

**HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY**

**PATAN - 384 265**

**NAAC Accreditation Grade- "B"**

**FACULTY OF SCIENCE**

**U.G. (B. Sc.) Programme**

Subject: **BOTANY**

**Under CBCS :: Semester :: Grading Pattern**

**Syllabus and Examination Scheme for**

**Semesters: III and IV**

With effect from

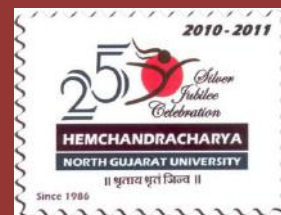
**June 2012 and December 2012**

**Date: 30/04/2012**

**Total Pages: 1 to 30**



**HEMCHANDRACHARYA  
NORTH GUJARAT UNIVERSITY  
PATAN-384 265**



NAAC 'B' (CGPA) Accredited (State University)

**Under CBCS :: Semester :: Grading Pattern**

**U.G. (B. Sc.) Programme**

in

**Faculty of**

**Science**

**B. Sc. Semesters: III and IV**

**Subject**

**Botany**

With effect from

**June 2012 and December 2012**

Total Number of Pages

**1 to 30**

**Submitted on**

**30/04/2012**

**SYLLABUS for**  
**B. Sc. (Semester III and IV) programme in**  
**BOTANY**  
 IN FORCE FROM  
**ACADEMIC YEAR**  
**June 2012 and December 2012**

**Summary of the Programme**

✓ Syllabus duration	Semester pattern i.e., <b>Six</b> months
✓ <i>No. of core compulsory (CC) course</i>	<b>02</b> (in each semester)
✓ <i>Credits per CC course</i>	<b>03</b>
✓ <i>Total credits for CC course</i>	<b>06/Semester</b>
✓ <i>Theory lectures per CC course</i>	<b>03 /week</b>
✓ <i>Total Theory lectures for CC course</i>	<b>06 /week</b>
✓ No. of Practical courses per semester	<b>02</b>
✓ Practical lectures	<b>03 /week/course/batch</b>
✓ Total Practical lectures	<b>06 /week/ batch</b>
✓ Credits per Practical course	<b>1.5</b>
✓ Total Credits of Practical course	<b>03 /Semester</b>
✓ No. of Practical course (in Uni. Exam.)	<b>02 /Semester</b>
✓ No. of Elective Subjective (ES) course	<b>01</b> (in each semester)
✓ Credits for ES course	<b>02</b> (in each semester)
✓ Theory lectures per ES course	<b>02/week</b>
✓ No. of Elective Generic (EG) course	<b>01</b>
✓ Credits for EG course	<b>02</b>
✓ Theory lectures per EG course	<b>02/week</b>
✓ Examination (including Preparation)(weeks)	<b>05</b>
✓ No. of Days per week	<b>06</b>
✓ Weeks (days) available for Teaching	<b>15 (90)</b>
✓ Duration of each lecture (minutes)	<b>55</b>
✓ No. of students/batch	<b>20</b> (on approval of AC and Exam. unit)

**Under Choice Based Credit System-Semester-Grading System pattern**  
**U G (B Sc) Programme in Botany**  
**Semester-III and IV**

The 11<sup>th</sup> Five Year plan of India proposed various measures for academic reforms in higher education. Keeping in view the challenges of the changed times and make the higher education in Indian Universities compatible with the universities in developed nations, the UGC (11<sup>th</sup> Plan, March 2009) and later on the Association of Indian Universities (AIU) stressed on the following recommendations:

- ❖ Semester System
- ❖ Choice Based Credit System.
- ❖ Curriculum Development
- ❖ Examination Reforms
- ❖ Administrative Reforms

All the above recommendations for reforms have been reviewed in by representatives of various universities in the Gujarat State and considered for implementation with the aim of transforming Higher Education-a **transformation where students change from being passive recipients of knowledge to becoming active participants of the knowledge imbibing process**. The education system in the State thus changes from a teacher-centric to **learner-centric** mode. It should aim at all-round integral development of students' personality so that they become good citizens of the new world order.

**Salient Features:** CBCS in UG programme in **Botany Semester III and IV** shall be offered from the Academic year **June 2012 and December 2012** respectively.

- ✓ Botany subject in the Universities/Affiliated Colleges shall offer undergraduate programme in Faculty of Science from the Academic year 2011-12.
- ✓ A student will have to get enrolled a **Core course** depending upon his/her requirement of a degree in the said discipline of study. A student will have a choice of selecting an **Elective** as well as **Foundation** courses from a pool of courses.
- ✓ Each course shall be assigned a specific number of **Credits**.
- ✓ A Core course is the course which should compulsorily be studied by a candidate as a Core requirement so as to get degree in a said discipline of study.
- ✓ There shall be two **Core Compulsory** courses (Theory) each with **3 credits** in each semester and their practical's each with **1.5 credits**. Thus, a credit weight-age in **B Sc** programme for each semester core course shall be of **6 credits**. In short, **9** credits multiplied by **2** subjects equal to total of **18 credits**.
- ✓ In addition to the Core courses, a student will have to choose Elective as well as Foundation courses from a pool of courses.
- ✓ **Two** courses of **Elective**, one each from **Generic Elective** and Interdisciplinary / Multidisciplinary / **Subject centric electives** shall have to be offered. The credit weight-age for each Elective course shall be of **02 Credits**. Hence, a total credit weight-age for Elective courses shall be of **4 credits**.
- ✓ One **Foundation** (English Language L.L.) course shall have to be offered. The credit weight-age for Foundation course shall be of **02 credits**.

Each course shall have a unique Course code. The Core courses, Elective courses and the Foundation courses shall be abbreviated respectively as **CC, PC, EG, ES and FC**.

1. Core Compulsory **CC**  
Practical Core (Core Elective) **PC**
2. Elective Generic **EG**  
Elective Subject **ES**
3. Foundation Compulsory **FC**

Each Academic year shall consist of **two** semesters, each of **15 weeks** of teaching equivalent to 90 working days. The Odd semester period shall be from **July to November** and the Even semester period shall be from **December to April**.

The course with **4 credits** shall be of **60 hrs** (15 weeks x 4 credits) duration. The course with **3 credits** shall be of **45 hrs** (15 weeks x 3 credits) duration. The course with **2 credits** shall be of **30 hrs** (15 weeks x 2 credits) duration.

**A general framework for Bachelor of Science (B Sc) programme shall be as follows:**

Semester wise credits						Total credits of the Programme
I	II	III	IV	V	VI	
24	24	24	24	24	24	<b>144</b>

**The semester wise weight age of core, elective and foundation courses shall be as follows:**

Academic year	Core compulsory Courses	Elective courses	Foundation courses
Semester I & II	65-75%	15-20%	10-15%
Semester III & IV	65-75%	15-20%	10-15%
Semester V & VI	65-75%	15-20%	10-15%

**Attendance:**

The Attendance Rules as per the norms of Hemchandracharya North Gujarat University.

