

**KARNATAK UNIVERSITY, DHARWAD.**

Ref. KU/Aca(S&T)/(VVV-05)//Botany/UG/2011-12/ 51

Date: 16-4-2012  
2012

**NOTIFICATION**

**Sub:** Revision of Syllabus of I and II semester of B.Sc., Botany from the academic year 2012-13 and III & IV semesters and also V & VI semesters of revised syllabus from the subsequent years i.e., from 2013-14 and 2014-15.

**Ref:** 1) BOS Res. No. 06, dt ; 31.10.2011.  
2) Science Faculty Res. No. 02, dt; 12.01.2012.  
3) Academic Council Res. No.12, dt. 26.03.2012.  
4) Vice-Chancellor's Order dated ; 16-4-2012

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Adverting to the above, the Principals of all constituent and affiliated Science degree colleges are hereby informed that the revised syllabus for B.Sc., Botany I,II, III, IV, V & VI semesters course will come into force with effect from the academic years as shown below,.

1. B.Sc. Botany - I & II Semesters	-	2012-13
2. B.Sc. Botany - III & IV Semesters	-	2013-14
3. B.Sc. Botany - V & VI Semesters	-	2014-15

Hence, the contents of this notification may please be brought to the notice of the teachers, students and all concerned.

The concerned syllabus may be obtained through the Karnatak University,  
Web Site: [www.kud.ac.in](http://www.kud.ac.in).

*S. Srinivasan*  
REGISTRAR 16/4/12

To,

Principals of all the Constituent and Affiliated Science degree colleges coming under the jurisdiction of Karnatak University, Dharwad.

**Copy F.W.cs to;**

1. Dean, Faculty of Science & Technology, P.G. Dept of studies in Geology, K.U.Dharwad.
2. The Registrar (Evaluation) K.U. Dharwad.
3. The Chairman, BOS in (UG) Botany, PG Dept. of Studies in Botany, K.U.Dharwad.
4. Dr. R.M Vatnal, In charge Director, Information Technology, Exam Section, Room No. 104, K.U.Dharwad, with a request to place the said Notification and Syllabi in the University website: [www.kud.ac.in](http://www.kud.ac.in)

**Copy to:**

1. P.S. to Vice-Chancellor, K.U. Dharwad.
2. S.A. to Registrar, K.U. Dharwad.
3. O.S. Exam Section (Science Faculty (UG)) K.U.D.
4. O.S. Exam Section (Confidential) K.U.D
5. O.S. Exam Section (QP Branch) K.U.D.
6. O.S. Exam Section (GAD) K.U.D.

## **SCHEME OF STUDY AND EXAMINATION OF SEMESTER I-VI OF BACHELOR'S DEGREE COURSE IN BOTANY**

1. B.Sc. course in Botany will be of three academic years, comprising of six semesters, two in each academic year.
2. There shall be one paper and one practical for I-IV semesters and two papers and two practicals for V and VI semesters.
3. For semesters I-IV each theory paper shall have 70 teaching hours (inclusive of 2 hrs. for tests) and 64 hours of practicals (inclusive of 4 hrs. for test). For semesters V and VI theory paper will have 48 hours and practicals shall have 64 hours of teaching.
4. There shall be study tour (1-2 days) during I and II semesters. During V semester study tour of about 6 days is mandatory. Students are required to submit the tour reports and collections made during the study tour.
5. There shall be two class tests, each of one hour duration, conducted at the end of 8<sup>th</sup> and end of 12<sup>th</sup> week of each semester. Each test should be conducted for 20 marks, later to be reduced to 10 marks. The average marks of two tests for 10 marks shall be taken as final internal assessment marks for the test component. The award of remaining 10 internal assessment marks should be for home assignment / seminar.
6. There shall be one practical test, to be conducted at the end of 12<sup>th</sup> week of semester, for 20 marks, later to be reduced for 10 marks.
7. The internal assessment marks awarded to the students shall be displayed on the notice board within two weeks from the date of conduct of the tests.
8. The practical journal should be evaluated for 5 marks. Submissions and tour reports (I, II and V semesters)/project assignment or skill development (III, IV and VI semesters) shall be evaluated for 5 marks out of 40 marks allotted for the practical examination.
9. At the end of each semester examination for theory and practical will be conducted for 80 and 40 marks respectively. The duration of examination shall be of three hours for theory and 4 hours for practicals of all semesters.

## PROFORMA FOR THE SCHEME OF STUDY AND EXAMINATION

Name of the Course: Bachelor's Degree in Botany      Duration of the Course: 3 years with six Semesters

Paper Code	Paper	Title of the Paper	Theory (Hrs/Week)	Practical (Hrs/Week)	Duration of Examination		Max. Marks for Examination		Internal Assessment		Total Marks
					Theory	Practical	Theory	Practical	Theory**	Practical***	
Botany Sem-I	I	Diversity of Microbes, Algae, Fungi and Lichens	5 hrs.	4 hrs.	3 hrs.	4 hrs.	80	40	20	10	150
Botany Sem-II	II	Diversity of Bryophytes, Pteridophytes and Gymnosperms	5 hrs.	4 hrs.	3 hrs.	4 hrs.	80	40	20	10	150
Botany Sem-III	III	Anatomy and Embryology of Angiosperms	5 hrs.	4 hrs.	3 hrs.	4 hrs.	80	40	20	10	150
Botany Sem-IV	IV	Plant Physiology and Phytochemistry	5 hrs.	4 hrs.	3 hrs.	4 hrs.	80	40	20	10	150
Botany Sem-V	V	Morphology of Angiosperms and Taxonomy	3 hrs.	4 hrs.	3 hrs.	4 hrs.	80	40	20	10	150
	VI	Ecology & Economic Botany	3 hrs.	4 hrs.	3 hrs.	4 hrs.	80	40	20	10	150
Botany Sem-VI	VII	Cell Biology and Genetics	3 hrs.	4 hrs.	3 hrs.	4 hrs.	80	40	20	10	150
	VIII	Evolution, Plant breeding and Plant Biotechnology	3 hrs.	4 hrs.	3 hrs.	4 hrs.	80	40	20	10	150

**[For Practical Maximum 10 Students per Batch]**

\* Test should be conducted at the end of 8<sup>th</sup> and 12<sup>th</sup> week of each semester.

\*\* 10 marks for test and 10 marks for assignment / skill development.

\*\*\* 5 marks for records and 5 marks for practical test.

# SEMESTER I

## PAPER I—DIVERSITY OF MICROBES, ALGAE, FUNGI AND LICHENS

**Unit 1:** Viruses – History, classification according to LHT System and status (living and non-living features). Ultrastructure, infection and multiplication of TMV. Brief account of Viroids and Prions. Viral plant diseases – Banana Bunchy Top, Yellow mosaic of Beans and Tobacco mosaic Disease. General account of Mycoplasma and diseases caused by them.

**08 Hours**

**Unit 2:** Bacteria – Distribution of bacteria. History and classification according to Bergy's manual of determinative Bacteriology, morphology and Ultra-structure of bacterial cell. Staining technique (simple and differential). Nutrition (autotrophic and heterotrophic). Reproduction - binary fission, endospore formation, conjugation, transduction and transformation. Economic importance of bacteria. Plant diseases caused by bacteria – Crown gall and Citrus canker.

**10 Hours**

**Unit 3:** Cyanobacteria – General account, Classification and distribution. Ultra-structure of the cell and reproduction. Economic importance of Cyanobacteria. Type study – Gloeotrichia and Oscillatoria.

