properties in different wood and non wood samples

- a) Moisture
  - b) Ash
  - c) Cold water solubility
  - d) Hot water solubility.
  - e) NaOH solubility.
  - f) Alcohol benzene solubility.
  - g) Holo cellulose
  - h)  $\alpha$ ,  $\beta$  and  $\gamma$  cellulose.
  - i) Lignin.
  - j) Pentosans.
  - k) Silica
2. Fiber separation and microscopic study of fibers of softwood, hardwoods, non woods.
  3. Determination of Pith content in bagasse.

### Reference :

1. TAPPI Test methods 1996-97, TAPPI Press, Atlanta Georgia
2. Laboratory manual of testing procedures published by Director, CPPRI, Saharanpur, UP, 2001

## Semester II: Chemical plant utilities as DSC

Subject Code	BASC – 2B	Credits	4
Teaching Hours/Week	4	IA Marks	20
Tutorial Hours/Week	0	Exam Marks	80
Total hours	60	Exam Hours	3

### UNIT – 1

**Introduction:** Different utilities. Role of utilities in process plant operation and criteria for selection and estimation of suitable utilities.

4 Hours

### UNIT -2

**Water :** Water resources, Process Water, Cooling Water, drinking water and boiler feed water Quality Standards. Water treatment processes for drinking, process and boiler feed. Storage and handling of water. Types and selection of pumps, piping and accessories. Water pre treatment, reuse and recycling.

10 Hours

### UNIT -3

**Compressed air and vacuum:** Compressors, fans and vacuum pumps performance characteristics and selection Boosters and air receivers quality of compressed air for instrument and process compressed air distribution system-piping and accessories.

8 Hours

### UNIT – 4

**Steam and Power:** Formation and use of wet dry and superheated steam Dryness fraction and its determination Enthalpy, specific volume External work Internal Energy- use of steam tables and charts Steam Handling and distribution calculation and estimation of steam piping and accessories.

8 Hours

### UNIT – 5

**Steam boilers:** Fire tube and water tube boilers, high-pressure boilers, boiler mountings and boiler accessories -waste heat boilers.

6 Hours

### UNIT – 6

**Steam Turbines:** Introduction, classification types and details of turbines compounding for pressure and velocity efficiency calculations and simple problems.

4 Hours

### UNIT – 7

**Steam Condensers:** Introduction basic types- function - cooling devices spray ponds and cooling towers.

4 Hours

### **UNIT – 8**

**Lubrication:** Types of lubricants - properties purpose and method of lubrication.

4 Hours

### **UNIT – 9**

**Metal forming Operations:** Casting, forging, rolling welding and extrusion (only principles and differences between them)

6 Hours

### **UNIT – 10**

**Insulation:** Insulation Materials & Selection – Economics of insulation. Insulating factors. Properties & Classification. Cold insulation and cryogenic insulation.

6 Hours

### **Reference books:**

1. Project Engineering of process plants - (Chem Engineering Edu Div. Centre IIT Madras, Bhasin SD-
2. Project Engineering of process plants - Rose HF and Barrow M. H Publisher-John Willey and sons, New York, 1964
3. Materials Science and Engineering - V. Raghavan, PHI Private Ltd, New Delhi, 1997.
4. Corrosion Engineering - Fontana and 'Greene.-Mcgraw Hill, EDCH, New Delhi -2013
5. Elements of Mechanicals Engineering - K. R. Gopalkrishna published by Subhash Stores

## Semester – II: Chemical plant utilities - Lab

Subject Code	DSC – 2B	Credits	2
Teaching Hours/Week	4	IA Marks	10
Tutorial Hours/Week	0	Exam Marks	40
Total hours	52	Exam Hours	4

### 1. Determination of the following in water, boiler water and effluent samples

- i. Hardness
- ii. Residual Chlorine
- iii. Sulphate
- iv. Sulphite
- v. Alkalinity
- vi. Acidity
- vii. Calcium
- viii. Phosphate
- ix. Silica
- x. Free CO<sub>2</sub>
- xi. Dissolved Oxygen
- xii. Dissolved solids, Suspended solids and Total solids

### 2. Analysis of coal- Moisture & Ash

#### Reference Books:

1. Standard methods for the examination of water and waste water (1980) – American Public Health Association, Washington DC
2. TAPPI Test methods 1996-97, TAPPI Press, Atlanta Georgia.
3. Laboratory manual of testing procedures published by Director, CPPRI, Saharanpur, UP, 2001

## Semester II:Electrical Engineering Basics as DSC

Subject Code	BASC – 3B	Credits	6
Teaching Hours/Week	5	IA Marks	20
Tutorial Hours/Week	1	Exam Marks	80
Total hours	60	Exam Hours	3

### UNIT – 1

**D.C Circutes:** Ohm's Law and Kirchhoff's current Law Kirchhoff's voltage Law-applications for the analysis of only series and parallel resistive circuits exited by independent voltage sources: Power and Energy in such circuits. Illustrative examples.

6 Hours

### UNIT – 2

**Electromagnetisum:** Faradays Laws, Lenz's Law Fleming's rules, Statically and dynamically induced E.M.F.'s Concept of self and mutual inductance. Concept of coefficient of coupling. Energy stored in magnetic field, Illustrative examples.

6 Hours

### UNIT – 3

**D. C. Machines:** Principle of D. C. Generator and motor constructional features, classification, simple, lap and wave windings. The e. m. f. equation, production of torque in a D. C. motor. The torque equation necessity of a starter. The three-point starter, Industrial applications of D. C. motors.

10 Hours

### UNIT – 4

**Three-Phase A. C. Circuits:** Generation of 3 phase voltages, advantages of 3-phase systems star and Delta connections current and voltage relations, 3-phase power and its measurement by 2-water meter method. Earthing of electrical appliances and systems.

6 Hours

### UNIT – 5

**The single-phase transformer:** Principles constructional features, E. M. F. Equation, Relation between primary and secondary turns, voltages and currents.

6 Hours

### UNIT – 6

**The three phase Induction Motor:** Construction, working principle production of Torque slip Industrial applications,

5 Hours

### UNIT – 7

**The synchronous generator:** (Alternator) Principle Construction features. The EMF equation synchronisation.

5 Hours

#### **UNIT – 8**

**Measuring Instruments:** Basic principles of moving iron, moving coil and induction, type meters for measuring current, voltage, power and energy.

10 Hours

#### **UNIT – 9**

**Electric Power:** Estimation of requirement HT and LT equipments. Receiving and distribution of power generation at mill site. Efficient use of electricity Safety in use of electric power.

6 Hours

#### **Reference Books:**

1. Electrical Technology, Hugar - CBSP & D, New Delhi, 1988
2. Applied Electricity - H. Cotton
3. Electrical Technology, H. Cotton
4. Electrical Engineering - Dowes Vol. I & II
5. Introduction to Electrical Engineering - M. H. Ward
6. Basic Electrical Engineering (4th Edition), Fitzgerald, Mcgrow Hill International Book Co., New York, 1989
7. Electrical Technology by B.L TherejaVol I& II
8. Basic Electrical By P.M Chandrashekarayya

## **Semester – III**

**Syllabi of B.Sc. Programme AECC is adopted for B.A. Sc. Programme**

### **Semester – III: Pulp Manufacture as DSC**

*Subject Code*

BASC – 1C Credits

4



<i>Teaching Hours/Week</i>	4	IA Marks	20
<i>Tutorial Hours/Week</i>	0	Exam Marks	80
<i>Total hours</i>	60	Exam Hours	3

#### UNIT – 1

**Introduction to Pulping:** General principles of pulping-classification of pulping, technical and commercial aspects of pulping.

2 hrs

#### UNIT – 2

**Mechanical Pulping:** History and description of the process-equipment and accessories - mechanical pulp from Chips Modifications like RMP, CSRMP, TMP Process details. Bleaching-characteristics and applications.

10 Hours

#### UNIT – 3

**High Yield Pulps:** Definition and scope- NSSC, cold soda, hot soda, Acid Sulfite bisulfite-Raw materials, cooking chemicals, digesters-fiberising-Process control and operation, Newsprint manufacture, characteristics and process technology, bleaching of these pulps. Characteristics and applications of high yield pulps.

10Hours

#### UNIT – 4

**Secondary fiber Pulping:** Sources, and grading contaminants consumption and use of secondary fiber-economics comparison with virgin fiber and their impact on paper machine process and their equipment, Pulping systems-washing ink from the pulp slurry flotation deinking, cleaning and screening, reject handling bleaching, process and quality control. Enzyme deinking, principles, mechanism,

8 Hours

#### UNIT – 5

**Chemistry of Alkaline Pulping:** Introduction, history of alkaline pulping-description of the Kraft process-standard Kraft pulping Terms,Composition of Kraft liquors.

**Nano Cellulose:** Manufacture, properties and application, advantages and disadvantages.

6 Hours

#### UNIT – 6

**Process Variables:** General considerations Analysis of experimental results The Ross diagram variables associated with the wood, with the process, with the pulping operation. H factor.

6 Hours

#### UNIT – 7

**Alkaline digester systems:** Batch digester and their operation-continuous digester and their operations Batch Vs continuous digesters digester scale and corrosion. Kraft batch digesting continuous digester control.Properties and uses of Kraft pulps.

8 Hours

#### UNIT – 8

**Extended delignification processes:** Vapour phase pulping-Modified Continuous Cooking (MCC) Rapid Displacement Heating (RDH) Super batch cooking Oxygen delignification catalysts used in pulping with respect to carbohydrate conservation soda-AQ, sulfate-AQ-etc.

**Reference Books:**

1. Alkaline Pulping, Vol. V - Published by Technical Section Canadian Pulp & Paper Association (1996)
2. Secondary fibers and nonwood pulping published by Joint Text Book Committee, Vol. III - TAPPI Press (1993)
3. Secondary fiber - recycling - Edited Richard J. Spangenberg, TAPPI – Press.
3. Micro and Nano technology in Paper Manufacturing - , Industry Paper, Patel avenue, Sambalpur, Orrisa, 2009

**Semester-III: Pulp Manufacture - LAB**

Subject Code	DSC – 1C	Credits	2
Teaching Hours/Week	4	IA Marks	10
Tutorial Hours/Week	0	Exam Marks	40
Total hours	52	Exam Hours	4

1. Preparation of Kraft cooking liquor
2. Analysis of Kraft cooking liquor
3. Analysis of caustic soda
4. Determination of kappa number of pulp.
5. Preparation of soda pulp using woody and non woody fiber  
( study of H factor, residual alkali, consumption, rejects and yield.)
6. Deinking of Waste Paper / Newsprint
7. Analysis of White Liquor - Sulphite, Sulphate & Chloride in white liquor
8. Analysis of CED solution
9. Determination of viscosity of pulp.
10. Analysis of sodium sulfite
11. Preparation of Kraft pulp using woody and nonwoody fiber  
( study of H factor, residual alkali, consumption, rejects and yield).
12. Optimization studies of cooking (chemical charge to get desired yield & Kappa Number)
13. AQ reinforced cooking and study of H factor residual alkali, consumption, rejects and yield.

**Reference Books:**

1. TAPPI Test methods 1996-97, TAPPI Press, Atlanta Georgia
2. Laboratory manual of testing procedures published by Director, CPPRI, Saharanpur, UP, 2001

**Semester III: Chemistry-II as DSC**

Subject Code	BASC – 2C	Credits	4
Teaching Hours/Week	4	IA Marks	20
Tutorial Hours/Week	0	Exam Marks	80
Total hours	60	Exam Hours	3

**UNIT – 1**

**Chromatography:** Introduction, Theory, Advantages and Classification of chromatographic methods. Introduction to column chromatography, paper chromatography, TLC, GLC and HPLC. 9 Hours

**UNIT – 2**

**Oxy acids of chlorine and their salts:** General methods of preparation, properties, applications in pulp and paper Industry and their structures.

4Hours

**UNIT – 3**

**Bleaching Chemicals:** Manufacturing processes of bleaching chemicals needed in pulp and paper industry and their applications in bleaching of pulp. a) Borohydrides b) Dithionites c) Oxygen and ozone d) Chlorine e) Chlorine dioxide f) Sodium hypochlorite g) Calcium hypochlorite and h) Bleaching powder. 9 Hours

**UNIT – 4**

**Addition and Condensation Polymers:** Definition with examples, methods of addition and condensation polymerization, cationic, anionic and free radical polymerisation.

Cellulose: occurrence, distribution, isolation and chemical structure of cellulose molecular structure, cellulose reactions - cellulose derivatives - solutions of cellulose. Nature of OH groups and end groups of cellulose. Cellulose Esters and Ethers- cellulose acetate, nitrate and starch derivatives cationic, anionic, oxidised, and enzyme starches their applications in paper industry.

**UNIT – 5**

**Hemicellulose:** Occurrence and distribution, structure of xylans, galactomannans glucomannans and arabinogalactans. Reactions of hemicellulose with cooking liquor.

