STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI

COURSE PLAN (November 2024 – April 2025)

Department : **B.VOC SUSTAINABLE ENERGY MANAGEMENT**

Name/s of the Faculty : **DR.R.VINCENT FEMILAA AND DR.P.ANTO CHRISTY**

Course Title : **ADVANCED BIO ENERGY**

Course Code : **23VS/VM/AB46**

Shift : **II**

COURSE OUTCOMES (COs)

COs	Description	CL
CO1	remember the advanced bioenergy concepts, biogas production, biogas plant, health and environment, biogas stove	K1
CO2	evaluate the bioenergy classifications, biogas phases, estimation of biogas plant capacity, sustainability on environment and use of biogas stove.	K2
CO3	refine the conceptual design of bioconversion, factors affecting biogas production, maintenance of biogas plant, public health impact and types of biogas stoves	K3
CO4	understand the importance of biobased products, feedstocks for biogas production, installation of biogas plants, bio gas cleaning systems	K4
CO5	apply principles of bio materials and conversion, organic components, safety of biogas plant and construction of biogas stove and construction of biomass gas stove	K5&K6

CL – Cognitive Level

K1 – Remember | K2 – Understand | K3 – Apply | K4 – Analyse | K5 – Evaluate | K6 –Create

Week	Unit No.	Content	Cognitive Level	Teaching Hours	COs	Teaching Learning Methodology	Assessment Methods
Nov 18 – 25, 2024 (Day Order 1-6)	1 3	1.1 Introduction- biomass, definition, classification. 3.2 Operation, maintenance of the biogas plant **Practical:** Evaluation of amount of energy given off in a combustion reaction by a Biomass-Water Boiling Test (WBT)	K1 K1-3 K1-6	2 1 3	CO1 CO1-3 CO1-5	Board and talk Board and talk	Group discussions Mini biogas model
Nov 26- Dec 3, 2024 (Day Order 1 to 6)	1 3	1.1 Biopower, Bioheat 3.2 Safety measures of the biogas plant **Practical:** Performance and evaluation of different stoves	K1-2 K1-3 K1-6	2 1 3	CO1 & 2 CO1-3 CO1-5	Board and talk Role Play	Practical Group skit
Dec 4-11, 2024 (Day Order 1 to 6)	1 3	1.1 Solid, Liquid and Gaseous biofuels 3.3 Slurry handling, utilization and enrichment	K1-2 K1-4	2 2	CO1-2 CO1-4	Board and talk Designs	Practical Mini biogas model

		Practical: Estimation of standard enthalpy of ethanol	K1-6	3	CO1-5		
Dec 12-19, 2024 (Day Order 1 to 6)	1 3	1.2 Bioconversion- aerobic 3.3 Slurry analysis, Biogas purification and utilization **Practical:** Site selection and estimation of the plant capacity of a biogas plant	K1-2 K1-K5 K1-6	2 1 3	CO1-2 CO1-5 CO1-5	Board and talk Experiments	Practical Mini biogas model
Dec 20, 2024 (Day Order 1)	1 3	1.2 Bioconversion- anaerobic 3.3 Composting methods	K1-2 K1-4	1 1	CO1-2 CO1-4	Board and talk Board and talk	Seminar **Khamba Case analysis-15 marks-Unit 3.3** (Component 1)
Jan 3 – 7, 2025 (Day Order 3 to 6)	1 4	1.2 Anaerobic digestion for methane production - microbial activities 4.1 Understanding sustainability	K1-3 K1	2 2	CO1-3 CO1	Board and talk Board and talk	Powerpoint presentation Group discussion

