

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
Four Years B.E. Course

Scheme of Examination B.E. First year (All Branches of Engineering)

First Semester

Sub Code	Subjects	Workload in hrs			Credits	Marks					Minimum Passing	
		L	T/A	P		Theory		Practical		Total	Marks	
						Internal	Uni	Internal	Uni		Theory	Practical
BSE1-1T	Mathematics-I	3	1	-	4	30	70	-	-	100	45	-
BSE1-2T	Applied Physics	3	2	-	4	30	70	-	-	100	45	-
BSE1-3T	Energy and Environment	2	2	-	3	30	70	-	-	100	45	-
BSE1-4T	Communication Skills	2	-	-	2	15	35	-	-	50	23	-
BSE1-5T	Engineering Graphics	1	-	-	1	15	35	-	-	50	23	-
BSE1-6T	Basics of Civil & Mechanical Engineering	4			Audit	50	-	-		Audit	-	-
BSE1-2P	Applied Physics Lab	-	-	3	1.5			25	25	50	-	25
BSE1-3P	Energy and Environment Lab	-	-	2	1			25	25	50	-	25
BSE1-4P	Communication Skills Lab	-	-	2	1			25	25	50	-	25
BSE1-5P	Engineering Graphics Lab	-	-	4	2			25	25	50	-	25
Three weeks Induction Program												
	Total	15	11		19.5	120*	280	100	100	600		

- L- Lecture , P-Practical, T- Tutorial , A- Activity (Half Credit per Hour)

RTMNU, Nagpur
SYLLABUS FOR FIRST YEAR (SEMESTER I & II) BACHELOR OF TECHNOLOGY
(For All Branches)

Course Code	BESI-3T			
Course Title	Energy and Environment			
Scheme & Credits	L	T/A	Credits	Semester I
	2	2	3	

Examination Scheme	
T (U) : 70 Marks T (I) : 30 Marks	Duration of University Exam. : 03 Hours

Course objectives

1. To impart knowledge in the domain of renewable and non-renewable energy sources.
2. To bring out Impact of Energy Technologies on Environment
3. To inculcate knowledge and skills about assessing the energy efficiency of different energy sources and use of advanced materials for sustainable development.

Course outcomes

After studying the course it is expected that the students will have/be able to:

- CO-1 Obtain the knowledge of solid and gaseous fuels and their Calorific Value determination.
- CO-2 Recognize the type of liquid fuels and their uses in IC engines.
- CO-3 Apply the knowledge about the use of alternative sources of energy& utilize solid waste as energy source
- CO-4 Analyze the impacts of Industrial pollution and its control.
- CO-5 Develop innovative ideas for use of advanced materials in sustainable development.

UNIT 1:- Basics of Energy and Solid Fuels

(8 Hours)

(Marks 14)

- Basics of Energy - Introduction, sources and types of energy, Units of energy, Thermal Basics of energy -fuels, thermal energy contents of fuel, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer.
- Classification of fuels, Calorific Value (HCV & LCV). Determination of Calorific value by Bomb and Boy's Calorimeter.
- Solid Fuels:- Significance of Proximate and Ultimate Analysis of coal,
- Numerical based on Dulong's formula.
- Numerical on Goutal's Formula for Gross Calorific Value based on Proximate Analysis
- Numerical on Calorific Value determination.
- Numerical on GCV & NCV by using relation formula (convert answer in joules or one of the CV given in joules)

UNIT 2: Liquid and Gaseous Fuels

(8 Hours)

(Marks 14)

- Liquid Fuel:-Fractional distillation of crude oil, Catalytic cracking and its advantages
- Knocking in internal combustion petrol and diesel engine, Octane and Cetane number, Knocking and its relationship with structure of fuel, Doping agents,
- Power alcohol, Gasohol, Diesehol, Aviation fuel, Bio-diesel.
- Gaseous Fuel:-CNG, H₂ as specialised fuel
- Combustion Calculations.