8 Hours.

**UNIT – 6**

**Physical Properties and chemical constitution:** Properties of liquids (a) Surface tension and its determination by using staligmometer, parachor and its applications. (b) Viscosity, fluidity, molar and intrinsic viscosity (definitions, determination of relative, viscosity by using Ostwald's viscometer. Viscosity as a major factor in black liquor evaporation, cellulose Viscosity.

( c ) Application of molar refractivity. i) Structural determination. ii) Percentage composition. iii) Dipole moment and its determination by temperature variation method. Applications of dipole moment.

10 Hours.

**UNIT – 7**

**Chemical kinetics:** Rate of a reaction, order of a reaction, expression for second order reaction and their experimental determination. Study of kinetics of reaction between KI and  $K_2S_2O_8$  and lignin oxidation. Arrhenius theory, energy of activation and interpretation on the rate of delignification. Half-life period, method of determination of order of a reaction by Hit and trial (integration) method, Half-life period method, Differential equation method, Ostwald's Isolation method.

8 Hours.

**Reference Books:**

1. Advanced Inorganic chemistry by R.D. Madan, S Chand & Co Ltd., New Delhi, 1987
2. Theoretical Inorganic chemistry by J.D. Lee, Blackwell Science Ltd., 5th Edition 2014
3. Inorganic Quantitative analysis by A.I. Vogel, E L B S & Londman, London, 1979
4. Pulp and paper chemistry and chemical technology by James P. Casey- Volume I, Pulp and Paper Industry Canada, 1985
5. Instrumental methods of analysis by Willard, merit and Dean., CBS P & D Delhi 1986

6. Organic chemistry by Morrison and Boyd - 5th edition, Pearson Education, Delhi, 2012.
7. Organic chemistry by I.L. Finar Vol I & II - 6th edition., Pearson Education, Delhi, 2001
8. Organic Quantitative analysis by Vogel, 4th edition, E L B S & Londman, London, 1979
9. Principles of physical chemistry by Prutton and Murrion, 4th edition, Oxford & IBH Publication New Delhi-1980
10. Physical chemistry by Deniels and Alberty, 1<sup>st</sup> Edition, John Weley& Co ltd., Newyork1995
11. Physical chemistry by Barrow, 5th edition, M C Graw hill book, Singapore -1988
12. Text book of physical chemistry by Glasstone. 2<sup>nd</sup> edition, M.C.Millan, India Ltd., Delhi.- 1989
13. Text book of practicals in physical chemistry by B.D.Khosla, R, Chand & Co. Delhi - 1980
14. Text book of physical chemistry by B.D. Khosla, 3<sup>rd</sup> Edition, R Chand & Co. Delhi-1982
15. Introduction to chromatography theory and practice by V.K. Srivastava K.K. Srivastava, S Chand and company Ltd 1991

### **Semester – III: Chemistry -II Lab**

Subject Code	DSC – 2C	Credits	2
Teaching Hours/Week	4	IA Marks	10
Tutorial Hours/Week	0	Exam Marks	40
Total hours	52	Exam Hours	4

#### **I. Experiments on Chromatography:**

1. Separation of sugars from a given mixture of D-Glucose, D-Xylanose and Lactose by paper chromatography.
2. Separation of indicators in a given mixture containing 0.05% Ethanol, Alizarin-Red, Methyl red Methyl orange.

3. Separation of components present in different inks by Column Chromatography.
4. Separation of Phenol on activated silica gel using TLC preparing a solution in 3% ethanol, (Resorcinol + m-nitrophenol + o-nitrophenol)

**II. Determination of the following in organic compounds:**

1. Phenol
2. Amide
3. Ester
4. Aniline
5. Acetyl content
6. Methoxy group

**III. Preparation and estimation of CED.**

**Note: There shall be instructions / training for the students about laboratory etiquettes, handling of reagents, laboratory safety measures, use of apparatus / instruments pertaining to the semester before commencement of the regular practicals. The same shall be recorded in the Journal.**

**Examination**

In a batch of ten students, each student should perform Chromatographic experiments and quantitative determination of organic compound containing different functional groups. Not more than 2 students should get the same experiment. Selection of experiments may be done by the students based on the picking up of chits. Viva questions may be asked on any of the experiments prescribed in the practical syllabus.

**Distribution of Marks:**

Journal – 05 marks , Viva-Voce-5 marks

Accuracy – 20 marks, Technique-4, presentation-3 marks, calculation-3, (Total=40 marks.)

**Deduction of Marks for accuracy (B.R.):**

$\pm 0.2$  CC -20marks,  $\pm 0.4$  CC- 16marks,  $\pm 0.6$  CC- 12 marks,  $\pm 0.8$  CC- 08 marks,  $\pm 0.9$  - 05 marks above 0.9 zero.

**Semester–III: Mechanical Operation & Process Calculations as DSC**

Subject Code	BASC – 3C	Credits	6
Teaching Hours/Week	5	IA Marks	20
Tutorial Hours/Week	1	Exam Marks	80
Total hours	60	Exam Hours	3

**UNIT – 1**

**Particle Technology:** Particle diameter different ways of expressions shape factor and sphericity determination of surface area.

6 Hours

**UNIT – 2.**

**Movement of solids in a stagnant fluids:** Terminal setting velocity, stokes law, Newton's law region, free and hindered setting, thickener design - cyclones, simple problems on stoke's law.

	4 Hours
<b>UNIT- 3</b>	
<b>Filtration:</b> Theory of filtration-batch and continuous filters, types of filters, industrial filters, plate and frame presses, filters aids washing filter cakes, centrifugal filtration.	6 Hours
<b>UNIT – 4</b>	
<b>Size reduction:</b> Size reduction laws governing size reduction, simple problems equipments for crushing and grinding –jaw crusher ball mill, open and closed circuit grinding (only mode of operation to be taught)	6 Hours
<b>UNIT – 5</b>	
<b>Dust and mist collection:</b> Definitions and ESP	4 Hours
<b>UNIT – 6</b>	
<b>Mixing storage and conveying:</b> only various types are to be taught	4 Hours
<b>UNIT – 7</b>	
<b>Introduction to Chemical Engineering:</b> Elementary description of major unit operation and related equipments. Units and dimensions, Conversion of units, Methods of expressing compositions of matter and their mixtures, Ideal and real gas equations of state, Vapour pressure, Raoult’s law, Henry’s law, Dependence of Vapour pressure on temperature, vapour pressure of solutions and their equilibrium vapours. Humidity charts and their uses.	12 Hours
<b>UNIT – 8</b>	
<b>Material balance involving unit operations:</b> Evaporation, drying, absorption and mixing of steams. Material balance involving recycle and bypass streams. Material balance of successive operations.	8 Hours
<b>UNIT – 9</b>	
<b>Energy balance:</b> Energy balance for systems without chemical reaction Application of material and energy balance with reference to pulp and paper industry.	6 Hours
<b>UNIT – 10</b>	
<b>Thermochemistry:</b> Heats of formation, Heat of combustion and heat of reaction- Heat of mixing - Heat capacity,	4 Hours

**Reference Books:**

1. Foust-et-al – Principles of unit operations
2. Budger& Benchers – Introduction to chemical Engg, McGraw Hill, Koga Kusha Ltd., Tokyo, 1978.
3. Unit Operations in chemical Engineering 7th Edition, 2008, McCabe and Smith McGraw Hill Co., New York

4. Coulson and Richardson- Chemical Engg. Vol. 2, Butter WorthHeinemam, 2006
5. Basic principles and calculation in chemical engineering David M. Himmelblau 6th edition Prentice Hall of India 1997.
6. Elementary principles of chemical processes 2nd edition Richart M. Felder Ronald W. Roussean 1986.
7. Process calculation for chemical Engineer chemical Engineering education Development Centre(1973) I I T Madras.
8. Stoichiometry Bhalt B.I and Vora SM Tata McGraw Hill, New Delhi, 1989.

## Semester IV

**Syllabi of B.Sc. Programme AECC is adopted for B.A. Sc. Programme**

### Semester – IV: Stock Preparation & Papermaking as DSC

Subject Code	BASC – 1D	Credits	4
Teaching Hours/Week	4	IA Marks	20
Tutorial Hours/Week	0	Exam Marks	80
Total hours	60	Exam Hours	3

#### UNIT – 1

**Refining of Pulp:** Introduction History - effect of refining on fiber structure theory of refining - refiner –Refiner construction operation and control, product properties calculation, application of enzymes in refining.

4hrs

#### UNIT – 2

**Stock Proportioning and blending:** White water and its reclamation debris removal-types of screens, cleaners -principle-types design and operation, deaerators. Types of Savealls. Broke system design and control



4 hrs

### UNIT – 3

**Fillers for Paper:** Introduction characteristics of fillers, types of fillers, filler selection – Retention and wet end chemistry retention aids, drainage aids and formation aids and their effect on paper properties - colloidal mechanisms, retention measurement.

6 hrs

### UNIT – 4

#### **Non fibrous additives:**

**Internal sizing:** Introduction -types of sizing like acidic, neutral and alkaline sizing-mechanisms, cellulose reactive sizing agents-other agents-

**Wet and Dry Strength resins:** Introduction –types and mechanism of wet and dry strength resin

**Paper Dyes:** dye stuffs classification storage and handling –shade matching -common problems - automated dyeing.

**Deposit control agents:** Introduction-classification- causes and problems slime, pitch and foam problems -

10hrs

### UNIT – 5

**Foundrinier Paper Machine:** History and development- Modern fourdrinier, sheet forming process fourdrinier stock and white water system. Approach flow systems-drainage and sheet formation, suction boxes couch roll, fourdrinier accessories and auxiliaries.

10 hrs

### UNIT – 6

#### **Accessories for paper machine:**

**Head boxes:** - types of head boxes, flow eveners, perforated rolls, baffles, slices, operation and controls of Head box, calculations.

**Paper machine wires:** Types , weave patterns, running and life of wires, wire cleaning devices, changing of wires, patching/repair of wires.

**Dandy Rolls:** Construction, function and method of operations. Problems faced with dandy rolls, watermarking dandies, Dandy drive.

**Paper Machine Showers And Doctors:** Introduction, shower application, doctor application and installation, maintenance calculation.

10 hrs

### UNIT – 7

**Cylinder Paper Machine:** History and development cylinder machine products single cylinder, wet Board machine, Multi cylinder paper board machine stock entries, factors affecting web formation, The cylinder mould, couch rolls, felt whippers, functions of felt, felt conditioning and cleaning rubber and other rolls coverings-broke handling, Pressure formers.

10 hrs

### UNIT – 8

**Twin wire and multiple wire formers:** Introduction –definitions Principles of twin and multiple wire formation and drainage and principles and operation tissue mechanisms.

6 hrs

#### **Reference Books:**

1. Pulp and Paper Manufacture Volume 6 Stock Preparation Edited by R. W Hagemeyer and D.W Manson. Published by Joint textbook committee of the Paper Industry

2. Pulp and Paper Manufacture Volume 7 Paper machine operations Edited by B. A. Thorp. Published by the Technical Section Canadian Pulp and paper Association
3. Pulp and Paper chemistry and chemical Technology - volume I to III James P. Casey.
4. Hand book for Pulp and Paper Technologists - G. A. Smook, Angus Wilde Publications, Vancouver Bellingham -1964.
5. Hand Book of Pulp Volume I – Edited by Herbert Sixta Published by Wiley-VCH VerlagGmbH and Company KGaA, Weinheim.
6. Pulp and Paper Chemistry and Chemical Technology by James P. Casey

### **Semester – IV: Stock preparation & Papermaking Lab**

Subject Code	DSC – 1D	Credits	2
Teaching Hours/Week	4	IA Marks	10
Tutorial Hours/Week	.....	Exam Marks	40
Total hours	52	Exam Hours	4

1. Analysis of Talc
2. Analysis of Clay
3. Analysis of Rosin emulsion
4. Analysis of calcium carbonate
5. Analysis of Alum
6. Analysis of Sodium Silicate
7. Analysis of Starch
8. Analysis of white water and head box stock and fiber and filler retention
9. pH and conductivity of white water
10. Laboratory beating of mill pulp to required <sup>0</sup>SR
11. Sheet making and pressing
12. Acid sizing in laboratory and testing
13. Shade matching & Optimization

**Reference Books:**

1. TAPPI Test methods 1996-97, TAPPI Press, Atlanta Georgia.

2. Laboratory manual of testing procedures published by Director, CPPRI, Saharanpur, UP, 2001

## **Semester- IV: Computer Concepts & C programming as DSC**

Subject Code	BASC – 2D	Credits	4
Teaching Hours/Week	4	IA Marks	20
Tutorial Hours/Week	0	Exam Marks	80
Total hours	60	Exam Hours	3

### **UNIT – 1**

**Introduction:** History & Evolution of Computers. Characteristics. Computer Architecture and functions, Types of Computers. I/O and storage devices

6 Hours

### **UNIT – 2**

**Operating system and internet:** Using Operating system and internet, Operating system basics-types of operating system, DOS, WINDOWS, introduction to internet, services, Networking, WWW, using e-mail

6 Hours

### **UNIT – 3**

**Over View of C:** Introduction. Importance and Features of C. Structure of a C Program. Sample C Programs. Creating and Executing a C Program. Block diagram of execution of C program.