Jan 8 – 17, 2024 (Day Order 1 to 6)	1 4 **Practical:** Determination of pH	1.3 Biobased products – Adhesives, Construction materials and composites 4.1 Effect of Environment on sustainability	K1-3 K1-2 K1-5	2 1 3	CO1-3 CO1-2 CO1-5	Board and talk Community Surveys	Practical Survey report
Jan 18 - 23, 2025	**C.A. Test - I**						
Jan 24 -31, 2025 (Day Order 1 to 6)	1 4 **Practical:** Setting up of a biogas plant out of the given components	1.3 Biobased products - Landscaping materials, Plants and vegetable sinks 4.2 Public sensitivity	K1-3 K1-3 K1-5	2 1 3	CO1-3 CO1-3 CO1-5	Board and talk Board and talk	Powerpoint presentation **Case analysis- 20 marks- Units 4.1 & 4.2** (Component 2)
Feb 3-8, 2025 (Day Order 1 to 6)	2 4	2.1 Biogas production process- phases- Hydrolysis,Acidogenesis 4.2 Public health impact	K1-3 K1-3	2 1	CO1-3 CO1-3	Board and talk Community Surveys	Model demonstration Model Article writing

		Practical: Model construction of biogas plant	K1-5	3	CO1-5		
Feb 10– 18, 2025 (Day Order 1 to 4)	2 5	2.1Acetogenesis, Methanogenesis. 5.1 Study and use of biogas stove	K1-3 K1-3	2 2	CO1-3 CO1-3	Board and talk Learning by Doing	Practical Group discussion
Feb 19- 26, 2025 (Day Order 1-6)	2 5	2.2 Factors affecting biogas production, Different feedstocks for biogas production 5.1 Dual fuel engines **Practical:** Assessment of safety measures	K1-4 K1-3 K1-5	2 1 3	CO1-4 CO1-3 CO1-5	Board and talk Board and talk	Group discussion Report writing
Feb 27- Mar 6, 2025 (Day Order 1 to 6)	2 5	2.2 First second and third generation, Residue Feedstock, 2.3Agricultural waste - Forestry waste, Organic components of residential waste 5.2 Study of different types of stoves **Practical:** Construction of biogas stove	K1-5 K1-5 K1-5	2 1 3	CO1-5 CO1-5 CO1-5	Board and talk Board and talk	Case study **Chart making-15 marks-Unit 5.2** (Component 3)

Mar 7 – 11, 2025 (Day Order 1 to 3)	2 5	2.3 Agricultural waste - commercial, institutional and industrial waste 5.2 Gas cleaning systems	K1-5 K1-3	2 1	CO1-5 CO1-3	Board and talk Board and talk	Case study Report writing
Mar 12 –17, 2025	**C.A. Test - II**						
Mar 18 – 20, 2025 (Day 4 to 6)	3 5	3.1 Biogas Plant- Estimation of plant capacity 5.3 Construction of biomass gas stove and study	K1-3 K1-6	2 2	CO1-3 CO1-5	Board and talk Board and talk	Case analysis Model making
Mar 21 - 28, 2025 (Day Order 1 to 6)	3 5	3.1 Biogas Plant- Construction guidelines and gas conveyance system 5.3 Construction of biomass gas stove and study **Practical:** Study of different types of stove	K1-5 K1-5 K1-6	2 1 3	CO1-5 CO1-5 CO1-5	Board and talk Board and talk	Group discussion Model making
Mar 29- April 2, 2025 (Day Order 1 to 3)	**REVISION**						

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STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI

COURSE PLAN (November 2024 – April 2025)

Department : B.VOC SUSTAINABLE ENERGY MANAGEMENT

Name/s of the Faculty : DR.R.VINCENT FEMILAA AND DR.P.ANTO CHRISTY

Course Title : BIOFUELS

Course Code : 23VS/VM/BF46

Shift : II

COURSE OUTCOMES (COs)

COs	Description	CL
CO1	outline the understanding of Biofuels, principle of thermochemical conversion, chemistry of biodiesel, types and generations of biodiesel	K1
CO2	summarize the cultivation process, gasification types, characteristics of vegetable oil, oil source of the biofuel, Bioethanol production process	K2
CO3	make use of energy plantation, mini gasifier, production technology of biodiesel, by product of biodiesel, bio hydrogen	K3
CO4	analyze policy issues, scrubbers, post production, storage of biodiesel, biodiesel from Algae	K4
CO5	determine the importance of vegetable oil, thermochemical conversion, testing parameters, testing gasifier and biorefinery concepts	K5&K6

CL – Cognitive Level

K1 – Remember | K2 – Understand | K3 – Apply | K4 – Analyse | K5 – Evaluate | K6 –Create

