



**WEST BENGAL STATE COUNCIL OF TECHNICAL & VOCATIONAL EDUCATION
AND SKILL DEVELOPMENT**

(A Statutory Body under Government of West Bengal Act XXVI of 2013)
Department of Technical Education, Training & Skill Development, Government of West Bengal
Karigari Bhawan, 4th & 5th Floor, Plot No. B/7, Action Area-III, Newtown, Rajarhat, Kolkata-700160

Memo No.: WBSCTVESD/TED/2024-25/2135

Dated 2nd August, 2024

**PROCEDURE & ELIGIBILITY CRITERIA FOR STARTING A NEW INSTITUTION WITH ADVANCED
DIPLOMA COURSES & POST GRADUATE DIPLOMA COURSES UNDER WBSCTVESD**

With respect to the affiliation of Advanced Diploma Courses, Post Graduate Diploma Courses & Certificate Courses under WBSCTVESD, the procedure of application, essential norms & standards & the eligibility criteria, are:

A. Process of Application by the Institution:

1. Institution to apply in hard copy, as per the eligibility criteria notified by the Council, to start the New Institution along with the required documents to the following address:
To
Chief Administrative Officer
WBSCTVESD, Government of West Bengal
Karigari Bhawan, 4th & 5th Floor, Plot No.
B/7, Action Area-III, Newtown, Rajarhat, Kolkata-700160
2. WBSCTVESD shall check the details, inspect the institution and then based on the inspection report affiliation as per Council norms may or may not be issued to the institution.

B. Documents to be submitted to WBSCTVESD for issue of No Objection Certificate

For application to start a New Institute, the mandatory documents to be submitted at 4th floor Karigari Bhawan, Rajarhat are:

1. Application letter of the institute with details of the institute address, Trust/Society & Contact details
2. By laws of the Registered body applying for the New Institution.
3. Board/Meeting Resolution of the institution, Trust/ Society to start the New Institution.
4. In case of OWN land/building, Land/Building Ownership document, latest land Revenue tax receipt, in the name of the institute or Trust.
5. In case of lease deed, a lease agreement of minimum 15 years is essential.
6. Rented building is not allowed.
7. Building Drawing with all classrooms and laboratories where off line classes must be conducted throughout the session, as per the criteria notified by the Council.
8. Faculty details with their qualifications as per eligibility criteria notified by the Council.

C. Eligibility Criteria to be fulfilled by the Institution

1. Infrastructure details of the institution,

	Required Number/ Course / Session	Required Area / Classroom, Sq.m	No of PCs / Equipment to students ratio	Printers including Colour Printer (% of total no of PC's)
Classroom (for 60 students)	1	66		
Laboratory (for 60 students)	1	66	1 equipment set : 4 students	
Computer Lab	1	150	1 PC:3 students	10%
Library & Reading Room	1	100		
Principal/ Head of the Institute	1			
Administrative Office room	1			
Faculty room	1			

2. Essential requirements for Technical Institution:

- Institution Website with mandatory Disclosure
- Secured Wi Fi facility & Purchase of most recent hardware in Computer lab
- Reprographic facility in the library is essential.
- Document scanning & printing facility in the library is essential.
- However subscription to E-Journals and National Journals is essential.
- Library books/non books classification as per standard classification methods is essential.
- General Notice board and departmental Notice Boards
- First Aid, Medical & Counselling Facilities
- Portable Water supply & outlets for drinking water at strategic locations.
- Separate toilets for ladies & gents with essential amenities.
- Electric Supply
- Sewage Disposal
- Telephone & FAX
- Vehicle Parking
- Motorized Road
- Safety provisions including fire & other calamities
- General insurance provided for assets against fire, burglary and other calamities
- Establishment of grievance Redressal Committee and Appointment of OMBUDSMAN in the institute
- Barrier Free Built Environment for disabled persons including availability of specially designed toilets for ladies and gents separately. Refer guidelines and space standards for Barrier free built environment for disabled and elderly persons by CPWD, Ministry of Urban Affairs & Employment, India.

3. Minimum Faculty Number required per Course

- Minimum 3 faculty member per course is essential

4. Minimum eligibility / entry educational qualification of the students

	Course	Duration	Faculty Qualification (Essential)	Student Educational Qualification & Experience (where applicable) (Essential):
	Advanced Diploma in Industrial Safety, (ADIS)	Full Time Course - Two Semesters: 1 year. Part Time Course - Three Semester: 1½ year	- BE / BTech with at least 5 year experience (Industry/Teaching) in the relevant field OR - ME/MTech or above with at least 3 year experience (industry/teaching) in the relevant field.	- A Degree from recognised University approved by AICTE with any branch of Engineering / Technology. OR - A Degree in Science of a University recognised by UGC with Physics, Chemistry & Mathematics. OR - A Diploma in any branch of Engineering or Technology recognised by the WBSCTVESD. Along with this educational qualification the candidate has to have the professional experience as stated below the below for ADIS course. NOTE: Equipment list if any provided by the Council need to be present at the institution.
	Advanced Diploma in Fire & Safety Management, (ADFSMD&I)	Full Time Course - Two Semester: 1 year. Part Time Course - Three Semester: 1½ year	- BE / BTech with at least 5 year experience (Industry/Teaching) in the relevant field. OR - ME/M.Tech or above with at least 3 year experience (industry/teaching) in the relevant field.	- A Degree from recognised University approved by AICTE with any branch of Engineering / Technology OR - Any Graduate from recognized university by UGC. OR - A diploma in any branch of Engineering / Technology recognized by the WBSCTVESD NOTE: Equipment list if any provided by the Council need to be present at the institution.
	Advanced Diploma in Construction Safety, (ADCS)	Full Time Course - Two Semester: 1 year.	- BE / B.Tech with at least 5 year experience (Industry/Teaching) in the relevant field. OR - ME/M.Tech or above with at least 3 year experience	- A Degree in Engineering / Technology in Mechanical, Civil & Construction Engineering of a recognized University approved by AICTE - A diploma in any branch of Engineering / Technology recognized

			(industry/teaching) in the relevant field.	by WBSCTVESD Graduate in Science from a recognized university approved by UGC with Physics, Chemistry & Mathematics NOTE: Equipment list if any provided by the Council need to be present at the institution.
	Advanced Diploma in Environmental Management and Sustainability (ADEMS)	Full Time Course - Two Semester: 1 year.	- A Bachelor degree in Engineering/ Science from Institution / University recognised by UGC/AICTE. With atleast 5-6 years' experience in relevant field. - A Post-graduate degree in Environmental Science / Environmental Engineering / Environmental Safety and Health Science/ Environmental Management from Institution / University recognised by UGC/AICTE, atleast 2 years of experience. NOTE: For Faculty Members teaching Environmental Auditing, Environmental Legislations, Fire Industrial - Process Safety – A bachelor degree in Engineering with a Post Graduate Diploma in Relevant field and 5years relevant experience may be considered.	- Graduation in Science or Engineering or Agriculture - OR - Diploma in Engineering from any University or affiliated college /Institute recognised by UGC / AICTE. NOTE: Equipment List as per the syllabus provided by the Council needs to be present at the institute.
	Advanced Diploma in Jute Technology and Automation (ADJTA)	Full Time Course - Two Semester Course: 1 year.	- BE / B.Tech with atleast 5 year experience (Industry/Teaching) in the relevant field. OR - ME/M.Tech or above with atleast 3 year experience (industry/teaching) in the relevant field.	- Graduate in Science / Engineering & Technology Or 3 years Diploma in Engineering & Technology Or - Graduate other than Science / Engineering & Technology with two years relevant experience* Or

				ITI with 3 years relevant experience* NOTE: 1. Students need to undergo a one month bridge course in basic mathematics and physics. 2. Equipment List as per the syllabus provided by the Council needs to be present at the institute.
	Post Graduate Diploma in Human Resource Development and Labour Welfare (HRDLW)	Full Time Course - Two Semester Course: 1 year.	- BE / B.Tech with 5 year experience (Industry/Teaching) in the relevant field OR - ME/M.Tech or Above with atleast 2 year (industry/teaching) experience in the relevant field.	Any Graduate from a recognized University NOTE: Equipment list/any essential requirement if provided by the Council need to be present at the institution.

VERY IMPORTANT:

ALL THE ABOVE MENTIONED COURSES ARE REGULAR COURSES AND HENCE REGULAR CLASSES & STUDENT ATTENDANCE ARE MANDATORY WITHIN THE TIME SLOT PROVIDED BY THE INSTITUTION. NO ONLINE CLASSES ARE ACCEPTABLE.

FOR ADIS COURSE,

Working Experience:

Practical experience in a Supervisory capacity or above for a period of 2 years in the case of Degree in Engg / Technology and 5 years in the case of Diploma in Engineering / Technology or Degree in Pgysics or Chemistry in the following fields:

Practical experience in Manufacturing, Maintenance or Safety Department in a factory as defined under The Factories Act, 1948. (Copy of factory License issued by CIF/DISH of the respective state is to be submitted).

OR

Building and other Construction works as defined under The Building and Other Construction Workers (Regulation of Employment and conditions of Service) Act, 1996. The establishment should have registered under the BOCW Act with respective Central or State Governments. (Copy of registration certificate under BOCW Act shall be submitted).

OR

DGFASLI/DISH approved Research, Training or Educational Institutes in the field of Industrial Safety

OR

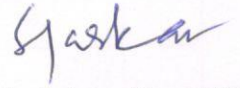
Government departments entrusted with the Administration of any Safety Legislation in India.

OR

Port or Dock work as defined under The Dock Workers (Safety, Health and Welfare) Act, 1986. The establishment/agency should have registration with the respective Port Authority or State Government.

NOTE:

- a. The qualifying experience shall be from any one of the above mentioned fields
- b. The foreign country work experience will not be considered.
- c. Experience in Consultancy Services will not be considered as a qualifying experience.
- d. Experience certificate from 3rd party contractor or construction or manpower outsourcing agencies or similar type of employment will not be considered as a qualifying experience.
- e. Experience during training period or probationary period or Apprentice will not be considered as a qualifying experience



Chief Administrative Officer

WBSCTVESD

**West Bengal State Council of Technical &
Vocational Education and Skill Development
(Technical Education Division)**



**Syllabus
of
Advanced Diploma in Technology and Automation of
Jute Fibre Processing
(ADTAJFP)**

1 year (Full time)

2024

ONE YEAR ADVANCED DIPLOMA IN TECHNOLOGY AND AUTOMATION OF JUTE FIBRE PROCESSING

Eligibility for Admission

Graduate in Science / Engineering & Technology

Or

3 years Diploma in Engineering & Technology

Or

Graduate other than Science / Engineering & Technology with two years relevant experience*

Or

ITI with 3 years relevant experience*.

Duration

Two Semester Course: 1 year.