**6 Hours**

**Unit 4:** Algae – General account, Structure, Pigmentation and classification (according to G.M.Smith). Type study of Volvox, Oedogonium, Chara, Vaucheria, Sargassum, Ectocarpus and Batrachospermum. General account of Diatoms. Economic importance of Algae.

**22 Hours**

**Unit 5:** Fungi – General account and classification (according to Alexopoulos). Type study of Albugo, Rhizopus, Penicillium, Peziza, Puccinia and Cercospora. General account of Mycorrhiza . Economic importance of Fungi

**20 Hours**

**Unit 6:** Lichens – Distribution, Types, structure and reproduction. Economic importance of lichens.

**2 Hours**

## PRACTICALS

1. Study of genera included under cyanobacteria, algae, fungi and lichens.
2. Observation of disease symptoms in hosts infected by virus, bacteria, and fungi.
3. Section cutting of infected materials and identification of pathogens included in theory.
4. Staining of bacteria (Simple and differential).

## SUGGESTED READINGS

- Smith, G.M. 1971. Cryptogamic Botany. Vol.I Algae & Fungi. Tata McGraw Hill Publishing Co., New Delhi.
- Sharma, O.P. 1992. Text Book of Thallophytes. McGraw Hill Publishing Co.
- Sharma, P.D. 1991. The Fungi. Rastogi & Co., Meerut.
- Dube, H.C. 1990. An Introduction to Fungi. Vikas Publishing House Pvt. Ltd., Delhi.
- Clifton, A. 1958. Introduction to the Bacteria. McGraw Hill & Co., New York.
- Aneja, K.R. 1993. Experiments in Microbiology, Pathology and Tissue Culture. Vishwa Prakashan, New Delhi.
- Vashista, B.R. 1978. Algae. S Chand & Co. Ltd., New Delhi.
- Basu A.N. 1993. Essentials of plant viruses, vectors and plant diseases. New Age International, New Delhi.
- Chopra, G.L. A text book of algae. Rastogi & Co., Meerut.
- Fritze, R.E. 1977. Structure and reproduction of Algae. Cambridge University Press.
- Rangaswamy, G. 1988. Diseases of crop plants in India. Prentice Hall of India, New Delhi.
- Sundarajan, S. 1997. College Botany Vol. I. S Chand & Co. Ltd., New Delhi.
- Alexopoulos, 1992. An Introduction to Mycology. New Age International, New Delhi.
- Vashista, B.R. 1978. Fungi. S Chand & Co. Ltd., New Delhi.
- H.N.Srivastava , 2003. Algae Pradeep Publication, Jalandhar, India
- Singh-Pande-Jain 2004-05. A Text Book of Botany. Rastogi Publication, Meerut
- Anil K.Thakur & Susheel K.Bassi. Diversity of Microbes and Cryptogams. Chand Publication,
- A.V.S.S.Sambamurty. A Text Book of Algae. I.K. International Private Ltd.

**Karnatak University, Dharwad**  
**SUB:BOTANY**  
**Semester – I**

**PAPER I—DIVERSITY OF MICROBES, ALGAE, FUNGI AND LICHENS**  
**Theory Question Paper Pattern**

Time : 3 Hours

Max. Marks: 80

Q. I. Answer any **TEN** of the following: 10 x 2 = 20 Marks

From Unit – 1 : Two Sub questions

From Unit – 2 : Two Sub questions

From Unit – 3 : One Sub question

From Unit – 4 : Three Sub questions

From Unit – 5 : Three Sub questions

From Unit – 6 : One Sub question

Q. II. Answer any **SIX** of the following: 6 x 05 = 30 Marks

From Unit – 1 : One Sub question

From Unit – 2 : One Sub question

From Unit – 3 : Two Sub question

From Unit – 4 : Two Sub questions

From Unit – 5 : One Sub question

From Unit – 6 : One Sub question

Q. III. Descriptive answers: 10 Marks  
From Unit-1 or from Unit -2

Q. IV. Descriptive answers: 10 Marks  
Two questions from Unit – 4 with an internal choice

Q. V. Descriptive answers: 10 Marks  
Two questions from Unit – 5 with an internal choice

**Karnatak University, Dharwad**  
**SUB:BOTANY**  
**Semester – I**

**PAPER I—DIVERSITY OF MICROBES, ALGAE, FUNGI AND LICHENS**  
**Practical - I**

Time : 04 Hours

Max. Marks: 40

Q. 1.	Identify and classify the given specimen A, B, C and D giving reasons	12 marks
Q. 2.	With the help of the symptoms observed in the given specimen E, identify the disease	02 marks
Q. 3.	Make Simple/ Differential staining of the given specimen F and show the preparation to the examiner (No written answer is expected).	02 marks
Q. 4.	Identify the given specimen / slide G and H giving reasons.	06 marks
Q. 5.	Identify the given specimen / slide I and J giving reasons.	04 marks
	Practical Record (Journal)	05 Marks
	Botanical Study-Tour Report	04 marks
	Viva-voce	05 Marks

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**Instructions to the Examiner**

- Q. 1. Two specimens from Algae and Two from Fungi
- Q. 2. Viral / Bacterial / Fungal diseases.
- Q. 3. Simple/ Differential staining of Bacteria
- Q. 4. One specimen / slide each from Algae & Fungi.
- Q. 5. One specimen / slide each from Cyanobacteria & Lichens

## **SEMESTER II**

### **PAPER II: DIVERSITY OF BRYOPHYTES, PTERIDOPHYTES AND GYMNOSPERMS**

**Unit 1:** Bryophytes – General account, classification (according to G.M.Smith). Type studies - Riccia, Marchantia, Anthoceros, Porella and Funaria. Evolutionary significance of Bryophytes. **18 Hours**

**Unit 2.** Pteridophytes – General account, classification (according to G.M.Smith). Type studies - Psilotum, Lycopodium, Selaginella, Equisetum, Ophioglossum, Adiantum and Marsilea. **20 Hours**

**Unit 3:** Stellar evolution; Heterospory and seed habit. **5 Hours**

**Unit 4:** Gymnosperms – General account, classification (according to G.M.Smith) Type studies - Cycas, Pinus and Gnetum. Economic importance of Gymnosperms. **15 Hours**

**Unit 5:** Paleobotany. Geological time scale, fossilization and different types of fossils – Study of Rhynia, Lepidodendron, Lepidocarpon, Calamites and Lyginopteris. **10 Hours**

### **PRACTICALS**

1. Study of morphology, anatomy and reproductive structures of the examples cited in Bryophytes, Pteridophytes and Gymnosperms.
2. Observations of fossil impressions and slides of the examples cited in theory.



## **SUGGESTED READINGS**

- Smith, G.M. 1971. Cryptogamic Botany. Vol. II. Bryophytes & Pteridophytes. Tata McGraw Hill Publishing Co., New Delhi.
- Sharma, O.P. 1990. Text Book of Pteridophyta. McMillan India Ltd.
- Puri, P. 1980. Bryophyta. Atma Ram & Sons, Delhi.
- Parihar, N.S. 1970. An Introduction to Embryophyta. Vol. I. Bryophyta. Central Book Depot. Allahabad.
- Sporne, K.R. 1966. Bryophytes.
- Vashista, B.R. 1978. Bryophytes. S Chand & Co. Ltd., New Delhi.
- Bhatnagar, S.P. and Moitra, A. 1996. Gymnosperms. New Age International Ltd., New Delhi.
- Gifford, E.M. and Foster, A.S. 1988. Morphology and Evolution of Vascular Plants. W.H. Freeman & Co., New York.
- Sporne, K.R. 1965. The Morphology of Gymnosperms. Hutchinson & Co., Ltd., London.
- Stewart, W.M. 1983. Paleobotany and the Evolution of Plants. Cambridge University Press, Cambridge.
- Agashe, S.N. 1995. Paleobotany. Plants of the past, their evolution, paleoenvironment and Application in exploration of fossil fuels. Oxford & IBH., New Delhi.
- Parihar, N.S. 1977. The morphology of Pteridophytes. Central Book Depot., Allahabad.
- Rashid, A. 1998. An Introduction to Pteriophyta. II Ed., Vikas Publishing House, New Delhi.
- Sporne, K.R. 1966. The morphology of Pteridophytes. The structure of ferns and Allied plants. Hutchinson & Co., Ltd., London.
- Singh-Pande-Jain 2004-05. A Text Book of Botany. Rastogi Publication, Meerut
- Pandey, Sihna and Trivedi. Text Book of Botany Vol-I. Bikas publishers.