**Medium of Instruction:**

The Medium of Instruction shall be of **Gujarati medium**. Student is free to write answers either in **Gujarati** and/or **English** language.

**Language of Question paper:**

Question paper should be drawn in **Gujarati** language and its **English** version should be given.

**Evaluation Methods:**

1. A student shall be evaluated through Comprehensive Continuous Assessment (**CCA**)/ (**Internal Evaluation**) as well as the **End of Semester examination (External Evaluation)**. The weight-age of CCA shall be 30%, whereas the weight-age of the Semester end examination shall be 70%. There will be **no internal evaluation in practical courses** as well as in **elective courses**.

2. The In Semester assessment (**CCA**)/ (**Internal Evaluation**) is spread through the duration of the course and is to be done by the Teacher teaching the course. BoS of the subjects will decide various criteria and their weight-age for CCA. The assessment is to be done by various means including:

- ✓ Written Tests
- ✓ MCQs based Tests/Quiz
- ✓ Presentations/Seminars
- ✓ Project work/Field work
- ✓ Group discussions/Group activities
- ✓ Assignments, etc.

The distribution of **Internal Evaluation** is given as per criteria given below for **30** marks:

Written Test...	20 marks,
Assignments/MCQs/Very Short questions...	5 marks and
Attendance, Regularity, Punctuality...	5 marks.

3. The **End of Semester examination (External Evaluation)** shall have an assessment based upon following perspective with respect to all the courses:

- ✓ Evaluation with respect to Knowledge
- ✓ Evaluation with respect to Understanding
- ✓ Evaluation with respect to Skill
- ✓ Evaluation with respect to Application
- ✓ Higher Order Thinking Skills

4. With respect to all the above components, there shall be following types of Questions from each unit of the course.

- ✓ MCQs/Fill in the blanks/ Match the pairs, etc
- ✓ Short answer questions
- ✓ Medium answer questions
- ✓ Long answer questions
- ✓ Examples/ Problems, etc.

5. The End of Semester Examination will be conducted by the University. A certified journal of the respective practical course **must be produced** at the time of practical examination by the student.

6. It will be compulsory for a candidate to obtain passing percentage in both Internal as well as External Evaluation. The passing marks for each course shall be **40%** as decided by concern Board of Studies in Botany.

7. Promotion, Re-Admission and Time for Completion of Course, Procedure for Awarding Grades, Provision for Appeal, etc. as decided by the Hemchandracharya North Gujarat University.

**Study tour:**

Botanical excursion/study tour may be arranged (by the concern faculty with prior permission of **HoD and/or Principal**) within state and/or outside the state to explore/study plant diversity in its natural habitats.

**Submission:**

Instead of submission of Herbarium sheets and/or specimens at the time of final (Uni.) practical examination student may submit photographs/drawings or CD having such photographs/drawings of plant species to conserve plant species in their natural habitats and to avoid any damage to plant species and its natural habitat.

**Selection of Elective (Subjective) course:**

For semester-III and IV a common list of three courses is given below. Students are requested to select any one of three courses in Semester-III and then in Semester-IV one course may be selected from the rest of the two courses.

1. **Elective (Subject) Course :: ES BOT-211:: DNA-a molecule of Life**
2. **Elective (Subject) Course :: ES BOT-212 :: Water quality analysis**
3. **Elective (Subject) Course :: ES BOT-213 :: Biodiversity**

**Selection of Elective (Generic) course:**

For semester-III and IV a separate list consists of **four** courses is given. Students may select **any one** of the four courses given in Semester-III and Semester-IV separately. (Semester-wise list of Elective (Generic) courses is given on Page No. 11)

<b>HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN</b>						
B.Sc. three year (General) Programme with 144 credits						
Semester-III and IV in BOTANY w.e.f. June-2012 and December-2012 respectively						
<b>General Pattern/Scheme of study components along with credits</b>						
Study Components	Ins. Hrs/ Week	Examination			Credit	
		Internal Marks	Uni. Exam. Marks	Total Marks		
<b>Semester-III</b>						
<b>Core Compulsory (CC) Course</b>						
CC-I-3	Core Course-I (Paper-3)	3	30	70	100	3
CC-I-4	Core Course-I (Paper-4)	3	30	70	100	3
CC-II-3	Core Course-II (Paper-3)	3	30	70	100	3
CC-II-4	Core Course-II (Paper-4)	3	30	70	100	3
<b>Soft-skill: Practical Core (PC) Course</b>						
PC-I-3	Practical Core Course-I (Paper-3)	3		50	50	1.5
PC-I-4	Practical Core Course-I (Paper-4)	3		50	50	1.5
PC-II-3	Practical Core Course-II (Paper-3)	3		50	50	1.5
PC-II-4	Practical Core Course-II (Paper-4)	3		50	50	1.5
<b>Foundation Course (FC)</b>						
FG-21	Compulsory English (L.L.)	2	30	70	100	2
<b>Elective Course (EC)</b>						
EG-21	Elective (Generic) Course	2		50	50	2
ES-21	Elective (Subject) Course	2		50	50	2
		<b>30</b>	<b>150</b>	<b>650</b>	<b>800</b>	<b>24</b>
<b>Semester-IV</b>						
<b>Core Compulsory (CC) Course</b>						
CC-I-5	Core Course-I (Paper-5)	3	30	70	100	3
CC-I-6	Core Course-I (Paper-6)	3	30	70	100	3
CC-II-5	Core Course-II (Paper-5)	3	30	70	100	3
CC-II-6	Core Course-II (Paper-6)	3	30	70	100	3
<b>Soft-skill: Practical Core (PC) Course</b>						
PC-I-3	Practical Core Course-I (Paper-5)	3		50	50	1.5
PC-I-4	Practical Core Course-I (Paper-6)	3		50	50	1.5
PC-II-3	Practical Core Course-II (Paper-5)	3		50	50	1.5
PC-II-4	Practical Core Course-II (Paper-6)	3		50	50	1.5
<b>Foundation Course (FC)</b>						
FG-21	Compulsory English (L.L.)	2	30	70	100	2
<b>Elective Course (EC)</b>						
EG-21	Elective (Generic) Course	2		50	50	2
ES-21	Elective (Subject) Course	2		50	50	2
		<b>30</b>	<b>150</b>	<b>650</b>	<b>800</b>	<b>24</b>



HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN  
Under CBCS-Semester-Grading pattern

**B.Sc. (Semester-III and IV) Programme**

Common format for Question paper

**Core Complementary Course in Botany**

Time: **3 Hours**

[w. e. f. June 2012]

Total Marks: **70**

**Part A**

(Answer all questions)

- 1-10.** Questions such as, MCQs, Fill in the blanks, Match the pairs, etc. **10**  
(Each of **1** Mark) [At least **two** questions from each Unit]