6 Hours

### **UNIT – 4**

**Basic Concepts:** C Character Set. C tokens: keywords, identifiers, constants and variables. Data types. Declaration & initialization of variables. Symbolic constants.

6 Hours

### **UNIT – 5**

**Input output :** Managing input output, Formatted i/o functions: printf and scanf: control stings and escape sequences, output specifications with printf functions. Unformatted i/o functions to read and display single character and a string: getchar, putchar, gets and puts functions.

6 Hours

#### **UNIT – 6**

**Operators & Expressions:** Arithmetic operators, Relational operators, Logical operators, Assignment operators, increment & decrement operators, bitwise operators, conditional operator and special operators. Computational Problems, Operator Precedence and Associativity. Evaluation of arithmetic expressions, mathematical functions. Type conversion

6 Hours

#### **UNIT – 7**

**Control Structures (Branching & Looping):** Decision making with different forms of if statements, goto, switch, continue and program thereto. looping Statements: while, do-while & for loops. Nested loops

6 Hours

#### **UNIT – 8**

**Arrays and Strings:** One Dimensional arrays: Declaration, Initialization and Memory representation. Two Dimensional arrays: Declaration, Initialization and Memory representation. Declaring & Initializing string variables. String handling functions

6 Hours

#### **UNIT – 9**

**User Defined Functions:** Format of C user defined functions. Components of user defined functions: structure and function call. Categories of functions, Recursive functions. Functions with arrays.

6 Hours

#### **UNIT – 10**

**Pointers:** Understanding pointers. Declaring and initializing pointers, accessing address and value of variables using pointers. Pointer and array. Pointer Arithmetic. Advantages and disadvantages of using pointers

6 Hours

#### **Reference Books:**

1. E. Balguruswamy: Programming in ANSI C ( TMH)
2. Kamthane : Programming with ANSI and TURBO C(Pearson Education)
3. V. Rajaraman : Programming in C (PHI – EEE), New Delhi
4. S. Byron Gottfried: Programming with C (TMH)
5. Kernighan & Ritchie : The C Programming Language.(PHI)
6. Yashwant Kanitkar : Let us C
7. P.B. Kottur: Programming in C (Sapna Book House)

## Semester – IV: C programming Lab

Subject Code	DSC – 2D	Credits	2
Teaching Hours/Week	4	IA Marks	10
Tutorial Hours/Week	0	Exam Marks	40
Total hours	52	Exam Hours	4

### Sample Programs:

1. Write a C Program to check for factorial of n.
2. Write a C Program to generate n primes
3. Write a C Program to check a number for palindrome
4. Write a C Program to generate n Fibonacci numbers
5. Write a C Program to read numbers from key board continuously till the user presses 999 and  
to find the sum of only positive numbers.
6. Write a C Program to find a length of a string without using built in function
7. Write a C Program to read string, reverse it and check it for palindrome.
8. Write a C Program to find GCD and LCM
9. Write a C Program to find the roots of quadratic equation.
10. Write a C Program to read, display and to find the trace of a square matrix
11. Write a C Program to read, display and add two m x n matrices using functions
12. Write a C Program to read, display and multiply two m x n matrices using functions
13. Write a C Program to find factorial of a number using both iterative & recursive function.
14. Write a C Program to read a string and to find the number of alphabets, digits, vowels, consonants, spaces and special characters.
15. Write a C Program to demonstrate student structure to read & display records of n students.
16. Preparing word documents: formatting, designing templates and mail merging -case studies
17. Preparing worksheets, working on formulae's and charts, data validation – case studies
18. Preparing PowerPoint presentation: simple, templates, quiz and add-on interactive-case studies
19. Prepare interactive online Presentations, simulations, ed-puzzles, quizzes, online test, learning mobile apps - case studies
20. Email and use of social media: Online screen recording, discussions, google apps, classroom & online apps -case studies

## Semester – IV: Thermodynamics and Heat Transfer as DSC

Subject Code	BASC – 3D	Credits	4
Teaching Hours/Week	4	IA Marks	20
Tutorial Hours/Week	0	Exam Marks	80
Total hours	60	Exam Hours	3

### UNIT – 1

**Introduction to thermodynamics:** Basic concept and terminologies used, First law of thermodynamics, Applications to steady and non-steady flow processes and simple problems.

8 Hours

### UNIT – 2

**Second law of thermodynamics:** Concept of Entropy, concept of Carnot cycle. Application to engineering relating to equilibrium, maximum and minimum work conditions concept of Gibbs and Helmholtz free energy and simple problems.

8 Hours

### UNIT – 3

**Properties of Pure substances:** Changes in thermodynamics, properties and their inter relationships, concept of fugacity and activity coefficient for real gases.

6 Hours

### UNIT – 4

**Conduction:** Fourier's law - Steady state unidirectional heat flow through single- and multi-layer slabs, cylinders and spheres for constant and variable thermal conductivity. Insulation - Properties of insulation materials, types of insulation, critical and optimum thickness of insulation. Simple problems.

10 Hours

### UNIT – 5

**Convection:** Individual and overall heat transfer coefficients, LMTD, Dimensionless numbers, dimensional analysis, Empirical correlations for forced and natural convection. Simple problems.

10 Hours

### UNIT – 6

**Radiation:** Properties and definitions (absorptivity, reflectivity, absorptivity) Emissive power and intensity of radiation, Black body radiation, Stefan Boltzmann law, Wien's displacement law, Gray body radiation, Kirchhoff law examples like dryer, digester.

10 Hours

### UNIT – 7

**Heat transfer equipments:** Elementary treatment of process design of double pipe heat exchangers, shell and tube type heat exchangers Extended surface heat exchangers - fins. Simple problems.

8 Hours

**Reference Books:**

1. Engineering Thermodynamics, Dodge & McGraw Hill Publication.
2. Thermodynamics, P.C. Rakshit The New booksheer, Calcutta
3. Postulate and statistical Thermodynamics, YVC Rao Allied publishers ltd.
4. Thermodynamics kinetics Theory and statistical thermodynamics, Sears and Selinger Noraso Publishing House, Chennai, 1996.
5. Chemical Engineering Vol. I 3rd Edn., Pergamon & ELBS 1977
6. Unit Operations in chemical Engineering 7th Edition, 2008, McCabe and Smith McGraw Hill Co., New York
7. Process Heat transfer, by Kern Tata, McGraw Hill Co., New York
8. Process Heat transfer by Kern D.O., McGraw Hill Co., New York

# Semester V

## Semester V: Pulp treatment and Bleaching as DSC

Subject Code	BASC – 1E	Credits	4
Teaching Hours/Week	4	IA Marks	20
Tutorial Hours/Week	0	Exam Marks	80
Total hours / sem	60	Exam Hours	3

### UNIT 1

**Post Digester Treatment of pulp:** Introduction - Blow tanks and agitation – Thickening and storage of pulp - High density storage towers. Drying of pulp and preparation for shipment.

4 Hours

### UNIT 2

**Brown stock washing:** Purpose-Basic washing methods - cylinder washing principles and operations-variable affecting washing soda loss, operation, control and calculations. Types of washers. Washing in continuous digesters.

4 Hours

### UNIT 3

**Screening and cleaning of pulp:** Objectives and theory of screening-coarse screening, fine screening-screening system, different types of screens, control parameters in pulp screening. Centrifugal cleaning-introduction, objectives, operation principles. Operating variables and problems.

6 Hours

### UNIT 4

**Kraft bleaching:** Introduction and general principles of pulp bleaching and chemicals employed. Lignin preservative and lignin removal bleaching methods, industrial importance of bleaching. Effect of bleaching on Paper making Properties.

8 Hours

### UNIT 5

**Brightness and brightness reversion:** Optical properties of pulp General optical principles tests and measurements of brightness and brightness reversion -Factors affecting brightness and brightness reversion during pulp treatment.

4 Hours

### UNIT 6

**Pulp chlorination and alkaline extraction:** Fundamental aspects of chlorination, Mixture of  $\text{Cl}_2$  and  $\text{ClO}_2$  in the chlorination stage. Chlorine free bleaching advantages and applications of ECF and TCF bleaching. Alkaline extraction, removal of chlorolignin cellulose degradation, Manufacture of  $\text{Cl}_2$ ,  $\text{ClO}_2$ . and NaOH.

8Hours

### UNIT 7

**Oxidative bleaching:** Oxidative bleaching agents like Hypochlorite, chlorine dioxide oxygen and peroxide – Variables and control. Oxidative combinations. Preparation of Bleaching Chemicals, Process Technology -bleach plant effluents.

8 Hours

### UNIT 8

**Reductive bleaching:** Reductive bleaching agents-sodium and zinc dithionites, borohydrides- preparation, properties, factors affecting bleaching.

4 Hours



**UNIT 9**

**Bleaching practices for different pulp types:** Introduction - Bleaching of low yield and high yield, Bleaching of dissolving pulps, coloured broke and nonwood fiber pulps with details of equipment

8Hours

**UNIT 10**

**Bleaching and pollution:** Closed cycle bleach plants modern bleaching practices with respect to minimizing environmental degradation. Safety in storage and handling of bleaching chemicals. Principles and enzymes used in Pulp bleaching. Advantages and disadvantages.

6 Hours

**Reference Books:**

1. Bleaching of pulp by R. P. Singh - TAPPI Press, Atlanta Georgia
2. Alkaline Pulping, Vol. V - Published by Technical Section Canadian Pulp & Paper Association .
3. Mechanical Pulping , Vol. II – Edited by Ray A. Leask -Published Joint Text Book Committee of the Paper Industry, 1983 TAPPI Press.
4. Pulp bleaching principles and practice - Ed. By Carlton W. Dence and Douglas W. Reeve - TAPPI Press.

### **Semester V: Pulp treatment and Bleaching Lab**

Subject Code	DSC – 1E	Credits	2
Teaching Hours/Week	4	IA Marks	10
Tutorial Hours/Week	0	Exam Marks	40

Total hours	52	Exam Hours	4
-------------	----	------------	---

1. Determination of soda loss by flame photometer method.
2. Preparation of bleach liquor in laboratory.
3. Analysis of bleach liquor.
4. Screening of pulp
5. Testing of pulp of cleanliness and shive content (speckscout)
6. Demonstration of fiber fractionation using Bauer McNett apparatus.
7. Analysis of chlorine dioxide bleach liquor
8. Preparation of Peroxide bleach liquor and analysis
9. Bleaching of pulp in laboratory using single stage bleaching.
10. Bleaching of pulp in laboratory using multi stage bleaching.
11. Bleaching of pulp by peroxide.
12. Bleaching of pulp using  $\text{ClO}_2$ .
13. Measurement of brightness and brightness reversion.

**Reference Books:**

1. TAPPI Test methods 1996-97, TAPPI Press, Atlanta Georgia.
2. Laboratory manual of testing procedures published by Director, CPPRI, Saharanpur, UP, 2001

**Semester V:Chemistry - III as DSC**

Subject Code	BASC – 2E	Credits	4
Teaching Hours/Week	4	IA Marks	20
Tutorial Hours/Week	0	Exam Marks	80
Total hours / sem	60	Exam Hours	3

**UNIT 1**

**Study of specialty chemicals used in pulp and paper industry:** Titanium dioxide, Potassium permanganate, Potassium dichromate, Cu en complex, Clays, Talc and Alum. Preparation, properties and industrial applications are to be stressed.

8 Hours.

#### UNIT 2.

**Dyes and colour Chemistry:** Colour and constitution, classification, study of azodyes, triphenyl methane dyes, vat dyes, phthalocyanine, dyes important colour pigments and dyes used in pulp and paper industry.

5 Hours.

#### UNIT 3.

**Chemistry of additives for paper coating:** foam control agents, lubricants, wax emulsion, preservatives, flow modifiers, isolubalizers

5 Hours.

#### UNIT 4.

**Fundamental principles of spectroscopy:** Electromagnetic radiation, energies corresponding to various kind of radiations, interaction of electromagnetic radiation with matter. Difference between molecular and atomic spectra. Representation of a spectrum, atomic and molecular transitions

3 Hours.

#### UNIT 5.

**UV Spectroscopy:** Introduction, origin of UV absorption spectrum, Instrumentation, important terminology associated with electronic spectroscopy –(Molar absorptivity, bathochromic effect, hypsochromic effect) and applications.