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**Karnatak University, Dharwad**  
**SUB:BOTANY**  
**Semester – II**

**PAPER II: DIVERSITY OF BRYOPHYTES, PTERIDOPHYTES AND GYMNOSPERMS**

Time : 3 Hours

Max. Marks: 80

Q. I. Answer any **TEN** of the following: 10 x 2 = 20 Marks

- From Unit – 1 : Three Sub questions
- From Unit – 2 : Three Sub questions
- From Unit – 3 : One Sub question
- From Unit – 4 : Three Sub questions
- From Unit – 5 : Two Sub questions

Q. II. Answer any **SIX** of the following: 6 x 05 = 30 Marks

- From Unit – 1 : Two Sub questions
- From Unit – 2 : Two Sub questions
- From Unit – 3 : One Sub question
- From Unit – 4 : Two Sub questions
- From Unit – 5 : One Sub question

Q. III. Descriptive answers: 10 Marks  
Two questions from Unit – 1 with an internal choice

Q. IV. Descriptive answers: 10 Marks  
Two questions from Unit – 2 with an internal choice

Q. V. Descriptive answers: 10 Marks  
Two questions from Unit – 4 with an internal choice

**Karnatak University, Dharwad**  
**SUB:BOTANY**  
**Semester – II**

**PAPER II: DIVERSITY OF BRYOPHYTES, PTERIDOPHYTES AND GYMNOSPERMS**  
**Practical - II**

Time : 04 Hours

Max. Marks: 40

- |       |   |           |
|-------|---|-----------|
| Q. 1. | Identify and classify the given specimen A, B, C, D and E giving reasons  | 15 marks. |
| Q. 2. | Identify and explain the internal features of specimen F with the help of neat labelled diagram. Show the preparation to the examiner.              | 05marks.  |
| Q. 3. | Make a temporary micro preparation of the specimen G so as to expose_____.<br>Show the preparation to the examiner (No written answer is expected). | 05 marks. |
| Q. 4. | Identify and describe the salient features observed in the specimen / slide H, I, J, K and L.   | 10 marks. |
|       | Practical Record (Journal)  | 05 Marks. |
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**Instructions to the Examiner**

- Q. 1. Two specimens from Bryophytes and Pteridophytes and one from Gymnosperms.
- Q. 2. Specimen from either Pteridophyte or Gymnosperms.
- Q. 3. Specimen from Bryophyte / Pteridophyte / Gymnosperms.
- Q. 4. One specimen / slide each from Bryophytes, Gymnosperms and Fossils and two specimen / slide from Pteridophytes.
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## SEMESTER III

### PAPER III: ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS

**Unit 1:** Tissues. Meristems – classification based on origin, function and position, apical cell, tunica- corpus and histogen theories. Functions of meristems. Permanent tissues – Structure, functions and distribution of simple and complex tissues. Tissue systems – Mechanical, dermal, conducting and secretory tissues.

**13 Hours**

**Unit 2:** Internal structure of primary body of root, stem and leaf in monocots and dicots. Normal secondary growth in dicot stem and root. Brief account of wood anatomy (Porous and non-porous wood). Anomalous secondary growth in Bignonia, Boerhaavia, Dracaena stems and Beet root.

**15 Hours.**

**Unit 3:** Anther - Microsporogenesis and gametogenesis. Types and functions of tapetum. Concept of Male Germ Unit (MGU). Palynology- Structure , ornamentation, pore size, buccate, significance of Palynology .

**10 Hours**

**Unit 4:** Ovule – Types. Megasporogenesis and its types (mono, bi and tetrasporic). Megagametogenesis. Concept of Female Germ Unit (FGU).

**08 Hours**

**Unit 5:** Pollination – Types – Self pollination and cross pollination, contrivances of cross pollination and significance of cross pollination. Special types of pollinations.

**05 Hours**

**Unit 6:** Fertilization – Pollen-pistil interaction. Entry of pollen tube into the stigma, style and embryo sac. Double fertilization – syngamy and triple fusion.

**07 Hours**

**Unit 7:** Endosperm – types and haustoria. Embryogeny – dicots (crucifer) and monocots (grass). A brief account of polyembryony, apomixis and their significance.

**10 Hours**

### PRACTICALS

1. Study of meristems (permanent slides).
2. Study of tissues and tissue system using hand-cut sections.
3. Study of internal structure of primary root, stem and leaf of dicots and monocots using hand-cut sections.
4. Study of normal and abnormal secondary growth using hand-cut double-stained sections of examples cited in theory.
5. Demonstration of microtomy.
6. Study of microsporogenesis, ovule types megasporogenesis, types of pollination, and embryogenesis using permanent slides.
7. Mounting of embryo and endosperms.

## SUGGESTED READINGS

- Bhoojwani, S.S. and Bhatnagar, S.P. 2000. The Embryology of Angiosperms. 4<sup>th</sup> revised and Enlarged edition. Vikas Publishing House, Delhi.
- Cutter, E.G. 1969. Part I. Cells and tissues. Edward Arnold, London.
- Cutter, E.G. 1971. Plant Anatomy: Experiment and Interpretation. Part II. Organs. Edward Arnold, London.
- Easu, K. 1977. Anatomy of seed plants. 2<sup>nd</sup> edition. John Wiley & Sons, New York.
- Fahn, A. 1974. Plant Anatomy. 2<sup>nd</sup> edition. Pergamon Press, Oxford.
- Mauseth, J.D. 1988. Plant Anatomy. The Benjamin/Cummings Publishing Co., Inc., Menlo Park, California, USA.
- Raven, P.H. , Evert, R.F. and Eichhorn, S.E. 1999. Biology of Plants. 5<sup>th</sup> edition. W.H. Freeman and Co., Worth Publishers, New York.
- Johri, B.M. 1984. Embryology of Angiosperms. Springer-Verlag, Berlin.
- Maheshwari, P. 1950. An Introduction to Embryology of Angiosperms. Tata McGraw Hill, New York.
- Shukla, A.K. 1999. Biology of Pollen. Atlas Books & Periodicals.
- Raghavan, V. 1986. Embryogenesis in Angiosperms: A Developmental and Experimental Study. Cambridge University Press, New York.
- B.P.Pandey. Plant Anatomy
- M.S.Tayal. Plant Anatomy
- Singh, Pandey and Jain. Embryology of angiosperms.
- V.K.Gupta. Embryology of angiosperms.
- K.R.Shivanna. Pollen Biotechnology.