**Part B**

(Answer all questions)

- 11-20.** Very short answer type questions such as, Definition, Explain the terms, etc **10**  
(Each of **1** Mark) [At least **two** questions from each Unit]

**Part C**

(Answer any ten/twelve of the following)

- 21-32.** Short answer type questions such as, Definition, Explain the terms, examples/problems, reasons, differences, figures/diagrams, etc. (Each of **2** Marks) [At least **two** questions from each Unit] **20**

**Part D**

(Answer any three/six of the following)

- 33-38.** Medium answer type questions such as, Short notes, figures/diagrams, examples/problems, reasons, differences, etc. (Each of **3** Marks) [At least one question from each Unit] **09**

**Part E**

(Answer any three/five of the following)

- 39-43.** Long answer type questions such as, Describe / Discuss in detail, diagrams, examples/problems, etc. (Each of **7** Marks) ) [At least one question from each Unit] **21**

**B.Sc. (Semester-III and IV) Programme**

Common format for Question paper

**Elective (Subject) Course in Botany**

Time: **2 Hours**

[w. e. f. June 2012]

Total Marks: **50**

**Part A**

(Answer all questions)

- 1-5.** Questions such as, MCQs, Fill in the blanks, Match the pairs, etc. **05**  
(Each of **1** Mark) [At least **two** questions from each Unit]

**Part B**

(Answer all questions)

- 6-10.** Very short answer type questions such as, Definition, Explain the terms, Functions, Principles, etc. (Each of **1** Mark) [At least **two** questions from each Unit] **05**

**Part C**

(Answer any five/seven of the following)

- 11-17.** Short answer type questions such as, Definition, Explain the terms, examples, reasons, figures differences, etc. (Each of **2** Marks) [At least **three** questions from each Unit] **10**

**Part D**

(Answer any three/five of the following)

- 18-22.** Medium answer type questions such as, Short notes, diagrams, examples, reasons, differences, etc (Each of **4** Marks) [At least **two** question from each Unit] **12**

**Part E**

(Answer any three/five of the following)

- 23-27.** Long answer type questions such as, Describe / Discuss in detail, diagrams, examples, etc **18**  
(Each of **6** Marks) [At least **two** question from each Unit]

**Hemchandracharya North Gujarat University, Patan**  
**B. Sc. (Sem-I to VI) Programme**  
**Elective (Generic) Courses**

**Semester I** (w.e.f. June 2011)

EG-111 Communication Skills  
EG-112 Human Society and Ethics  
EG-113 Indian Constitution  
EG-114 Basics of Mathematics

**Semester-II** (w.e.f. December 2011)

EG-121 Environmental Studies  
EG-122 Disaster Management

**Semester-III** (w.e.f. June 2012)

EG-211 Culture and Civilization  
EG-212 National Ethics  
EG-213 Fundamentals of Computer  
EG-214 Value oriented education

**Semester-IV**(w.e.f. December 2012)

EG-221 Yoga and Wellness  
EG-222 Social Ethics  
EG-223 Computer applications-I  
EG-224 Human Rights

**Semester-V** (w.e.f. June 2013)

EG-311 General Knowledge-I  
EG-312 Atmospheric hazards  
EG-313 Computer applications-II  
EG-314 Naturopathy

**Semester-VI** (w.e.f. December 2013)

EG-321 General Knowledge-II  
EG-322 Nutritional Management in Health  
EG-323 Fundamental rights and duties  
EG-324 Rural Health

**NOTE:** The syllabi, examination pattern as well question paper style, etc. for above mentioned Elective (*Generic*) Courses for Sem.-III and IV will be decided and prepared by Uni. Expert(s) / Expert Committee.

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

Under CBCS-Semester-Grading pattern

**B. Sc. (Semester-III) Programme**

Core Compulsory Course in BOTANY

CC-BOT-211

(Morphology, Gymnosperm and Palaeobotany, Angiosperm Taxonomy, Cell Biology)

Theory teaching hours: **3 Hours/week**

Credit: **3.0**

Practical teaching hours: **3 Hours/week**

Credit: **1.5**

**Unit-I :: MORPHOLOGY**

- [A] **BRACTS AND INFLORESCENCE:** **Bracts:** Definition and types of Bracts (SSC 280-281): Foliaceous (GDD 118), Petaloid (GDD 118), Spathe (GDD 119), Involucre (GDD 120) and Epicalyx (GDD 120). **Inflorescence:** Definition (GDD 121). **Racemose:** Definition (121), **Types:** Raceme (121), Spike (122), Umbel (124), Capitulum (126). **Cymose:** Definition (126), **Types:** Solitary (SSC 283/GDD 126), Monochasial (Helicoid and Scorpioid) (SSC 284/ GDD 126-127), Dichasial (SSC 285/ GDD 127) and Polychasial cyme (SSC 285/ GDD 127-128).
- [B] **FLOWER: Definition and parts** of flower (GDD 132). **Kinds of flower:** Actinomorphic and Zygomorphic (GDD 133), Tri\_, Tetra\_ and Pentamerous (GDD 134), Hypogynous (GDD 137), Perigynous and Epigynous (GDD 138). **Calyx, Corolla and Perianth:** Numbers and Unity (SSC 292-295). **Aestivation:** Definition (GDD 144). **Types:** Valvate, Twisted, Imbricate, Quinquefoliate, Vexillary (GDD 144/SSC 298-299).
- [C] **ANDROECIUM: Cohesion of stamens:** Mono\_, Di\_ and Polyadelphous (SSC 299-300/ GDD 150), **Attachment of filament to the anther:** Adnate, Dorsifixed, Basifixed and Versatile (SSC 304-305/ GDD 148). **GYNOECIUM:** Free or United (GDD 151/SSC 310), Number (GDD 151/SSC 311). **PLACENTATION:** Definition (GDD 155). **Types:** Axile, Marginal, Parietal and Basal (GDD 155-156/SSC 313-314). **POLLINATION:** Definition (GDD 161), explanation of self-pollination (GDD 161) and cross-pollination (GDD 161). Mode of Pollination in *Ficus* (GDD 169), *Calotropis* (GDD 170) and *Vallisneria* (GDD 172).

**References:**

SSC: Santra S C, Chatterjee T P and Das A P (1993, 1<sup>st</sup> edition) **College Botany Practical Vol.-II.** New Central Book Agency (P) Ltd, Kolkatta.

GDD: Gangulee H C, Das K S and Datta C (1993, New Print) **College Botany Vol.-I.** New Central Book Agency (P) Ltd, Kolkatta.

**PRACTICALS:**

**Question 1.** Study of morphology examples as per theory syllabus through fresh/preserved specimens.

Specimen **D :: Bracts:** Foliaceous bract: *Adhatoda vasica*, **Petaloid bract:** *Bougainvillea spectabilis*, **Spathe:** *Rhoeo discolor*, **Involucre:** *Helianthus annuus* and **Epicalyx:** *Hibiscus rosa-sinensis*.