4 Hours.

#### UNIT 6.

**Infrared spectroscopy:** Introduction – Regions of infrared spectrum, Requirement of IR absorption (selection rule) – correct wavelength of radiation and change in electric dipole moment of a molecule. Theory of IR absorption. Types of vibration –Stretching vibrations – symmetrical stretching and asymmetric stretching and bending vibrations –scissoring rocking wagging and twisting vibrations. Fundamental modes of vibrations- coupled interactions, electronic effects and hydrogen bonding. Instrumentation –IR radiation source, monochromator, and detectors. Sample handling techniques – solution, nujol mull and KBr pellet. Characteristic group infrared absorption for organic molecules and Applications . Introduction to F T -IR and its advantages

8 Hours.

#### UNIT 7

**Nuclear magnetic resonance spectroscopy:** Introduction, principle, theory and instrumentation. population of nuclear spin level, spin –spin and spin – lattice relaxation, chemical shift- definitions, causes, measurement and advantages of TMS as a reference compound factors affecting chemical shifts with chemical environment aliphatic alkenic, alkynic, aldehydic, ketonic, aromatic, alcoholic, phenolic carboxylic and amino protons. Spin –spin coupling, applications. Introduction to F T NMR and <sup>13</sup>C advantages and applications.

8 Hours.

#### UNIT 8

**Mass spectrometry:** Introduction, instrumentation, Mass spectrum, Determination of molecular formulae, Parent peak, Base peak, Use of molecular fragmentation. Nitrogen rule

4 Hours.

### UNIT 9

**Flame photometry and atomic absorption spectroscopy:** Introduction, principle, flames – ionization and dissociation in flames, types of flames used in AAS and flame spectra, variation of emission intensity with flame, metallic spectra in flame, flame ground, role of temperature on absorption emission and fluorescence Comparative study of flame emission spectroscopy (FES) and Atomic absorption spectroscopy (AAS). Instrumentation –line source, source modulation in AAS. Application – Qualitative and Quantitative determination of alkali and alkaline earth metals.

5 Hours.

### UNIT 10

**Corrosion:** Introduction - Definitions of Corrosion - Overall classification of types of corrosion-Basic electrochemistry – Galvanic and electrolytic cells – Potential measurements - EMF and Galvanic series – Galvanic corrosion and bimetallic contacts – Eh – pH diagrams – Electrode – solution interface – Electrode kinetics and polarization phenomena – Exchange current density – Polarization techniques to measure corrosion rates – Mixed potential theory – Activation and diffusion controlled mixed electrodes – Methods of corrosion prevention and control – Design, coatings and inhibition – Cathodic protection – Stray current corrosion – Passivity phenomena and development of corrosion resistant alloys – Anodic control – Biological aspects of corrosion – Microbially induced corrosion.

10 Hours

### Reference Books:

1. Advanced Inorganic chemistry by R.D. Madan, S Chand & Co ltd., New Delhi, 1987
2. Theoretical Inorganic chemistry by J.D. Lee, Blackwell Science Ltd., 5th Edition 2014
3. Inorganic Quantitative analysis by A.I. Vogel, E L B S & Londman, London, 1979
4. Pulp and paper chemistry and chemical technology by James P. Casey- Volume I, Pulp and Paper Industry Canada, 1985
5. Instrumental methods of analysis by Willard, merit and Dean., CBS P & D Delhi 1986
6. Organic chemistry by Morrison and Boyd - 5th edition, Pearson Education, Delhi, 2012.
7. Organic chemistry by I.L. Finar Vol I & II - 6th edition., Pearson Education, Delhi, 2001
8. Basic principles of organic chemistry by Roberts and Caserio, Wabenzaman, London,1976
9. Organic Quantitative analysis by Vogel, 4th edition, E L B S & Londman, London, 1979

10. Principles of physical chemistry by Prutton and Murrion, 4th edition, Oxford & IBH Publication New Delhi-1980
11. Physical chemistry by Deniels and Alberty, 1st Edition, John Weley & Co ltd., Newyork-1995 Physical chemistry by Barrow, 5th edition, M C Graw hill book, Singapore -1988
12. Text book of physical chemistry by Glasstone.2nd edition, M.C.Millan, India Ltd., Delhi.-1989 Text book of practicals in physical chemistry by B.D.Khosla, R, Chand & Co. Delhi - 1980
13. Text book of physical chemistry by B.D. Khosla, 3rd Edition, R Chand & Co. Delhi1982
14. Principles of physical chemistry B.R.Puri, L.R. Sharma & M.S.Pathania, S.Nagin Chand & Co., 33rd Ed., 1992
15. Corrosion Engineering – by M.G.Fontana, Mc Graw Hill Publications. 3rd Edition New Delhi-2013
16. Spectrometric Identification of organic compounds, R.M. silverstein and W.P. Webster, Wiley & Sons, 1999.
17. Instrumental Methods of Analysis, H.H.Willard, L.L. Merritt and J.A Dean and F.A. settle, CBS Publishers, 7th Edition 1988.

### **Semester V: Chemistry - III Lab**

Subject Code	DSC – 2E	Credits	2
Teaching Hours/Week	4	IA Marks	10
Tutorial Hours/Week	0	Exam Marks	40

**PHYSICAL CHEMISTRY EXPERIMENTS**

1. Surface tension of liquids
2. Viscosity of liquids, cellulose and pulp.
3. First order kinetics.
4. Second order kinetics.
5. Partition co-efficient.
6. pH metric titration.
7. Conductometric titration.
8. Potentiometric titration.
9. Colourimetric determination of copper(II) and iron(III).
10. Flame photometry.
11. Determination of  $\lambda_{\max}$  of lignin and Azo dyes using U V spectroscopy
12. Identification of -OH, -CO - and -NH<sub>2</sub>- groups in a given compound using FT IR spectrum.

**Note: There shall be instructions / training for the students about laboratory etiquettes, handling of reagents, laboratory safety measures, use of apparatus / instruments pertaining to the semester before commencement of the regular practicals. The same shall be recorded in the Journal.**

**Examination**

In a batch of ten students, not more than two students should get the same experiment in the practical examination. Selection of experiments may be done by the students based on the picking up of chits. Viva questions may be asked on any of the experiments prescribed in the practical syllabus.

**Distribution of Marks:**

Accuracy-18 marks, Technique and Presentation-3marks Calculation and graph- (5+4) 9 marks, Journal-5 marks, Viva-Voce-5 marks, Total=40 marks.

**Deduction of Marks for accuracy:**

Error up to 5% - 18 marks, 6 - 10% 15 marks, 11-15%- 12 marks, 16-20% 09 marks, above 20% zero (0) marks

## Semester V: Mass Transfer & Fluid Mechanics as DSC

Subject Code	BASC – 3E	Credits	6
Teaching Hours/Week	5	IA Marks	20
Tutorial Hours/Week	1	Exam Marks	80
Total hours	60	Exam Hours	3

### UNIT 1.

**Molecular and eddy diffusion in fluids:** Mass transfer by Diffusions measurement and calculation of diffusivities mass transfer coefficients and their correlations, analogies in transfer processes - Theories of mass transfer.

4 Hours

### UNIT 2.

**Evaporation:** Single and multiple effect evaporators - different methods of feeding in multiple effect evaporator Capacity and economy equipment for evaporation Design and performance.

6 Hours

### UNIT 3.

**Humidification:** General Theory, Psychrometric chart fundamental concepts in humidification and dehumidification cooling towers.

6 Hours

### UNIT 4.

**Drying:** Drying rate curves, Batch and continuous drying mechanism of drying calculation of batch and continuous drying.

6 Hours

### UNIT 5.

**Absorption:** Principles of gas absorption types of absorption towers design of absorption towers.

4 Hours

### UNIT 6.

**Adsorption:** Principles and theories of adsorption types of adsorption recovery of solvent vapours. Industrial adsorbents adsorption equipment.

6 Hours

### UNIT 7.

**Fluid Statics:** Static fluid pressure-hydrostatic equilibrium measurement of fluid pressure, manometry, hydrostatic forces on plane and curve surfaces-buoyance.

8 Hours

### UNIT 8.

**Fluid Dynamics:** Types of flow-shear stress and shear rate fields, viscosity, classification of fluids. Basic equations of incompressible fluid, flow conservation of mass, momentum and energy, unidimensional flow, derivation of unidimensional flow. Euler's and Bernoulli's equations. Applications of basic equation of flow.

8 Hours

**UNIT 9.**

**Flow of incompressible fluid:** Flow of incompressible fluid through circular conduits, laminar and turbulent flow equations-Derivation of Hagen Poiseuille's equation.

8 Hours

**UNIT 10.**

**Transportations and metering of fluids:** Pipes fittings and valves, liquid and gas, pumps and compressors for chemical plants-reciprocating, rotary centrifugal, air lift pumps

4Hours

**Reference Books:**

1. Mass transfer Operations 3rd edition Mc Graw Hill 1985 - Robert Trayball
2. Unit Operations of chemical Engineering 7th Edition, McCabe and Smith Mc Graw Hill 2005
3. Chemical Engineering Volume I and II 4th edition Coulson and Richardson. Pergamon Press Publication.
4. Absorption and Extraction - Sherwood J.K. and Rigford R.L. Mc Graw Hill International Edition, New York 1952
5. Principles of Unit Operations - Foust et al 2nd edition John Wiley 1980.

**Semester V: Personality development and Business Communication as GE**

Subject Code	BASC GE -1E	Credits	2
Teaching Hours/Week	2	IA Marks	10
Tutorial Hours/Week	0	Exam Marks	40
Total hours	30	Exam Hours	1.5

1. Importance of communication skills in Business Management
2. Types of communication, Communication Networks,



3. Reading skills-Speaking skills- Conversation skills,
4. Effective and Ineffective listening skills
5. Business presentations and public speaking
6. Group Discussions,Meetings and Conferences
7. Improving writing skills
8. Types of Business messages
9. Basic Principles-Components and strategies for letter writing, Formats For Business Letters
10. Basic Official Correspondence- Memos, Notices, Office Orders and Circulars.
11. Basics of Report Writing;
12. Preparing a Professional Resume and Cover Letter, Business Etiquettes. Preparation for and mastering the art of facing interviews

20 Hours

**13. Aptitude tests:**

- i. Time and space
- ii. Measurements & Mensuration
- iii. Mixtures
- iv. Logical Reasoning (Assertions, Relationships, Coding)
- v. Basic Arithmetic
- vi. Fractions (All mathematical operations on fractions)

10Hours

( Includes work shops, practice sessions, mock tests, interviews, seminars and regular assignments)

**Reference books:**

1. Hory Sankar Mukerjee (2013) Business Communication Business Communication: Connecting at work: 2/e, OUP, New Delhi.
2. P. D. Chaturvedi and Mukesh Chaturvedi (2013) Business Communication: Concepts, cases and applications, 3/e, Pearson Education, New Delhi.
3. Meenakshi Raman &Prakash Singh Business Communication, 2/e, OUP, New Delhi.
4. Raymond V. Lesikar, Marie E. Flatley, Kathryn Rentz and Neeaja Pande (2010) Business Communication: Making Connections in a Digital World, 11/e, TMH, New Delhi.
5. M.K. Sehgal & Vandana Kheterpal (2010) Business Communication, 2/e, Excel Books, ND.

**Semester V: Speciality paper as SEC**

Subject Code	BASC SEC1E	Credits	2
Teaching Hours/Week	2	IA Marks	10
Tutorial Hours/Week	0	Exam Marks	40
Total hours	30	Exam Hours	1.5

### UNIT 1

**Paper saturation and saturating agents:** Base paper requirements, technology and methods of saturating agents, applications of saturated papers.

6Hours

### UNIT 2

**Gift wraps and decorative papers:** Gift-wraps, wallpapers, lamp shade stock and other miscellaneous papers.

2Hours

### UNIT 3

**Gum tapes:** Materials used for gum tapes description of gumming plant and equipment properties of gumtapes and applications, gummed papers and other speciality tapes and labels.

4Hours

### UNIT 4.

**Functional papers:** Safety papers. Coated chart papers, solvent coated papers. Electrical papers. Filter papers,cigarette papers, Waxed papers,protective packaging papers, metal foil papers.

8Hours

### UNIT 5

**Carbon and other copying papers:** Introduction, types of carbon papers, Base paper requirements, carbon inks used and itsformulation. Manufacture of different carbon papers and its applications.

6Hours

### UNIT6

**Pressure sensitive and release papers:** Chemistry of release treatment, manufacture of pressure sensitive and release papers. types ofrelease papers and their uses.