**Karnatak University, Dharwad**  
**SUB:BOTANY**  
**Semester – III**

**PAPER III: ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS**

Time : 3 Hours

Max. Marks: 80

Q. I. Answer any **TEN** of the following: 10 x 2 = 20 Marks

- From Unit – 1 : Four Sub questions
- From Unit – 2 : Three Sub questions
- From Unit – 3 : One Sub question
- From Unit – 4 : One Sub questions
- From Unit – 5 : One Sub questions
- From Unit – 6 : One Sub questions
- From Unit – 7 : One Sub questions

Q. II. Answer any **SIX** of the following: 6 x 05 = 30 Marks

- From Unit – 1 : One Sub questions
- From Unit – 2 : One Sub questions
- From Unit – 3 : One Sub question
- From Unit – 4 : One Sub questions
- From Unit – 5 : Two Sub questions
- From Unit – 6 : One Sub question
- From Unit – 7 : One Sub questions

Q. III. Descriptive answers: 10 Marks  
From Unit – 1 Or from Unit - 2

Q. IV. Descriptive answers: 10 Marks  
From Unit – 3 Or from Unit - 4

Q. V. Descriptive answers: 10 Marks  
From Unit – 6 Or from Unit - 7

**Karnatak University, Dharwad**  
**SUB:BOTANY**  
**Semester – III**

**PAPER III: ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS**  
**Practical - III**

Time : 04 Hours

Max. Marks: 40

- Q. 1. Prepare a double stained temporary micropreparation of T.S. of specimen A. Draw a labelled diagram and mention the features of anatomical interest. 08 marks  
Show the preparation to the examiner.
- Q. 2. Make a temporary micropreparation of specimen B so as to expose \_\_\_\_\_.  
Show the preparation to the examiner (No written answer is expected). 04marks
- Q. 3. Make a temporary micropreparation of specimen C so as to expose \_\_\_\_\_.  
Draw a neat labelled diagram Show the preparation to the examiners. 05marks
- Q. 4. Identify and describe the salient features observed in the specimen / slide  
D, E, F, G, H and I. 18 marks
- Practical Record (Journal) 05 Marks

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**Instructions to the Examiner**

- Q. 1. Any one stem showing anomalous secondary growth.
- Q. 2. One specimen from anatomy.
- Q. 3. Mounting – Embryo / endosperm.
- Q. 4. Two slides from anatomy, One specimen from Pollination and Microtomy each ,  
two slides from embryology.
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## SEMESTER IV

### PAPER IV - PLANT PHYSIOLOGY AND PHYTOCHEMISTRY

**Unit 1: Plant Water Relations:** Diffusion, Imbibition, Osmosis, water potential and its components. Absorption of water: Path of water movement, theories to explain water absorption, symplast and apoplast movement of water. Ascent of Sap: Path of ascent of sap, vital theories and physical theory of ascent of sap (Cohesion tension theory). Transpiration of water: Types of transpiration, stomatal frequency, Proton transport theory. Factors affecting the rate of transpiration. Significance of transpiration, antitranspirants. General account of Guttation.

**Mineral Nutrition:** Theories to explain mineral uptake (Passive and Active). Role, deficiency and toxicity symptoms of Macro (N,P,K,Mg) and Micro (Zn,Mn,B,Co) nutrients, Salt antagonism. Translocation of Organic solutes: Transcellular streaming theory, Mass flow hypothesis, Vein loading. **15 Hours**

**Unit 2: Bioenergetics: Photosynthesis:** Light as source of energy, Ultra structure of Chloroplast, Photosynthetic pigments, Concept of two photo systems, Action spectra. Mechanism of Photosynthesis, Light reaction, Dark reactions (Calvin cycle, C4 cycle, CAM pathway) Photorespiration. Factors affecting the process. Blackmann's law of limiting factors.

**Respiration:** Ultra structure of Mitochondria, Mechanism of aerobic respiration-Glycolysis, Krebs' cycle and terminal oxidation (ETS, Chemiosmotic hypothesis). Mechanism of Anaerobic respiration. Types of fermentations. Pentose phosphate pathway. Factors affecting the process. **20 Hours**

**Unit 3: Nitrogen Metabolism:** Sources of nitrogen to plants. Nitrogen cycle, importance of Nitrate reductase and its regulation, mechanism of nitrogen fixation. **05 Hours**

**Unit 4: Growth and Plant Growth Regulators:** General account of growth, Phases of growth, Growth curve. Factors affecting the growth. Physiological effects and Practical applications of Auxins, Gibberellins, Cytokinins, Ethylene, ABA and Coumarines. **09 Hours**

**Unit 5: Seed Dormancy:** General account, Factors regulating seed dormancy.

**Physiology of Flowering:** Photoperiodism, Vernalization, Devernalization, Florigen concept.

**Physiology of Senescence:** General account, role of plant growth regulators in senescence.

**Plant Movements:** Tropic and Nastic movements, Geotropism, Thigmotropism, Phototropism, Hydrotropism, Seismonasty and Thigmonasty **09 Hours**

**Unit 6: Enzymes:** Discovery and nomenclature, characteristics of enzymes; prosthetic groups, apoenzymes and holoenzymes, regulation of enzyme activity, mode of action of enzymes, mechanism of enzyme action, factors affecting the enzyme activity. Enzyme Inhibitors – Competitive, noncompetitive and uncompetitive inhibitors. **10 Hours**



## Practicals

1. Experiment to demonstrate independent diffusion.
2. Experiment to demonstrate plasmolysis.
3. Permeability of membranes by using various organic solvents.
4. Experiment to demonstrate Imbibition pressure by using Dilatometer.
5. Determination of Osmotic potential of cell sap by plasmolytic method.
6. Determination of rate of transpiration by using Ganong's potometer.
7. Unequal transpiration by using Garreau's apparatus.
8. Suction developed due to transpiration.
9. Comparison between absorption and transpiration
10. Translocation of organic solutes through phloem (ringing Experiment).
11. Effect of light wave length on photosynthesis.
12. Effect of concentration of  $\text{CO}_2$  on photosynthesis.
13. Separation of photosynthetic pigments by paper chromatography.
14. Demonstration of rate of respiration by using Ganong's respirometer.
15. Demonstration of anaerobic respiration.
16. Determination of R.Q. of carbohydrates, fats and proteins.
17. Experiment to demonstrate both green and non-green tissues respire
18. Linear growth by using Arc auxanometer.
19. Experiment to demonstrate the effect of auxins.(Apical dominance).
20. Experiment to demonstrate the effect of gibberellins (Bolting)
21. Study of Hydrotropism, Geotropism and Phototropism.
22. Study of Seismonasty and Thigmonasty.
23. Determination of pH of plant samples
24. Biochemical tests for proteins, carbohydrates and fats.

## **SUGGESTED READINGS**

- Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell (eds). 1997. *Plant Metabolism* (2<sup>nd</sup> edition). Longman, Essex, England.
- Galston, A.W. 1989. *Life Processes in Plants*. Scientific American Library, Springer-Verlag, New York.
- Hopkins, W.G. 1995. *Introduction to Plant Physiology*. John Wiley & Sons, Inc. New York.
- Lea, P.J. and Leegood, R.C. 1999. *Plant Biochemistry and Molecular Biology*. John Wiley Sons, Chichester, England.
- Mohr, H. and Schopfer, P. 1995. *Plant Physiology*. Springer-Verlag, Berlin.
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**Karnatak University, Dharwad**  
**SUB:BOTANY**  
**Semester – IV**

**PAPER IV - PLANT PHYSIOLOGY AND PHYTOCHEMISTRY**

Time : 3 Hours

Max. Marks: 80

Q. I. Answer any **TEN** of the following: 10 x 2 = 20 Marks

- From Unit – 1 : Three Sub questions
- From Unit – 2 : Three Sub questions
- From Unit – 3 : One Two Sub question
- From Unit – 4 : Two Sub questions
- From Unit – 5 : Two Sub questions
- From Unit – 6 : One Sub questions