Specimen **E :: Inflorescence:** **Racemose:** **Raceme:** *Caesalpinia*, **Spike:** *Achyranthes*, **Umbel:** **Simple:** Onion and **Compound:** Coriander, **Capitulum:** Sunflower.

**Cymose:** **Solitary:** **Terminal:** *Datura*, **Axillary:** Shoe-flower, **Monochasial:** **Helicoid:** *Hamelia*; **Scorpioid:** *Heliotropium*, **Dichasial:** *Clerodendrum*, **Polychasial:** *Calotropis*.

Specimen **F :: Flower:** **Actinomorphic:** Shoe-flower, **Zygomorphic:** Pea / Bean, **Hypogynous:** *Datura*, **Perigynous:** Rose, **Epigynous:** *Coccinia*.

**Calyx, Corolla:** Polysepalous/ Polypetalous: Mustard, Gamosepalous/ Gamopetalous: *Datura*. **Perianth:** *Crinum*

Specimen **G** :: **Aestivation: Valvate:** Calyx of *Datura*, **Twisted:** Corolla of *Hibiscus*, **Imbricate:** *Crotalaria*/Bean, **Quincuncial:** Corolla of *Citrus/Murraya* or Calyx of *Ipomoea*, **Vexillary:** *Butea*/Pea flower.

Specimen **H** :: **Androecium: Cohesion:** Monadelphous: Shoeflower, Diadelphous: Bean/Pea, Polyadelphous: *Bombax*. **Attachment:** *Dorsifixed: Sesbania*, Basifixed: *Adhatoda* and Versatile: *Crinum*/Grass.

Specimen **I** :: **Gynoecium:** Apocarpous ovary: Rose, Syncarpous ovary: Shoeflower. **Placentation:** Axile: Shoeflower, Marginal: Pea/Bean, Parietal: *Argemone* and Basal: Sunflower.

Study of mode of pollination as per theory syllabus through fresh/preserved specimens.

## Unit-II :: GYMNOSPERM and PALAEOBOTANY

[A] **Gymnosperm:** General characters of Gymnosperm (JRM 3-4). **CYCAS** (JRM 26-62): Classification (Bierhorst,1971), habit-habitat (VPC 235), Sporophyte: general morphology (236-237), Anatomy of leaf and coralloid root, reproduction (247), gametophyte (except development) (256) and embryogeny (259).

[B] **Fossils:** Definition (MH 455), Formation (MH 455/JRM 267-268) and Types (MH 456/JRM 268-269) of Fossils: Petrification (GK 892), Cast/Incrustation (GK 893), Impression (GK 894) and Compression (GK 894-895). Geological Time-scale (GK 890-891).

[C] **Fossils of Pteridophytes:** *Rhynia* ((MH 473/JRM 271-272). *Lepidodendron* (MH 485-487/JRM 272-273/GK 954-55) and *Lepidostrobus* (MH 487-488/GK 956). The false seed: *Lepidocarpon* (MH 491/GK 957). **Fossils of Gymnosperms:** The stem: *Lyginopteris oldhamia* (JRM 278-281/GK 1060-62) and The seed: *Lagenostoma lomaxii* (JRM 282-283/GK 1062-63).

### References:

VPC: Vasishta P C, Sinha A K and Kumar Anil (2009, Reprint) **Botany for Degree students-GYMNOSPERMS** (Multicolour illustrative edition). S. Chand & Co. Ltd, New Delhi.

JRM: Johri R M, Lata Sneh and Tyagi Kavita (2005) **A Textbook of Gymnosperm**. Dominant Publishers & Distributors, New Delhi.

MH: Mukherji H (1990, 9th edition reprint) **Plant Groups**. New Central Book Agency, Kolkatta.

GK: Gangulee H C and Kar A K (1993, New Print). **College Botany Vol.-II**. New Central Book Agency, Kolkatta.

## PRACTICALS:

**Question 1 a and b:: Gymnosperm: Fresh and/or Preserved specimens of following plant species.**

*Cycas*: Vegetative structures, Microsporophyll, Megasporophyll

Specimen **J** :: T.S. of *Cycas* leaflet to show transfusion tissue, T S of coralloid root. *Cycas*: Microspores

Slide/specimen **K** :: **Fossils/Palaeobotany:**

**Fossil Pteridophytes: Permanent slides:** *Rhynia*, *Lepidodendron*, *Lepidostrobus*, *Lepidocarpon*

**Specimens:** *Lepidodendron*.

**Fossil Gymnosperms: Permanent slides:** *Lyginopteris oldhamia*, *Lagenostoma lomaxii*

**Specimens:** *Lyginopteris oldhamia*.

## Unit-III :: ANGIOSPERM TAXONOMY

[A] **SYSTEMS OF CLASSIFICATION:** Special features, merits and de-merits of Classification systems of Angiosperms: Linnaean system (Carolus Linnaeus) [SAV 10-11/SNS 52-53], Bentham and Hooker's system [SAV 24-33/SNS 56-60] and Engler and Prantl's system. [SAV 33-42/SNS 65-67]

[B] **HERBARIUM:** Introduction and uses of herbaria (SAV 202), List of Indian Herbaria (only their establishment and number of sheets) (DSC 111-112 / SNS 200), Field and Herbarium techniques (DSC 113-115). **Botanical Gardens of India** (SAV 206-207): National Botanic Garden, Lucknow (SNS 194), Botanical Garden, Kolkata (SNS 195) and Lloyd Botanic Garden, Darjeeling (SNS 195-196).

[C] **PLANT NOMENCLATURE: Rules of Nomenclature** (MSK 49-51): Introduction of ICBN (P&M 30), Guiding principles (P&M 36-37), Nomenclatural types (7 types) (P&M 41-42), Rules of Priority (P&M 48), Names of Taxa (P&M 45), Effective and valid publication (P&M 44-45) and Retention of specific and intra-specific epithets (P&M 49).

**References:**

DSC: **Datta S C** (1999, 4<sup>th</sup> edition reprint) **Systematic Botany**. New Age International (P) Ltd., Publishers, N. Delhi.  
SNS: **Subrahmanyam N S** (1999, reprint) **Modern Plant Taxonomy**. Vikas Publishing House P. Ltd., New Delhi.  
SAV: **Sambamurthy A V S S** (2005) **Taxonomy of Angiosperms**. I K International P. Ltd., New Delhi.  
MSK: **Mukerjee Susil Kumar** (1990, 2<sup>nd</sup> edition). **College Botany Vol.-III**. New Central Book Agency, Kolkatta.  
P&M: **Pandey S N and Misra S P** (2008). **Taxonomy of Angiosperms**. Ane Books India, New Delhi.