****A bridge course with basic mathematics and physics to be incorporated with one month duration***

Course curriculum:

Advanced Diploma in Technology and Automation of Jute Fibre Processing					
First Semester					
Sl. No.	Module Title	Contact Hours / Week	Theory (Marks)	Practical (Marks)	Total Marks
		L - T - P			
TAJF - 101	Introduction to Industrial Control and Automation Systems	4 - 1 - 2	100	50	150
TAJF - 102	Basics of Electrical Engineering and Power Electronics	4 - 1 - 3	100	50	150
TAJF - 103	Jute Yarn Manufacturing	4 - 1 - 3	100	50	150
TAJF - 104	Basic Maintenance and Jute Mill Machinery	4 - 1 - 2	100	50	150
	Total:				600
Second Semester					
Sl. No.	Module Title	Contact Hours / Week	Theory (Marks)	Practical (Marks)	Total Marks
		L - T - P			
TAJF - 105	Sensors and Actuators used in Jute Machinery	4 - 1 - 3	100	50	150
TAJF - 106	Jute Fabric Manufacturing	4 - 1 - 3	100	50	150
TAJF - 107	Jute Diversified Product	2 - 1 - 0	50		50
TAJF - 108	Statistical Quality Control for Jute	4 - 1 - 2	100	50	150
TAJF - 109	Project on Industrial application related to automation in material handling, Jute / Textile processing	0 - 1 - 5		100	100
	Total:				600

- Semester-1 & 2 is of 18 weeks duration of which 15 weeks for contact week, 2 weeks for Internal Assessment.
- Each week consists of 30 contact periods including tutorials and practical. Each period will be of one-hour duration.
- Mark distribution in Semester - 1 & 2:- 600 in Semester - 1 and 600 in Semester - 2: Total 1200.
- Hour of examination for semester examination is 3 hours.
- Classes will be held five days in a week (including two days Lab/Industry Visit) for the one-year course.

Name of the Course: Introduction to Industrial Control and Automation Systems.		Duration: 18 Weeks
Course Code: TAJF/T - 101	Maximum Marks: 100	
Semester: First	Internal Continuous Assessment: 25 Marks	
Teaching Scheme: Theory – 4Hrs./week	Semester End Exam: 75 Marks	
Course Objectives:		
1.	Introduction to PLC hardware, programming, interfacing and diagnostics.	
2.	Implementing automatic close loop control using a PLC.	
3.	Study of the speed control of a 3-phase AC Induction Motor using a Variable Frequency Drive (VFD). Introduction to hardware, configuration, operational aspects, performance, safety features, and diagnostics.	
Course Contents:		
Chapter 1		18 Hours
	Number systems: Decimal, binary, hexadecimal, BCD. Boolean Algebra. Basic logic gates. Simplification of Boolean expressions, binary addition and subtraction-1's compliment and 2's compliment, signed binary numbers. combinational and sequential circuits: multiplexers, demultiplexers, decoders, encoders, shift registers, latches. ADC and DAC (block level functional representations). Relay based logic systems, Evolution of Programmable Logic Controllers (PLC).	
Chapter 2		18 Hours
	Compact and modular PLCs. Components of a PLC. Hardware – selection of PLC components - Processor, Memory, Communication interface, Digital / Analog - Input and Output modules: Types of Inputs & outputs, Source and Sink Concepts. Connecting Field devices to PLCs I/Os. Familiarization with NEMA / IEC symbols used to represent input, output and field devices. Concept of remote & distributed I/O. Concept of scan cycle execution, scan time, process input-output image. IEC 61131 programming languages.	

Chapter 3		18 Hours
	Open loop and close loop control, components of an automatic feedback control loop, on-off controller, continuous controller, controller modes and tuning, close loop response. Implementing automatic close loop control using the integrated PID block.	
Chapter 4		18 Hours
	Speed control of induction motor, stator voltage control, variable frequency control, necessity of maintaining V/F ratio. Block diagram of a VFD. Used for speed control or motion control (servo) operation. Load types – constant torque or variable torque. Mode of operation; open loop control, closed loop control with or without speed feedback. Stepper motor drives. Half and full stepping.	
1. PLC training kit with CPU,DI,DO, AI,AO card 2. AC VFD with Motor 3. HMI with Ethernet Port (Software: TIA portal v18) 4. DOL, STAR DELTA STARTER TRAINING PANEL 5. SENSORS : PROXIMITY, LEVEL SENSOR, LOAD CELL 6. Desktop with Windows 10 i5 processor, minimum 8 GB RAM 7. Software : Step7 MicroWIN SMART 8. Measuring instrumental : Voltmeter, Ammeter, Multi meter		
References:		
1. Programmable logic Controllers by W. BOLTON 2. Programmable Logic Controllers Principles and Applications by John W. Webb – Ronald A. Reis., 5th Edition, Published by PHI Publication. 3. Introduction to PLCs by Gary Dunning, 3rd Edition, Thomson India Edition 4. Electric Motors and Drives by Austin Hughes and Bill Drury.		

Name of the Course: Industrial Automation Laboratory		Duration: 18 Weeks
Course Code: TAJF/P – 101		Maximum Marks: 50
Semester: First		Internal Continuous Assessment: 25 Marks
Teaching Scheme: Practical - 2 Hrs./week		Semester End Evaluation: 25 Marks
Course Objectives:		
1.	Study of PLC hardware. PLC program development (using Ladder diagram), program execution & testing. Interfacing Input – Output devices to the PLC.	
2.	Development of a HMI for process visualization and user interactions.	
3.	Study of the operational aspects, features and performance of a Variable Frequency Drive used to control a 3 phase Induction Motor.	
4.	Shall be able to develop PLC based automation systems with HMI for the control of simple processes and machines.	
List of Experiments:		
Sl. No:	Name of the Experiment	Hours
1.	Implementation of a Control Relay based logic circuit: Use push buttons and a control relay to implement logic to operate an AC Motor.	2
2.	Introduction to PLC Programming Software: Familiarization with the PLC programming software. Setting up the PLC. Connecting power supply, CPU, I/O modules, and Communication port. PLC Hardware configuration, various types of modules supported by the PLC and their specifications, concepts of Input-Output addressing, defining Tags, writing simple Ladder Diagram programs using contacts and coils, program execution in PLC.	4
3.	Basic Ladder Diagram Programming: PLC Data types, Implementation of basic Logic Functions using contacts and evaluating those using switches, push-buttons and indicators connected to the PLC. Use of SR latches and edge-detection instructions. PLC memory addressing.	3
4.	PLC trouble-shooting and Diagnostics: CPU operating modes. Forcing I/O & Toggling Bits, monitor, modify inputs and outputs. Scan time monitoring. Monitoring the status of PLC modules. CPU, I/O module replacements.	

5.	Input-Output wiring methods: Connecting transducers, actuators and input - output devices to the PLC Digital and Analog I/O modules.	2
6.	Timers and Counters Function Blocks: Study of various Timer and Counter functions supported by the PLC.	3
7.	Additional Programming Functions: Study of Arithmetic functions, Comparison functions, Shift & Rotate, Program control instructions.	2
8.	Development of HMI: Development of a Human Machine Interface / SCADA for process visualization and user inputs. SCADA Screen: Creating & editing graphic display with animation, real time trending and Alarms.	6
9.	PLC based Close Loop Control: Study of the PID-control function block for close loop control. Observe how change of controller parameters affects loop response.	4
10.	PLC Mounting and Control panel wiring practices.	2
11.	Use of a Variable Frequency Drive (VFD) to control the speed a 3-phase Induction Motor: Wiring the VFD to the Motor and power supply, setting up by VFD by defining Motor parameters and VFD operating mode. VFD operation. Defining advanced functions- acceleration / deceleration, motor braking, jogging, and protection. VFD – PLC interfacing, controlling motor operation from PLC.	6
12.	Study of a Stepper Motor and its Drive Electronics.	2

Tools, Equipment and Other Requirements

1. PLC training kit with CPU,DI,DO, AI, AO card
2. AC VFD with Motor
3. HMI with Ethernet Port (Software: TIA portal v18)
4. DOL, STAR DELTA STARTER TRAINING PANEL
5. SENSORS : PROXIMITY, LEVEL SENSOR, LOAD CELL
6. Desktop with Windows 10 i5 processor, minimum 8 GB RAM
7. Software: Step7 MicroWIN SMART
8. AC Motor with AC drive
9. Servo Motor with drive
10. Measuring instrumental: Voltmeter, Ammeter, Multi meter

Name of the Course: Basics of Electrical Engineering and Power Electronics		Duration: 18 Weeks
Course Code: TAJF/T - 102		Maximum Marks: 100
Semester: First		Internal Continuous Assessment: 25 Marks
Teaching Scheme: Theory – 4Hrs./week		Semester End Exam: 75 Marks
Course Objectives:		
1.	To introduce the basic concepts of DC and AC circuits.	
2.	Providing an overview of the construction, operating principles and application aspects of DC and AC machines.	
3.	Introduction to solid state switching devices and an overview of DC-DC converters and Inverters.	
Course Contents:		
Chapter 1		24 Hours
	DC-Circuits: Basic electrical quantities: voltage, current, resistance, power, energy. Ohm’s law. Resistances in series and parallel. Kirchhoff’s laws, super position and maximum power transfer theorems. Single-phase AC Circuits: Sinusoidal and non-sinusoidal waveforms, waveform parameters, AC Through pure resistor, inductor and capacitor. Concept of impedance, RLC circuits, Power in AC circuits, Power Factor. 3-Phase AC Circuits: 3-phase supply, Line and Phase voltage and current in Star and Delta connected circuits, 3-phase power. Electrical wiring practices, Cables, Protective Devices, Earthing. Single Line Diagrams.	
Chapter 2		24 Hours
	DC Machines: DC motors: construction, principle of operation and applications. Speed control of DC motor. AC Machines: 3-phase alternator, construction and principle of operation, relation between RPM and frequency. Three phase induction motors – Squirrel cage and slip ring Induction motors (construction and working principle only), methods of starting of 3-phase induction motor - DOL and star/delta starter, slip. Speed control of 3-phase Induction motor. Single	

	phase induction motor – principle of operation, capacitor start motors. Special Machines: Stepper motor, construction and principle of operation. Brushless servo motor, permanent magnet servo motor. Transformer: Ideal transformer, construction and principle of operation, emf equation, turns ratio, core loss, copper loss, efficiency, SC and OC tests. Transformer operation on No load and under load. Auto transformer.
Chapter 3	24 Hours
	Single phase and 3-phase uncontrolled rectifiers, capacitor filters, linear voltage regulator ICs. Use of MOSFETs, IGBTs and TRIACs as switching devices. DC-DC converter (features and operational aspects at a function-block level): Buck and Boost converters. SMPS. Inverter (features and operational aspects at a function-block level). LEDs: use in solid state lighting and in Display Devices. LCD Displays. Emergency power supply system: On site alternator, UPS system (at a function-block level). Secondary cells: current charging and maintenance.
References:	
1. Electric Circuit Theory Dr.M.Arumugam & Dr.N.Premkumaran, Khanna Publishers, New Delhi. 2. A text book of Electrical Technology, Vol. I & II, Theraja. B.L., S.Chand & Co Electrical Technology, Edward Hughes Addison – Wesley International Student Edition 3. Power Electronics, MD Singh, KB Khanchandani, McGraw Hill Publishing Company, New Delhi. 4. https://www.tutorialspoint.com/power_electronics/index.htm	