Week	**Unit No.**	**Content**	**Cognitive Level**	**Teaching Hours**	**COs**	**Teaching Learning Methodology**	**Assessment Methods**
Nov 18 – 25, 2024 (Day Order 1-6)	1 3	1.1 Introduction and classification of Biodiesel, Different types of biofuel crops 3.3 Characteristics of vegetable oil **Practical** Characteristics of different types of feedstock	K1 K1-4 K1-6	2 1 3	CO1 CO1-4 CO1-5	Board and talk Board and talk	Question/Answer session Quiz
Nov 26- Dec 3, 2024 (Day Order 1 to 6)	1 3	1.1 Different types of biofuel crops 1.2 Cultivation practices of biofuel crops 3.4 Storage of biodiesel **Practical** Determination of density of different fuel on Biofuels	K1-3 K1-4 K1-6	2 1 3	CO1-3 CO1-4 CO1-5	Board and talk Board and talk	Interactive Discussion. Group Discussion
Dec 4-11, 2024	1	1.2 Energy plantation	K1-3	2	CO1-3	Board and talk	Quiz

(Day Order 1 to 6)	3	1.3 Energy scenario 3.4 Standards and emission norms of biodiesel **Practical** Determination of viscosity of Biofuels	K1-4 K1-6	1 3	CO1-4 CO1-5	Board and talk	**Case study-15 marks-Unit 1.3** (Component 1) Mini projects
Dec 12-19, 2024 (Day Order 1 to 6)	1 4	1.3 Scenario, policy issues and importance of vegetable oil based biodiesel 4.1 Fabrication of mini plant for biodiesel production **Practical** Sensory, Physical appearance and Identification of different Biofuels	K1-3 K1-5 K1-K6	2 1 3	CO1-3 CO1-5 CO1-5	Board and talk Board and talk	Practical Mini biogas plant
Dec 20, 2024 (Day Order 1)	2 4	2.1 Thermochemical conversion 4.1 Different types of biodiesel production processes	K1-3 K1-5	2 1	CO1-3 CO1-5	Board and talk Hands on training	Practical Mini project

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Jan 3 – 7, 2025 (Day Order 3 to 6)	2 4	2.1 Principles and types, combustion and types 4.1 Different types of biodiesel production processes	K1-5 K1-5 .	2 1	CO1-5 CO1-5	Group discussion Board and talk	Assignment **Case analysis-20 marks-Units 4.1 & 4.2** (Component 2)
Jan 8 – 17, 2024 (Day Order 1 to 6)	2 4	2.2 Gasification - principles-types 4.2 Fuel Production of biodiesel from different oil **Practical** Cloud point and Pour and point measurement of Biodiesel	K1-2 K1-4 K1-6	2 1 3	CO1-2 CO1-4 CO1-5	Board and talk Board and talk	Group project Survey report .
Jan 18 - 23, 2025	**C.A. Test - I**						
Jan 24 -31, 2025 (Day Order 1 to 6)	2 4	2.2 (Fluidized, updraft, downdraft and cross draft) 4.2 Oil extraction-Oil Refining	K1-2 K1-4	2 1	CO1-2 CO1-4	Experiment Board and talk	Model demonstration Report writing

		Practical Estimation of standard enthalpy of ethanol	K1-6	3	CO1-5		.
Feb 3-8, 2025 (Day Order 1 to 6)	2 4	2.3 Scrubbers-types, methods and selection, Biomass Densification and utilization 4.3 By product of biodiesel production process and utilization **Practical** Determination of effect of temperature on density of different fuels	K1-2 K1-4 K1-K6	2 1 3	CO1-2 CO1-4 CO1-5	Board and talk Board and talk	Practical Report writing .
Feb 10– 18, 2025 (Day Order 1 to 4)	3 4	3.1 Processing of oil seeds 4.4 Laboratory analysis of Biodiesel (Cetane number, Kinematics Viscosity, Caloric Value and Flash point) **Practical** Estimation of soap content in the Biodiesel - Quality Test	K1-2 K1-4 K1-K6	2 1 3	CO1-2 CO1-4 CO1-5	Board and talk Experiments	Assignment Report writing .

