|  |  |
| --- | --- |
| Course title : **Plant Science II** | Full marks : 50 (40T + 10P) |
| Course No. : Sc. Ed. 427 | Pass marks : 14T + 4P |
| Nature of the course : Theory & Practical  Level : B.Ed. (4 Year) | Periods per week : 3T  Practical ( 3P) : 3pds/day/ 2Weeks/gr. |
| Year : Second | Total Periods : 75  Time per period : 45 minutes |

**1. Course Description**

This course is designed to acquaint the students with Plant science. It consists of theory and practical sections. It carries 40 marks in theory and 10 marks in practical. Students are required to secure pass marks independently both in Theory and Practical of Plant Science.

**Plant Science II**

The Plant science theory part covers plant anatomy, cytogenetics and breeding , embryology, life processes , plant diseases . The practical part includes practical activities / experiments related to the content courses.

**2. General Objectives**

The general objectives of this course are as follows

* To provide an in-depth knowledge to the students on cytogenetics, physiological, anatomical and embryological features of plants ..
* To enable the students in conducting experiments on different aspects of cytogenetics, embryological and physiological features of plant .

**3**. **Specific Objectives and Contents**

**Plant Science II : Theory**

|  |  |
| --- | --- |
| **Specific objectives** | **Contents** |
| * Describe the internal structures of different parts of angiospermic plants. | **Unit I: Plant Anatomy (10)**   * 1. Anatomical structures of dicot and monocot stems   2. Anatomical structures of dicot & monocot roots   3. Secondary growth of dicot stem   4. Anatomical structures of dorsiventral and isobilateral leaves |
| * Explain the morphology and chemical nature of chromosome. * List the chromosome number of some plants and animals. * Discuss the processes of Mitosis and its significance * Discuss the processes of meiosis and its significance. * Draw the chart on Mendel’s laws of inheritance. * Describe the process of linkage and its significance. * Discuss the process of crossing over and its significance. * List down different types of plant breeding. * Pinpoint the general principles of plant breeding. | **Unit II: Cytogenetics and breeding ( 25 )**   * 1. Chromosome: morphology, and concept of karyotype   2. Chromosome no of some plants   3. Chemical nature: nucleic acids: DNA (structure), RNA (types: tRNA, rRNA and mRNA and structure)   4. Mitosis and its significance   5. Meiosis and its significance   6. Mendel’s laws of inheritance      1. A short biography of Mendel      2. Mendel’s experiments on Monohybrid and di-hybrid crosses      3. Mendel’s laws of inheritance   7. Linkage -process and significance   8. Crossing over -process and significance   9. General principles of plants breeding      1. Selection of plant breeding - mass, pureline and clonal      2. Procedure and hybridization      3. objectives and techniques different steps for Hybridization( parental selection, emasculation, bagging, collection and storage of pollen grains, crossing, labeling, collection of Hybrid seeds) |
| * Describe the process of sporogenesis and gametogenesis. * Explain the process of double fertilization in angiosperms. * Explain the development of endosperm and embryo in in a typical dicot plant. | **Unit III: Embryology ( 10 )**   * 1. Embryology of Plants      1. General account of microsporangium, micro sporogenesis and micro gametogenesis   2. General account of megasporangium, megasporogenesis and megagametogenesis   3. Fertilization – Double fertilization and significance   4. Formation of endosperm and embryo in a typical dicot plant |
| * Show the mechanism of photosynthesis. * Describe Calvin cycle, C4 Cycle, CAM pathway, photorespiration.   .   * Explain Nitrogen fixation and its importance * Describe the mechanism of aerobic and anaerobic respiration * Describe Alcoholic fermentation, Lactic acid formation, Acetic acid formatio * Describe the characteristics, roles and application of auxins, gibberellins and cytokinins. | **Unit IV: Life** **Processes** **( 20 )**   * 1. Photosynthesis      1. Mechanism of light and dark reaction - Calvin cycle, C4 Cycle, CAM pathway, photorespiration.      2. Factors affecting photosynthesis   2. . Nitrogen fixation and its importance   3. . Respiration      1. Types      2. Mechanism of aerobic and anaerobic respiration( Alcoholic fermentation, Lactic acid formation, Acetic acid formation)      3. Factors affecting respiration   4. Plant growth hormone      1. Roles and application of Auxins, Gibberellins, cytokinins |
| * Explain plant diseases caused by some viruses, bacteria and fungi. | **Unit V: Plant Diseases (10)**   * 1. Viral diseases : Tobacco Mosaic, Potato Mosaic      1. Symptom      2. Modes of transmission      3. Control measures   2. Bacterial diseases: Black rot of crucifers, Citrus canker      1. Symptoms      2. Control measures   3. Fungal diseases: Late Blight of potato, white rust of crucifers, loose smut of wheat      1. Symptoms      2. Control measures |

*Note: The figures in the parentheses indicate the approximate periods for the respective units.*