Name of the Course: Electrical and Power Electronics Laboratory		Duration: 18 Weeks
Course Code: TAJF/P – 102		Maximum Marks: 50
Semester: First		Internal Continuous Assessment: 25 Marks
Teaching Scheme: Practical - 3 Hrs./week		Semester End Evaluation: 25 Marks
Course Objectives:		
1.	Familiarization with electrical circuits, components and techniques used for the measurement of electrical parameters in a circuit.	
2.	To analyze and describe electromagnetic and electromechanical performance of electrical machines.	
3.	To study the operation of various power electronic circuits.	
List of Experiments:		
Sl. No:	Name of the Experiment	Hours
1.	Study of wiring practices in single / three phase power systems, Earthing and use of Circuit Protective Devices (Fuse, MCB and ELCB).	3
2.	Study of Push Buttons (NO and NC) switches (with differing poles, ways and ratings), electromechanical and solid-state Relays, Contactors, MCBs.	6
3.	Familiarization with Instruments used for the measurement of current, voltage and power in AC circuits. Measure the Voltage, Current, Power, Frequency, Energy and Power Factor in simple, single and three phase loads.	6
4.	Determination of the performance characteristics of a D.C. Shunt motor by load test. To control the speed of DC shunt motor by varying armature circuit and field circuit.	6
5.	Verify the characteristics of star-delta connections. Evaluate different methods of starting and reversing 3 phase AC induction motor. Study the construction of a DOL and astar-delta starter.	6
6.	Determination of the performance characteristics of a three-phase squirrel cage induction motor by load test.	6
7.	To perform polarity, turns ratio test and load tests on a single-phase	3

	transformer.	
8.	To study a single phase and three phase uncontrolled rectifier with a smoothing Capacitor.	3
9.	Testing the performance of an IC Linear Voltage Regulator.	3
10.	Study of a IGBT and MOSFET as a switching device in a DC circuit and TRIAC as a switching device in an AC circuit.	3
11.	Study (functional level) of a Buck, Boost DC–DC Converter.	3
12.	Study (functional level) of a single-phase PWM inverter.	6
	Tools, Equipment and Other Requirements	
	1. PLC training kit with CPU,DI,DO, AI,AO card 2. AC VFD with Motor 3. HMI with Ethernet Port 4. DOL, STAR DELTA STARTER TRAINING PANEL 5. SENSORS : PROXIMITY, LEVEL SENSOR, LOAD CELL 6. Desktop with Windows 10 i5 processor ,minimum 8 GB RAM 7. Software : Step7 MicroWIN SMART 8. AC Motor with AC drive 9. Servo Motor with drive 10. Measuring instrumental : Voltmeter, Ammeter, , Multi meter	

Name of the Course: JUTE YARN MANUFACTURING		Duration: 18 Weeks
Course Code: TAJF/T - 103		Maximum Marks: 100
Semester: First		Internal Continuous Assessment: 25 Marks
Teaching Scheme: Theory – 4Hrs./week		Semester End Exam: 75 Marks
Course Objectives:		
1.	To explain working principles and process parameters of Selection, Batching, Carding, Drawing and Spinning	
2.	To describe design aspects of machine and mechanisms involved in Batching, Carding, Drawing and Spinning.	
3.	To enumerate parameters influencing Selection, Batching, Carding, Drawing and Spinning	
4.	To describe utilities, maintenance need and methods to evaluate the processes	
5.	To acquaint the students with features of modern machines and industrial working by organizing mill visits	
Course Contents:		
Chapter 1		6 Hours
	History & overview of Indian Jute Industry Introduction to Jute: Jute: Plant and Fibre, classification of textile fibres, terminologies, different systems of yarn count, Important calculations etc. Process flow chart, basic mechanism of Jute processing machinery	
Chapter 2		16 Hours
	Selection and Batching : Objectives, Assessment of fibre quality, Raw Jute grading, Influence of Moisture in jute processing & calculation, Selection Jute Batching: Emulsion, Softener, Spreader & Piling Important check points	
Chapter 3		16 Hours
	Jute Carding: Objectives, Classification of Cards, Carding technology & calculations, Important check points	
Chapter 4		14 Hours
	Jute Drawing: Objectives, Classification of Drawing, Drawing technology &	

	calculations, Important check points
Chapter 5	20 Hours
	Jute Spinning: Objectives, Description of Jute Spinning, Classification of Jute Spinning frame, Jute Spinning technology & calculations, Concept about quality parameters of yarns, processing norms, Important check points
Text &Reference Books:	
1. Understanding of Jute - Dr. D. Sur 2. Jute Fibre to Yarn By R. R. Atkinson , ATI 3. Handbook on Jute (Part - I, II & III) - T. C. Ranjan 4. The Textile Testing - J E Booth 5. Spun Yarn Technology by Eric Oxtoby. 6. A practical Treatise on Jute Cultivation and Jute Spinning part -1 – S K Pal	

Name of the Course: JUTE YARN MANUFACTURING LAB		Duration: 18 Weeks
Course Code: TAJF/P – 103		Maximum Marks: 50
Semester: First		Internal Continuous Assessment: 25 Marks
Teaching Scheme: Practical - 3 Hrs./week		Semester End Evaluation: 25 Marks
Course Objectives:		
1.	To understand operational characteristics of Spreader, Carding, Drawing and Spinning machine	
2.	To understand Mechanism and function of Spreader, Carding, Drawing and Spinning machine	
List of Experiments:		
Sl. No:	Name of the Experiment	Hours
1.	Spreader / Softener - Study of fibre path, Driving arrangement & calculations of Spreader / Softener machine	12
2.	Carding - Study of sliver path, transmission of power and gearing calculations of Carding machine	15
3.	Drawing - Study of sliver path, transmission of power and gearing calculations of Drawing machine	12
4.	Spinning - Driving arrangement, settings & calculations of draft constants, twist constants for Spinning machine	15
N.B - Mill visit to study the features of Spreader, Carding, Drawing and Spinning machine.		
Tools, Equipment and Other Requirements		
Spreader/softener, Breaker Card, Inter card, Finisher card, Screw Gill 1st Drawing frame, Screw Gill 2nd Drawing frame and Screw Gill Finisher Drawing frame, ¼" Slip draft Spinning frame, 4¼" Apron draft Spinning frame, Jute flyer twisting frame, Vernier, Yarn Strength Tester, Moisture Meter, Measuring Tape, projector, laptop / Desktop.		

Name of the Course: BASIC MAINTENANCE AND JUTE MILL MACHINERY		Duration: 18 Weeks
Course Code: TAJF/T - 104		Maximum Marks: 100
Semester: First		Internal Continuous Assessment: 25 Marks
Teaching Scheme: Theory – 4Hrs./week		Semester End Exam: 75 Marks
Course Objectives:		
1.	To Perform basic workshop operations using suitable tools for fitting, riveting, milling, lathe, grinding, files, drilling etc.	
2.	To Measure using scale, Vernier etc. & conversion factor in metric system precisely & accurately	
3.	To Identify power transmission through belt and gear drive, motors, different Bushes and Bearings & safety precaution devices and its uses in Jute Mill Machinery	
4.	Apply lubricants in various machine based on utility and quality Store lubricant properly	
5.	To describe utilities, maintenance need and methods to evaluate the processes	
6.	Brief discussion about the Jute Mill Machineries and its working principle, lubrication system etc.	
Course Contents:		
Chapter 1		32 Hours
	Identify basic hand tools for fitting, riveting, drilling, welding etc. with due care and safety. Different Operations for Lathe, Shaper, Reaming, Taping, Dies etc. Explain different measuring tools and operating tools, Key preparation, types and applications General idea about various types of Nuts and Bolts Power transmission through Belt and gear drive – Types of gears- spur gear, bevel gear, helical gear, worm and worm wheel, rack and pinion and calculation Belts – Flat, v-belt and hexagonal belt and calculation Different Mechanical Components – Pulley, Gear, Keys, Jibs and Shafts. Various kinds of bush, ball and roller bearing, thrust bearing and their application in jute machinery.	

Chapter 2		30 Hours
	• Explain the maintenance objectives, outcomes, etc. • Explain about various types of standard maintenance management systems and their proper execution in the shop floor. • Plan & perform basic day to day preventive maintenance, repairing and check functionality. • Maintenance Audit - Preparation of Audit Format, Important check points • Maintenance type and frequency • Type of breakdowns - Causes and remedies • Maintaining records and ensuring availability of spares • Adopt proper inventory control and classify them as V(Vital), E(Essential), D(Desirable) • Do's and Don'ts for maintenance operation	
Chapter 3		10 Hours
	Lubrication and its schedule • Principle of lubrication. • Lubricants and their properties • Various application of lubricants • Selection of lubricants for various Jute machineries (Mill side) Lubrication Schedule	
Text &Reference Books:		
1. Engineering Mechanics by R S Khurmi 2. Maintenance management in spinning by Ratnam, T V. 3. Factory services maintenance II for engineering craftsmen: instruction manual vol.1 by Engineering Industry Training Board 4. Factory services maintenance II for engineering craftsmen: instruction manual vol.2 by Engineering Industry Training Board 5. Motor application and maintenance handbook by Smeaton, R.W 6. Maintenance Management by Lewis, Bernard 7. Spinning weaving & processsing machinery maintenance in textile mills by Joshi, B. B. 8. Industrial electronics apparatus: steps in design and maintenance by Ploeg, P. Van Der		

Name of the Course: BASIC MAINTENANCE AND JUTE MILL MACHINERY LAB		Duration: 18 Weeks
Course Code: TAJF/P – 104		Maximum Marks: 50
Semester: First		Internal Continuous Assessment: 25 Marks
Teaching Scheme: Practical - 2 Hrs./week		Semester End Evaluation: 25 Marks
Course Objectives:		
1.	To understand Mechanism and function of Spreader, Carding, Drawing and Spinning machine	
2.	Perform basic workshop operations using suitable tools for fitting, riveting, milling, lathe, grinding, files, drilling etc.	
3.	Measurement using scale, Vernier etc. & conversion factor in metric system precisely & accurately	
4.	Repair / replacements of machine parts by using workshop machinery and reduce the downtime of machinery.	
List of Experiments:		
Sl. No:	Name of the Experiment	Hours
1.	- Different measuring tools, operating tools and associate tools used in Jute mill workshop - Appropriate Measuring Instrument– Vernier, Screw Gauge, Micrometer - Calculation of speed ratio through different types of gears- spur gear, bevel gear, helical gear, worm and worm wheel, rack and pinion and	16
2.	Maintenance Audit of Jute Spreader, Softener, Carding, Drawing, Spinning,	6
3.	Perform preventive maintenance/ dismantle, repair parts and assemble sub-assemblies of simple machine as per layout plan and standard procedure.	8
4.	- Various application of lubricants - Determine amount and frequency of application of Lubricant.	6
N.B - Mill visit to study the features of Spreader, Carding, Drawing, Spinning and weaving machine.		
Tools, Equipment and Other Requirements		
Vernier, Measuring Tape, gauge, lathe, shaping, drilling, welding, milling and grinding, various type of power transmission equipments, Various types of nuts & bolts, bush & bearing		

etc.

Grease gun, Lubrication Injectors, Lubrication Pumps, Hydraulic Pumps, Oil Injectors projector, laptop / Desktop.

Name of the Course: Sensors and Actuators used in Jute Machinery		Duration: 18 Weeks
Course Code: TAJF/T - 105		Maximum Marks: 100
Semester: Second		Internal Continuous Assessment: 25 Marks
Teaching Scheme: Theory – 4Hrs./week		Semester End Exam: 75 Marks
Course Objectives:		
1.	Introduction to sensing principles and sensor characteristics.	
2.	To describe the operating principles of measurement systems used in Jute processing machinery.	
3.	To provide an overview of Pneumatic, Hydraulic and Electrical Actuators.	
Course Contents:		
Chapter 1		6 Hours
	Sensors and Transducers, sensor characteristics, functional blocks of a measurement system,sensor classification and physical principles of sensing. Sensor calibration. IEC Enclosure classification – protection of measurement systems against entry of liquids, solids & dust.	
Chapter 2		16 Hours
	Sensors in Jute machinery: ▪ Different types of proximity switches, photo electric sensors and magnetostrictive sensor. ▪ LVDT and Potentiometer for displacement measurement. ▪ Incremental Encoder, Magnetic pick up and Hall sensor for RPM measurement. ▪ Yarn breaks / tension sensor. ▪ Non-contact, IR based moisture sensor. ▪ Accelerometers for vibration monitoring. ▪ Pressure sensor for suction measurement. ▪ Load cell for static and in-motion weighing.	