Q. II. Answer any **SIX** of the following: 6 x 05 = 30 Marks

- From Unit – 1 : Two Sub questions
- From Unit – 2 : Two Sub questions
- From Unit – 3 : One Sub question
- From Unit – 4 : One Sub questions
- From Unit – 5 : One Sub question
- From Unit – 6 : One Sub question

Q. III. Descriptive answers: 10 Marks  
Two questions from Unit – 1 with an internal choice

Q. IV. Descriptive answers: 10 Marks  
Two questions from Unit – 2 with an internal choice

Q. V. Descriptive answers: 10 Marks  
From Unit – 4 Or from Unit - 6

**Karnatak University, Dharwad**  
**SUB:BOTANY**  
**Semester – IV**

**PAPER IV - PLANT PHYSIOLOGY AND PHYTOCHEMISTRY**

Time : 04 Hours

Max. Marks: 40

- Q. 1. Set up an experiment as per slip A. Write requirements, principle involved, procedure and conclusion. (Show the set up of the experiment to the examiners). 12 marks.
- Q. 2. Perform and write the Biochemical test of the given sample B for \_\_\_\_\_ (Show the result to the examiners). 04 marks.
- Q. 3. Determine the P<sup>H</sup> of the given sample C. Show the result to the examiners Write the procedure and result. 03 marks.
- Q. 4. Identify and comment on the physiological phenomenon involved in the experiments D, E, F and G. 16 marks.
- Practical Record (Journal) 05 Marks.

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**Instructions to the Examiner**

- Q. 1. One experiment as per the slip. ( Requirements – 2 marks, setting – 4 marks, procedure – 4 marks, conclusion – 2 marks)
- Q. 2. Perform the test for Carbohydrates or Proteins or Fats. (procedure – 2 marks, result – 2 marks)
- Q. 3. Determination P<sup>H</sup> – 2 marks, Inference – 1 mark.
- Q. 4. One experiment from Unit-1, two experiments from Unit-2 and one experiment from Unit-4 or Unit-5. ( Identification – 1 mark, procedure – 1 mark and Inference – 2 marks)
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## SEMESTER – V

### PAPER V: MORPHOLOGY OF ANGIOSPERMS AND TAXONOMY

**Unit 1:** Angiosperms – Morphology of root, stem and leaf. Their modifications for various functions. Inflorescence – types. Flower as a modified shoot. Structure and variations of flower. Floral diagram and floral formula. Fruits–types. **14 Hours.**

**Unit 2:** Angiosperm taxonomy - Brief history, botanical nomenclature, principles and rules, taxonomic ranks and principle of priority. **04 Hours.**

**Unit 3:** Classification of Angiosperms – systems proposed by Bentham and Hooker, Engler & Prantl and Angiosperm Phylogeny Group III (APG III) system of classification, their salient features, merits and demerits. Major contributions of Cytology (Cytotaxonomy) and Phytochemistry (Chemotaxonomy) to taxonomy. **04 Hours.**

**Unit 4:** Diversity of flowering plants as illustrated by members of the following families: Annonaceae, Brassicaceae, Malvaceae, Rutaceae, Fabaceae, Myrtaceae, Combretaceae, Apiaceae, Rubiaceae, Asteraceae, Sapotaceae, Apocynaceae, Convolvulaceae, Acanthaceae, Lamiaceae, Solanaceae, Amaranthaceae, Euphorbiaceae, Orchidaceae, Liliaceae, Arecaceae and Poaceae. **22 Hours.**

**Unit 5:** Herbarium techniques, botanical gardens and Botanical Survey of India and its functions. **02 Hours.**

## PRACTICALS

1. Study of root, stem and leaf structure and modifications.
2. Study of inflorescence types.
3. Study of flower and its parts, floral diagram and floral formula.
4. Study of fruits.
5. Study of families mentioned in theory with at least two examples for each.

## SUGGESTED READINGS

1. Bharati Bhattacharyya, 2005. Systematic Botany. Narosa Publishing House, New Delhi.
2. Daniel, M. 2009. Taxonomy; Evolution at work, Narosa Publishing House, New Delhi.
3. Dutta, S.C. 1988. Systematic Botany. Wiley Eastern, New Delhi.
4. Davis, P.H. and Heywood, V.H. 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd, London.
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6. Jaques, H.E. 1999. Plant families – How to know them. IBS, New Delhi.
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8. Jones, S.B. Jr. and Luchsinger, A.E. 1986. Plant Systematics (2nd edition). McGraw Hill Book Co., New York.
9. Lawrence, G.H.M. 1951. Taxonomy of vascular plants. MacMillan, New York.
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11. Naik V. N. 1984. Taxonomy of Angiosperms. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
12. Radford, A.E. 1986. Fundamentals of Plant Systematics. Harper and Row, New York.
13. Singh, G. 1999. Plant Systematics: Theory and Practice. Oxford and IBH, New Delhi.
14. Singh, V. & D.K. Jain 1996. Taxonomy of Angiosperms, Rastogi Publications, Meerut.
15. Sivarajan, V.V., 1984. Introduction to the Principles of Plant Taxonomy. Oxford & IBH Publishing. Co. Pvt. Ltd. New Delhi.
16. Stace, C.A. 1989. Plant Taxonomy and Biosystematics (2nd edition). Edward Arnold, London.
17. Stewart, W.M. 1983. Paleobotany and the Evolution of Plants. Cambridge University Press, Cambridge.

# Karnatak University, Dharwad

SUB:BOTANY

Semester – V

Theory Question Paper Pattern

**PAPER V: MORPHOLOGY OF ANGIOSPERMS AND TAXONOMY** Theory

Time : 3 Hours

Max. Marks: 80

Q. I. Answer any **TEN** of the following: 10 x 2 = 20 Marks

From Unit – 1	:	Four Sub questions
From Unit – 2	:	One Sub question
From Unit – 3	:	One Sub question
From Unit – 4	:	Six Sub questions
From Unit – 5	:	-Nil-

Q. II. Answer any **SIX** of the following: 6 x 05 = 30 Marks

From Unit – 1	:	Two Sub questions
From Unit – 2	:	One Sub question
From Unit – 3	:	One Sub question
From Unit – 4	:	Three Sub questions
From Unit – 5	:	One Sub question

Q. III. Descriptive answers: 10 Marks  
Two questions from Unit – 1 with an internal choice

Q. IV. Descriptive answers: 10 Marks  
Two questions from Unit – 4 with an internal choice

Q. V. Descriptive answers: 10 Marks  
Two questions from Unit – 4 with an internal choice

# Karnatak University, Dharwad

SUB:BOTANY

Semester – V

**PAPER V: MORPHOLOGY OF ANGIOSPERMS AND TAXONOMY**

## **Practical - V**

Time : 04 Hours

Max. Marks: 40

- |       |   |           |
|-------|---|-----------|
| Q. 1. | Assign the specimens A, B, C and D to the respective families giving diagnostic features and their classifications. | 16 marks. |
| Q. 2. | Draw the floral diagram and write floral formula of specimen E.   | 03 marks. |
| Q. 3. | Explain the morphological peculiarities observed in the specimens F, G, H and I.                                    | 12 marks. |
|       | Practical Record (Journal)  | 05 Marks. |
|       | Botanical Study-Tour Report   | 04 marks. |

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### **Instructions to the Examiner**

- Q. 1. One from monocot or apetalae/ One or two either from Polypetalae or Gamopetalae.  
(Identification – 1 mark, Classification – 1 mark, Features – 2 marks)
- Q. 2. A twig with flower buds (Floral diagram – 2 marks, Floral formula – 1 mark)
- Q. 3. One each from root / stem, Leaf, inflorescence/ flower and fruit.
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# SEMESTER V

## PAPER VI: ECOLOGY AND ECONOMIC BOTANY

**Unit 1: Plants and Environment:** Atmosphere (gaseous composition), Water (properties of water cycle), Light (global radiation, photosynthetically active radiation) and soil (development, soil profiles, physico-chemical properties) .