Feb 19- 26, 2025 (Day Order 1-6)	3 5	3.1 Chemistry of biodiesel 5.1First, second and third generation biofuels 5.2 Bioethanol production process **Practical** Model construction and assembling of various gasifiers	K1-2 K1-5 K1-6	2 1 3	CO1-2 CO1-5 CO1-5	Board and talk Board and talk	Group Discussion Quiz .
Feb 27- Mar 6, 2025 (Day Order 1 to 6)	3 5	3.1 Transesterification. 3.2 Properties of Biodiesel and testing 5.2 Bio hydrogen production 5.3 Biodiesel from algae and other oceanic species its merits and demerits **Practical** Estimation of acid number of different types of fuels	K1-2 K1-5 K1-6	2 1 3	CO1-2 CO1-5 CO1-5	Board and talk Experiments	Mini projects Group discussion .

Mar 7 – 11, 2025 (Day Order 1 to 3)	3 5	3.2 Properties of Biodiesel and testing 5.3 Biodiesel from algae and other oceanic species its merits and demerits	K1-2 K1-5	2 1	CO1-2 CO1-5	Board and talk Board and talk	Quiz **Report writing-15 marks-Unit 5.3** (Component 3)
Mar 12 –17, 2025	**C.A. Test - II**						
Mar 18 – 20, 2025 (Day 4 to 6)	2 4	2.1 Thermochemical conversion 4.1 Different types of biodiesel production Processes	K1-3 K1-5	2 1	CO1-3 CO1-5	Board and talk Board and talk	Practical Group discussion
Mar 21 - 28, 2025 (Day Order 1 to 6)	3 5	3.2 Properties of Biodiesel and testing 5.4 Biorefinery concepts and advantages **Practical** Estimation of acid number of different types of fuels	K1-2 K1-5 K1-K6	2 1 3	CO1-2 CO1-5 CO1-5	Board and talk Board and talk	Assignment Journal report .
Mar 29- April 2, 2025 (Day Order 1 to 3)	**REVISION**						

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI

COURSE PLAN (November 2024 – April 2025)

Department : **B.VOC SUSTAINABLE ENERGY MANAGEMENT**

Name/s of the Faculty : **DR.R.VINCENT FEMILAA AND DR.P.ANTO CHRISTY**

Course Title : **MICROBIAL FUEL CELLS**

Course Code : **23VS/VA/MF45**

Shift : **II**

COURSE OUTCOMES (COs)

COs	Description	CL
CO1	Find the need, electro catalysis, safety issues, in situ and ex-situ characterization techniques of fuel cell and principle of microbial fuel cell and bioelectricity for various applications	K1
CO2	Describe microbial cell, charge and mass transport, life cycle analysis, need for characterization of fuel cell, component of microbial fuel cell, bio hydrogen production for further applications and Electrogenic Microbes	K2
CO3	Illustrate types of fuel cell, hydrogen source, cost expectation, IV curve, comparative study of microbial fuel cell and traditional fuel cell and MFC in biosensor for energy utility	K3
CO4	Compose fuel cell modelling, analytical solutions, working of MFC for alternative solution for energy management	K4
CO5	Create and construct MFC, waste water treatment for energy generation	K5

CL – Cognitive Level

K1 – Remember | K2 – Understand | K3 – Apply | K4 – Analyse | K5 – Evaluate | K6 –Create

Week	Unit No.	Content	Cognitive Level	Teaching Hours	COs	Teaching Learning Methodology	Assessment Methods
Nov 18 – 25, 2024 (Day Order 1-6)	1 2	1.1 Need of fuel cell 2.1 Electro catalysis – activation kinetics – hydrogen source	K1-2 K1-2	2 3	CO1-2 CO1-2	Board and talk Board and talk	Quiz Assignment
Nov 26- Dec 3, 2024 (Day Order 1 to 6)	1 2	1.1 History of Fuel Cells 2.2 Fuel cell charge and mass transport – flow field	K1-2 K2-3	2 3	CO1-2 CO2-3	Board and talk Board and talk	Seminar Chart making
Dec 4-11, 2024 (Day Order 1 to 6)	1 2	1.2 Types of fuel cells 2.2 transport in electrode and electrolyte	K1-2 K2-4	2 3	CO1-2 CO2-4	Board and talk Board and talk	Model making Group Discussion
Dec 12-19, 2024 (Day Order 1 to 6)	1 2	1.3 low and high temperature fuel cells 2.3 Safety issues -cost expectation - life cycle	K1-3 K2-4	2 3	CO1-3 CO2-4	Board and talk Board and talk	Quiz Group Discussion
Dec 20, 2024 (Day Order 1)	1 2	1.3 Microbial fuel cells 2.3 life cycle analysis of fuel cells	K1-3 K2-4	2	CO1-3 CO2-4	Presentation Board and talk	Group discussion **Assignment-15 marks-Unit 2.3** (Component 1)

