Gyanmanjari Innovative University

Course Syllabus
Gyanmanjari Institute of Technology
Semester-5 (B.Tech.)

Subject: Fuels and Combustion – BETCH15316

Type of course: Professional Elective Courses

Prerequisite: Material and Energy Balance Calculations

Rationale: Fuels and combustion course introduces basic knowledge about solid, liquid and gaseous fuels, their origin, classification, preparation procedure and characterization in terms of physico-chemical properties. Coal being the main solid fossil fuels, its mining, cleaning and combustion processes covered in detail. Petroleum is the liquid fuel which is elaborated in terms of exploration, evaluation, distillation and secondary processing.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
CI	T	P	C	Theory Marks		Practical Marks		CA	
				ESE	MSE	V	P	ALA	
3	0	0	3	60	30	10	0	50	150

Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Sr. No.	Course content	Hrs.	Weightage
1	**Introduction:** Types of fuels, solid, liquid and gaseous fuels, History of solid liquid and gaseous fuels, production, present scenario and consumption pattern of fuels, fundamental definitions, properties and various measurements, properties of solid liquid fuels and their measurement techniques. **Solid fuels :** Coal origin, its classification, composition, and properties. Coal mining, preparation, and washing. Combustion of coal and coke making, different types of coal combustion techniques, coal tar distillation, coal liquefaction: direct and Indirect liquefaction, coal	10	30%

	gasification, oxidation and hydrogenation. Efficient use of solid fuels.		
2	**Liquid Fuels :** Origin and classification of petroleum, refining, properties & testing of petroleum products, various petroleum products, petroleum refining in India, liquid fuels from other sources, storage and handling of liquid fuels. **Gaseous Fuels :** Types of gaseous fuels: natural gases, methane from coal mines, manufactured gases, producer gas, water gas, biogas, refinery gas, LPG, hydrogen, acetylene, other fuel gases. Cleaning, purification and quality enhancement of gaseous fuels.	15	20%
3	**Manufactured fuels :** Agro fuels, solid fuel handling, properties related to combustion, handling, and storage. bio-Fuels: types of bio-fuels, production processes and technologies, Bio-fuel applications.	10	30%
4.	**Combustion Technology:** Stoichiometry and thermodynamics of combustion, calculation of heat of formation and heat of combustion, first law analysis of reacting system, combustion of oil, combustion of coal, combustion of gas, flue gas analysis, flame properties, draft system, combustion appliances, gas burners, functional requirement of burners, gas burner classification, stoker firing, pulverized system of firing, fluidized bed combustion process, combustion controls. Introduction to different types of furnaces: heat treatment furnaces, industrial furnaces, process furnaces, and kilns. Applications of batch and continuous furnaces, oxy-rich combustion.	10	20%

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1.	**Fuel** Make presentation on a fuel and its property and use in different industries, fuel name will be provided by faculty. presentation must be uploaded on GMIU web portal	10
2.	**Coal Gasification:** Make a short report on coal gasification policy of government and its implication in different states, name of induvial state provided by the faculty to individuals/group of students, report must be submitted on GMIU web portal.	10
3.	**Gaseous fuel:** Make poster presentation on gaseous fuel and its importance in tackling environmental pollution problem, specific topic will be provided by faculty in group/individually and upload poster in GMIU web portal	10

4.	**Numerical on Stoichiometry of combustion:** 5 numerical based on fuel burning will be provided by faculty, solution of numerical will be uploaded on GMIU web portal by students.	10
5.	**Awareness Program for Rural areas about fuel:** Students should visit rural areas to conduct a awareness program on solid fuel utilization in village household and health problems and simultaneous solution, photos of awareness program must be uploaded on GMIU web portal.	10
Total		50

Suggested Specification table with Marks (Theory): 60

Distribution of Theory Marks (**Revised Bloom's Taxonomy**)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	40%	40%	20%	0%	0%	0%

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from the above table.

Course Outcome:

After learning the course, the students should be able to:	
CO1	Summaries importance of solid liquid and gaseous fuels.
CO2	Understand basic processing of fuels.
CO3	Select appropriate equipment for combustion and fuel.
CO4	Apply stoichiometry to evaluate combustion performance.

Instructional Method:

The course delivery method will depend upon the requirement of content and needs of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

The internal evaluation will be done based on Active Learning Assignment

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Reference Books:

[1] S.P. Sharma & Chander Mohan, "Fuels & Combustion", Tata McGraw Hill Publishing Co. Ltd

[2] Gupta O.P, "Elements of Fuels, Furnaces & Refractories", 3rd ed., Khanna Publishers

[3] Irvin Glassman, "Combustion" 2nd ed., Academic Press