4Hours

### Reference Books:

1 Pulp and Paper Manufacture Volume VIII Coating,Converting edited by Michael Kouris  
Published by Joint textbook committee of the Paper Industry

2 Industrial and Speciality Papers, Robert H. Mosher, Volume I to IV Chemical Publishing  
Co. Inc. New York, 1969

3 The essential guide to Aqueous coating of paper and Board edited by TWR Dean TAPPI  
Press.

# SEMESTER VI

## Semester VI: Pressing, Drying & Finishing as DSC

Subject Code	BASC – 1F	Credits	4
Teaching Hours/Week	4	IA Marks	20
Tutorial Hours/Week	0	Exam Marks	80
Total hours / sem	60	Exam Hours	3

### UNIT – 1

**Pick up and press:** Introduction, Objectives types of presses Theory of pressing section pick up section, factors affecting moisture distribution, felts and felt conditioning, suction rolls, open draw - press operation and controls, roll crown, mechanical details of press section, Calculations

8 Hours

### UNIT – 2

**Paper drying:** Introduction -Theory of drying, cylinder drying -general description, dryer cylinders. Dryerfelts, steam and condensate system, dryer ventilation system, hoods and hood exhaust, pocketventilation, dryer section run ability, dryer safety. Bearing and lubrications, performancecalculation,Types of drying - Air drying, radiant drying, Yankee dryers-design and construction, creeping process.Cross direction control Calculations

12 Hours

### UNIT –3

**Calendering and super calendering:** Introduction, calender roll construction, Heating systems for metal rolls, calender stackoperation, hardness of rolls, crowning of rolls, swimming rolls, calender defects, variableSuper calendars-special features-factors affecting

6 Hours

### UNIT – 4

**Reeling and winding:** Introduction, Reeling winding definition and theory, finishing room winders and unwinding,productivity and manpower, Roll build up.

4 Hours

### UNIT – 5

**Paper Machine and winder drives:** Introduction, types of drives and regulators, drive fundamentals and requirements in press section, dryer section, calender section, Reelsection and winder

4 Hours

### UNIT –6

**Finishing of paper:** Introduction, Rotary slitters, Cutters, types of cutters Backstands, Combination cutters,automatic layboys, counting and tagging reams, cutter knives and dust cutter broke, sortingand inspection- Recent trends in finishing.

6 Hours

### UNIT – 7

**Paper evaluation:** Review of paper testing and process properties relationship Importance of paper properties in defining usage of paper. Effect of atmosphere conditions on paper properties.

Physical properties of paper, Strength properties of paper, Optical Properties of Paper, Chemical properties of paper (Measurement control and significance of these tests to be taught)

12 Hours

#### UNIT – 8

**Paper board testing:** Crush properties of paper board, flat crush, ring crush, plybond, stiffness & IGT printability-Measurement control and significance of these tests to be taught.

4 Hours

#### UNIT –9

**Electrical properties of paper:** Dielectric constant, dielectric strength importance and measurement, types of electrical papers.

4 Hours

#### Reference Books:

1. Joint textbook series volume 7 paper machine Operations edited by M. J. Kocurek and B.A.Thorp.
2. Hand book for Pulp and Paper Technologists - Gray A. Smook
3. Joint textbook committee volume 8 of the pulp and Paper manufacture series edited by M.J.Kocurek and Kouris.
4. Pulp and Paper chemistry and chemical Technology - volume I to III James P. Casey.
5. Paper Physics edited by Karrlo Niskanen.
6. Handbook of Pulp Volume I and II – edited by Herbert Sixta

### Semester VI: Pressing, Drying & Finishing Lab

Subject Code	DSC – 1F	Credits	2
Teaching Hours/Week	4	IA Marks	10
Tutorial Hours/Week	0	Exam Marks	40
Total hours	52	Exam Hours	4

1. Determination of moisture and ash
2. Testing Physical properties – Grammage, Thickness, Density, Bulk, Grain, Folding strength, dimensional stability, smoothness, fluffing, strength Index
3. Mechanical- Burst, impact, tensile, elongation, tear
4. Determination of smoothness and porosity
5. Chemical properties – acidity, pH, sulfate, chloride
6. Determination of Copper Number

7. Determination of rosin content
8. Optical properties – brightness, brightness reversion (P.C.NO) gloss, opacity, Haze, see through
9. Stiffness of board and corrugating medium.  
(Different samples of low and high gsm paper and board are to be tested)
10. Preparation of coating solution and testing for viscosity and TS
11. Surface sizing of paper and board and testing, Wax pick, sizing, oil absorbency, edge wick test and ply bond strength
12. Preparation of Duplex board and testing
13. Testing of prepared board for strength index

**Reference Books:**

1. TAPPI Test methods 1996-97, TAPPI Press, Atlanta Georgia.
2. Laboratory manual of testing procedures published by Director, CPPRI, Saharanpur, UP, 2001

## **Semester VI: Chemical Recovery as DSC**

Subject Code	BASC – 2F	Credits	4
Teaching Hours/Week	4	IA Marks	20
Tutorial Hours/Week	0	Exam Marks	80
Total hours / sem	60	Exam Hours	3

**UNIT – 1**

**Introduction and Principles of Chemical Recovery:** Standard terms used in recovery - Historical development early development- Overview of chemical recovery system - By product recovery -merits demerits. Black liquor oxidation, Desilication and their merits and demerits

8 Hours

**UNIT – 2**

**Evaporation and concentration of black liquor:** Introduction - General properties of black liquor -principles of heat transfer - multiple effect evaporators types -calculation of performance, instrumentation and process control - Auxiliary operations in the evaporation plant. Direct contact evaporators -Cyclone and cascade - High-density evaporation –process Technology advantages and limitations.

12 Hours

**UNIT – 3**

**Non condensable gases(NCG) :** Introduction - composition of NCG. Properties of NCG Ignition sources -transporting NCG, Scrubbing NCG Burning NCG-conclusion.

2Hours

**UNIT – 4**

**Chemical Recovery process chemistry:** Chemical recovery boilers-overview of burning chemistry material and energy balance –Burning methods -deposits and plugging.

8Hours

**UNIT – 5**

**Chemical recovery equipment:**Introduction -pressure parts-air and liquor systems chemical recovery boiler -selection criteria, auxiliary systems -operation and control safety measures - Air emissions and control.

8Hours

**UNIT – 6**

**Green liquor preparation:** Smelt - composition and analysis - smelt -dissolving tanks - Green liquor clarifiers – dreghandlingproperties of green liquor and analysis.

4Hours

**UNIT – 7**

**White liquor preparation:** Introduction -process description - slakers - causticizers - white liquor clarifiers -recausticizing plant equipment -system design -calculations for causticizing andrecausticizing -Properties and analysis of white liquor.

8Hours

**UNIT – 8**

**Lime reburning:** Introduction -overview of lime reburning process and sizing considerations- lime productionprocess equipment Rotary lime kiln Auxiliary lime kiln operations Instrumentation andcontrol - Testing of lime and lime stone - Air emissions during burning and their control.

10 Hours

**Reference Books:**

1. Chemical Recovery in the Alkaline Pulping Processes co edited by Robert P. Green and Gerald Hough, TAPPI Press, Atlanta, 1992
2. Pulp and Paper Manufacture Volume-V Alkaline Pulping Edited by T M Grace and E W Malcolm Published by the Technical Section Canadian Pulp and paper Association
3. Kraft pulping - Edited by A. Mimms M.J.Kocurek
4. Handbook of Pulp Volume I and II – edited by Herbert Sixta
5. Hand book of Pulp and Paper by Gray A. Smook.

## Semester VI: Chemical Recovery Lab

Subject Code	DSC – 2F	Credits	2
Teaching Hours/Week	4	IA Marks	10
Tutorial Hours/Week	0	Exam Marks	40
Total hours	52	Exam Hours	4

1. Analysis of salt cake- moisture. pH, Chloride, insolubles
2. Analysis of soda ash- moisture. purity, Chloride, insolubles.
3. Analysis of lime -purity and free Na<sub>2</sub>O.
4. Analysis of lime -stone and seashell - moisture calcium, magnesium and silica.
5. Analysis of filter cake-moisture Na<sub>2</sub>O, CaO, CaCO<sub>3</sub> hydrated lime and silica.
6. Analysis of black liquor – Active alkali, Total titrable alkali and Activity
7. Determination of pH and conductivity of black liquor
8. Determination of viscosity of black liquor at different temperature.
9. Determination of granulation point.
10. Determination of calorific value of black liquor.
11. Analysis of white liquor
12. Analysis of mill green liquor.

13. Causticizing of green liquor -settling rate and analysis of white liquor and lime mud produced.

**Reference Books:**

1. TAPPI Test methods 1996-97, TAPPI Press, Atlanta Georgia.
2. Laboratory manual of testing procedures published by Director, CPPRI, Saharanpur,UP, 2001

**Semester VI: Process Control & Instrumentation as DSC**

Subject Code	BASC – 3F	Credits	6
Teaching Hours/Week	5	IA Marks	20
Tutorial Hours/Week	1	Exam Marks	80
Total hours	60	Exam Hours	3

**UNIT - 1**

**Introduction to Control Systems:** Transfer functions, laplace transformations, block diagrams, closed loop and open loop control systems, on-off control.

12 Hours

**UNIT - 2**

**Open loop response of simple systems:** Response to step, semisudal inputs, first order systems, second order systems, response of interacting and non interacting elements.

12 Hours

**UNIT - 3**

**Transducers:** Analog transducers, electrical types, digital transducers, frequency domain transducers, digital encoders,

6 Hours

**UNIT - 4**

**Measurements:** Temperature measurements, optical pyrometer, resistance thermometer, bimetallic thermometer. Pressure measurements: pressure standards, pressure transducers, pressuregauge, measuring high and low pressure, Flow measurement: Venturimeter, Orificemeter, Rotameter,

16 Hours

**UNIT 5**

**Control systems:** Control of Chemical reactors and drying operations, control systems in rotary dryers, drum dryers, spray dryers, control of batch operations, control of stirred tank reactors, tubularreactors and batch reactors.

14 Hours



**Reference Books:**

1. Process system analysis and control, Coughanour and Koppel Mc Graw Hill International Edition, New York
2. An introduction to Theory and Practical, Prentice Hall, New Delhi.
3. Chemical process control, George Stephanopoulos, Prentice Hall of India, New Delhi, 1990
4. Industrial instrumentation Eckmann, Willey Eastern Ltd., New Delhi, 1991
5. Industrial instrumentation fundamentals, Tata McGraw Hill Co., New Delhi

**Semester VI: Disaster Management as GE**

Subject Code	BASC GE -1F	Credits	2
Teaching Hours/Week	2	IA Marks	10
Tutorial Hours/Week	0	Exam Marks	40
Total hours	30	Exam Hours	1.5

**UNIT - 1**

**Introduction to Environmental Hazards & Disasters:** Meaning and definition of Environmental hazards. Environmental Disasters and Environmental stress. Types of Environmental hazards & Disasters, Cyclones, Floods, Droughts, Soil Erosion Release of toxic chemicals, nuclear explosion, Biological hazards and disasters

8 Hours

**UNIT - 2**

**Disaster Management:** Emerging approaches in Disaster Management- Three Stages,

a)Pre- disaster stage (prevention and preparedness)

b)Emergency Stage

c)Post Disaster stage- (relief,rehabilitation and recovery)

6 Hours

**UNIT- 3**

**Do's & Dont's during disaster:** Emergency Preparedness for disaster, Plant Emergency, On-Site Emergencies, Off-Site Emergencies, General Precautions and health Care During disaster

4 Hours

**UNIT- 4**

**Environmental policies & programmes in India:** Institutions & National Centres for Natural Disaster reduction, Environmental Legislations in India, Awareness, Conservation Movement. Education & training

8 Hours

**UNIT - 5**

**Occupational Safety and Health Administration: (OSHA)** rights and responsibilities under OSH Act law, Health and safety standards

4 Hours

**Reference Books:**

1. Disaster Mitigation: Experiences And Reflections by Pradeep Sahni
2. Natural Hazards & Disasters by Donald Hyndman & David Hyndman – Cengage Learning
3. Industrial Safety, Health and Environment Management Systems by R K Jain and Sunil S Rao Khanna Publications
4. Industrial safety Management Madras shoppe
5. Natural and Anthropogenic Disasters - Springer
6. *An Introduction to Disaster Management eBook* by S. Vidyathan
7. Disaster Management in India: Challenges and Strategies Book by Dr. R. K.Dave

## Semester VI: Engineering & CAD Drawing as SEC

Subject Code	BASC SEC1F	Credits	2
Teaching Hours/Week	2	IA Marks	10
Tutorial Hours/Week	0	Exam Marks	40
Total hours	30	Exam Hours	1.5

### UNIT 1

**Introduction:** Use of drawing instruments, line work & Geometrical constructions, lettering.

Scales & Curves, Plain, Diagonal and Vernier Scales, Engineer curves

3 Hours

### UNIT 2

**Orthographic projections:** Projections of points, lines & planes Projections of simple solids

4 Hours

### UNIT 3

**Development:** Types, Development of cylinders, prisms, pyramids & cones, Isometric drawing of some simple machine parts

3 Hours

### UNIT 4

**Introduction to CAD:**

1. Study of CAD graphic package, creation of drawings of simple machine parts, -  
(Orthographic and Isometric) –

2. Drawing of Assembly of machine parts with specifications, dimensioning and bill of material.

6 Hours

### UNIT 5

**Forms of Threads and Fasteners:** Forms of threads, Squareheads, Acme threads. Types of joints

4 Hours

### UNIT 6

**Couplings:** Rigid & flexible types, Muff, Flanged and flexible couplings. Socket and spigot joint

4 Hours

## UNIT 7

**Pipe joints and Valves:** Flanged joint, Universal Joint, union joint, Safety valves, Globe valves, plug valves, ball valves

4 Hours

## UNIT 8

Conversation of pictorial views into Orthographic views

2 Hours

### Reference Books:

1. Engineering Drawing by N. D. Bhat – Charotra Publications, Anand, India, Delhi, 1989
2. Engineering Drawing by K. R. Gopalkrishna, Subhash stores, Bangalore, 2001
3. Machine Drawing by N. D. Bhat- Charotra Publications, Anand, India, Delhi, 1989.
4. Process equipment design by M. V. Joshi – Mcmillan India Ltd., Delhi, 2007
5. CAD-CAM – P N Rao

# SEMESTER VII

## Semester VII: Paper Coating & Conversion as DSE

Subject Code	DSE BASC – 1G	Credits	6
Teaching Hours/Week	5	IA Marks	20
Tutorial Hours/Week	1	Exam Marks	80
Total hours	60	Exam Hours	3

### UNIT – 1

**Introduction:** Introduction to paper conversion in brief giving general aspects of conversion.

2 Hours

### UNIT – 2

**Introduction to surface treatment:** Surface treatment of paper-surface sizing, different size press equipment, variables and control. Surface sizing materials and its preparations. Characteristics of surface sized papers and their application.