Morphological, anatomical and physiological responses of plants to water (hydrophytes, xerophytes and epiphytes) and salinity (Halophytes/Mangroves). Response of plants to temperature (Thermo-periodicity) and light (heliophytes and sciophytes). **08 Hours.**

**Unit 2: Population and Community Ecology:** Population and its characteristics-population density, natality, mortality, age distribution, ecotypes and ecades. Community and phytosociological characteristics - frequency, density, cover, life forms and biological spectrum. Ecological succession- hydrarch and xerarch. **06 Hours.**

**Unit 3: Ecosystems:** Introduction and types, Structure of ecosystems - biotic and abiotic components. Ecosystem functions and processes- food chain, food web, ecological pyramids (pyramid of energy, biomass and number), energy flow , bio-geo chemical cycles of carbon, nitrogen and phosphorus. **08 Hours.**

**Unit 4: Vegetation types and distribution:** Biomes of the world, Phyto-geographical regions of India, Concept of biodiversity hotspots and hotspots of India (The Western Ghats and Eastern Himalayas), Vegetation types of India and Karnataka and their distribution. **06 Hours.**

**Unit 5: Forest/wildlife resources and their conservation:** Uses of forest, causes and consequences of forest destruction in India, *in situ* and *ex situ* methods of wildlife conservation - concept of biosphere reserves, national parks and sanctuaries. National parks and wildlife sanctuaries of Karnataka. **06 Hours.**

**Unit 6: Pollution and Global climatic Changes:** A brief account of causes, consequences and control of air, water and soil pollution. Green house effect, ozone depletion and international efforts to control them. Global climatic change and its consequences. **06 Hours.**

**Unit 7: Utilisation of Plants:** Origin, distribution, botany and uses of the following: **06 Hours.**

- a. Food plants: rice, wheat, maize, pulses (pigeon pea and soya bean), potato and sugarcane
- b. Fibres: Cotton and jute.
- c. Vegetable oils: Groundnut, sunflower and coconut.
- d. Timber – Teak, sissoo
- e. Paper and Pulp: Bamboo and Eucalyptus
- f. Beverages: Tea and coffee
- g. Spices and condiments: Black pepper, Cinnamomum, clove, Cardamom,
- h. Medicinal Plants: *Rauvolfia serpentina*, *Tinospora cordifolia*, *Withania somnifera*, *Justicia adhatoda* and *Digitalis purpurea*.
- i. A brief account of Ethnobotany- definition, branches and significance.

# PRACTICALS

1. Study of frequency and density of herbaceous plants by quadrat method.
2. To determine moisture content and water holding capacity of sandy and clayey soils.
3. To estimate transparency, pH and temperature of different water bodies.
4. To estimate the salinity of water samples.
5. Ecological instruments.
6. Morphology and anatomical adaptations in three hydrophytes, one succulent and one non-succulent xerophyte, one epiphyte and one halophyte.
7. Simple microchemical tests to demonstrate carbohydrates, fats, and proteins in food plants. Test for cellulose in cotton fibres.
8. Field visits: To study the sources of firewood, timber-yielding trees and bamboos. A list to be prepared mentioning special features.
9. Spices: Examine black pepper, cloves, cinnamon (Hand sections) and describe them briefly.
10. Preparation of an illustrated inventory of ten medicinal plants used in indigenous systems of medicine or allopathy: write their botanical and common names, parts used and diseases/ disorders for which they are prescribed.
11. Beverages: Coffee beans and tea leaves.
12. Rubber: Collect illustrative materials of *Hevea brasiliensis*; morphology of the plant and tapping practices, history of rubber. List the many uses of rubber.

## SUGGESTED READINGS

- Odum, E.P. 1983. Basic Ecology, Saunders, Philadelphia.
- Kormondy, E.J. 1996. Concepts of Ecology. Prentice-Hall of India Pvt. Ltd. Delhi.
- Mackenzie, A et al. 1999. Instant Notes in Ecology. Viva Books Pvt. New Delhi.
- Kocchar, S.L. 1998. Economic Botany in Tropics. 2<sup>nd</sup> edition, Macmillian India Ltd., New Delhi.
- Sambamurthy, A.V.S.S. and Subramanyam, N.S. 1989. A Text Book of Economic Botany, Wiley Eastern Ltd. New Delhi.
- Sharma, O.P. 1996. Hill's Economic Botany. Tata McGraw Hill Co., Ltd., New Delhi.
- Simpson, B.B. and Conner-Ogorzaly, M. 1986. Economic Botany-Plants in our world. McGraw Hill, New York.
- Hill, A.F. 1989. Economic Botany. Tata McGraw-Hill, New York.
- Sharma, P.D. 1993. Ecology and Environment. Rastogi Publications, New Delhi.

### **For laboratory exercises**

- Krebs, C.J. 1989. Ecological Methodology. Harper and Row, New York.
- Ludwig, J.A. and Reynolds, J.F. 1988. Statistical Ecology. Wiley, New York.
- Moore, P.W. and Chapman, S.B. 1986. Methods in Plant Ecology. Blackwell Scientific Publications.
- Misra, R. 1968. Ecology Work Book. Oxford & IBH, New Delhi.

# Karnatak University, Dharwad

## SUB:BOTANY

### Semester – V

#### Theory Question Paper Pattern

#### PAPER VI: ECOLOGY AND ECONOMIC BOTANY

Time : 3 Hours

Max. Marks: 80

Q. I. Answer any **TEN** of the following: 10 x 2 = 20 Marks

From Unit – 1	:	Three Sub questions
From Unit – 2	:	Two Sub questions
From Unit – 3	:	Two Sub questions
From Unit – 4	:	One Sub question
From Unit – 5	:	One Sub question
From Unit – 6	:	Two Sub questions
From Unit – 7	:	One Sub question

Q. II. Answer any **SIX** of the following: 6 x 05 = 30 Marks

From Unit – 1	:	One Sub question
From Unit – 2	:	One Sub question
From Unit – 3	:	One Sub question
From Unit – 4	:	One Sub question
From Unit – 5	:	One Sub question
From Unit – 6	:	One Sub question
From Unit – 7	:	Two Sub questions

Q. III. Descriptive answers: 10 Marks  
One Question from Unit-1 Or Unit-2

Q. IV. Descriptive answers: 10 Marks  
One Question from Unit-3 Or Unit-4

Q. V. Descriptive answers: 10 Marks  
One Question from Unit-5 Or Unit-6

# Karnatak University, Dharwad

SUB:BOTANY

Semester – V

PAPER VI: ECOLOGY AND ECONOMIC BOTANY

**Practical - VI**

Time : 04 Hours

Max. Marks: 40

- Q. 1. Give an account of external and internal features of ecological adaptations of specimen A and mention the habitat to which it belongs. 06 marks
- Q. 2. Conduct the microchemical test for specimen B and write the inference 04 marks
- Q. 3. Estimate the salinity / P<sup>H</sup> of given water sample C. Write the procedure and inference 05 marks
- Q. 4. a. Identify and describe the slide D 03 marks  
b. Describe the use and working mechanism of the instrument E 03 marks
- Q. 5. Identify by giving the Botanical names and family of the specimen F and G. 06 marks  
Mention the parts used and their uses.