	▪ Turbine or Paddle wheel sensor for flow measurement and totalization.
Chapter 3	10 Hours
	Basic elements of pneumatics / hydraulics, fluid power control elements and their standard graphical symbols, pneumatic & hydraulic cylinders, pneumatic & hydraulic valves for pressure, flow & direction control. Hydraulics/pneumatic safety. Electrical Actuators based on Servo motors and Stepper motor and their Drives. 2-way and 3-way solenoid valves (NO and NC type), direct and pilot operated. Linear and Rotary control valves.
Chapter 4	4 Hours
	Electro-pneumatic systems, solenoid direction control valves, magnetic - reed switch and linear sensors for actuator position feedback, sequence operation of two/more than two cylinders as per the design requirement to automate the systems. Study of an Industrial compressed air supply system and its typical constituents.
References:	
J. Fraden, Handbook of Modern Sensors: Physical, Designs, and Applications, AIP Press, Springer. 2. D. Patranabis, Sensors and Transducers, PHI Publication, New Delhi 3. https://www.festo-didactic.com/ov3/media/customers/1100/573030_lb_pep_extract_en.pdf 4. https://www.festo-didactic.com/ov3/media/customers/1100/095001_leseprobe_web.pdf	

Name of the Course: Sensors and Actuators Laboratory		Duration: 18 Weeks
Course Code: TAJF/P – 105	Maximum Marks: 50	
Semester: Second	Internal Continuous Assessment: 25 Marks	
Teaching Scheme: Practical - 2 Hrs./week	Semester End Evaluation: 25 Marks	
Course Objectives:		
1.	To evaluate the operational characteristics of sensors and measurement systems used in Jute machinery.	
2.	To assemble and study the performance of pneumatic / electro-pneumatic actuations systems of varied configurations and functionalities.	
3.	To study the functional features of various types of solenoid valves used to control fluid flow.	
List of Experiments:		
Sl. No:	Name of the Experiment	Hours
1.	Study of the measurement characteristics and the electrical output produced by the following: ▪ Different types of proximity switches and photoelectric sensors. ▪ LVDT and Potentiometer for displacement measurement. ▪ Incremental Encoder, magnetic pick up for RPM measurement. ▪ Accelerometers for vibration monitoring. ▪ Load cell for static and in-motion weighing. ▪ Pressure sensor for suction and level measurement. ▪ Turbine or Paddle wheel sensor for flow measurement and totalization.	16
2.	Familiarization with pneumatic and electro-pneumatic symbols and circuits as per ISO-1219 standard.	6
3.	To assemble and study the operation of the following electro pneumatic systems. ▪ A single acting cylinder operated by a 3/2-way pneumatic solenoid directional control valve. A one-way flow control valve is used to control the actuator response. The actuator is operated by a Push Button and a magnetic proximity switch detects the	8

	actual actuator position. ▪ A double acting cylinder operated by a 5/2-way pneumatic solenoid directional control valve. The actuator is operated by a Push Button. ▪ A double acting cylinder operated by a 5/2-way pneumatic, dual solenoid directional control valve. The actuator is operated by two Push Buttons. ▪ Implement sequence control using two double acting cylinders operated by 5/2-way pneumatic, dual solenoid directional control valves. ▪ Set up single/continuous cycle mode of operation in the above system.	
4.	Study of the components in an Industrial compressed air supply system and the function of each of these.	2
5.	Study of 2-way and 3-way solenoid valves (NO and NC type), direct and pilot operated, used to control the flow of fluids.	4
	Tools, Equipment and Other Requirements	
	1. PLC training kit with CPU,DI,DO, AI,AO card 2. AC VFD with Motor 3. HMI with Ethernet Port (Software: TIA portal v18) 4. DOL, STAR DELTA STARTER TRAINING PANEL 5. SENSORS : PROXIMITY, LEVEL SENSOR, LOAD CELL 6. Desktop with Windows 10 i5 processor ,minimum 8 GB RAM 7. Software : Step7 MicroWIN SMART 8. AC Motor with AC drive 9. Servo Motor with drive 10. Measuring instrumental : Voltmeter, Ammeter, Multi meter	

Name of the Course: JUTE FABRIC MANUFACTURING		Duration: 18 Weeks
Course Code: TAJF/T - 106		Maximum Marks: 100
Semester: Second		Internal Continuous Assessment: 25 Marks
Teaching Scheme: Theory – 4Hrs./week		Semester End Exam: 75 Marks
Course Objectives:		
1.	To explain working principles and process parameters of Winding, Beaming, Weaving, Finishing machinery and Non-woven technologies	
2.	To describe design aspects of machine and mechanisms involved in Winding, Beaming, Weaving and Finishing machinery	
3.	To enumerate parameters influencing Winding, Beaming, Weaving and Finishing process	
4.	To describe utilities, maintenance need and methods to evaluate the processes	
5.	To acquaint the students with features of modern machines and industrial working by organizing mill visits	
Course Contents:		
Chapter 1		6 Hours
	Winding: Objectives of Winding, Types of Winding machines, Winding technology and different type of settings, Important Calculations	
Chapter 2		6 Hours
	Jute Sizing & Beaming – Objectives of Pre-beaming, Warping & Sizing, Description of Pre-beaming, Warping & Sizing, Particulars of Jute Warping & Sizing, Important check points	
Chapter 3		12 Hours
	Weaving – Objectives of Jute weaving, Jute weaving technology and calculations, Important check points Idea about modern jute weaving: different types of Shuttle-less technologies	
Chapter 4		8 Hours
	Sack Sewing & Finishing – Objectives of Jute finishing, Description & Types of Jute finishing, Basic idea about jute finishing machinery and calculations, Important check points	
Text &Reference Books:		

1. Winding and Warping by M. K. Talukdar
2. Sizing by Ajgaonkar
3. The Technology of Warp Sizing by J.B. Smith
4. Principle of Weaving by Marks A.T.C. and Robinson
5. Handbook on Jute (Part - II & III) - T. C. Ranjan
6. Jute Weaving - Dr. S. K. Neogi
7. Jute spinning and weaving calculations - S N Kar
8. Modern Preparation & Weaving by A. Ormerod

Name of the Course: JUTE FABRIC MANUFACTURING LAB		Duration: 18 Weeks
Course Code: TAJF/P – 106		Maximum Marks: 50
Semester: Second		Internal Continuous Assessment: 25 Marks
Teaching Scheme: Practical - 3 Hrs./week		Semester End Evaluation: 25 Marks
Course Objectives:		
1.	To understand operational characteristics of Winding, Beaming, Weaving and Finishing	
2.	To understand Mechanism and function of Winding, Beaming, Weaving and Finishing	
List of Experiments:		
Sl. No:	Name of the Experiment	Hours
1.	Study of yarn path, Driving arrangement & different type of setting of winding machine	10
2.	Study of yarn path, Driving arrangement & calculations of beaming machine	12
3.	Concept of loom tuning and Driving arrangement Design and function of loom spares	18
4.	Mechanism and function of Measuring, Calender, Cutting, Stitching Machinery, Bale press and its spares	14
N.B - Mill visit to study the features of Winding, Beaming, Weaving and Finishing machinery		
Tools, Equipment and Other Requirements		
Jute Beaming machine, Jute Sizing machine, Hessian Jute Loom, Sacking Jute Loom, Shuttleless Jute Loom, Damping machine, Calendering machine, Lapping machine, Cutting machine, Hemming sewing machine, Herackle sewing machine, projector, laptop / Desktop.		

Name of the Course: Jute Diversified Product		Duration: 18 Weeks
Course Code: TAJF/T - 107		Maximum Marks: 50
Semester: Second		Internal Continuous Assessment: 25 Marks
Teaching Scheme: Theory – 2Hrs./week		Semester End Exam: 25 Marks
Course Objectives:		
1.	To understand the emerging trend of Technical Textiles	
2.	Illustrate the yarn & fabric properties and requirements for Technical Textile applications	
3.	Design different structures based on various Jute Diversified applications	
4.	Explain different types of Technical Textiles and suitable products	
5.	To acquaint the students with features of modern machines and industrial working by organizing mill visits	
Course Contents:		
Chapter 1		8 Hours
	Introduction and necessity of Jute Diversified Product Jute Geotextile: Important Characteristics of geotextiles, type of geotextiles and their relevance in geotechnical field, yarn & fabric properties and requirements, Identification of the products, mechanism of formation of different geotextiles, Selection of suitable material as per the design specifications or regulations,	
Chapter 2		6 Hours
	Jute Agro-textile – Important Characteristics of agrotextiles, type of agrotextiles and their uses, yarn & fabric properties and requirements, Identification of the products, mechanism of formation of different agrotextiles, Selection of suitable material as per the design specifications or regulations,	
Chapter 3		6 Hours
	Jute Composite – Important Characteristics of Composite , type of Composite and their uses, yarn & fabric properties and requirements, Identification of the products, mechanism of formation of different Composite , Selection of suitable material as per the design specifications or regulations,	
Chapter 4		8 Hours
	Nonwoven – Working principle of various Non-woven technologies, Development of Nonwoven Technology for Jute, Nonwoven machinery for Jute	

Chapter 5		8 Hours
	Jute Handicrafts – Introduction to Jute Handicrafts and Yarns, scope of Jute handicrafts, Brief introduction to various Markets of Jute Products, Selection of raw material. Material use of Different size of Jute Yarns, Raw Jute, Quality concept, Concept on identification of different raw jute yarns. Concept of different types of braiding and knots, Brief introduction on different designs of Jute Products, Use of matching colour on the Jute product, Blending of jute with others materials.	
Text &Reference Books:		
1. Handbook of Technical Textiles by A R Horrocks and S C Anand 2. Handbook of Geosynthetics by Geosynthetic Materials Association 3. Jute –Geo-Textiles and their Applications 4. Application of Jute in Technical Textiles by IJIRA 5. Study on Developing Measures to Promote the Use of Agrotextiles in India under The Technology Mission on Technical Textiles (TMTT)		
Tools, Equipment and Other Requirements		
Jute Fibre Strength Tester, Yarn Strength Tester, T.P.I Tester, Moisture Meter, Measuring Tape Jute Fabric Strength Tester, Sewing Machine,Braiding Machine and accessories		

Name of the Course: Statistical Quality Control for Jute		Duration: 18 Weeks
Course Code: TAJF/T - 108		Maximum Marks: 100
Semester: Second		Internal Continuous Assessment: 25 Marks
Teaching Scheme: Theory – 4Hrs./week		Semester End Exam: 75 Marks
Course Objectives:		
1.	Skilling on process and quality control in jute processing	
2.	Understand the reason for sliver / yarn break, waste%, loom efficiency, warp/weft tension, yarn / fabric defects	
3.	Measures various Statistical Quality Control parameters like mean, standard deviation, CV%, PMD etc, and related standards	
4.	Explain various quality used in Jute mill like Sacking, Hessian and other nonconventional fabric	
5.	Explain the inspection procedure and standards for Jute finished goods.	
Course Contents:		
Chapter 1		36 Hours
	Testing and Quality Control in Jute Yarn Manufacturing Process : • Concept of Quality and Statistical Quality Control • Role of Sampling for testing • Testing standard and SOP of test method • Fibre Testing parameters – strength, fineness, defects, colour, MR% etc. • Sliver Testing – Sliver Weight and its CV% at different stages Yarn Testing – Count & its CV%, Strength & its CV%, TPI and its CV%, Quality Ratio • Explain Statistical Quality Control for jute processing • Identify different techniques for methods of process control • Quality and standards required in the jute mill in Jute Spinning,	
Chapter 2		36 Hours
	Testing and Quality Control in Jute Fabric Manufacturing Process – • Role of Sampling for testing • Testing standard and SOP of test method • Fabric Testing: Strip strength (warp and weft way), ends/ dm, picks / dm, gsm, cover factor calculation etc. • Inspection of Gunny bags as per BIS standards (IS 16186:2014) or Buyers’ Specifications ✓ Procedure of inspection.	