**PRACTICALS:**

**Specimen L** :: Study of Botanical gardens and Herbaria of India as per theory syllabus through Photographs/Charts.

**UNIT-IV: CELL BIOLOGY**

[A] **THE CELL WALL:** Introduction (V&A 146), **Chemical composition:** Cellulose (V&A 147), Hemicellulose (V&A 147), Pectins (V&A 148), Lignin (V&A 148). **The wall layers:** The primary wall (V&A 148), Secondary wall (V&A 148) and Middle lamella (V&A 148). Plasmodesmata (V&A 149-150). Functions of cell wall (V&A 150-151). Schizogenous and lysigenous cavity (PBP 67-68).

[B] **THE PLASMA MEMBRANE:** Introduction (V&A 112), **Chemical composition:** Lipids, proteins and carbohydrates (V&A 114-115). **Membrane models:** Sandwich model (V&A 117), Unit-membrane hypothesis (V&A 118) and Fluid-mosaic model (V&A 118-119), Function of plasma membrane and its types according to permeability (V&A 125-126).

[C] **THE CELL DIVISION:** Historical (V&A 318), Cell cycle and Mitosis (318-326), Significance (329). Meiosis: process and various phases (332-339), Significance (339). Comparison (340).

**References:**

V&A: **Verma P S and Agarwal V K** (2006, Reprint) **Cell Biology, Genetics, Molecular Biology, Evolution and Ecology**. S. Chand & Co. Ltd, New Delhi.  
PBP: **Pandey B P** (1982) **Plant Anatomy**. S. Chand & CO.

**PRACTICALS:**

**Question 2.** Material C Various stages of Mitotic division in Onion root tip and Meiotic division in flower bud.

**Specimen-M**:: Study of cell wall and plasma membrane through Microphotographs/charts/diagrams/slides.

Study of various stages of cell division Mitosis and Meiosis through permanent slides.

Hemchandracharya North Gujarat University, Patan  
**B. Sc. (Semester-III) Practical Examination, March/April-20**  
**Botany Practical:: PC BOT-211**

[Based on: CC-BOT-211]

(Morphology, Gymnosperms and Palaeobotany, Angiosperm Taxonomy, Cell Biology)

[In force from **June 2012**]

**Date:**        /        /20

**Time: 4 Hours]**

**Place:**

**[Maximum Marks: 50**

1. a. આપેલ નમૂનો **A** ઓળખો, યોગ્ય કારણો આપી વર્ગીકરણ કરો (કુળ સુધી) અને તેમાં જોવા મળતી રચનાકીય લાક્ષણિકતાઓ જણાવો.

[Identify, classify giving suitable reasons (up to family) and describe the structural peculiarities observed in the given specimen **A**.]

**3**

- b. આપેલ નમૂના **B** માંથી \_\_\_\_\_ ખુલ્લુ કરો/સ્થાપન કરો.

[Expose/Mount \_\_\_\_\_ from the given specimen **B**.]

**3**

2. આપેલ પદાર્થ **C** માંથી સમવિભાજન / અર્ધસૂત્રીભાજનનું અકાયમી સ્થાન તૈયાર કરો. યોગ્ય અભિરંજન પદ્ધતિના ઉપયોગથી કોષવિભાજનની અવસ્થા(ઓ) આકૃતિ(ઓ) સહિત પરીક્ષકને બતાવો.

[Prepare a temporary mounting of **Mitosis/Meiosis** from given material **C**. Using appropriate staining method show stage(s) of cell division to the examiner with diagram(s).]

**6**

3. આપેલ નમૂનાઓ **D** થી **I** ને ઓળખો અને આકૃતિ સહિત તેમાં જોવા મળતી બાહ્યકાર વિધાનું વર્ણન કરો.

[Identify and describe with diagram the external morphology observed in given specimens **D** to **I**.]

**18**

4. આપેલ નમૂનાઓને ઓળખો અને તેમાં જોવા મળતી લાક્ષણિકતાઓ લખો.

[Identify and mention peculiarities seen in given specimens.]

**12**

1. કાયમી સ્લાઈડ/નમૂનો **J** (અનાવૃત્તબીજધારી).

[Permanent slide /specimen **J** (Gymnosperm).]

2. અશ્મિની સ્લાઈડ/નમૂનો **K** (ત્રિઅંગી અથવા અનાવૃત્તબીજધારી અશ્મિ).

[Fossil's slide /specimen **K** (Pteridophyte or Gymnosperm fossil).]

3. ભારતીય વાનસ્પતિક ઉદ્યાન/હર્બેરિયાનો ફોટોગ્રાફ/ચાર્ટ **L**.

[Botanical garden / Herbaria of India through Photograph/Chart **L**.]

4. માઈક્રોફોટોગ્રાફ/ચાર્ટ/સ્લાઈડ **M** (કોષવિદ્યા).

[Microphotograph/chart/ diagram/ slide **M** (Cell Biology).]

5. a. સબમીશન અને મૌખિક પ્રશ્નોત્તરી. [Submission and viva-voce.]

**5**

- b. પ્રયોગપોથી [Journal.]

**3**

## B. Sc. Programme : Semester-III

### Core Compulsory Course in BOTANY

#### CC-BOT-212

(Plant Physiology, Plant Ecology, Microbial world, Genetics)

Theory teaching hours: 3 Hours/week

Credits: 3.0

Practical teaching hours: 3 Hours/week

Credits: 1.5

#### Unit-I :: PLANT PHYSIOLOGY

- [A] **WATER:** Structure of water molecule (D&W 33), Properties of water important to plants (34), Solutions (34-35). Role of water in plant life (M&G 163).
- [B] **SOLUTIONS:** Definition of solvent, solute and solution. **Types:** True, colloidal and suspension. Explanation of Hypertonic, Isotonic and Hypotonic solutions. **Colloidal systems:** Introduction (D&W 499), Phases (499), properties: Tyndall effect (500), Brownian movement (501), Filtration (501), Adsorption (501), Electrical properties (501-502), Flocculation and Precipitation (502-503), Dialysis ( ).
- [C] **PLANT WATER RELATIONS:** Diffusion (M&G 155). Osmosis: Definition (155), laws of osmosis (156-157), **Types:** Exosmosis and endosmosis, role of osmosis in plants (162-163). Plasmolysis (D&W 42) and Deplasmolysis (D&W 42). Imbibition and its importance (K&K 65-66).

#### References:

- M&G: **Mukherji S** and **Ghosh A K** (2005, Revised) **Plant Physiology**. New Central Book Agency Pvt Ltd, Kolkatta.
- D&W: **Devlin R M** and **Witham F H** (1986, First Indian Edition) **Plant Physiology** (Fourth Edition). CBS Publishers & Distributors, New Delhi.
- K&K: **Kochhar P L** and **Krishnamoorthy H N** (1985, 16<sup>th</sup> Revised Edition) **Plant Physiology**. Atma Ram & Sons, Delhi.