8 Hours.

### UNIT – 3

**Pigment Coating:** Introduction, purpose of coating, terminology of coating. Materials used in coatings, i.e. types of pigments, binders, dyes other additives. Coating colour preparation and formulation. Types of coating i.e. on machine coating and off-machine coating equipment and its

control. Drying systems. Types and applications of coated papers.

12 Hours.

#### UNIT – 4

**Paper lamination embossing:** Introduction history of Laminates, description of Laminating processes and its variables. Papers used in Lamination, Types and role of resins used in paper laminates. Introduction to embossing, process of embossing and its application.

6 Hours

#### UNIT – 5

**Corrugation of paper:** General, characteristics of corrugated board, flutings and creeping for corrugation, corrugating machines and its operation. Adhesives used for corrugation. Testing corrugated papers, box fabrication and end uses.

6 Hours

#### UNIT – 6

**Pulp moldings:** History Technology of pulp moldings manufacture techniques, properties of pulp molded products applications and future of pulp moldings.

2 Hours

#### UNIT – 7

**Nonwovens:** Introduction, Definition, nonwoven fibers, natural and manmade fibers used in wet laid and dry laid nonwovens, method of manufacturing principle, formation bonding and finishing. Types of nonwoven products, properties, testing and end use of nonwoven.

8 Hours

#### UNIT – 8

**Synthetic and man made fibers used in paper:** synthetic and man made fibers used in paper ,advantages, slurry preparation, forming drying and calendaring. Advantages and disadvantages and their applications

6 Hours

#### UNIT – 9

**Noncellulosic Fibers:** Noncellulosic Fibers used in papermaking Merits and demerits and their Applications

4 Hours

#### UNIT – 10

**Tissue paper manufacture:** Introduction, the tissue making process, design and construction, the creeping process, characteristics, Testing and applications of tissues.

6 Hours

#### Reference Books:

1. Pulp and Paper Manufacture Volume 8 Coating, Converting edited by Michael Kouris Published by Joint textbook committee of the Paper Industry
2. Industrial and Speciality Papers, Robert H. Mosher, Volume I to IV Chemical Publishing Co. Inc. New York, 1969
3. The essential guide to Aqueous coating of paper and Board edited by TWR Dean TAPPI Press.

### Semester VII: Polymers used in Paper Industry as DSE

Subject Code	DSE BASC – 1G	Credits	6
Teaching Hours/Week	5	IA Marks	20
Tutorial Hours/Week	1	Exam Marks	80
Total hours	60	Exam Hours	3

### UNIT – 1

**Introduction:** Basic definitions, Polymerisation, Functionality and their monomers, Degree of polymerization.

2 Hours

### UNIT – 2

**Classification of Polymers:** Natural and synthetic polymers, thermoplastics and thermosetting resins, addition and condensation polymers, Elastomers, fibers, resins and plastics.

6 Hours

### UNIT – 3

**Polymerisation:** Addition polymerization, condensation polymerization, methods of polymerization. Molecular weights of polymers, Glass transition temperature, Resins and Plastics and their applications. Polymer blends and Alloys. Polymer auxiliaries, Plasticisers, Stabilisers and Lubricants

12 Hours

### UNIT – 4

Manufacture, processing and properties and applications of Urea formaldehyde, phenol formaldehyde and melamine formaldehyde, Polyethylene, polypropylene, polyvinyl chloride, Polystyrene, polyacrylonitrile, polyisoprene, poly butadiene, polystyrene butadiene, poly(acrylonitrile butadienestyrene), Nylon6, nylon66, polyethylene and their phthalates.

12 Hours

### UNIT – 5

**Plastic laminates:** Manufacture of plastic laminates, decorative laminates and industrial laminates.

4 Hours

### UNIT – 6

**Polymers:** Polymers used in specialty processes, special co extrusion adhesives, Cellulose derivatives (Film forming resins), Vinyl polymers (Film forming resins), Terpene resins, Silicone resins, Chlorinated Poly phenols

12 Hours

### UNIT – 7

**Extrusion Coating:** Primer coater, web dryers, Extruder, Co-extrusion, extruder controls, coater laminator

6 Hours

### UNIT – 8

**Hot wax based treatments:** Introduction, ingredients and formulation, application equipment, evaluative performance tests, uses and markets.

6 Hours

### References Books:

1. Pulp and Paper Manufacture Volume 8 Coating, Converting edited by Michael Kouris Published by Joint textbook committee of the Paper Industry
2. Industrial and Speciality Papers, Robert H. Mosher, Volume I to IV Chemical Publishing Co. Inc. New York, 1969

## Semester VII: Pollution abatement in Paper Industry as DSE

Subject Code	DSE BASC – 2G	Credits	6
Teaching Hours/Week	5	IA Marks	20

Tutorial Hours/Week	1	Exam Marks	80
Total hours	60	Exam Hours	3

#### UNIT – 1

**Introduction:** Air pollution Definition and causes of Photochemical Smog, Acid Rain, Green House effect.

2 Hours

#### UNIT – 2

**Classification of Air Pollutants:** Gaseous Pollutants, Particulate Pollutants, Aerosol Pollutants, Pesticides, Metallic Contaminants, Carcinogenic, Radio Active Pollutants, Biological Contaminants.

4 Hours

#### UNIT – 3

**Air Pollution in paper mill:** Definition Units of expression- classification of pollutants-sources of pollution on the receiving environment-organic pollutants inorganic pollutants like carbon CH<sub>2</sub>, CH, CH<sub>3</sub>, SCH<sub>3</sub>, compounds, sulphur photochemical oxidants biological and nonbiological odorous pollutants. Odour and Noise pollution air pollutants from different units of paper mill.

12 Hours

#### UNIT – 4

**Techniques for Air Pollution Control:** Zoning, Air pollution Control at Source, Installation of Controlling Devices and Equipment, Control by stack, by planting trees and growing vegetation. Advances in pollution control methods-measures to minimize air pollution Absorption adsorption, combustion and other control of gaseous pollutants, filter bags, ESP and wet scrubbers.

6 Hours

#### UNIT – 5

**Water Pollution:** Sources and characteristic of water pollution, pollutions from different unit operations of the mill practices followed to minimize the generation of pollution at source ex. Close Kraft's mill concept, effluent treatment-primary, secondary, biological and tertiary treatments, advances in pollution control methods, analysis methods for COD, BOD, AOX, pH, colour, suspended solids and other pollutants.

10 Hours

#### UNIT – 6

**Solid waste:** Definition, characteristics and perspectives of solid waste. Types of solid waste. Physical and chemical characteristics Solid waste utilization and disposal in paper mills.

6 Hours

#### UNIT – 7

**Environmental managements, legislations and methods:** Introduction to regulations and statutory requirements Solid, water and air pollutants in paper industry. ISO 14000 systems. Environment protection Act, Air (Prevention and Control of pollution) Act, Water (Prevention and Control of pollution) Act, Forest conservation Act, Issues involved in enforcement of environmental legislation, Public awareness.

10 Hours

#### UNIT – 8

**Process modifications:** Process modifications in stock preparations, paper machine, Kraft mill processes, high yield processes like NSSC, TMP & RMP process modifications, new pulping and bleaching technologies for pollution abatement, colour removal monitoring and control of paper



industry emissions including odour pollution.

10 Hours

### References Books:

1. Pollution control in process Industries - S. P. Mahajan, TATA Mcgrow Hill Publishing Company Ltd., New Delhi, 1985
2. Industrial Environmental Control Pulp and Paper Industry - Allan M. Springer 3rd Edition
3. Environmental Chemistry, Sameer K. Banerji, 1999, Prentice Hall of India, New Delhi.
4. Environmental Chemistry, A.K. Day – New Age International Ltd. Publishers 1994, Wiley Estern Ltd., New Delhi.
5. Environmental Encyclopedia edited by William P. Cunningham, Jaico Publishing House, Mumbai, 2001

## Semester VII:Bio technology in Paper Industry as DSE

Subject Code	DSE BASC – 2G	Credits	6
Teaching Hours/Week	5	IA Marks	20
Tutorial Hours/Week	1	Exam Marks	80
Total hours	60	Exam Hours	3

### UNIT – 1

**Introduction:** Concept of Industrial Biotechnology, An introduction to Microbiology, Structure of cells, Prokaryotes and Eukaryotes, Different trends in classification of Microorganisms.

4 Hours

### UNIT – 2

**Enzymes and Proteins:** Detailed structure of Proteins and Enzymes. Functions. Methods of Production and Purification of Enzymes. Nomenclature and classification of Enzymes. Kinetics of Enzyme action. Enzyme inhibition

4 Hours

### UNIT – 3

**Culturing of Microorganisms:** Culture media- synthetic and non synthetic – solid, liquid and semi solid media. Special media – enriched, selective, transport, differential, enrichment media, methods of isolation of bacteria, fungi – serial dilution, pour plate, spread plate and streak plate. Maintenance of pure cultures. Cultivation of Anaerobic bacteria - Anaerobic jar method.

6 Hours

### UNIT – 4

**Enzymatic Deinking and refining:** Enzymatic deinking – Application of Enzymes in the deinking process to reduce the need for chemicals, Merits and demerits. Enzymatic refining – Application of Enzymes in the refining process to reduce the refining time and amount of electricity. Effect of enzyme cellulase on cellulose fibres during refining.

8 Hours

### UNIT – 5

**Drainage improvement and Bleach Boosting:** Poor drainage properties of Secondary fibers. Cellulase and hemicellulase treatment of ONP, OCC, and virgin. Enzymatic treatment of the linerboard furnish with crude cellulase to improve drainage and to increase the compression strength. Enzymatic delignification, Fungal treatment of wood chips for chemical pulping, organosolv pulping, biomechanical and dissolving pulp production Effect of xylanase on lignin. Bleach Boosting technique used in the treatment of kraft pulp.

8 Hours

#### UNIT – 6

**Enzymetic Starch hydrolysis Stickies control and pitch control:** Coating and surface sizing of paper using modified starches, preparation of starch pastes, Modifying starch with Amylase enzymes. Merits and demerits. Mechanical and chemical cleaning to remove stickies. Use of enzyme esterase to hydrolyse the PVAc and to remove stickies and to reduce downtime of the paper machine. Pitch deposit problem for thermo-mechanical pulp (TMP) and ground wood pulp (GP) mills, frequent shutdowns and inferior pulp quality problems due to Pitch deposits, enzymatic pitch control technology.

12 Hours

#### UNIT – 7

**Biomass:** CO<sub>2</sub> emission reductions from transportation using Biofuels. Conversion of lignocellulosic biomass to ethanol. Liberation of sugars from biomass feed stocks and conversion of cellulose and hemicellulose sugars in polymeric form by enzymes to fermentable monomers and subsequent fermentation.

8 Hours

#### UNIT – 8

**Down stream processing (Enzyme application in effluent treatment):** Waste treatment of Kraft effluent by white rot fungi. Strategies and steps involved in product purification. Methods of cell disruption, Filtration, centrifugation, sedimentation, Chromatography, freeze drying / lyophilization, Membrane separation Technology, Reverse Osmosis, Ultra filtration, Micro filtration, Dialysis. Reducing the colour of the effluent stream using Enzymes like Laccase.