	✓ Sampling in the inspection. ✓ Parameters of the products considered for inspection. ✓ Specifications of the common products. ✓ Paper job related for inspection. Papers related to pass/fail a consignment.
Text & Reference Books:	
1. Understanding of Jute - Dr. D. Sur 2. Principles of textile testing by J E Booth 3. Statistical quality control by D H W Allan 4. Quality control and statistical methods by Schrock, Edward M. 5. Quality Control in jute Industry by S N Kar 6. Quality control handbook by J M Juran 7. A handbook of quality control and its techniques(Jute) by Mital, S. C. 8. Manual on quality control in spinning by Ratnam, T. V 9. Elements of quality control by Mukherjee, R. R. 10. An introduction to quality control for the apparel industry by Pradip V Maheta	

Name of the Course: Statistical Quality Control for Jute LAB		Duration: 18 Weeks
Course Code: TAJF/P – 108		Maximum Marks: 50
Semester: Second		Internal Continuous Assessment: 25 Marks
Teaching Scheme: Practical - 2 Hrs./week		Semester End Evaluation: 25 Marks
Course Objectives:		
1.	To understand operational procedure for various type of machinery to assess Jute/yarn/fabric quality	
2.	Explain various quality standard for Jute/yarn/fabric	
List of Experiments:		
Sl. No:	Name of the Experiment	Hours
1.	- Fibre Testing of strength, fineness, defects, colour, MR% etc. - Sliver Testing of Sliver Weight and its CV% at different stages like spreader, carding, drawing etc. - Yarn Testing of yarn count and count CV%, yarn strength and strength CV%, Quality Ratio, T.P.I and T.P.I CV% etc. Demonstrate various sampling technique	12
2.	Oil content% in emulsion, emulsion application, oil add-on, emulsion stability	4
3.	Testing standards and SOP of test methods- No of ends in beaming, size add-on, moisture in beam, identification mark (Quality wise), keel mark, temperature of saw box, reed porter, change pinion, picks/dm, fabric width, selvedge forming, bias fabric, loop, reed mark, Hard waste% checking at weaving stage	10
4.	Identify Moisture before damping, bias at calendering, Cutting length, herakle & hemming stitch, bag length, specified branding, Fabric wastage %, strength checking (warp way, weft way, seam strength)	10
Tools, Equipment and Other Requirements		
Jute Fibre Strength Tester, Yarn Strength Tester, T.P.I Tester, Moisture Meter, Measuring Tape, Jute Fabric Strength Tester, Weight Machine, projector, laptop / Desktop.		

Name of the Course: Project on Industrial application related to automation in material handling, Jute / Textile processing		Duration: 18 Weeks
Course Code: TAJF - 109		Maximum Marks: 100
Semester: Second		Internal Continuous Assessment: 50 Marks
Teaching Scheme: Tutorial – 1Hrs./week		Semester End Exam: 50 Marks
Project work - 5Hrs./week		
Course Objectives:		
1.	To acquaint the students with application based industrial project	
2.	To explain about Research Methodology	
3.	To describe design aspects of Research and report preparation	
4.	To describe patent processes and copyright	
Course Contents:		
Chapter 1		14 Hours
	Research Meaning of Research, Purpose of Research, Types of Research (Educational, Experimental, Descriptive, Basic applied and Patent Oriented Research) – Objective of research- Literature survey – Use of Library, Books, & Journals –Internet, getting patents and reprints of articles as sources for literature survey. The Research Report / Paper writing / thesis writing - Different parts of the Research paper	
Chapter 2		4 Hours
	Intellectual property rights • The patent system in India – Present status Intellectual property Rights (IPR), Future changes expected in Indian Patents • Advantages • What may be patented • Who may apply for patent • Preparation of patent proposal	
Chapter 3		90 Hours
	Present possible potential areas of Project work**	

	• Morah weight variation and its control • Uniform Feeding at Spreader • Dust Removal for better ergonomics at Spreader • Emulsion Flow Rate Control and MR% at Spreader • Auto-doffing at spreader, carding, drawing • Uniform feed rate of Spreader Roll at Carding • Sliver Stop Motion & other controls at Drawing • Soft Start, Drafting Roller control, bobbin building, auto doffing, SCADA for efficiency monitoring at Spinning • Winding tension control, slub catcher, splicing etc at Winding • Stop motions, yarn tension measurement, SCADA for efficiency monitoring etc. at Weaving • Continuous Damping Calendering and Cutting through speed synchronisation
**These are the present potential areas for doing project area however student may carry out project work in other areas also	
References:	
1. A Practical Introduction to copy right – Gavin Mcfarlane 2. Thesis projects in Science and Engineering – Richard M. Davis 3. Scientists in legal system – Ann labor science 4. Thesis and Assignment writing – Jonathan Anderson 5. Protection of Industrial property rights- Purushottam Das and Gokul Das 6. Preparing for publication – King Edwards Hospital fund for London 7. Documentation – Genesis & Development	

ONE YEAR ADVANCED DIPLOMA IN ENVIRONMENTAL MANAGEMENT AND SUSTAINABILITY

Eligibility for Admission:

A Degree from any recognized university in any branch of Engineering/Technology with minimum 1 year practical experience (Industry / Laboratory / Field / Teaching).

OR

An Undergraduate Degree in Science from any University recognized by UGC with minimum 1 year practical experience (Industry / Laboratory / Field / Teaching).

OR

A Diploma in any branch of Engineering or Technology recognized by the WBSCT&VE&SD with minimum 2 years practical experience (Industry / Laboratory / Field / Teaching).

Duration: Two Semesters each of six months duration: Total 1 Year.

- Semester- 1 & 2 is of 18 weeks duration each of which 17 weeks for Contact Classes and 1 week for Semester Examination.
- Each week consists of 30 contact periods. Each period will be of one-hour duration.
- Marks distribution in

Semester – 1: 500 marks.

Semester – 2: 700 marks.

Total: 1200 marks.

- Hour of examination for semester examination is 3 hours.
- Classes will be held five days a week for the one-year course.
- On Job Training, Dissertation & Seminar are suggested to be compulsory and in line with the objective behind launching this industry-focussed course.

The Course Structure and Detailed Curriculum may be re-evaluated/ modified after 3years or anytime as decided by the WBSCT&VE&SD based on the feedbacks of the students and the participating institutions.

**CURRICULAR STRUCTURE FOR FIRST SEMESTER OF THE ADVANCED DIPLOMA COURSE IN
ENVIRONMENTAL MANAGEMENT AND SUSTAINABILITY**

Sl. No.	Subject Code	Subject of Study THEORETICAL PAPERS	Contact Periods/Week			Examination Scheme				Full Marks	
			Lec	Tut	Sess	Internal		External		Th	Sess.`
						Assessment	Attendance	Objective	Subjective		
1	ESD_101	Ecology, Environment and Suatainable Development	6	-	-	20	10	20	50	100	-
2	ESD_102	Resource Management and RS-GIS	6	-	-	20	10	20	50	100	-
3	ESD_103	Air, Noise and Water Pollution and Management	6	-	-	20	10	20	50	100	-
4	ESD_104	Industrial Pollution, Solid and Hazardous Waste Management	6	-	-	20	10	20	50	100	-
		SESSIONAL PAPERS									
5	ESD_105	Pollution Monitoring and Mapping Lab	-	-	6	Internal		External		Th	Sess.
						50		50		-	100
TOTAL						-		-		400	100

**CURRICULAR STRUCTURE FOR SECOND SEMESTER OF THE ADVANCED DIPLOMA COURSE
IN ENVIRONMENTAL MANAGEMENT AND SUSTAINABILITY**

Sl. No.	Subject Code	Subject of Study THEORETICAL PAPERS	Contact Periods/Week			Examination Scheme				Full Marks	
			Lec	Tut	Sess	Internal		External		Th	Sess.`
						Assessment	Attendance	Objective	Subjective		
6	ESD_201	Energy Management and Sustainable Technology	6	-	-	20	10	20	50	100	-
7	ESD_202	EIA and Environmental Lgislations	6	-	-	20	10	20	50	100	-
8	ESD_203	Fire, Industrial Process, Environment and Health Safety and Management	6	-	-	20	10	20	50	100	-
		SESSIONAL PAPERS									
9	ESD_204	Term Paper	-	-	3	Internal		External		Th	Sess.
						50		50		-	100
10	ESD_205	On the Job Training	4 weeks			60		140		-	200
11	ESD_206	Dissertation and Seminar	-	-	3	50		50			100
TOTAL						-		-		300	400

N.B. – The Examination Scheme and Distribution of Marks are only indicative and are subject to change as per the prevalent norms of WBSCT&VE&SD.

**Advanced Diploma in Environmental Management and Sustainability
(ADEMS)**

SEMESTER - I

Name of the Course	ADEMS	Course duration	2 semester
Course Title	Ecology, Environment and Sustainable Development	Course Code	ESD_101
Subject offered in Semester	First	Number of Contact Hours per week	L:6, T: 0, S: 0
Total Marks	100	Total Allotted Hours	100
Question distribution	As per standing norms of WBSCT&VE&SD	Marks distribution	As per standing norms of WBSCT&VE&SD

Course Content

a) Fundamentals of Ecology and Environment:

Concept of ecology, ecosystem and ecosystem services; Structure and function of ecosystem; Energy flow in an ecosystem; Ecological pyramid; Food chain and food web (terrestrial and aquatic ecosystems); Ecological balance and imbalance, Ecological niche; Ecosystem classification, pond, river, forest, marine, desert etc; Interrelationship in an ecosystem and biogeochemical cycle; Basic concept of population and community ecology; Ecological succession.

b) Concepts of Sustainable Development:

Concept of sustainability; Genesis of Sustainable Development – Brundtland's commission. Rio declaration – Agenda 21; Sustainable Development Goals (SDG); Sustainability development index; Sustainability in the context of energy use, agriculture, industry, urbanization etc.; Watershed management and sustainable land use. Rudiments of corporate sustainability practices, CSR.

Suggested learning resources:

ESD 101(a) Fundamentals of Ecology and Environment

1. Fundamental of Ecology and environment – by Pranavkumar Ushamina – Pearson Publication
2. Biodiversity – by MN William – CBS Publication
3. An advanced textbook on biodiversity Principles & Practice 2020 – by KV Krishnamurthy – CBS Publication

4. Environment & Ecology – by Eugene Odum – Centage India Publication
5. Ecology & Environment – by P.D. Sharma – Rastogi Publication
6. Environment & Ecology – by Vaisali Anand – McGraw Hill
7. A practical manual on biodiversity & conservation – by Dr. A. Pramila – Genetic Publication
8. Introduction to Environmental Engineering - G.M.Masters - Prentice Hall India.
9. Fundamentals of Ecology – E. Odum - Cengage India Private Limited
10. Fundamentals of Ecology and Environmental Biology – S. C. Santra - New Central Book Agency
11. Biochemical methods - S. Sadasivam - New Age International.
12. Environmental Chemistry – S.E. Manahan, CRC Press.