UNIT 3:- Alternate Sources of Energy & Waste to Energy Conversion

(8 hours)

(Marks 14)

- Bio-energy, Photolysis of water- Chemical Conversion of Solar Energy.
- Nuclear fuels: Numerical on Binding Energy & Average Binding Energy per Nucleon
- Fuel cells- working, advantages and disadvantages of alkaline, methanol fuel cells.
- Classification of waste on the basis of segregation at source, hazardous solid waste management technology: Physical method, chemical method, biological treatment, Eco-friendly Incineration, Depolymerization, landfill techniques.
- Utilization of Biogas and Landfill Gas for Biofuels and High Value Chemicals, gasification and Utilization of Syngas, Thermochemical Conversion of Syngas

UNIT 4:- Environmental impacts of Energy Technologies

(8 Hours)

(14 Marks)

- Industrial pollution due to non-renewable energy sources: General Introduction of Industrial pollution and its types. Principle, processes, source of pollution.
- Environmental impact and its control with reference to specific industries; like Nitrogen containing fertilizers- ammonia synthesis, Cement manufacturing Industry; Sulfuric acid manufacturing industry and petroleum Industry

UNIT 5:- Advanced materials for sustainable development

(8 Hours)

(14 Marks)

- Introduction of Advance materials, properties and applications:- composites, liquid Crystal polymers, conducting polymers, insulating materials, adhesives, biodegradable polymers.
- Nanomaterials in energy- Photochemical devices like lithium ion batteries, Nanomaterials for Energy Storage, nanomaterials in solar cells.

Books Recommended:

1. Text Book of Engineering Chemistry: S.S. Dara, S. Chand and Company Ltd. New Delhi.
2. Textbook of Engineering Chemistry: P.C. Jain and Monica Jain, Dhanpat Rai and Sons, New Delhi.
3. Materials Chemistry: A.V. Bharati and Walekar, Tech Max Publications, Pune.
4. Energy and Environment: Archana R Chaudhari and Aditi Pandet, S. Chand Publication

Reference Books:

1. A Text book of Engineering Chemistry: Shashi Chawla; Dhanpat Rai & Sons, New Delhi.
2. Applied Chemistry by N. Krishnamurthy: P. Vallinavagam. And K. Jeysubramanian TMH
3. Applied Chemistry for Engineers: T.S. Gynge.
4. Fuels and Combustion: Amir Circar, Orient Longmans
5. Fundamentals of Engineering Chemistry (Theory and Practice) :S. K. Singh (New Age Materials)
6. Environmental Chemistry: B. K. Sharma
7. Industrial Energy Management and Utilization: L.C. Witte, P.S. Schmidt and D.R. Brown (Hemisphere Publishing Corporation, Washington, 1998)
8. Energy and Environment- NPTEL lecture notes

ENERGY AND ENVIRONMENT LABORATORY (BESI-3P)

Course Code	BESI-3P				
Course Title	Energy and Environment Lab				
Scheme & Credits	L	T	P	Credits	Semester I
	0	0	2	1	

Examination Scheme	
P (U) : 25 Marks P (I) : 25 Marks	Duration of University Exam. : 03 Hours

Laboratory outcomes

After completion of this course, the student will develop competencies in

1. The practical knowledge of handling chemicals.
2. Analysing a broad foundation in energy and environment that stresses scientific reasoning and analytical problem solving with a molecular perspective.
3. Experimental techniques using modern instrumentation.

Students should-

- Perform any six experiments.
- Study of any one experiment in virtual lab topics based on the syllabus.
- Study of any one demonstration experiment.

- 1) Determination of Flash Point of the given sample by Cleveland's open cup apparatus.
- 2) Determination of Flash Point of the given sample by Abels/ Pensky Martens close cup apparatus.
- 3) Determination of Neutralisation number (Acid value) of oil.
- 4) Determination of Viscosity by Redwood Viscometer and specific gravity of Biodiesel at different temperatures.
- 5) To determine Sulphate Concentration in a given water sample.
- 6) Determination of amount of Chloride (in Cl^- form) by Mohr's method.
- 7) Determination of COD of water sample.
- 8) To determine the Total Solids, Suspended Solids and Total Dissolved Solids of a given water sample.
- 9) Determination of turbidity of given water sample by Nephelometry
- 10). Proximate analysis of coal -Determination of % of Moisture and % of Volatile Matter in coal sample
- 11) Proximate analysis of coal -Determination of % of ash in coal sample
- 12) Demonstration of determination of % carbon by Carbon residue conradson apparatus.
- 13) Demonstration of determination of Consistency of grease by Penetrometer.
- 14) Demonstration (Virtual) of determination of Calorific value of solid/liquid fuels.
- 15) Demonstration (Virtual) of estimation of flue gas by Orsat's apparatus.

Activities

1. Preparation of Audit Report for Industry waste generation.
2. Survey of greener synthesis of common drugs (in the form of chart and/or model)
3. Nearby industrial chemicals safety measures
4. Study of Chemical processes involved in nearby industries (Cement, Paper, Electroplating, Water purification industry etc.)
5. Study of separation and recycling techniques of polymers and E-waste.
6. Study of Biogas plant.
7. Study of the production process of biofuels.
8. Study of the biomass briquetting machine.