10 Hours

#### Reference Books:

1. Biotechnology in the pulp and paper industry- 8th ICBPPI by Liisa Viikari; R Lantto; ScienceDirect (Online service) Amsterdam ; New York : Elsevier, 2002.
2. Lignocellulose biotechnology- future prospects by Ramesh Chander Kuhad; Ajay Singh New Delhi : I.K. International Pub. House, ©2007
3. Biotechnological Applications of Microbes-Volume II Editor(s): Ajit Varma, Gopi K. Podila ISBN:9788188237319, 2005
4. Environmentally friendly technologies for the pulp and paper industry-Raymond A Young; Masood Akhtar New York : J. Wiley, 1997.
5. Wood and Cellulosic Chemistry-Second Edition, Revised, and Expanded David N.- S. Hon, Clemson University, South Carolina, USA; Nobuo Shiraishi Kyoto, JAPAN Cat. #: DK1364 ISBN: 9780824700249 ISBN 10: 0824700244
6. Handbook on Bioethanol Production and Utilization ISBN:978-1-56032-553-6
7. The Realm of Industrial Biotechnology – Ashok Pandey – Asia Tech Publishers New Delhi.

### Semester VII: Management and Costing DSE

Subject Code	DSE BASC – 3G	Credits	6
Teaching Hours/Week	5	IA Marks	20
Tutorial Hours/Week	1	Exam Marks	80

Total hours 60 Exam Hours 3

**UNIT – 1**

**Industrial organization:** General principles of organization-Types of organization charts, merits and demerits span of control delegation of responsibility and authority, leadership, types of leadership motivation.

6 Hours.

**UNIT –2**

**HRD:** Recruitment training job interviews types of interviews preparation for interview employees, health insurance and compensation incentives Provident fund, industrial safety.

6 Hours.

**UNIT – 3**

**Quality and Reliability:** Basics of SQC, concepts of reliability optimization quality inspection and quality control TQM maintenance methods ISO certification. Factory Act- Payment of wages act workmen's compensation act employees state insurance act, IBR Acts and Rules.

6 Hours.

**UNIT – 4**

**PERT/CPM & Material Handling:** Basics of PERT & CPM simple problems production planning and control. Importance, principles & functions, types of material movement, material handling equipment's.

6 Hours.

**UNIT – 5**

**Purchase and sales management:** Basic inputs for production, capital, land, materials - cost factors Methods of purchasing market research, selling and marketing advertisement, storekeeping, inventory control.

6 Hours.

**UNIT – 6**

**Cost accounting:** Introduction and scope of Cost Accounting Cost Classification Accounting for Direct Costs Accounting for Indirect Costs, Overhead costs

6 Hours

**UNIT – 7**

**Methods of costing:** output costing, operating costing, job costing, contract costing, process costing.

6 Hours.

**UNIT – 8**

**Overhead costs:** Activity Based Costing Methods Marginal Costing BEP and CVP Analysis- cases Decision making cases and Budgeting cases Standard Costing and Variance Analysis Standard Costing cases and introduction of cost audit.

6 Hours

**UNIT – 9**

**Management accounting:**Preparation of cost sheet, Treatment of stock in cost sheet, Budgeting as tool of Management Accounting -Uses & applications, Different types of Budget -Master budget, Flexible budget & cash budget – case studies

6 Hours

**UNIT – 10**

**Variance analysis:** A case study, Marginal Costing - Meaning and rationale, Tools & techniques of Marginal Costing, Applications of marginal costing in management decision making. ABC Concept, Methods/Techniques in Manufacturing industry/Service industry. Management Control system - Tools & Techniques.

6 Hours.

**References Books:**

1. Industrial Engineering and management science - TR Banga AK Agarwal and SC Sharma
2. Business organization and principles of management - Basu Mc Graw Hill.
3. Industrial Engineering and management science - Banga Agarwal
4. Cost and Accounting – A Basic Approach by PT Pattanshetty and DR Palekar
5. Cost Accounting by S P Jain and K L Narang
6. Cost T management Accounting by GB Baligar

**Semester VII: Electronics and Communication Engineering as DSE**

Subject Code	DSE BASC – 3G	Credits	6
Teaching Hours/Week	5	IA Marks	20
Tutorial Hours/Week	1	Exam Marks	80
Total hours	60	Exam Hours	3

**UNIT – 1**

**Conduction in Semiconductors:** Concept of conductor, insulator & semiconductor, Energy band diagram, Bonds in semiconductor, commonly used semiconductors, Intrinsic and Extrinsic semiconductor, Electrons and holes in an intrinsic semiconductor, conductivity of a semiconductor, Effect of temperature on semiconductor, carrier concentrations, donor and acceptor impurities,

10 Hours

**UNIT – 2**

**Semiconductor and Diode Characteristics:** Qualitative theory of a PN-junction, PN junction as diode. Volt-Ampere characteristics, temperature dependence of P-N characteristics, Half wave and Full wave rectifiers, other fullwave circuits, ripple factor, capacitor filter; Zener diode characteristics, Zener and avalanche breakdown, zener regulated power supply.

8 Hours

**UNIT – 3**

**Transistor Characteristics:** Junction transistor, transistor current components, transistor as an amplifier, common-base configuration, common-emitter configuration, CE cut-off region. CE saturation region, large signal, DC and small-signal CE values of current gain, operating point, bias stabilization, cascading transistor amplifiers, decibel; Classification of amplifiers, distortion in amplifiers, frequency response of an amplifier, RC coupled amplifier.

10 Hours

**UNIT – 4**

**Electronic Devices:** Electronic Circuits, classification of amplifiers, single stage cascade and push pull amplifiers, introduction to feedback amplifiers, principles of oscillation.

6 Hours

#### **UNIT – 5**

**Communication Systems:** Basic block diagram of communication systems modulation, Amplitude Modulation, frequency spectrum, power relations. Phase and Frequency Modulation, frequency spectrum, comparison of AM and FM radio telegraphy, radio telephony, super heterodyne receiver, Mill-wide computer systems, Local area networks, Standardized: the ISO/OSI model, Manufacturing Automation protocol, Non ISO standard protocol (TCP/IP)

10 Hours

#### **UNIT – 6**

**Distributed control system and programmable logic controllers:** Function, history, Architecture, communication, Integration of DCS/PLC.

6 Hours

#### **UNIT – 7**

**Digital Electronics:** Digital logic-Binary numbers, number base conversion, Octal and Hexadecimal numbers, complements, Binary addition and subtraction using One's and Two's complements, addition and subtraction in other number system, fractional numbers and BCD numbers, Binary logic symbols, basic theorems and properties of Boolean Algebra, De-Morgan's theorem AND, OR logic gate realization using diodes, NOT gate using transistor, Diode-Transistor Logic (DCTL), Current Mode Logic (CML), and Transistor-Transformer Logic (TTL), symbols used for NOT, OR, AND, NAND, XOR gates and their truth tables, Boolean functions, Half adder, Full adder and Parallel binary adder, introduced to sequential logic circuits, working of an R-S Flip-flop (transistor version NAND/NOR version)

10 Hours

#### **Reference Books:**

1. Electronic Devices and Circuits: Millman and Halkains, TMI 1991, Reprint 2001 (T1)
2. Electrical, Electronics & Computer Engineering for Scientists and Engineers Second Edition K A Krishnamurthy & M R Raghuvver New age international Publishers
3. (Wiley Easten) 2008 (T2)
4. Electronic Communication Systems, George Kennedy, TMGH Co. Ltd., New Delhi, 1999
5. Electronic Principles A.P Malvino, TMGH Co. Ltd., New Delhi, 2008.
6. Digital Logic & Computer Design, Morris Mano PHI, EEE (R3)
7. Basic Electronics by V.K Mehta
8. Pulp and Paper Manufacture Volume 10 Mill – Wide Process Control & Information Systems –edited by Donald B. Brewster and Michael J. Kocurek

## Semester VII: Industrial Training as SEC

Subject Code	BASC SEC1G	Credits	2
Teaching Hours/Week	2	IA Marks	10
Tutorial Hours/Week	0	Exam Marks	40
Total hours	30	Exam Hours	1.5

Industrial Training to be conducted for 30 days during the vacation after VI semester as planned by the Head of the institution assigning the mills for training. The various departments in which the students should undergo training will be distributed by the Head of the Department and training officer/ Incharge in deputed mill.

The student after completion of training should submit the training report of about 100 typed thesis size pages and maintain daily diary. The reports duly signed by the Head of the Department and Head of the institution will be evaluated during practical examination at the end of VII th Semester

***The inplant training report will be evaluated out of 50 marks. The viva and report evaluation will be conducted by the Examination Panel constituted by the University consisting of at least one member from Paper Industry. The Panel will submit a comprehensive viva and report mark list to the University.***

### **Distribution of marks**

IA marks/Performance report	- 10 marks
Report Evaluation	- 20 marks
Oral/Viva	- 10 marks
PowerPoint presentation	- 10 marks
<b>Total :</b>	<b>50 marks</b>

## SEMESTER VIII

### Semester VIII: Printing and Packaging as DSE

Subject Code	DSE BASC – 1H	Credits	6
Teaching Hours/Week	5	IA Marks	20
Tutorial Hours/Week	1	Exam Marks	80
Total hours	60	Exam Hours	3

#### UNIT - 1

**Base paper for Printing:** Introduction to printing. Different grades of paper for printing, News paper, cartridge, craft, duplex, tissue, blotting, map litho, bond, art paper, coated and uncoated, book publishing and paper boards, paper related printing problems, their causes and remedies

8Hours

#### UNIT - 2

**Printing Inks:** Types of printing inks, formulation, Ink component, methods of ink drying and ink terminology, printing problems related to printing inks, their causes and remedies

4 Hours

#### UNIT - 3

**Types of printing:** Commonly used printing processes – Letterpress, gravure, flexographic and offset, non impact printing, Screen-printing. – Machine parts, working principle and base paper requirements and applications Limitations of Process Latest trends in printing, Waterless lithography, dot matrix printing, inkjet printing, laser printing and digital printing

12Hours

#### UNIT - 4

**Testing and predicting print quality:** Introduction, nonprinting tests, ink holdout printing tests, evaluation of paper and paper board for printing,

6Hours

#### UNIT - 5

**Introduction to packaging:** Introduction, elements of packaging, scope of packaging, requirements of good packaging

2Hours

## UNIT - 6

**Base paper for Packaging:** Different grades of paper required for packaging - Rigid packaging, Paper and paper based packaging materials, kinds of boards, solid board, food approved board, corrugated board, paper cartons, folding cartons, boxes multiply, types of flute, pitch, thickness Layout of various carton styles – Universal, Reverse tuck end, Make ready for carton punching, layout designing Die making- Unit die, jigged die punching, scoring, box building, flat stitching machine, labels of packaging

12Hours

## UNIT- 7

**Industrial packaging papers:** Base paper requirements for textile paper cones, paper cores, edge protectors, fiber drums, box boards, boxes and cartons Extensible sack kraft papers. Various printing processes used for packaging

6 Hours

## UNIT -8

**Specialized packaging papers:** Food packaging papers, base paper requirements, tetrapak and aseptic packaging papers, methods of storage and packing of foods, pharmaceuticals, cosmetics and chemicals, rules and regulations

8 Hours

## UNIT -9

**Packaging and life cycle:** Packaging life cycle, environmental aspects, recovery and recycling, waste disposal, bans and restrictions

2 Hours

### Reference books:

1. Printing Science – Young and Pateman
2. Printing basic science – Wallis- Pergaman
3. What the printer should know about ink- Scarlett – GATF
4. What the printer should know about paper – Bureau - GATF
5. Printing fundamentals by Alex Glassman, Tappi Press (1985)
6. Printing by Pirkko Oittiren, Vol. 13, Papermaking Science and Technology Series of TAPPI and Finish Paper Engineers Association. (1998)
7. Package printing by N. R. Edward (1993), TAPPI Press.
8. Handbook of printing processes- GATF
9. Survey of printing processes- Krishnamurthy
10. Printing Technology- Delmar publication
11. Converting for flexible packaging by A. Miller, 1994. Tappi



## Semester VIII: Paper evaluation, defects and control as DSE

Subject Code	DSE BASC – 1H	Credits	6
Teaching Hours/Week	5	IA Marks	20
Tutorial Hours/Week	1	Exam Marks	80
Total hours	60	Exam Hours	3

### UNIT – 1

**Paper evaluation:** Review of paper testing and process properties relationship paper defects and their remedies. Importance of paper properties in defining usage of paper. Effect of atmosphere conditions on paper properties. Statistical aspect of testing sampling, standard conditioning of sample and its testing.