#### PRACTICALS:

##### Question 1: Perform following physiological experiments:

1. To show the process of osmosis through potato osmoscope/*Colocasia* petiole.
2. To show the process of Plasmolysis using *Rhoeo* leaf peelings and sucrose solutions (Show Non plasmolyzed cell, incipient and complete plasmolyzed cell).
3. To separate Starch and Salt by Dialysis.
4. To study the property of Mechanical adsorption of colloids using sand particles.
5. To study the property of Electrical adsorption of colloids using Whatman No. 1 filter paper.
6. To study phenomenon of diffusion through ring formation using ammonia and hydrochloric acid.

##### Question 4(B): Demonstrate following physiological experiments:

1. To study osmosis using Thistle funnel.
2. To study imbibitional pressure exerted by imbibed seeds.
3. To show the process of exosmosis by using green grapes and salt solution.
4. To show the process of endosmosis by using dried black grapes and water.
5. To show the phenomenon of Tyndall effect.



## Unit-II :: PLANT ECOLOGY

- [A] **ECOLOGICAL ADAPTATIONS:** Classification (on the basis of water requirements) [SPD 82], External and internal features of Hydrophytes (83-94), Mesophytes (94) and Xerophytes-Non-succulents (94 & 96-104).
- [B] **COMMUNITY ECOLOGY:** Definition (173), characteristics of a community (174), structure (175-176).
- [C] **CHARACTERS USED IN COMMUNITY STRUCTURE:** Analytical- Quantitative (179-181) and Qualitative (181-185) characters, Synthetic characters (186). Methods of study of communities: Physiognomic methods (187) and Phytosociological methods (188-191).

### Reference:

SPD: Sharma P D (2003, 7<sup>th</sup> edition-reprint) **Ecology and Environment**. Rastogi Publications, Meerut.

### PRACTICALS:

#### Question 2:

1. To determine the minimum size of Quadrat (Sampling unit) by species area curve method to study the grassland communities.
2. To determine the minimum number of Quadrat (Sampling unit) to be laid down in the field to study the grassland communities.
3. To Determine the Frequency of any five plants of Grassland communities using Quadrat, then distribute them among Raunkiaer's frequency classes. Compare with the Normal frequency diagram using graph paper.
4. To determine the abundance of any five plant species using quadrat of any size (area) to study the grassland communities.
5. To determine the density of any five plant species using quadrat of unit size (area) to study the grassland communities.

**Question 3(A):** Ecological adaptations-morphological and anatomical studies of following plant parts: *Hydrilla* stem, *Eichhornia* petiole, Sunflower stem, Sunflower leaf, *Nerium* leaf, *Capparis* stem.

**Question 4(C): Permanent slides:** T S of *Hydrilla* stem, T S of *Eichhornia* petiole, T S of Sunflower stem, T S of Sunflower leaf, T S of *Nerium* leaf, T S of *Capparis* stem.

## UNIT-III: MICROBIAL WORLD

- [A] **CLASSIFICATION OF LIVING WORLD:** Whittaker's Five-kingdom system (Pelczar 11). Micro-organisms: Features distinguishing Prokaryotic cells from Eukaryotic cells (9-10). Distinguishing characteristics of major groups of Micro-organisms: Algae, Viruses, Bacteria, Protozoa and Fungi (12-14).
- [B] **VIRUSES:** Classification of viruses on the basis of differences in their transcription processes and their inherent properties (450-451). Structure of TMV (Tobacco Mosaic Virus) ().
- [C] **BACTERIA:** Classification based on shape (74-75) and flagella (78-79). Types of Nutrition in Bacteria. Economic importance of Bacteria.

**Reference:**

Pelczar: **Pelczar M J, Chan E C S & Krieg N R** (2004, 27<sup>th</sup> reprint) **Microbiology**. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.

**PRACTICALS:**

**Question 4(D): Study through micro photographs/charts/diagrams:**

Structure of TMV, Types of bacteria, Types of nutrition in bacteria, Typical Prokaryotic cell, Typical Eukaryotic cell.

**UNIT-IV: GENETICS**

[A] **QUANTITATIVE GENETICS/POLYGENIC INHERITANCE:** Introduction (V&A 64), Characteristics of multiple genes (65), **Examples:** Kernel colour in Wheat (65), Skin colour in Man (67).

[B] **LINKAGE AND CROSSING OVER: Linkage:** Introduction, Coupling and Repulsion hypothesis (V&A 86) and Chromosome theory of Linkage (88). **Kinds:** Complete (88), incomplete (89) and linkage groups (90). **Crossing over:** Introduction and characteristics (92-93), Definition of mitotic and meiosis crossing over (94-95). **Kinds:** Single, Double and Multiple (98), Significance of Crossing over (104).

[C] **MULTIPLE ALLELES:** Introduction (V&A 115), Characters of Multiple alleles (116), Blood groups in humans (118-120), Rh factor (121), Self-sterility alleles (123-124).

**Reference:**

V&A: Verma P S and Agarwal V K (2006, Reprint) **Cell Biology, Genetics, Molecular Biology, Evolution and Ecology**. S. Chand & Co. Ltd, New Delhi.

**Other references:**

GPK: Gupta P K (2000, 3<sup>rd</sup> edition-reprint) **Genetics**. Rastogi Publications, Meerut.

**PRACTICALS:**

**Question 5:**

Genetical problems based on polygenic inheritance and multiple alleles.

Hemchandracharya North Gujarat University, Patan  
**B. Sc. Semester-III Practical Examination, March/April-20**  
**Botany Practical:: PC BOT-212**

[Based on: CC-BOT-212]

(Plant Physiology, Plant Ecology, Microbial world, Genetics)

[In force from **June 2012**]

**Date:**        /        /20  
**Time: 4 Hours]**

**Place:**  
**[Maximum Marks: 50**

1. તેમને આપવામાં આવેલ દેહધાર્મવિદ્યાનો પ્રયોગ કરો. તમારા અવલોકનો કોઠામાં નોંધો અને પરીક્ષકને પરિણામ/તારણ બતાવો.

[Perform the Physiological experiment assigned to you. Tabulate your observations and show the result/conclusion to the examiner.]

10

2. આપેલ વિસ્તાર માટે ચતુષ્કર્ણ લઘુત્તમ કદ / ચતુષ્કર્ણની લઘુત્તમ સંખ્યા નક્કી કરો. તમારા અવલોકનો કોઠામાં નોંધો અને પરિણામ તેમજ આલેખ પરીક્ષકને બતાવો.

[Determine Minimum size of the quadrat / Minimum number of quadrat for given area. Tabulate your observations and show the result and graph to the examiner.]

8

અથવા / OR

આપેલ વિસ્તારની કોઈપણ પાંચ વનસ્પતિઓની આવૃત્તિ / વિપુલતા / ઘનતા(ગીચતા) ની ગણતરી કરો. તમારા અવલોકનો નોંધો અને પરિણામ તેમજ આલેખ (આવૃત્તિ માટે) પરીક્ષકને બતાવો.