Practical Record (Journal) 05 Marks

Submission of Economic products ( Any Five) 04 marks

Viva-voce (On ecology / Vegetation types) 04 Marks

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## Instructions to the Examiner

- Q. 1. One ecological specimen (External adaptation – 1 mark, Internal adaptation – 2 marks, diagram (T.S.) – 2 marks, mentioning habitat – 1 mark)
- Q. 2. Microchemical test for protein/ Carbohydrates/ fat/ cellulose.  
(conducting the test – 2 marks, writing the test - 1 mark, result - 1 mark)
- Q. 3. For P<sup>H</sup> (Setting instrument – 2 marks, record of reading – 2 marks, conclusion & result – 1 mark)  
For salinity of water ( conducting the test – 2 marks, tabulation of readings – 1 mark, calculation and result – 2 marks)
- Q. 4. a. Slide / specimen of ecological interest (Identification – 1 mark, description – 2 marks)  
b. Ecological instrument (Identification – 1 mark, working mechanism and use – 2 marks)
- Q. 5. Utilization of plants  
( Identification – 1 mark, Botanical names – 1 mark, economic importance – 1 mark)
-

## SEMESTER VI

### PAPER VII: CELL BIOLOGY, GENETICS AND MOLECULAR BIOLOGY

**Unit 1: Cells:** Ultra-structure of prokaryotic and eukaryotic cell (plant cell), ultra-structure and functions of cell wall, membranes (fluid-mosaic model), endoplasmic reticulum, golgi bodies, lysosomes, peroxisomes, ribosomes, mitochondria, plastids, vacuole and nucleus. Non-living cell inclusions. **10 Hours.**

**Unit 2: Chromosomes:** Morphology and ultrastructure of chromosome (nucleosome model). Chromosome types based on centromere, autosomes and allosomes. Chromosomal aberrations- deletion, duplication, translocation and inversion. Variation in chromosome number- aneuploidy and euploidy. Mitosis and meiosis, their significance. **10 Hours.**

**Unit 3: Nucleic acids:** Chemical composition, structure and types of DNA and RNA, DNA replication (semi-conservative), concept of gene – prokaryotic and eukaryotic, genetic code. Gene expression – transcription and translation. Regulation of gene expression in prokaryotes (Lac operon model) and eukaryotes. **08 Hours.**

**Unit 4. Genetic inheritance :** Introduction to Genetics, Mendel's life and work - monohybrid cross and law of inheritance, dihybrid cross and law of independent assortment, in-complete dominance (eg: *Mirabilis jalapa*), Interaction of genes with plant examples– dominant epistasis (12:3:1 ratio), supplementary genes (9:3:4 ratio) and complementary genes (9:7 ratio), multiple alleles (eg. Self sterility in tobacco). Genetic problems related to above topics. Linkage (eg. Maize), Sex determination in plants (eg. *Melandrium*) **12 Hours.**

**Unit 5. Genetic variations:** mutations - spontaneous and induced. Transposable genetic elements, DNA damage and repair. Extra nuclear genome - presence and function of mitochondrial and plastid DNA, Plasmids. **06 Hours.**

## PRACTICALS

1. Study of Cell structure from onion peels, study of cyclosis in *Tradescantia* staminal hairs and *Hydrilla* leaf.
2. Comparative study of bacterial and cyanobacterial cells using electron micrographs.
3. Study of ultrastructure of plant cell and its organelles using electron micrographs,
4. Study of cell inclusions – cystolith, raphides & inulin
5. Measurement of length and breadth of cells by micrometry.
6. Study of mitosis in onion root cells.
7. Study of meiosis in onion/ *Rheo* flower buds.
8. Observation of permanent slides of cell division
9. Genetic problems related to laws of Mendelism and incomplete dominance (min-5 Problems)
10. Genetic problems related to interaction of genes (minimum 5 Problems).

## **SUGGESTED READINGS**

- Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K. and Watson, I.D. 1999. Molecular Biology of Cell. Garland Publishing Co., Inc., New York.
- Atherly, A.G., Girton, J.R. and McDonald, J.F. 1999. The Science of Genetics. Saunders College Publishing, Fort Worth, USA.
- Gupta, P.K. 1999. A Text-Book of Cell and Molecular Biology. Rastogi Publications Meerut.
- Kleinsmith, L.J. and Kish, V.M. 1995. Principles of Cell and Molecular Biology (2<sup>nd</sup> Edition). Harper Collins College Publishers, New York.
- Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell, J. 2000. Molecular Cell Biology. W.H. Freeman & Co., New York.
- Russel, P.J. 1998. Genetics. The Benjamin/Cummings Publishing Co. Inc. USA.
- Snustad, D.P. and Simmons, M.J. 2000. Principles of Genetics. John Wiley & Sons, Inc. USA.
- Stent, G.S. 1986. Molecular Genetics. CBS Publications.
- Wolfe, S.L. 1993. Molecular and Cell Biology. Wadsworth Publishing Co., California, USA.
- Stickbarger, M. 1990. Genetics. (3<sup>rd</sup> edition). MacMillan Publishing Co.

### **For laboratory exercises**

- Fukui, K and Nakayama, S. 1996. Plant Chromosomes: Laboratory Methods. CRC Press, Boca Raton, Florida.
- Gunning, B.E.S. and Steer, M.B. 1996. Plant Cell Biology: Structure and Function. Jones and Bartlett Publishers, Boston, Massachusetts.
- Harris, N. and Oparika, K.J. 1994. Plant Cell Biology: A Practical Approach. IRL Press, at Oxford University Press, Oxford, UK.
- Sharma, A.K. and Sharma, A. 1999. Plant Chromosomes: Analysis, Manipulation and Engineering. Harwood Academic Publishers, Australia.

# Karnatak University, Dharwad

## SUB:BOTANY

### Semester – VI

#### Theory Question Paper Pattern

#### PAPER VII: CELL BIOLOGY, GENETICS AND MOLECULAR BIOLOGY

Time : 3 Hours

Max. Marks: 80

Q. I. Answer any **TEN** of the following: 10 x 2 = 20 Marks

From Unit – 1	:	Three Sub questions
From Unit – 2	:	Two Sub questions
From Unit – 3	:	Two Sub questions
From Unit – 4	:	One Sub question
From Unit – 5	:	One Sub question
From Unit – 6	:	Two Sub questions
From Unit – 7	:	One Sub question

Q. II Answer any **SIX** of the following: 6 x 05 = 30 Marks

From Unit – 1	:	One Sub question
From Unit – 2	:	One Sub question
From Unit – 3	:	One Sub question
From Unit – 4	:	One Sub question
From Unit – 5	:	One Sub question
From Unit – 6	:	One Sub question
From Unit – 7	:	Two Sub questions

Q. III. Descriptive answers: 10 Marks  
One Question from Unit-1 Or Unit-2

Q. IV. Descriptive answers: 10 Marks  
One Question from Unit-3 Or Unit-5

Q. V. Descriptive answers: 10 Marks  
Two questions from Unit – 4 with an internal choice.



# Karnatak University, Dharwad

SUB:BOTANY

Semester – VI

PAPER VI: CELL BIOLOGY, GENETICS AND MOLECULAR BIOLOGY

**Practical - VII**

Time : 04 Hours

Max. Marks: 40

- Q. 1. Make a temporary micropreparation of the squash/ smear of the material A. Draw labeled diagram of any two stages of cell division seen in your preparation and show to the examiners 08 marks.
- Q. 2. Determine the length and breadth of the given material B by micrometric method. 05 marks.
- Q. 3. Solve the genetic problem C and D. 08 marks.
- Q. 4. Identify and describe the cytological stage in the slides F, G and H 09 marks.
- Practical Record (Journal) 05 marks.
- Submission of slides (2 meiosis slides and 3 mitosis slides) 05 marks.