ESD 101(b) Concepts of sustainable Development

1. An introduction to Sustainable Development – by P. Rogers, K. Jalal, J.A. Boyd - Routledge (Earthscan) Publication
2. Getting started with CSRD – A beginners manual for corporate sustainability – by John Maxwealth – Kinley edition - Notion Press
3. A green economy – India's sustainable development – by N.R. Krishnan - Notion Press
4. Sustainable development goals – by Ajay Ahlawat – Notun press –Chennai
5. An introduction to sustainable development – by J.A. Elliot – Routledge Press perspective
6. Sustainable development and earthcare – by Sundaram, Jha, Tewari – Concept Publication
7. Sustainable development report 2021 – Cambridge University Press and Assessment
8. Sustainable development goals vertical including SDG indexing – NITI Aayog Govt. of India
9. Sustainable development M. E. D. 2 issues and challenges – NEERAJ Publication
10. Introduction to sustainable engineering – by R.L. Rag, L.D. Ramesh – PHI Publication
11. Sustainable engineering- principles and practices – by Bharik R. Bakshi – Cambridge Univ. Press
12. Sustainable engineering – Concept design and Case studies – by David T. Allen, David R. Shonnerd – Pearson Education India

NOTE: Reference Books though listed under individual modules may cover topics of more than one module or part of a module. Individual teachers / students may compile comprehensive notes for individual modules based on the given reference books or other sources.

Name of the Course	ADEMS	Course duration	2 semester
Course Title	Resource Management and RS-GIS	Course Code	ESD_102
Subject offered in Semester	First	Number of Contact Hours per week	L:6, T: 0, S: 0
Total Marks	100	Total Allotted Hours	100
Question distribution	As per standing norms of WBSCT&VE&SD	Marks distribution	As per standing norms of WBSCT&VE&SD

Course Content

a) Natural Resource Management and Circular Economy

Concept of natural resources; Land resources: Concept, Land use land cover (LULC), Wetlands, Wastelands, Land degradation, Soil erosion, desertification; Forest resources: Types, Deforestation – causes, consequences, and remedial measures; Water resources: Water use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international and inter-state); Energy resources: Conventional and non-conventional energy sources, Environmental impacts of energy generation; Green energy; Natural resource accounting, Participatory resource Management.

Fundamentals of environmental economics; Cost-benefit analysis (CBA); Concept of circular economy (CE) vis-à-vis linear economy, Environmental, economic and social implications of circular economy: History, aim, product circulation, leasing, reuse, share, valorisation, waste elimination, UN network model vis-à-vis National Guidelines.

b) GIS and RS in Environmental Management

Introduction of GIS and RS; Digital image processing and ground truthing; Thematic information extraction using satellite data; Applications of RS and GIS in natural resource management (mining, urban, forest, coastal and marine, wetland, wasteland etc.); Concept of AI/ML enabled GIS and RS in environmental management.

Suggested learning resources:

ESD 102(a) Natural Resource Management and Circular economy

1. Understanding Circular Economy – by Dr. Ashutosh Misra – Bharti Publication
2. Introduction to Environmental Economics – by Subhasini Muthukrishnan – PHI
3. Natural resource management – by Debojit Saikia, Pradip Kr. Baruah – Mahaveer Publication
4. Introduction to forestry and natural resources – by D.L. Grebner – Academic Publisher
5. Environmental Economics- an Indian perspective – Rabindra N Bhattacharya - Oxford University Press

6. Fundamental of natural resource management – by Ghanashyam Varse, V. manjarekar, A.K. Sarkar – AGPH book
7. Environmental Accounting Sustainability Accounting – by Somnath Debnath – Sage publication
8. Environmental and Natural Resources Management – by H.K. Mishra – Akansha Publishing
9. New Trends in Green Chemistry-V.K. Ahluwalia and M.Kidwai, Anamaya Publishers, New Delhi.
10. Introducing natural resources – by Graham Park – Dunedin Academic Press, New Zealand

ESD 102(b) GIS and RS in Environmental Management

1. Text book of Remote Sensing and Geographical Information System – by Kali Charan Sahu – Atlantic Publication
2. Remote Sensing and GIS – by Basudev Bhatta – Oxford University Press
3. Remote Sensing and Geographical Information System – by A.M. Chandra, S.K. Ghosh – Narosa
4. Text Book of Remote Sensing and GIS – by M. Anji Reddy – B.S. Publication
5. Remote Sensing and GIS application in Environmental Management – by Rintoo Rajesh, P. mohana, Ashok Jayavanta Dushing, Rajesh Bhaskar Surase – Alpha International Publication
6. Remote Sensing, GIS & Wetland Management – by Tasneem Abbasi, S.A. Abbasi – Discovery Publishing House
7. Remote Sensing and GIS for Environmental Management – by Saif Said, Shamshed Ahmed – World Education Publication
8. Introductory Digital Image Processing: A Remote Sensing Perspective – J.R. Jensen - Pearson
9. Remote Sensing and Image Interpretation– Lillesand, Keifer and Chipman _Wiley
10. Remote Sensing: Principles and Interpretation - F.F Sabins - W.H.Freeman & Co Ltd
11. Remote sensing and GIS - B. Bhatta - Oxford University Press

NOTE: Reference Books though listed under individual modules may cover topics of more than one module or part of a module. Individual teachers / students may compile comprehensive notes for individual modules based on the given reference books or other sources.

Name of the Course	ADEMS	Course duration	2 semester
Course Title	Air, Noise and Water Pollution and Management	Course Code	ESD_103
Subject offered in Semester	First	Number of Contact Hours per week	L:6, T: 0, S: 0
Total Marks	100	Total Allotted Hours	100
Question distribution	As per standing norms of WBSCT&VE&SD	Marks distribution	As per standing norms of WBSCT&VE&SD

Course Content

a) Air and Noise Pollution Monitoring and Management

Source, nature, classification and effects of different air pollutants (NO_x, SO_x, PM, CO, CO₂, hydrocarbons and VOCs); Global environmental issues - causes, consequences, mitigative and adaptive measures (Climate change, Acid rain; Ozone layer depletion etc.); Vehicular air pollution; Status of air pollution in major Indian cities; Air quality standards, AQI; Air pollution monitoring, control techniques and management; Green belts; Case studies: air pollution from some specific industries. Indoor pollution : Control and management strategies. Fugitive and stack area dust emission.

Noise pollution: Sources, effects, measurement of noise indices (L_{eq}, L₁₀, L₉₀, L₅₀, L_{DN}, TNI); Noise abatement strategies; Status of noise pollution in major cities in India (few citation only); Regulation and control of noise pollution; Noise mapping; Case studies.

Firecrackers-impacts on human health.

b) Water and Wastewater Monitoring and Management

Concept of surface water and ground water; Consumptive water uses, fire water demand, rain water harvesting, water reuse; Water quality parameters - monitoring and assessment (pH, EC, turbidity, TDS, hardness, chlorides, salinity, DO, BOD, COD, nitrates, phosphates, sulphates, heavy metals, organic, microbial contaminants etc.); Water quality standards (Drinking, irrigation, cooling, fire, industrial etc.); Water pollution – wastewater generation, monitoring, concept of wastewater treatment methods including emerging technology; Namami Gange (NMCG) program etc.; Case studies.

Suggested learning resources:

ESD_103(a) Air & Noise Pollution Monitoring and Management

1. A text book of Air Pollution and Control – by S.C. Bhatia – Atlantic Publication

2. Introduction of Environmental Engg. & Science – by Gilbert M. Mastus, Wendel Patta – Pearson Education India
3. Air Pollution – by M.N. Rao & H.V.N. Rao – McGraw-Hill Publication
4. Air Pollution – by K.L. Doren – CBS Publication
5. Environmental Engg. – by Peavy, Rowe & Tchobanoglous – McGraw-Hill (Indian edition)
6. Air Pollution and Control – by K.V.S.G. Muralikrishna – Laxmi Publication
7. Environmental Engg. – by Gerard Kiely - McGraw-Hill (Indian edition)
8. Environmental Engg. – by A.P. Sincero & G.A. Sincero – Prentice Hall – Pearson education
9. Noise and air pollution – monitoring and control – by Swami Abhisek, Avinash Chauhan – Discovery Publishing House
10. Environmental pollution Monitoring and Control – by S.M. Khopkar – New Age Publication
11. Noise Pollution – Law & Remedies – by Rathi – Regal Publication
12. Environmental Pollution Control Engineering- CS Rao – New Age International publishers
13. Air Pollution: Its Origin and Control – Wark, Warner and Davis - Pearson
14. Environmental Noise Pollution – PF Cunniff – John Wiley

ESD 103(b) Water & Wastewater Monitoring and Management

1. Wastewater Quality Monitoring and Treatment – by Philippe Quevauvillar, Olivier Thomas, Andre Vander Beken – Willey
2. Water and wastewater Engg. – by Sudha Goel – Cambridge University Press
3. Water and wastewater Engg. Technology – by Subhas Verma – CRC Press
4. Water Supply Engineering – by S.K. Garg – Khanna Publisher
5. Water quality monitoring and Management-Bases, technology & case studies – by Daoliang L – Academic Press
6. Guidelines for CPCB manual for Water Quality Management – CPCB Publication
7. Guidelines for CPCB manual for Water Quality Monitoring - CPCB Publication
8. Guidelines for monitoring online- monitoring wastewater/ effluent quality monitoring – by R.M. Bhardwaj – CPCB Publication
9. Wastewater Engineering – Treatment, Disposal and Reuse – Metcalf and Eddy, Inc. - McGrawHill.

NOTE: Reference Books though listed under individual modules may cover topics of more than one module or part of a module. Individual teachers / students may compile comprehensive notes for individual modules based on the given reference books or other sources.

Name of the Course	ADEMS	Course duration	2 semester
Course Title	Industrial Pollution, Solid and Hazardous Waste Management	Course Code	ESD_104
Subject offered in Semester	First	Number of Contact Hours per week	L:6, T: 0, S: 0
Total Marks	100	Total Allotted Hours	100
Question distribution	As per standing norms of WBSCT&VE&SD	Marks distribution	As per standing norms of WBSCT&VE&SD

Course Content

a) Industrial Pollution Monitoring and Control

Environmental impacts of industrial effluents/sewage on water-bodies; National and International standards; Brief ideas on Industrial Wastewater treatment (Thermal, Tannery, Textile and Dye, Food Processing) of ETPs and STPs; Concept of industrial symbiosis and industrial ecology; Quality assurance and quality control. Industrial waste survey, Concept of flow diagram and water balance diagram, housekeeping, inventory. Industrial discharge/flow measurement, concept of equalisation.

Emissions (gaseous, particulates) control-ESP, stack monitoring etc. Concept of stack height determination as per CPCB guideline, atmospheric stability and wind roses, Concept of different control technology, venture, cyclone, scrubbers, fabric house.

b) Solid and Hazardous Waste Monitoring and Management

Introduction to wastes – Municipal, hazardous, biomedical, plastic, electronic, radioactive; Sources, characterization (proximate and ultimate analysis etc.); Conventional methods and design of collection, transport, treatment (neutralization, oxidation-reduction, precipitation, solidification, stabilization, incineration) and disposal (sanitary landfill); Environmental hazards of disposal; Reuse, recycling and recovery of materials and resources; Electrical energy generation from solid waste (Fuel pellets, Refuse derived fuels), composting and vermicomposting, biomethanation of solid waste, Management policies; Waste management in India. Classification of hazardous waste, HAZOP analysis. CPCB rules and guidelines for hazardous waste management,

Suggested learning resources:

ESD 104(a) Industrial Pollution Monitoring and Control

1. USEPA. 1999. Guide for Industrial Waste Management. Washington D.C.
2. Industrial Water Pollution Control – W.W. Eckenfelder - McGraw-Hill.