[Calculate Frequency /Abundance /Density of any five plant species of given area. Tabulate your observations and show the result and graph (for frequency) to the examiner.]

3. નમૂના **A** માંથી અકાયમી સ્લાઈડ તૈયાર કરો. નામનિર્દેશિત આકૃતિ દોરો અને તેના બાહ્ય અને આંતરિક પારિસ્થિતિકીય અનુકૂલિત લાક્ષણિકતાઓ લખો. તેનો યોગ્ય પારિસ્થિતિકીય સમૂહ દર્શાવો.

[Make temporary slide from the specimen **A**. Draw labeled diagrams and write its external and internal ecological adaptive peculiarities. Mention proper ecological plant group it belongs.]

8

4. ઓળખો અને નીચેનામાં જોવા મળતી ક્રિયા/વિશિષ્ટતાઓની ચર્ચા કરો.

[Identify and discuss process/peculiarities seen in followings]

1. પ્રયોગ **B** (નિદર્શન પ્રયોગ) [Experiment **B** (Demonstration experiment)]

3

2. સ્લાઈડ **C** (વનસ્પતિ પરિસ્થિતિવિદ્યા). [Slide **C** (Plant Ecology).]

3

3. માઈક્રોફોટોગ્રાફ / ચાર્ટ / આકૃતિ / સ્લાઈડ **D**. (સૂક્ષ્મજીવી વિશ્વ).

[Microphotograph/ chart/ diagram/slide **D** (Microbial world).]

5

5. નીચેનો જનીન વિદ્યાકીય કોયડો ઉકેલો અને નિર્ણય કરો.

[Solve and conclude the following genetical problem]

5

બહુજનીનીક આનુવંશિકતા / બહુવિકલ્પી જનીનો. [Polygenic inheritance / Multiple alleles]

6. a. સબમીશન અને મૌખિક પ્રશ્નોત્તરી. [Submission and viva-voce.]

5

- b. પ્રયોગપોથી [Journal.]

3

# B. Sc. Programme : Semester-IV

## Core Compulsory Course in BOTANY

CC-BOT-221

w.e.f. December 2012

(Morphology and Angiosperms, Angiosperm families, Plant Anatomy, Bio-statistics)

Theory teaching hours: 3 Hours/week

Credits: 3.0

Practical teaching hours: 3 Hours/week

Credits: 1.5

### Unit-I :: MORPHOLOGY and ANGIOSPERMS

[A] **INFLORESCENCE AND FRUITS: Special Inflorescence:** Hypanthodium, Cyathium and Verticillaster (SSC 286). **Fruits:** Definition (SSC 320), True and false fruits (SSC 320), Parts of the fruit ( ). **Simple fruits: Indehiscent:** Caryopsis (SSC 322), Samara. **Dehiscent:** Capsule: Loculicidal (SSC 321), Septicidal. **Schizocarpic:** Lomentum, Regma. **Fleshy fruits:** Drupe, Berry (SSC 323). **Aggregate:** Etaerio of barriers (SSC 325). **Composite:** Sorosis (SSC 326).

[B] **ANGIOSPERMS:** General characters of Angiosperms. **Sun-flower (*Helianthus*):** Classification (Bentham and Hooker, 1862-80), habit-habitat, sporophyte (external structure), reproduction (inflorescence and florets) and gametophyte (except development), embryogeny (in short).

[C] **Maize (*Zea mays*):** Classification (Bentham and Hooker, 1862-80), habit-habitat, sporophyte (external structure), reproduction (inflorescence and flowers) and gametophyte (except development), embryogeny (in short).

#### References:

SSC: Santra S C, Chatterjee T P and Das A P (1993, 1<sup>st</sup> edition) College Botany Practical Vol.-II. New Central Book Agency (P) Ltd, Kolkatta.

#### Practicals:

Specimen G: Inflorescence: Hypanthodium, Cyathium and Verticillaster.

#### Fruit :

Specimen H: Caryopsis - Maize or Wheat, Samara: *Holoptelea*. Loculicidal: Cotton, Septicidal: Castor/Mustard. Lomentum: *Acacia nilotica*, Regma: *Ricinus*

Specimen I: Fleshy - Drupe – Mango; Berry - Tomato or Brinjal, Etaerio of berry - *Anona squamosa*; Sorosis – Pineapple or *Morus*

#### Question 1: Specimens A and B

Classification and Mountings of *Helianthus* - Rayfloret and discfloret, pollen grains.

Classification and Mountings of *Zea mays* – spikelet/flower, fresh material of *Zea mays* plant with male and female inflorescence.

Permanent slides of *Helianthus* and *Zea mays* - T.S. of anther, L.S. of ovule

### Unit-II :: ANGIOSPERM FAMILIES

**Studies of families:** Distinguishing characters and classification as per Bentham and Hooker (1862-80) of the following families including floral formula, floral diagram and botanical names (**at least two**) of economically important plants.

**Dicotyledons:** **Polypetalae:** Malvaceae (SAVSS 294-302), Myrtaceae (SAVSS 372-378)  
**Gamopetalae:** Rubiaceae (SAVSS 397-407), Apocynaceae (SAVSS 424-433)  
**Apetalae:** Nyctaginaceae ( ), Euphorbiaceae (SAVSS 514-525)

**Monocotyledons:** Liliaceae (SAVSS 570-577), Palmae (Arecaceae) (SAVSS 586-592)

**Reference:**

SAVSS: Sambamurty A V S S (2005) **Taxonomy of Angiosperms**. I K International P Ltd. New Delhi.

**PRACTICALS:**

**Question 2 (C & D):** In addition to locally available plants, the following plants may be used for the study of the Families:

- Malvaceae: Jasud, Kanski, *Sida*
- Myrtaceae: Bottle brush, Nilgiri, Jamboo, Jamphal.
- Rubiaceae: *Ixora*, *Hemelia*, *Borreria*.
- Apocynaceae: Barmasi, Pili/Lal Karen, Chandani, *Plumeria*.
- Nyctaginaceae: Bogan vel, Satodi, *Mirabilis*.
- Euphorbiaceae: Lal Patti, Castor, *Jatropha*.
- Liliaceae: Dungro, *Asparagus*, *Allium*.
- Palmae (Arecaceae): Shivjata, Khajuri, Bottle Palm, Coconut palm.