4 Hours

### UNIT – 2

**Physical properties of paper:** Grammage, Thickness, Density, Porosity, Smoothness, Softness and Hardness Dimensional Stability and Curl

4Hours

### UNIT – 3

**Mechanical properties of paper:** Stress, Strain, Tensile strength, Bursting strength, Tearing resistance, Folding, endurance, Stiffness

6 Hours

### UNIT – 4

**Optical Properties of Paper:** Absorption of light, reflectance of light, colour of paper Tristimulus system Brightness, opacity and gloss-importance-measurement and factors affecting. Brightness reversion, shade matching for bleached paper effect of optical whiteners.

6 Hours

### UNIT – 5

**Electrical properties of paper:** Dielectric constant, dielectric strength importance and measurement, types of electrical papers.

4 Hours

### UNIT – 6

**Paper and Corrugated board testing:** Crush properties of paper board, flat crush, ring crush, plybond, stiffness & IGT printability,

8 Hours

**Note - Measurement control and significance of the above tests to be taught.**

### UNIT – 7

**Chemical properties of paper:** Chemical properties and measurement, importance of these tests, alpha cellulose, viscosity and copper number, Rosin content, moisture, ash durability and permanence of paper.

6Hours

#### UNIT – 8

**Functional Evaluation:** Paper Evaluation for special papers like MICR, Security Papers, Photographic papers. Functional performance tests for packaging papers

4Hours

#### UNIT – 9

**Testing and predicting print quality:** Introduction, Evaluation and testing of paper for its printing qualities, non printing tests, ink holdout printing tests, evaluation of paper board for printing

6 Hours

#### UNIT – 10

**Paper defects and control:** Paper related problems in papermaking, coating and printing, paper related common problems in printing and converting, Operating difficulties in Paper Machine poor formation, foam marks in the sheet, Basis weight variation in Machine and Cross direction, Low and high Brightness, Ash and Caliper too Low, Caliper variations, Picking & Crushing at dandy, press dryer, calendar defects, winder and slitter defects, linting, fuzz etc. Their causes and remedies.

12 Hours

**Note: Common problems faced at formation, pressing, drying, calendaring, coating, printing, and finishing with probable causes and remedies to be taught)**

#### Reference Books:

1. Joint textbook series volume 7 paper machine Operations edited by M. J. Kocurek and B.A.Thorp.
2. Hand book for Pulp and Paper Technologists - Gray A. Smook
3. Joint textbook committee volume 8 of the pulp and Paper manufacture series edited by M.J.Kocurek and Kouris.
4. Pulp and Paper chemistry and chemical Technology - volume I to III James P. Casey.
5. Paper Physics edited by Karrlo Niskanen.
6. Handbook of Pulp Volume I and II – edited by Herbert Sixta

### Semester VIII: Energy resources & Management as DSE

	2H		
Teaching Hours/Week	5	IA Marks	20
Tutorial Hours/Week	1	Exam Marks	80
Total hours	60	Exam Hours	3

### UNIT – 1

**Energy Resources:** Renewable and Non-Renewable Energy, Indian Energy Scenario

4 Hours

### UNIT – 2

**Converting System:** Forms of Energy : Electricity basics – DC & AC currents, Methods of producing various forms of Energy from Resources Thermal basics – Fuels, Thermal energy contents of fuel, Heat transfer, Units and conversion.

8 Hours

### UNIT – 3

**Transfer media:** Thermodynamics of Energy carrier/transfer media.

4 Hours

### UNIT – 4

**Energy storage and transfer:** Advances in Energy storage and transfer.

4 Hours

### UNIT – 5

**Energy Systems:** Instrumentation and Control of Energy Systems.

4 Hours

### UNIT – 6

**Design of Waste Heat Recovery Systems:** Classification, Advantages and applications, Commercially viable waste heat recovery devices, Saving potential.

6 Hours

### UNIT – 7

**Energy Management and Auditing:** Energy audit – need, Types of energy audit, understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution.

8 Hours

### UNIT – 8

**Fuels:** Introduction, Classification of fuels, Calorific value, Characteristics of good fuels. Composition between solid, liquid and gaseous fuels.

6 Hours

### UNIT – 9

**Scope for Energy conservation in paper mills:** Water recycling, VFDs for centrifugal pumps, Fans and blowers, Type of Steam and condensate systems for paper machines, heat exchangers, Insulation and refractories, Co-generation, Boilers, High efficiency motors, Compressed air system, Cooling towers, lighting systems.

16 Hours

### Reference Books:

1. Non-Conventional Energy Sources – GD Rai, 4<sup>th</sup> Edition, Second Reprint, 1997, Khanna Publications.
2. Engineering Chemistry – PC Jain & M. Jain, 10<sup>th</sup> Edition, 3<sup>rd</sup> Reprint, 1995, Dhanpat Rai & Sons.
3. BEE (Bureau of Energy Efficiency, Govt. of India) Books

## Semester VIII: Waste Management and recycleas DSE

Subject Code	DSE BASC – 2H	Credits	6
Teaching Hours/Week	5	IA Marks	20
Tutorial Hours/Week	1	Exam Marks	80



4 Hours

## UNIT – 8

**Case Studies:** Major Paper Industries and management methods used in typical industries. Types of solid wastes in paper mill and methods of solid waste utilization and disposal in paper mills.

10 Hours

### Reference Books:

1. Environmental Engineering – Howard S. Peavyetal, McGraw Hill International Edition, 1986.
2. Industrial Solid Waste Management and Land Filling Practice – Dutta etal, Narose Publishing House, 1999.

## Semester VIII: Process Designingas DSE

Subject Code	DSE BASC – 3H	Credits	6
Teaching Hours/Week	5	IA Marks	20
Tutorial Hours/Week	1	Exam Marks	80
Total hours	60	Exam Hours	3

## UNIT 1

**Properties of Metals:** Elastic and Plastic deformation hardening of metals and alloys An elastic behaviour of polymeric materials creep in metallic (Alloys) materials and viscoelasticity in plastics class transition temperature fracture Brittle, Ductile, Fatigue.

10 Hours

## UNIT 2

**Corrosion:** Type of Corrosion, Corrosion Mechanisms, Materials of Construction, Corrosion ProtectionMeasures

4 Hours

## UNIT 3

**Effect of system closure:** Recycling of water, methods, effect, challenges

4 Hours

## UNIT 4

**Stock Pumps and Piping:** Sizing of piping and pumps for stock flow in different sections of a pulp mill, powerrequirement for pumping.

2 Hours

## UNIT 5

**Process Equipment design:** Introduction - operating conditions - pressure vessel code - selection of material – vessel operating at low temperatures - vessels operating at high temperatures design conditions and stresses - design of shell and its components stresses from local loads and thermal gradients - thermal streses in cylinder shell supports of vessels Bracket or lug supports- leg supports

16 Hours

**UNIT 6**

**Design of tall vertical vessels:** Design of agitators - types - baffling - power requirements - drive for agitators - design of pipelines.

6 Hours

**UNIT 7**

**Storage vessels:** Introduction - storage of fluids large capacity storage tanks design aspects - design of tanks - nozzles and mounting.

6 Hours

**UNIT 8**

**Study of process parameters and metallurgy:** Study of process parameters and metallurgy for digester design, heat exchanger design and for multi effect heat exchanger design

12 Hours

**Reference Books:**

1. Process design of equipment - Dr /Dawande central Techno Publication Nagpur.
2. Process equipment design - M.V.Joshi.
3. Equipment design - Brownell and Young
4. Perry's chemical Engineer's Hand Book 7th edn Mc GrawHill 1997
5. Process design equipment S.P.Davande Central Retino Publications 1999
6. Chemical Engineering Volume VI (Design) Coulson and Richardson
7. Workshop technology - Hazara and chowdhary (vol I & II)

**Semester VIII:Computer Applications in Paper Industry as DSE**

Subject Code	DSE BASC – 3H	Credits	6
Teaching Hours/Week	5	IA Marks	20
Tutorial Hours/Week	1	Exam Marks	80
Total hours	60	Exam Hours	3

**UNIT – 1**

**Fundamentals of Computers and Operating Systems:** Evolution of Computers - Organization of Modern Digital Computers- Types of Operating system-Open Sources operating system- Linux/Mac/MS

6 Hours.

## UNIT – 2

**Open Source Office Automation:** Libre office and Google Office Applications Use of

Documents, ESS, Presentations, Interactive videos, quizzes and forms. Introduction of SPSS and sample case studies

6 Hours.

## UNIT – 3

**DBMS:** Introduction and SQL commands and queries – industry/services-based case studies

6 Hours.

## UNIT – 4

**Computer Networks and Internet:** Network Concepts, Categories of Network. Types, Seven Layers of the OSI Reference Model, Business through Internet, Introduction to Internet and services.

6 Hours.

## UNIT – 5

**E-commerce:** Concepts of Ecommerce, why ecommerce, Types of ecommerce, areas of ecommerce, types of transaction web, presenting an organization in web. Launching e-business.

6 Hours.

## UNIT – 6

**Electronic Payment Systems:** Online Electronic Payment Systems, Prepaid and Post-Paid Electronic Payment Systems Information Directories and Search Engines.

6 Hours.

## UNIT – 7

**Enterprise Resource planning (ERP) Introduction:** What is ERP -Need of ERP, Advantages of ERP, Growth of ERP, ERP and Related Technologies: Business process Reengineering (BPR), Management Information System (MIS), Decision Support Systems (DSS) Executive Support Systems (ESS), Data Warehousing, Data Mining, Online Analytical Processing (OLTP), Supply Chain Management (SCM), and Customer Relationship Management (CRM)

6 Hours

## UNIT – 8

**ERP Modules:** Finance Production planning, control & maintenance, Sales & Distribution, Human Resource Management (HRM), Inventory Control System, and Quality Management ERP Market,

6 Hours

## UNIT – 9



**ERP Implementation:** Life Cycles, Evaluation and selection of ERP package, Project planning,

Implementation team training & testing, End user training & Going Live, Post Evaluation & Maintenance, E-business, ISO 9000 – Quality check module, send and receive module etc.

6 Hours.

#### UNIT – 10

**Online practical problems:** Applications/Discussions/Building online workspace based on OER and softwares.

6 Hours.

#### Reference Books:

1. V. Rajaraman, Fundamentals of computer
2. Peter Norton, Introduction to computers
3. Sagman, Microsoft office for windows
4. Microsoft Office – Complete Reference – BPB Publication
5. SQL, PL\SQL – Ivan Bayross - BPB
6. Oracle PL\SQL programming –Urman - Tech Media
7. Enterprise Resource Planning - Alexis Leon
8. ERP Ware: ERP Implementation Framework –V.K. Garg & NK Venkitakrishnan
9. ERP: By Leon, ERP Concepts and Planning - Garg & Venkitakrishnan
10. Google corporations and khan academy

### Semester VIII: Project Work as SEC

Subject Code	BASC SEC1H	Credits	2
Teaching Hours/Week	2	IA Marks	10
Tutorial Hours/Week	0	Exam Marks	40
Total hours	30	Exam Hours	1.5

- ❖ The head of the institution shall at the beginning of the VIII semester assign to each student an independent topic, for project work.

- ❖ The topic for the project work shall deal with any aspect of the process side of the paper mill or laboratory
- ❖ Each student is expected to work under the guidance of an expert from the Paper Mill and a staff member to be assigned to him by the Head of the institution.
- ❖ The student has to visit the plant and collect data pertaining to his project work.
- ❖ A work diary shall be maintained for the Plant visits and data collection with dated entries and initials of the guide. This should be submitted along with the project report to the Head of the institution.
- ❖ As prescribed by the Head of the Institution and before the end of VIII semester, student shall submit to the Head of the institution the typewritten project report of approximately 100 typed pages of standard thesis/dissertation size.
- ❖ The report shall be supported, wherever necessary, by charts, drawings, flow sheets, tables, etc.
- ❖ Each student shall put in the following minimum of working hours during the semester for his project work and it shall count as the teaching hours.

Library and Reference work	10 Hours
Plant visit and Data Collections	15 Hours
Project Reviews	05Hours

**Total : 30 Hours**

- ❖ The students shall visit along with staff member to various paper mills in the country undertaking an Industrial Tour and submit the report at the time of examination.
- ❖ The Project Report and Tour Report should be certified by the Head of the department and Head of the Institution.
- ❖ **Examination:** There shall be one report evaluation and Viva voce at the end of VIII semester during practical examinations of 50 marks and the assessment shall be done on the following lines

i. Evaluation of Project Report	20 marks
ii. Viva Voce	10 marks
iii. Internal assessment	10 marks (To be given on the basis of reviews)
iv. PowerPoint presentation	05marks
v. Industrial Tour Report	05 marks

**Total : 50 marks**

***The Project report will be evaluated out of 50 marks. The viva and report evaluation will be conducted by the Examination Panel constituted by the University consisting of at least one member from Paper Industry. The Panel will submit a comprehensive viva and report mark list to the University.***