3. Biological wastewater treatment: Theory and Applications - Grady Jr. C.P.L and Lin H.C. - Marcel Dekker, Inc
4. Environmental Pollution and Control - J. Jeffrey Peirce, P Aarne Vesilind, Ruth Weiner - Butterworth-Heinemann Ltd
5. Environmental Toxicology - D. A. Wright and P. Welbourn - Cambridge University Press.

ESD 104(b) Solid and Hazardous Waste Monitoring and Management

1. Solid Waste Management – by Harimohan Singh – Alfa Publication
2. Treatment of Urban Solid Waste Engineering and Integrated Management- by Sampa Chakraborty - TERI (The Energy & Resource institute)
3. Solid and Hazardous Waste Management – by M.N. Rao & Razia Sultana – B.S. Publication
4. Solid and Hazardous Waste Management – by P.M. Cherry – CBS HB
5. Solid and Hazardous Waste Management – by Sunil Kumar – New India Publishing agency
6. Hazardous Waste Management (HAZWAMS)– CPCB Series
7. Text Book of Solid Waste Management – by Iqbal H Khan, Naved Ahsan – CBS Publication
8. Solid and Hazardous Waste Management – by S.C. Bhatia – Atlantic Publication
9. Hazardous Waste Management – by M. Chael, D. Lagrega, Phillip L Buckingham, J.C. Evans - McGraw-Hill International
10. Manual on Solid Waste Management – Ministry of Housing & Urban Affairs- govt. of India
11. Municipal Solid Waste Management – T.V. Ramachandra, TERI press.

NOTE: Reference Books though listed under individual modules may cover topics of more than one module or part of a module. Individual teachers / students may compile comprehensive notes for individual modules based on the given reference books or other sources.

Name of the Course	ADEMS	Course duration	2 semester
Course Title	Pollution Monitoring and Mapping Lab	Course Code	ESD_105
Subject offered in Semester	First	Number of Contact Hours per week	L:0, T: 0, S: 6
Total Marks	100	Total Allotted Hours	100
Question distribution	As per standing norms of WBSCT&VE&SD	Marks distribution	As per standing norms of WBSCT&VE&SD

Course Content

1. Sampling and sampling techniques for air, water, soil.
2. Analysis and monitoring of environmental quality (air, water, soil, noise) parameters using standard operating procedure (SOP).
3. Sampling techniques for bio-diversity.
4. Analysis of wastewater and sludge using SOP.
5. Demonstration of analytical instruments for environmental monitoring.
6. Measurement of precipitation and evaporation by raingauge and pan evaporator.
7. Concept of SCADA / Online Monitoring.
8. Development techniques for preparation of green belts.
9. Environmental mapping (resource, land, waterbodies, biodiversity etc.) using RS and GIS and reporting using some conventional statistical tools.
10. Field trip.

Suggested learning resources:

ESD_105 Pollution Monitoring and Mapping Lab

1. APHA, AWWA, WEF. Standard Methods for the Examination of Water and WasteWater – American Public Health Association
2. Introduction to Industrial Control Systems and SCADA in Water Industry – by Praveen Arora – clever Fox Publication
3. Monitoring Water Quality, Pollution assessment, analysis & remediation – by Satinder Ahuja – Elsevier Publication
4. SCADA System design using Lab view _ by Pradeep Kumar, Nitish Pradhan – Notion Press

5. Environmental Engineering Laboratory Manual – by S.K. Panigrahi, L Mohanty – SK Kataria & Sons
6. Land Resources Monitoring, Modelling, Mapping with Remote sensing –by Prasad S Thenkabail – Apple academic Press
7. Green Belt Development – guidelines – CPCB
8. Quality Assurance / Quality Control – CPCB Guidelines
9. India-Wris – help manual for Water mapping – National Water Information Centre
10. Manual on aquifer mapping – Govt of India – Central Ground Water Board
11. Handbook of analytical instruments – by RS Bhandpur – McGraw Hill
12. Soil analysis – In drain Society of Soil Science – Generic
13. Principles and methods in soil chemical analysis – by P Manjula Chandramohan – Mahi Publication- Gujarat
14. Soil Sampling and method of analysis – by Carter, Gregorich – Routledge, Taylor & Francis Group
15. Guidelines for measurement of ambient air Pollutants – Sampling and analysis – Volume-II – CPCB, MOEF, Govt of India
16. Guidelines on methodologies for source emission monitoring – CPCB
17. Sampling of Water and Wastewater – JS Laura – e-Adhyayan
18. Water Sampling and Preservation Techniques – Standard Operating Procedure (SOP) – By A Gnanavclu – CPCB, Bangalore
19. Sampling protocols for Water and Wastewater – Gujarat Environmental Management Institute
20. Methods for Sampling for Water & Wastewater – IS:3025-1(latest version)

NOTE: Reference Books though listed under individual modules may cover topics of more than one module or part of a module. Individual teachers / students may compile comprehensive notes for individual modules based on the given reference books or other sources.

**Advanced Diploma in Environmental Management and Sustainability
(ADEMS)**

SEMESTER - II

Name of the Course	ADEMS	Course duration	2 semester
Course Title	Energy Management and Sustainable Technology	Course Code	ESD_201
Subject offered in Semester	Second	Number of Contact Hours per week	L:6, T: 0, S: 0
Total Marks	100	Total Allotted Hours	100
Question distribution	As per standing norms of WBSCT&VE&SD	Marks distribution	As per standing norms of WBSCT&VE&SD

Course Content

a) Energy Management and Sustainability

Non-renewable energy sources: Coal, petroleum, natural gas, nuclear energy; Renewable energy sources: Solar photovoltaic and solar thermal; Wind energy; Tidal energy; Ocean energy (OTEC); Geo-thermal energy; Biomass; Coal bed Methane, Energy recovery from wastes; Global energy consumption/use patterns; Efficacy of Energy System and Energy Audit, Energy conservation and sustainable energy management; Energy Pricing, National energy policy.

b) Sustainable Technology and Innovation

Introduction; Components of sustainability:: Social, Economic, Environmental; Linkages between resource use, technology, and sustainability; Sustainability Transitions - Drivers and Barriers; Smart environmental monitoring using IoT and sensors (Smart Cities: Air quality, Smart grid, Water distribution, Precision agriculture, Multimodal transportation); Low carbon material and process, Green Technology, Waste Minimization and Source Reduction, Emerging technologies and innovations in environmental management; Global perspective of Environmental concerns; Climate change (National and International Protocols, National Action Plans), Waste auditing; Cleaner Production (CP), Conservation of Bio-diversity, Bio-diversity assessment, Case studies.

Suggested learning resources:

ESD_201(a) Energy Management and Sustainability

1. Non-Conventional Energy Sources and Utilization – by R.K. Rajput – S. Chand Publication
2. Non-Conventional Energy Sources – by B.H. Khan – McGraw Hill Education

3. Non-Conventional Energy Sources – by G.D. Rai – Khanna Publishers
4. Non-Conventional Energy Resources – by D.S. Chauhan – New Age Publication
5. Energy Resources – Conventional and non-conventional – by MVR Koteswara Rao – BS Publication
6. Natural Sources of Energy – by A.H. Gibson – Cambridge University Press
7. Energy Resources and management – by Renu Dhupper – CBS Publication
8. Energy audit and management – by Dr. Subhash Gadhave, Arup Goil, Siddu Patil – Technical publication, Pune
9. Fundamentals and application of renewable energy – by Mehmet Kanoglu, Yunus A Cengel, John M Cimbalo – McGraw-Hill (Indian edition)
10. Energy Pricing – Prem Kalra
Energy Efficiency and conservation – Sanjeev s Aluwalia & A Goyal -- Asian Development Bank
11. Energy Pricing in India: Perspective, Issues & Options – by Sarkar Hiren – Intl Labour Organisation

ESD 201(b) Sustainable Technology and Innovation

1. Introduction to sustainable engineering – by R.L. Rag, Lakshmi D Ramesh – Prentice Hall (PHI)
2. Green technologies for sustainable development – by Azad Kumar, Ashok Kumar – Blue Rose Publication
3. Smart technologies for sustainable development – by Dr. D. Akita, Kiranpreet Kaur, Lavkush Mishra – Book drivers.com
4. Climate change – Environmental Law Policies – Manoj Kumar Sharma – e-adhyayan
5. Green technology for a better future – by Soli J Arceivala – McGraw Hill
6. Environmental Sustainability with Green Technology – by Archana Saini, Mandeep Kaur, Prabha Nalinity Sing – Iterative International Publishers (IIP)
7. Climate change programme- Dept. of Science & Technology – DST, Govt. of India
8. City climate action plan – Training Manual – Ministry of Housing & Urban Affairs - Govt. of India
9. Sustainable Development Innovation and Opportunities – by Nandkumar, Shailesh Kumar Singh – ABS Books
10. Innovation for Sustainable Development – A planet for life – The Energy and Resource Institute (TERI)
11. Sustainability Technology and Innovation 4.0 – edited by Zbigniew Makiela, Magdalena M Stuss – Routledge Publication
12. Energy, Society and Environment (Chapter3) – D. Elliott– Routledge Publication
13. Sustainable innovation: Exploring technologies & solution for an ecofriendly future – Book I & II – by Antonio Jaimez – Kindley edition

NOTE: Reference Books though listed under individual modules may cover topics of more than one module or part of a module. Individual teachers / students may compile comprehensive notes for individual modules based on the given reference books or other sources.

Name of the Course	ADEMS	Course duration	2 semester
Course Title	EIA and Environmental Legislations	Course Code	ESD_202
Subject offered in Semester	Second	Number of Contact Hours per week	L:6, T: 0, S: 0
Total Marks	100	Total Allotted Hours	100
Question distribution	As per standing norms of WBSCT&VE&SD	Marks distribution	As per standing norms of WBSCT&VE&SD

Course Content

a) **Environmental Impact Assessment (EIA), Environmental Auditing and Risk Assessment**

Introduction to Environmental Impact Assessment (EIA) including its history and components, Aims and objectives of Environmental Impact Assessment (EIA); Environmental Impact Statement (EIS) and Environmental Management Plan (EMP); Integrated Environmental Management (Urban and Rural), EIA Guidelines, Impact Assessment Methodologies, Procedure for reviewing EIA of developmental projects; Life-cycle analysis; cost-benefit analysis; Guidelines for Environmental Audit, Environmental Planning as a part of EIA and Environmental Audit; Environmental Management System Standards (ISO14000 series); GHG certification , Energy certification; EIA Notification, 2006 and amendments from time to time; Eco-labelling schemes; Environmental Management Systems (EMS); Ecological footprint and emission trading; Green Accounting and Reporting. Standard EIA report of few industries.

Risk Assessment - Hazard identification, Hazard accounting, Scenarios of exposure, Risk characterization and Risk management.