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## Instructions to the Examiner

- Q. 1. Squash - *Allium* root tips.  
Smear - *Allium*, *Tradescantia*, *Aloe vera* – flower buds may be given.  
(preparation - 5 mark, drawing – 3 marks)
- Q. 2. Onion peels  
( calibration – 2 marks, drawing – 1 mark, measurement – 2 marks)
- Q. 3. Any two genetic problems ( 04 marks each)
- Q. 4. One slide from mitosis and two slides from meiosis  
( identification – 1 mark, description – 1 mark, labelled diagram – 1 mark)
-

# SEMESTER VI

## PAPER VIII: EVOLUTION, PLANT BREEDING AND PLANT BIOTECHNOLOGY

**Unit 1. Origin and evolution of life-** Theory of chemical origin, Lamarkism, Darwinism, Mutational theory and Neo-darwinism concepts. **5 Hours.**

**Unit 2. Plant propagation and breeding:** Methods of Plant propagation - cutting, grafting, layering and their types. History and objectives of plant breeding, methods of plant breeding – Introduction, Selection and types, Polyploidy breeding, mutation breeding and Hybridisation (Types - interspecific and intergeneric, techniques - emasculation, artificial pollination, bagging), Male sterility – types, production and significance in plant breeding. Quarantine methods, germ-plasm conservation, pollen banks. **13 Hours.**

**Unit 3. Plant tissue culture:** History, scope and significance, concept of cellular totipotency , tissue culture laboratory and equipments. Basic aspects – sterilization techniques, culture media and its preparation, role of growth hormones in tissue culture. Types of cultures – callus culture and organogenesis, somatic embryogenesis and synthetic seeds, anther culture and haploid plants, protoplast culture and somatic hybridisation. Application of tissue culture in agriculture, forestry, industries and plant conservation. **12 Hours.**

**Unit 4. Plant Genetic Engineering and transgenic plant production:** Introduction to GE and transgenic plants, tools and techniques of direct gene transfer and vector-mediated gene transfer (Ti plasmid) to plant cells. Steps involved in the production of golden rice. Applications and threats of transgenic plants with examples. **10 Hours.**

**Unit 5. PCR** and its applications in plant genome analysis, ELISA and its applications in plant pathogen detection, Immuno-fluorescence and its application in plant tissue culture. **06 Hours.**

## PRACTICALS

1. Study of organic evolution using charts
2. Study of plant propagation methods – cutting, layering and grafting.
3. Techniques of emasculation, artificial pollination and bagging.
4. In-vitro germination of pollens and estimation of percentage of pollen viability by hanging drop method.
5. Study of morphology and anatomy of wet and dry stigma, solid and hollow styles.
6. Study of Tissue culture Lab equipments: Laminar Air Flow, Autoclave, Incubator, Oven, etc.
7. Preparation of tissue culture media and its composition (MS), surface sterilization of explants/inoculation/callus induction
8. Preparation of synthetic seeds by alginate encapsulation
9. Study of transgenic plant production with the help of charts/photographs
10. Demonstration of DNA isolation from plant tissues
11. Demonstration of ELISA/ DNA electrophoresis

## SUGGESTED READINGS

- Chahal. Principles and procedures of Plant Breeding. L.B. Publications.
- Gopalakrishnan, T.S., Itta Sambasivaiah and Kamalakar Rao. Principles of organic evolution
- Gupta, P.K. Cytology, Genetics and Evolution. Rastogi publications, Meerut .
- Khanna, S.S. Genetics, Heridity and Evolution.
- Sinha and Sinha. Cytogenetics, Plant Breeding and Evolution. Vikas Publications.
- Joshi, P. Genetic engineering and its applications. Panima Book Distribution, Bangalore.
- Menetre, S.S. Molecular basis of cytoplasmic male sterility in crop plants.  
International Book Distribution.
- Purohit, S.S. Molecular Biology and Biotechnology. Daya Publishing House, New Delhi.
- Ratledge. Basic Biotechnology. L.B. Publications.
- Sawahel and Wagley, 1997. Plant Genetic Engineering. Daya Publishing House, New Delhi.
- Vyas, S.P. and Kohi, D.V. Methods in Biotechnology and Bioengineering. Daya Publishing House, New Delhi.
- Yadav. Biotechnology. L.B. Publications.
- Vasil, I.K. and Thorpe, T.A. 1994. Plant Cell and Tissue Culture. Kluwer Academic Publishers, The Netherlands.
- Bhojwani, S.S. 1990. Plant Tissue Culture: Applications and Limitations. Elsevier Science Publishers, New York.
- Collins, H.A. And Edwards, S. 1998. Plant Cell Culture. Bios Scientific Publishers, Oxford, UK.
- Old, R.W. and Primrose, S.B. 1989. Principles of Gene manipulation. Blackwell Scientific Publications, Oxford, UK.

# Karnatak University, Dharwad

SUB:BOTANY

Semester – VI

Theory Question Paper Pattern

## PAPER VIII: EVOLUTION, PLANT BREEDING AND PLANT BIOTECHNOLOGY

Time : 3 Hours

Max. Marks: 80

Q. I. Answer any **TEN** of the following: 10 x 2 = 20 Marks

- From Unit – 1 : One Sub question
- From Unit – 2 : Four Sub questions
- From Unit – 3 : Three Sub questions
- From Unit – 4 : Three Sub question
- From Unit – 5 : One Sub question

Q. II. Answer any **SIX** of the following: 6 x 05 = 30 Marks

- From Unit – 1 : One Sub question
- From Unit – 2 : Two Sub question
- From Unit – 3 : Two Sub question
- From Unit – 4 : Two Sub question
- From Unit – 5 : One Sub question

Q. III. Descriptive answers: 10 Marks  
Two questions from Unit – 2 with an internal choice.

Q. IV. Descriptive answers: 10 Marks  
Two questions from Unit – 3 with an internal choice.

Q. V. Descriptive answers: 10 Marks  
Two questions from Unit – 4 with an internal choice.

# Karnatak University, Dharwad

## SUB:BOTANY Semester – VI

### PAPER VIII: EVOLUTION, PLANT BREEDING AND PLANT BIOTECHNOLOGY

### Practical - VIII

Time : 04 Hours

Max. Marks: 40

- Q. 1. Estimate the percentage of pollen viability in the given flower A by Hanging drop method 07 marks
- Q. 2. Demonstrate the plant propagation method \_\_\_\_\_ in the given Sample B. Show the preparation to the examiners and write the procedure. 06 marks.
- Q. 3. Prepare synthetic seeds by alginate encapsulation method using the provided embryos C. Show the preparation to the examiners. Explain the principle of the experiment. 07 marks.
- Q. 4. Identify and comment on the specimens D, E, F, G & H. 15 marks.
- Practical Record (Journal) 05 Marks.

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### Instruction to the Examiners

- Q. 1. Unopened flowers with intact anthers (Preparation – 2 marks, procedure – 3 marks, Inference – 2 marks)
- Q. 2. One plant propagation or hybridization technique (Grafting, Layering, emasculation. (Preparation – 2 marks, Procedure – 2 marks, inference – 2 marks)
- Q. 3. Green embryos removed from fresh dicot seeds (Preparation – 2 marks, Procedure – 2 marks, Principle – 3 marks)
- Q. 4. i. One material from Organic Evolution (Photos or Chart).  
ii. One material each from plant propagation and plant breeding (photos / exhibits of propagation methods / hybridization techniques)  
iii. Two materials from plant tissue culture and Biotechnology ( Tissue culture laboratory equipments, culture media, Growth hormones culture types, Electrophoresis etc.)

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