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| **Course No.** | **:** | **REE 111** | **Course Title** | **:** | **Engineering Chemistry** |
| **Semester** | **:** | **I** | **Credits** | **:** | **2(1+1)** |

**Syllabus:**

**Theory**

Phase rule and its application to one and two component systems. Fuels: classification. calorific value. Colloids: classification. properties. Corrosion: causes. types and method of prevention. Water: temporary and permanent hardness. disadvantages of hard water, scale and sludge formation in boilers, boiler corrosion. Analytical methods like thermo-gravimetric. polarographic analysis. nuclear radiation. detectors and analytical applications of radioactive materials. Enzymes and their use in the manufacturing of ethanol and acetic acid by fermentation methods.Principles of food chemistry.Introduction to lipids, proteins, carbohydrates, vitamins, colouring and flavouring reagents of food. Lubricants: properties. mechanism. classification and tests. Polymers.types of polymerization. properties. uses and methods for the determination of molecular weight of polymers. Introduction to IR spectroscopy.

**Practical**

Determination of temporary and permanent hardness of water by EDTA method: Estimation of chloride in water: Estimation of dissolved oxygen in water: Determination of BOD in water sample: Determination of COD in water sample: Estimation of available chlorine in bleaching powder: Determination of viscosity of oil: Estimation of activity of water sample: Estimation of alkalinity of water sample: Determination of carbonate and non- carbonate hardness by soda reagent: Determination of coagulation of water and chloride ion content: Determination of specific rotation of an optically active compound: Determination of Xnax and verification of Beer Lambert Law: Determination of calorific value of fuel: Identification of functional groups (alcohol, aldelyde, ketones, carboxylic acid and amide) by IR: Chromatographic analysis: Determination of molar refraction of organic compounds.

**Teaching Schedule:**

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| **Lect No** | **Topics to be covered** | **Book No** | **Chapter No** | **Article no** | **Page no** |
| 1 | **Fuels: classification. Calorific value.**  Fuel –definition  Classification of fuels  Calorific value  Characteristics of a good fuel  Comparison between solid, liquid and gaseous fuels.  Solid fuels: wood , coal | 1 | 2 | 2.1  2.2  2.3  2.4  2.5  2.9 -2.10 | 73  73  74  75  75-76  81 |
| 2-3 | Classification of coal by rank  Peat, Lignite , Bituminous, Anthracite  Analysis of coal  Solved ProblemNo.9  Unsolved problems No. 24 &25  Gross and Net calorific Value  Determination of CV by Bomb Calorimeter  Theoretical calculations of CV of a fuel  Solved problems No. 1-5  Un-solved Problems No.1,3,4,7,22,23 | 1 | 2 | 2.11  2.13  2.6  2.6  2.8 | 81-82  84-86  118-119  131  78-80  76-79  80  128  128-130 |
| 4 | Liquid fuels  Petroleum Classification of Petroleum  Origin of Petroleum( modern theory only)  Refining of crude oil  Cracking-thermal cracking. | 1 | 2 | 2.18  2.18 | 91  91  92  92  93-95 |
| 5-6 | Gaseous fuel( Definition, composition and uses only)  Natural gas  Coal gas  Oil gas  Producer gas  Water gas  Bio gas  Determination of CV of gas by Junkers gas Calorimeter  Flue gas analysis by Orsat’s apparatus | 1 | 2 | 2.28  2.28  2.29  2.30  2.31  2.32  2.33  2.36 | 106  106  106  107  108  109  110  113  113-115 |

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| 7-9 | **Corrosion: causes, types and method of prevention.**  Introduction: Definition  Gravity of corrosion problems  Dry or chemical corrosion (Definition only)  Wet or electrochemical corrosion  Galvanic corrosion  Concentration cell corrosion  Passivity | 1 | 6 | 6.1  6.2  6.3  6.5  6.6  6.7 | 351  351-352  352  353  357  358  360 |
| 10-11 | Underground or soil corrosion  Pitting corrosion  Inter granular corrosion  Waterline corrosion  Stress corrosion  Microbiological corrosion  Erosion corrosion  Corrosion control( protection against corrosion) methods in short | 1 | 6 | 6.8  6.9  6.10  6.11  6.12  6.13  6.14  6.17 | 360  361  361  362  363  364  365  369-374 |
| 12 | **Water: temporary and permanent hardness. disadvantages of hard water, scale and sludge formation in boilers, boiler corrosion.**  Hardness of water: temporary & permanent  Disadvantages of hard water | 1 | 1 | 1.5  1.6 | 4-5  5 |
| Scale and sludge formation in boilers  Disadvantages of sludge formation  Disadvantages of scale formation  Boiler corrosion |  |  | 1.7  1.7  1.7  1.9 | 6  6  7  10-11 |
| 13-14 | **Lubricants: properties. mechanism. classification and tests.**  Lubricants  Functions of lubricants  Mechanism of lubrication  Classification of lubricants  Lubricating oils | 1 | 18 | 18.2  18.3  18.4  18.5 | 721  721  721-723  723  723 |
| 15-16 | Greases or semi –solid lubricants  Solid lubricants  Properties of lubricating oils Viscosity, Viscosity Index , Flash & Fire point, Oiliness  Cloud and pour point, Emulsion, Volatility, Carbon residue etc.  Solved examples(1,2 &3)  Unsolved examples(1,2&3) | 1 | 18 | 18.6  18.7  18.10  18.10 | 726  727  729-733  733-737  741  742 |

**Practical Exercise:**

1. Determination of viscosity of oil:
2. Estimation of alkalinity of water sample:
3. Determination of carbonate and non- carbonate hardness by soda reagent:
4. Determination of coagulation of water and chloride ion content:
5. Determination of specific rotation of an optically active compound:
6. Determination of Xnax and verification of Beer Lambert Law:
7. Determination of calorific value of gaseous fuel:
8. Determination of various properties of water: Hardness/TDS,Na,Cl.MgCO3,Ph
9. Ulltimate analysis of selected biomass
10. Proximate analysis of selected biomass
11. Determination of Fire point and Flash point of liquid fuel

**Suggested Reading**

1. Jain P L and Jain M. 1994. Engineering Chemistry. DanpatRai publishing company Pvt. Ltd., Delhi.
2. Bahl B S, ArunBahl and Tuli B D. 2007. Essentials of Physical Chemistry. S.Chand and Co. Ltd., Delhi.
3. M. Swaminathan, 1993. Hand Book of Food and Nutrition. Bangalore Printing and Publishing Co. Ltd., No. 88, P.B. No. 1807, Mysore Road, Bangalore-560018
4. Shubhangini A. Joshi. Nutrition and Dietetics. Tata McGraw-Hill Publishing Company Limited, New Delhi. (2nd Edition)
5. S. N. Mahindru, 2009. Food Science & Technology. A P H Publishing Corporation 4435-36/7, Ansari Road, Darya Ganj, New Delhi-110002.