Corporate Environmental Responsibility (CER), Fundamentals of Environmental, Social, and Governance (ESG). Notification, public participation procedure.

b) **Environmental Legislations and Policies**

Brief overview of Environmental Laws in India: Constitutional provisions in India (Article 48A and 51A); Wildlife Protection Act, 1972 amendments 1991, Forest Conservation Act, 1980, Indian Forest Act, Revised 1982, Biological Diversity Act, 2002; Water (Prevention and Control of Pollution) Act, 1974 amended 1988 and Rules 1975; Air (Prevention and Control of Pollution) Act, 1981 amended 1987 and Rules 1982; Environmental (Protection) Act, 1986 and Rules 1986; Motor Vehicle Act, 1988; The Hazardous and Other Waste (Management and Transboundary Movement) Rules, 2016; The Plastic Waste Management Rules, 2016; The Bio-

Medical Waste Management Rules, 2016; The Solid Waste Management Rules, 2016; The e-waste (Management) Rules 2016; The Construction and Demolition Waste Management Rules, 2016; The Manufacture, Storage and Import of Hazardous Chemical (Amendment) Rules, 2000; The Batteries (Management and Handling) Rules, 2010 with Amendments; The Public Liability Insurance Act, 1991 and Rules 1991; Noise Pollution (Regulation and Control) Rules, 2000; Coastal Regulation Zones (CRZ) 1991; and all amendments from time to time; National Forest Policy, 1988; National Water Policy, 2002; National Environmental Policy, 2006; Environmental Conventions and Agreements. Biodiversity act 2002, National green tribunal act 2010, compensatory aforestation fund act 2016. International Frameworks for Environmental Protection/Management, The role of Environmental Governance Institutions.

N.B.- Latest versions / amendments to be followed for all the Acts/Rules.

Suggested learning resources:

ESD 202(a) Environmental Impact Assessment(EIA), Environmental Auditing and Risk Assessment

1. Introduction to Environmental Impact Assessment – J. Glasson, R. Therivel & A. Chadwick - Routledge
2. Environmental Impact assessment Methodologies – Anjaneyulu Yerramilli and Valli Manickam – BS Publications
3. Environmental Impact assessment : A guide to Best Professional Practices – Charles H. Eccleston – CRC Press
4. Environmental Impact assessment – N Raman, A.R. Gajbhiye, S.R. Khandeswar – TechSar Pvt. Ltd.

ESD 202(b) Environmental Legislations and Policies

1. A textbook of Environmental Law – by N. Maheshwara Swamy – Asia Law House
2. Environment and Pollution Laws Acts & Rules – by Universal – Aggarwal Law House
3. Environmental Law – by Vinay N Paranjape – Central Law Agency
4. Pollution Control Acts, Rules & Notification issued thereunder – Green Book –by Central pollution Control Board (CPCB)
5. All Pollution Control Rules & Acts with latest amendments – CPCB
6. Handbook of Environmental Laws, Acts, Guidelines, Compliance & Standards – Dr. R.K. Trivedi - BS Publication
7. Environmental Legislation in India – K.R. Gupta - Atlantic Publishers and Distributors.
8. Environmental Law in India – P. Leelakrishnan - Lexis Nexis

NOTE: Reference Books though listed under individual modules may cover topics of more than one module or part of a module. Individual teachers / students may compile comprehensive notes for individual modules based on the given reference books or other sources.

Name of the Course	ADEMS	Course duration	2 semester
Course Title	Fire, Industrial Process, Environment and Health Safety and Management	Course Code	ESD_203
Subject offered in Semester	Second	Number of Contact Hours per week	L:6, T: 0, S: 0
Total Marks	100	Total Allotted Hours	100
Question distribution	As per standing norms of WBSCT&VE&SD	Marks distribution	As per standing norms of WBSCT&VE&SD

Course Content

a) Fire Safety, Industrial Process Safety and Management

Concept of Classification of fire, Portable fire extinguishers, fire water reservoir capacity, Pumps and primers, Foam and foam making equipments, Hose and hose fittings, Water relay systems, Breathing apparatus (SCBA), Small gears, Fire protective clothing, Ladders, Ropes and lines, bends and hitches, Fire prevention, Fire-fighting codes and standards, Electrical fire hazards, Structures under fire. Fire safety equipments - smoke alarms, extinguishers, sprinklers, CO alarms. fire blankets, signage, stair case design, emergency exit.

Fundamentals of industrial safety; Safety systems and equipments in different industries; Safety policy and safety terminology; Work permit systems, Job safety analysis, HIRA study, Fault tree analysis, Emergency planning, Safety inventory systems, Safety survey, Safety organization and duties of a safety officer, Accident prevention methods, Safety committee, Accident investigation, Safety management systems. Emergency management::Onsite and offsite emergency plan

b) Environment, Health and Safety management

Concept of Industry specific health risks and diseases; Occupational health hazards and risks of industrial workers; Health insurance; Policy issues and welfare programs; Evaluation of injuries; Action programs for work related diseases at the national level; Requirements and Assessment of PPE; Safety awareness, Training program; Need for safety, legal, humanitarian factors impending safety; Safety Audit; Definition of accidents: injury, types of accidents, causes and remedial measures, injury records, prevention, modes of prevention, physiological factors; Few episodes of industrial accidents in India,

Concept of ISO: 14001; Promotional Framework for Occupational Safety and Health Convention, 2006; Constitutional framework on health and safety of employees in India, National Policy on Safety, Health and Environment at

Workplace (NPSHEW), Laws related to safety (Factories ACT 1948 (the safety aspects only) Explosive ACT, Electricity ACT etc.) and all amendments from time to time.

Suggested learning resources:

ESD 203(a) Fire, Industrial Process Safety and Management

1. Manual of Fire Safety – N. Sessa Prekash, CBS Publishers and distributors Pvt. Ltd.
2. A handbook on Industrial safety & Fire Management – Ravi Kant Pandey – Chetan Prakashan
3. Electrical Safety, Fire Safety Engineering and Safety Management – S. Rao. R.K. Jain, Prof. H.L. Saluja – Khanna Publishers
4. Principles of Fire Safety Engineering – Akhil Kumar Das – PHI

ESD 203(b) Environment, Health and Safety Management

1. Environmental Management – N.K.Uberoi - Excel Books
2. Corporate Environmental Management – R. Welford - Earthscan Ltd
3. Environmental Health and Occupational Health & Safety – S. O. Afubwa, M.A. Mwanthi.
4. Handbook of OSHA Construction Safety and Health - Charles D. Reese, James V. Eidson – CRC Press

NOTE: Reference Books though listed under individual modules may cover topics of more than one module or part of a module. Individual teachers / students may compile comprehensive notes for individual modules based on the given reference books or other sources.

Name of the Course	ADEMS	Course duration	2 semester
Course Title	Term Paper	Course Code	ESD_204
Subject offered in Semester	Second	Number of Contact Hours per week	L:0, T: 0, S: 3
Total Marks	100	Total Allotted Hours	100
Evaluation System and Marks Distribution		As per standing norms of WBSCT&VE&SD and as provided in the Course Structure	

Topic for Term Paper may be selected from any topic in the syllabus. Number of words should not be less than 3000.

Name of the Course	ADEMS	Course duration	2 semester
Course Title	On the Job Training	Course Code	ESD_205
Subject offered in Semester	Second	Number of Contact Hours per week	4 weeks
Total Marks	200	Total Allotted Hours	4 weeks
Evaluation System and Marks Distribution		As per standing norms of WBSCT&VE&SD and as provided in the Course Structure	

Evaluation should be on the basis of the training report endorsed by the organisation providing training. The organisation providing training should also award the external marks.

Name of the Course	ADEMS	Course duration	2 semester
Course Title	Dissertation and Seminar	Course Code	ESD_206
Subject offered in Semester	Second	Number of Contact Hours per week	L:0, T: 0, S: 3
Total Marks	100	Total Allotted Hours	100
Evaluation System and Marks Distribution		As per standing norms of WBSCT&VE&SD and as provided in the Course Structure	

The marks should be awarded in the ratio 70:30 for Dissertation and Seminar respectively.

Annexure – I

ESD 105 Pollution Monitoring and Mapping Lab

Laboratory facilities

Minimum Room size – 80 Sq. M. / 850 Sq. ft.

Facilities

- Water Supply Connection with 2 laboratory sinks
- Working tables – Wooden / Glazed tiles / Marble
- Adequate ventilation- at least 2 nos. Exhaust Fan
- Refrigerator Minimum 300 Litre Capacity
- Glass / wooden Windows with 30% of Vertical content of the room
- Wooden Cabinet for Glassware / Chemical Storage
- Space for Portable Device / Instrument Storage
- Space for sitting of Instructor and Students
- Table Top for installation of electronic equipments / instruments with cover
- Broken glass/equipments/waste storage bins
- Fire and other safety arrangements
 1. Lab Gloves
 2. Sprinklers
 3. Smoke and Fire alarms
 4. Fire Extinguishers
 5. Mask(Disposable) N95
 6. Apron
 7. Safety Goggles
 8. Fume Hoods
 9. First aid Kits
- Adequate lighting arrangement
- 440 Volt Connection, few 32 amp socket and switches for furnace
- Electrical Board with 5-6 sockets for 15 amp and switches
- Entrance door – Minimum 1400 mm wide
- Quality assurance / control Certificates for Standardisation of equipments through accredited agencies

Laboratory instruments / devices /equipments required for the above laboratory

1. Noise level meter / Sound level meter (30-130 dB) (Digital)
2. Water and wastewater sampling device (Conforming to IS: 3025- Latest Edition)
3. pH meter; TDS meter; Thermometer; Dissolved Oxygen meter (Digital type with probe)
4. BOD incubator (20°C / 37°C)
5. COD Digestor
6. UV-Visible Spectrophotometer
7. Portable DO/ COD/ BOD meter
8. Ion selective electrode(ISE) meter for NO₂, NH₃, PO₄ measurement
9. Muffle furnace (900°C) with Microprocessor (Minimum size 150 X 150 X 300 mm)

10. Standard Light Microscope
11. Petri film kit
12. Coliform testing kit
13. Autoclave
14. Flame photometer
15. Hot air oven
16. Shaker
17. Magnetic Stirrer
18. Jar Tester
19. Imhoff Cone for sludge testing
20. Oil and grease measuring device (Sohxlet Apparatus)
21. Standard Indian Raingauge (non recording) natural siphon type with funnel collector (400-1000 mm) (as per IS: 5225-Latest Edition)
22. Pan evaporator (open pan type) (as per IS: 5973- Latest Edition)
23. Hydrometer with 1000 mL glass cylinder for soil analysis
24. Auger boring apparatus for Soil Sampling
25. Pond & stream Sampling Kits including nets Computer with Statistical Software tools
26. Glasswares (Beaker, Conical flask, Measuring Cylinder, Bowl, BOD Bottles etc.)
27. Weighing balance (with 1 mg accuracy)
28. Respirable Dust Sampling equipments with ISI specification
- 29. Portable Multi-Gas Detector**

Note: The Institute offering the course may collaborate with approved laboratories of Institutes / standard agencies with necessary accreditation / approval.

Annexure – II

Faculty Requirement for ADEMS Course

Essential Qualifications

1. A bachelor degree in Engineering/ Science from Institution / University recognised by UGC/AICTE.
2. A Post-graduate degree in Environmental Science/Environmental Engineering/ Environmental Safety and health Science/ Environmental Management or Equivalent from Institution / University recognised by UGC/AICTE.
3. The incumbent must have at least 5 years experience in relevant field.
4. For Faculty Members teaching Environmental Auditing, Environmental Legislations, Fire-Industrial-Process Safety – A bachelor degree in Engineering with a Post Graduate Diploma in Relevant Field and 7 years relevant experience may be considered.

Desirable Qualification (Over and above Essential Qualifications)

1. Post Graduate degree/diploma in Environmental Management/ Environmental Laws/ Industrial Safety and Hazard Management or equivalent.
2. Experience in Environmental health and Safety Audit in Workspace.
3. Conducting laboratory teaching / Environmental Quality monitoring.
4. Experience of using modern mathematical lab pertaining to this course.