Jan 3 – 7, 2025 (Day Order 3 to 6)	1 3	1.3 Microbial fuel cells – Introduction 3.1 Need for characterization of fuel cell	K1-3 K2-4	 3	CO1-3 CO2-4	Board and talk Video presentation	Group discussion Seminar
Jan 8 – 17, 2024 (Day Order 1 to 6)	1 3	1.3 Microbial fuel cells – Introduction 3.2 In-situ and ex-situ characterization techniques, IV curve, frequency response analysis	K1-3 K2-4	2 3	CO1-3 CO2-4	Board and talk Video presentation	Group Discussion Assignment
Jan 18 - 23, 2025	**C.A. Test - I**						
Jan 24 -31, 2025 (Day Order 1 to 6)	5 3	5.1 Generation of bioelectricity 3.3 Fuel cell modelling and system integration	K1-3 K2-4	2 3	CO1-3 CO2-4	Board and talk Board and talk	Group Discussion Assignment
Feb 3-8, 2025 (Day Order 1 to 6)	5 3	5.2 Commercial waste management 3.3 1D model – analytical solution and CFD models	K1-5 K1-4	2 3	CO1-5 CO1-4	PPT Simulation	Quiz **Model Demonstration-20 marks-Unit 3.3** (Component 2)

Feb 10– 18, 2025 (Day Order 1 to 4)	5 4	5.2 Biohydrogen production 5.3 Wastewater treatment. 4.1 Principle and components of microbial fuel cells	K1-5 K1-5	2 3	CO1-5 CO1-5	Board and talk Board and talk	Quiz Assignment
Feb 19- 26, 2025 (Day Order 1-6)	5 4	5.4 Application of MFCs in biosensor 4.2 Construction and working of microbial fuel cells-Electrogenic Microbes-Aerobic and Anaerobic Bacteria, Fungi and Algae	K1-5 K1-5	2 3	CO1-5 CO1-5	Board and talk Board and talk	Report writing Model making
Feb 27- Mar 6, 2025 (Day Order 1 to 6)	5 4	5.4 Application of MFCs in biosensor 4.2 Aerobic and Anaerobic Bacteria, Fungi and Algae	K1-5 K1-5	2 3	CO1-5 CO1-5	Board and talk Board and talk	Quiz Assignment
Mar 7 – 11, 2025 (Day Order 1 to 3)	5 4	5.4 Application of MFCs in biosensor 4.3 Microbial fuel cells vs Traditional fuel cells -comparative study	K1-5 K1-5	 3 	CO1-5 CO1-5	Board and talk Case analysis	Quiz Group Discussion

Mar 12 –17, 2025	**C.A. Test - II**						
Mar 18 – 20, 2025 (Day 4 to 6)	5 4	5.4 Application of MFCs in biosensor 4.2 Construction and working of microbial fuel cells	K1-5 K1-5	2	CO1-5 CO1-5	Board and talk Board and talk	**Report writing- 15 marks-Units 5.1 & 5.4** (Component 3) Quiz
Mar 21 - 28, 2025 (Day Order 1 to 6)	1 3	1.3 Microbial fuel cells – Introduction 3.2 In-situ and ex-situ characterization techniques, IV curve, frequency response analysis	K1-3 K2-4	2 3	CO1-3 CO2-4	Board and talk Video presentation	Group Discussion Assignment
Mar 29- April 2, 2025 (Day Order 1 to 3)	**REVISION**						

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