**Plant Science II : Practical**

|  |  |
| --- | --- |
| **Specific Objective** | **Content** |
| * To prepare temporary slides of plant parts. * To prepare permanent slides of anatomy of plant parts | **Anatomy**   * Dicot and monocot stem, root and leaves * Secondary growth of dicot stem * Dicot and monocot stem |
| * To find out the pollen sterility in angiospermic plants. | **Pollen Sterility**   * Pollen grains from different flowers |
| * To identify dicot and monocot groups of plant on the basis of pollen morphology. | **Pollen Morphology**   * Pollen grains from different flowers |
| * To observe, draw and label diagram of mitotic and meiotic cell divisions | **Permanent Slides**   * Different stages of mitosis and meiosis |
| * To observe and draw different stages of embryo development in plants | **Embryology of Plants**   * Embryo sac , Endosperm and dicot embryo |
| * To observe the rate of photosynthesis under different conditions of light * To observe and find out that chlorophyll is essential for photosynthesis | **Experiment on Photosynthesis**   * Effect of light on rate of photosynthesis (red, blue, green light) * Role of chlorophyll in photosynthesis |
| * To perform an experiment on anaerobic respiration | **Respiration in Plant**   * Anaerobic respiration by germinated seeds |
| * To observe and identify selected viral, bacterial and fungal diseases. | **Plant Diseases**   * Viral, bacterial and fungal diseases included in the course |
| * To visit fields and agricultural laboratories for studying plant pathological and plant breeding experiments. | **Field Trip**   * Visit to agricultural farms and laboratories * Submission of field trip report |

**. Instructional Techniques**

The instructional techniques for this course are divided into two parts. First part deals with general instructional techniques applicable to most of the units. The second part pin points the specific instructional techniques applicable to particular unit/s.

**4.1 General Instructional Techniques**

* Lecture method
* Discussion method
* Demonstration method
* Problem solving method
* Collaborative method
* Experimental method
  1. **Specific Instructional Techniques**

**Unit II and Unit V:** Project method with report writing

**5.**      **Evaluation**

**Plant Science II : Theory**

Annual examination will be held by the Office of the Controller of Examinations at the end of the academic session for which 40 percent of total marks will be allocated. The number and types of questions are given below:

|  |  |  |  |
| --- | --- | --- | --- |
| **Types of questions** | **Total questions**  **to be asked** | **Number of questions**  **to be answered and marks allocated** | **Total marks** |
| Group A: Multiple choice items | 7questions | 7x 1 mark | 7 |
| Group B: Short answer questions | 3 with 1 or questions | 3 x 7 | 21 |
| Group C: Long answer questions | 1 with 1 or question | 1 x 12 marks | 12 |
|  |  | Total | 40 Marks |

**Plant Science : Practical Part**

The marks allocated to practical part are given in the following table.

|  |  |  |  |
| --- | --- | --- | --- |
| **Practical Examination** | **Area of Examination** | **Marks** | **Total** |
| Internal | Regularity | 1 | 2 |
| Record book | 1 |
| External | Major Experiment | 2 | 8 |
| Minor Experiment | 2 |
| Project work and collection of teaching materials | 2 |
| Viva | 2 |

**Recommended Books and References**

**Recommended Books**

Dutta, A. C. (2007). *Botany for Degree students*. Oxford University Press. **(For units I- IV)**

Pandey, B. P. (2003). *Plant Pathology*. New Delhi: S. Chand and Company Ltd. **(For unit V)**

Pandey, B. P. (2009). *Plant Anatomy*. New Delhi: S. Chand and Company Ltd. **( For unit I)**

Pandey, S. N. & Chadha, A. (2008). *Plant Anatomy and Embryology*. New Delhi: Vikash Publishing House Ltd. **(For units I & III)**

Pandey, S. N. & Sinha, B. K. (2006). *Plant Physiology*. New Delhi: Bikash Publishing House Pvt Ltd.**( For unit IV)**

Shukla, R. S. & Chandel, P. S. (2007). *Cytogenetics,Evolution and Plant Breeding*. New Delhi: S. Chand & Company Ltd. **( for unit II)**

**References**

Bhattarai, T. (2007). *Plant Physiology*. Kathmandu: Bhudipuran Prakasan.

Jain, V. K. (2008). *Fundamentals of Plant Physiology*. New Delhi: S. Chand & Company Ltd.

Noggle, G. R & Fritz, G. J. (2006). *Introductory Plant Physiology*. New Delhi: Prentice Hall of India Pvt Ltd,

Salisbury, B. & Rodd, C. W. (2007). *Plant Physiology*. New Delhi: Thomson/ Wadsworth & Akash Press.

Shukla, R. S. & Chandel, P. S. (2007). *Cytogenetics, Evolution and Biostatistics*. New Delhi: S. Chand & Company Ltd.

Singh, R.S. (2008). *Plant Diseases*. New Delhi: Oxford & IBH Pub. Co. Pvt Ltd.

Sinha, U. & Sinha, S. (2004). *Cytogenetics, Plant breeding and Evolution*. New Delhi: Bikash Publishing House.

**Recommended Books** **for Practical**

Pandey, B. P. (2009). *Modern Practical Botany Vol. I & II.* New Delhi: S. Chand & Company Ltd.

Sharma.O.P. (1989). *Practical Botany for Degree students*, India : Pragati Prakashan, Meerut.

Santra, S.C. et al ( 2006). *College Practical Botany,* *Vol.I,* India: New Central Book Agency ( P) Ltd.

**Reference Books** **for Practical**

Ranjitkar, H.D ( 2005). *A Handbook of Practical Botany*, Kathmandu: Arun . K.Ranjitkar

Sharma.A.K and Sharma.A ( 1990) ; *Chromosomal Techniques: Theory and Practice.* Butterwork and company, U.K