Recommended Books:

1. Davet P, 2004. Microbial ecology of soil and plant growth. Science Publishers.
2. Nico et al., 2006. An Introduction to Ecological Genomics. 1st Edition; Oxford University Press.
3. Aston et al., 2004. Ecological Genetics: Planning and Application. Blackwell Science (UK).
4. Costa LG, and Eaton DL, 2006. Gene-Environment Interactions: Fundamentals of Ecogenetics. 1st Edition; John Wiley and Sons.
5. Freeland JR, 2005. Molecular Ecology. 1st Edition; John Wiley and Sons.
6. Wenz PS, 2001. Environmental Ethics Today. Oxford University Press.
7. Louis P and Pojman LP, 2007. Environmental Ethics: Readings in Theory and Application. 5th Edition; Wadsworth Publishing.
8. Light A, and Rolston III H, 2002. Environmental Ethics. 1st Edition; Wiley Blacwell Publishing.
9. Raven PH, and Berg LR, 2005. Environment. 5th Edition; John Wiley and Sons.

General-V: CHEM-03305 Physical Chemistry 2+1 CH

Course Objective:

The specific objectives are:

- To understand the basic concepts of physical chemistry
- To strengthen the understanding of principles of kinetics and thermodynamics
- To attire graduates with elementary practical skills

Learning Outcome:

Students completing this course will be able to;

- Elaborate the fundamental principles of physical chemistry
- Analyze physical chemistry related matters
- Apply the obtained knowledge of physical chemistry in biochemical sciences

Course Outline:

Chemical Thermodynamics:

Equation of states, ideal and real gases, the real gas equation.
Van der Waals equation for real gases, critical phenomena and critical constants.
Laws of thermodynamics and their applications, thermochemistry, calorimetry, heat capacities and their dependence on temperature, pressure and volume, reversible and non-reversible processes.
Spontaneous and non-spontaneous processes, relations of entropy and Gibbs free energy with equilibrium constant.
Gibbs Helmholtz equation, fugacity and activity. Chemical Equilibrium:
General equilibrium expressions, reaction quotients, examples of equilibrium reactions in solid, liquid and gas phases, extent of reactions and equilibrium constants.
Gibbs energies of formation and calculations of equilibrium constants, effect of temperature and pressure on the equilibrium constants/compositions, van't Hoff equation, Le-Chatelier's principle.

Solution Chemistry:

Physical properties of liquids, surface tension, viscosity, refractive index, dipole moment and their applications.
Interactions among the moleculesin liquids, ideal and non-ideal solutions.
Raoult'slaw and its applications, lowering of vapor pressure, elevation of boiling point, depression of freezing point, osmotic pressure, vapor pressure of non- ideal solutions.
Henry's law, abnormal colligative properties, degrees of association and dissociation of solutes, osmotic pressure and its measurement, fractional distillation and concept of azeotropic mixtures.

Chemical Kinetics:

The rates of reactions, Order of Reactions; zero, first, second and third order reactions with same and different initial concentrations, half-lives of reactions.
Experimental techniques for rate determination and methods for determination of order of reaction (integration, half-life, initial rate, and graphical methods), Arrhenius equation.

Practicals:

Determination of viscosity and refractive index of liquids
Determination of percent composition of liquid solutions viscometrically

Determination of refractive index and molar refractivity
Determination of percent composition of liquid solutions by refractive index measurements.
Determination of molecular weight of a compound by elevation of boiling point ebullioscopic method)
Determination of molecular weight of a compound by lowering of freezing point (cryoscopic method)
Determination of heat of solution by solubility method.
Determination of heat of neutralization of an acid with a base, Kinetic study of acid catalyzed hydrolysis of ethyl acetate.
Determination of partition coefficient of a substance between two immiscible liquids.

Recommended Books:

1. McQuarrie, D. A. and Simon, J. D., Physical Chemistry – A Molecular Approach, (1997).
2. AtkinsP. and PaulaJ.D., Atkin's Physical Chemistry, 9th ed., Oxford University Press, (2010).
3. Shoemaker, D., Experiments in Physical Chemistry, 8th ed., McGraw Hill
4. Silbey R., Alberty R. and Bawendi M., Physical Chemistry, 4th ed., (2005).
5. Glasstone S., Textbook of Physical Chemistry, Macmillan London (1960).
6. Chaudhary S.U., Ilmi Textbook of Physical Chemistry, 2nd ed., IlmiKitabKhana Lahore, (2013).
7. Linder, B., Elementary Physical Chemistry, World Scientific Publishing Co. Ptv. Ltd., (2011).