**Course-Plan**

**L2-T0-P1-CR3**

**School: Science**
**Department:Environmental Science**
**Course Code: ES-567**

**Course Name: Environmental Plant Physiology and Biochemistry**

**Instructor: Dr. Nirmali Gogoi**

1. **Abstract**: An increase in population, urbanization and industrialization have posed many environmental problems in recent years. The course deals with interaction of metabolic components and physiological processes of cells with the environment. The environmental changes will have lot of impact on basic cellular and molecular processes. Macro and micromolecules of cells have to develop adaptability to adverse environmental condition for sustainability of plant growth and development. The generic frame work of the course comprises basic changes in the molecular level to organ level due to environmental heterogeneity.

2. **Objective:** what the course seeks to do; the course intends to give knowledge to the students on various molecular and metabolic changes that take place in the plant cells under varied environmental conditions from atomospheric pollutant to environmental stress.

**3. Prerequisites of the course**:
Knowledge about plant physiological and biochemical processes of cells and cellular reactions at adverse environmental conditions.

4. **Course outline+ suggested reading**:

Plant growth and development in relation to environmental stress -water and temperature stress, drought stress and resistance Anaerobiosis in soils, the effect of anoxia on plant metabolism, plant adaptation, survival and growth in waterlogged soils. UV radiation and its effect on cellular processes and metabolism. Effect of air pollutants in light reactions in chloroplasts, photosynthesis, photorespiration and dark respiration, membrane transport Physiological and molecular aspects of plant tolerance to atmospheric pollutants Oxyradicals and scavenging systems, enzyme system associated with plant defense mechanisms, superoxidedismutase, role of stomata in plant defense system Bioconversion of pollutants-active vs. inactive process Enzymatic degradation by monooxygenase Role of cytochrome P 450 and its multiple forms. Metal toxicity: metal biomacromolecule interaction.

**Practical:** Quantitative estimation of protein. Total amino acid analysis. Chlorophyll and chlorophyll stability index, proline estimation as index of drought resistance, measurement of growth parameters in the field.

**Text Books :**
1. A.H. Fitter and R.K.M. Hay Environmental Physiology of Plants, Academic Press, 1987

2. J. Levitt Responses of Plants to Environmental Stress, Academic Press,1987
3. A. Lehninger Biochemistry, Kalyani Publishers,1993
4. L. Taiz and E. Zeiger Plant Physiology, Sinauer Associates, 1998
5. W. Larcher , Physiological Plant Ecology, Springer-Verlag, 1975
6. Park S. Nobel, Physicochemical & Environmental Plant Physiology (3rd Edition) Academic Press, 2005

**References :**

7. Roberto Pintan, Zeno Varanini, Paolo Nannipieri (editors), The Rhizosphere-Biochemistry and Organic Substances at the Soil Plant interface 2nd Edition, CRC Press, 2007
8. D. Voet and J. Voet Biochemistry, John Wiley and Sons, 2004
9. R. Roger Hand Book of Plant Ecophysiology Techniques, Kluwer, 2001

Plant growth and development in relation to environmental stress -water and temperature stress, drought stress and resistance Anaerobiosis in soils, the effect of anoxia on plant metabolism, plant adaptation, survival and growth in waterlogged soils. UV radiation and its effect on cellular processes and metabolism. Effect of air pollutants in light reactions in chloroplasts, photosynthesis, photorespiration and dark respiration, membrane transport Physiological and molecular aspects of plant tolerance to atmospheric pollutants Oxyradicals and scavenging systems, enzyme system associated with plant defense mechanisms, superoxidedismutase, role of stomata in plant defense system Bioconversion of pollutants-active vs. inactive process Enzymatic degradation by monooxygenase Role of cytochrome P 450 and its multiple forms. Metal toxicity: metal biomacromolecule interaction.

**5.** (a)**Time-Plan**

| **Learning units/content** | **Contact hours** | **Total hours** |
|---|---|---|
| Plant growth and development in relation to environmental stress introduction | 1 | 1 |
| Plant growth and development in relation to water stress | 2 | 2 |
| Anaerobiosis in soils-the effect of anoxia on plant metabolism | 2 | 2 |
| Plant adaptation, survival and growth in waterlogged soils | 2 | 2 |
| TEST-I | | |
| Plant growth and development in relation to temperature stress | 2 | 2 |
| UV radiation and its effect on cellular processes | 1 | 1 |
| UV radiation and its effect on metabolism | 1 | 1 |
| Air pollutants and their effect on plant cell ultrastructure | 2 | 2 |
| Major-I | | |
| Effect of air pollutants in light reactions in chloroplasts | 1 | 1 |
| Effect of air pollutants on photosynthesis | 1 | 1 |
| Effect of air pollutants on photorespiration | 1 | 1 |
| Physiological and molecular aspects of plant tolerance to ozone,oxiradicles | 3 | 3 |
| Scavanging system,escape mechanism | 2 | 2 |
| TEST-2 | | |
| The role of stomata in resistance mechanism | 1 | 1 |
| Emission of hydrogen sulphide by higher plants | 1 | 1 |
| Bioconversion of pollutants:active Vs inactive processes | 2 | 2 |
| Enzymic degradation by monooxygenases,role of cytochrome | 1 | 1 |

| | | |
|---|---|---|
| P450 and its multiple form | | |
| Metal toxicity:chemical form,Metal-biomacromolecule interaction | 2 | 2 |
| Major-II | | |

Practicals

| | | |
|---|---|---|
| 1. Terminologies | | |
| 2. Examine the effect of $H_2O_2$ on seed germination | | |
| 3. Estimation of chlorophyll and carotenoid content of plant leaf | | |
| 4. Determining the buffering capacity of plant foliage | | |
| 5. Estimation of Proline Content in plant leaves | | |
| 6. Determination of leaf area index | | |
| 7. Effect of water stress on germination and subsequent growth of plant | | |
| 8. Effect of heavy metals on seed germination | | |

(b) Evaluation plan

Performance of the student is evaluated on the basis of the following continuous assessment

| | |
|---|---|
| Test I | 25 marks |
| Major-I | 40 marks |
| TestII | 25 marks |
| Major II | 60 marks |
| Practical | 50 marks |

**Total: 200 marks**

**6. Pedagogy** :

Lecture and Discussion, Power point presentation, group discussion, quize and Assignment.

**7. Expected outcome:** Students will be enriched with knowledge on physiology and biochemistry of plant cells under changed environmental condition; this will help the students to encounter the applied environmental problems in the field.

**(Dr. Nirmali Gogoi)**

**Signature of the course instructor**