**UNIT-III: PLANT ANATOMY**

- [A] **MERISTEMS:** Definition, Classification (on the basis of position) (JJP 31-33), Characteristics (34), **Apical Meristem:** Introduction (35-36), **Shoot apex:** Theories of apical organization-Histogen (37), Tunica-Corpus (37). **Root apex:** Theories of apical organization-Histogen (40), Korper-Kappe (42) and Quiescent centre (42).
- [B] **MECHANICAL TISSUE:** Introduction (PBP 402), structure and functions of mechanical tissues – Collenchyma (404-406) and Sclerenchyma: Fibers and Sclereids (409-413), Xylem (413), Phloem (415). **Mechanical tissues:** I-girdle in herbaceous stem i.e., Sunflower, in leaves i.e., *Eucalyptus* and *Pancreatium*, in square stem i.e., *Nyctanthus* and in prop root i.e., *Zea mays* (418-422).
- [C] **CONDUCTING TISSUE:** Structure and functions of xylem (JJP 76-87) and phloem (JJP 88-98) elements. **Vascular cambium:** Definition (99), Activity of the cambium (101), Secondary growth (130-134). **Normal secondary growth** - Definition and secondary growth in sunflower stem (PBP 250-257) and sunflower root (210-215). **Anomalous secondary growth** - definition and anomalous secondary growth in *Salvadora* stem (interxylary phloem) (305-307), *Bignonia* stem (Phloem wedges in the xylem) (285-287) and *Tinospora* aerial root (203).

**References:**

JJP: E. John Jothi Prakash (2000, 2nd revised edition) A Text Book of Plant Anatomy. Emkay Publications, Delhi.  
PBP: Pandey B P (1982, 3<sup>rd</sup> edition) **Plant Anatomy**. S. Chand & Co. Ltd, New Delhi.

## **PRACTICALS:**

**Specimen E:** Mechanical tissue:

**Material:** Sunflower stem, *Eucalyptus* leaf, *Pancreatium* leaf, *Nyctanthus* stem, Maize prop root.

**Specimen E:** For Secondary growth:

**Material:** *Salvadora* stem, *Bignonia* stem, *Tinospora* aerial root, Sunflower root and stem.

**Specimen F:**

**Permanent slide:** Shoot apex, Root apex.

**Permanent slide:** Sunflower stem, *Eucalyptus* leaf, *Pancreatium* leaf, *Nyctanthus* stem, Maize prop root.

**Permanent slide:** *Salvadora* stem, *Bignonia* stem, *Tinospora* aerial root, Sunflower root and stem.

## **Unit-IV :: BIOSTATISTICS**

[A] **BIO-STATISTICS:** Definition (CSRS A-3), Aims (CSRS A-2) and Limitations (CSRS A-4 to A-6) of Statistics.

[B] **CLASSIFICATION AND TABULATION OF DATA:** Aims (CSRS A-9), Basis (CSRS A-9) and Types (CSRS A-9 to A-10) of Classification. **Tabulation:** Definition (CSRS A-11), Types (CSRS A-11 to A-13) of Tabulation. **Diagrammatic representations:** Types: Simple Bar (CSRS A-22), Compound Bar (CSRS A-23), Sub-divided Bar (CSRS A-24 & 25) and utility (CSRS A-20 & A-21).

[C] Frequency Distribution and its Table (CSRS A-17 to A-19). **Measures of Central Tendency:** (CSRS A-44 to 87): Mean, Mode and Median with their merits-demerits and uses.

### **Reference:**

CSRS: **Chandel S R S** (2006) **A Handbook of Agricultural Statistics**. Achal Prakashan Mandir, Kanpur.

## **PRACTICALS:**

### **Question 4:**

Solve and conclude the statistical problems based on theory syllabus.

i.e., Frequency distribution, Mean, Median and Mode.

Hemchandracharya North Gujarat University, Patan  
**B. Sc. Semester-IV Practical Examination, March/April-20**  
**Botany Practical:: PC BOT-221**

[Based on: CC-BOT-221]

(Morphology and Angiosperms, Angiosperm families, Plant Anatomy, Bio-statistics)

[In force from **December 2012**]

**Date:**        /        /20  
**Time: 4 Hours]**

**Place:**  
[Maximum Marks: **50**

1. a. આપેલ નમૂનો **A** ઓળખો, યોગ્ય કારણો આપી વર્ગીકરણ કરો (કુળ સુધી) અને તેમાં જોવા મળતી રચનાકીય લાક્ષણિકતાઓ જણાવો.

[Identify, classify giving suitable reasons (up to family) and describe the structural peculiarities observed in the given specimen **A**.]

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- b. આપેલ નમૂના **B** માંથી \_\_\_\_\_ ખુલ્લુ કરો/સ્થાપન કરો.

[Expose/Mount \_\_\_\_\_ from the given specimen **B**.]

2. નમૂનાઓ **C** અને **D** ને તપાસો અને કારણો આપી તેને તેમના યોગ્ય કુળમાં મૂકો. નામનિર્દેશન વાળી આકૃતિ દોરો અને તેઓના પુષ્પસૂત્ર અને પુષ્પાકૃતિ આપો.

[Refer the specimens **C** and **D** and place them in to their respective families giving reasons. Draw the labeled diagrams, and give their floral formula and floral diagram]

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3. યાંત્રિક પેશી માટે નમૂના **E** નું અકાયમી અભિરંજીત આસ્થાપન તૈયાર કરો. નામનિર્દેશિત આકૃતિ દોરો અને તમારી સ્લાઈડ પરિક્ષકને બતાવો.

[Make a temporary stained preparation of specimen **E** for Mechanical tissue. Draw a labeled diagram and show your slide to the examiner.]

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અથવા / OR

દ્વિતીય વૃદ્ધિ માટે નમૂના **E** નું અકાયમી અભિરંજીત આસ્થાપન તૈયાર કરો. નામનિર્દેશિત આકૃતિ દોરો અને તમારી સ્લાઈડ પરિક્ષકને બતાવો.

[Make a temporary stained preparation of specimen **E** for Secondary growth. Draw a labeled diagram and show your slide to the examiner.]

4. નીચેનો આંકડાશાસ્ત્રીય કોયડો ઉકેલો અને નિર્ણય તારવો.

[Solve and conclude the following statistical problem]

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આવૃત્તિ વિતરણ અથવા મધ્યક, મધ્યસ્થ અને બહુલક (કોઈપણ એક)

[Frequency distribution OR Mean, Median and Mode (any one).]

5. a. ઓળખો અને સ્લાઈડ **F** માં જોવા મળતી અંતઃસ્થ રચનાકીય લાક્ષણિકતાઓ વર્ણવો.

[Identify and describe the anatomical structure observed in slide **F**.]

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- b. આપેલા નમૂનાઓને ઓળખો અને તેમાં જોવા મળતી બાહ્યકારવિદ્યાકીય લાક્ષણિકતાઓ આકૃતિસહ વર્ણવો.

[Identify and describe with diagram the external morphology observed in given specimens]

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નમૂનો **G**: પુષ્પવિન્યાસ [Specimen **G**: **Inflorescence**]

નમૂનો **H**: ફળો (સાદા) [Specimen **H**: **Fruits** (simple)]

નમૂનો **I**: ફળો (સમૂહ અને સંયુક્ત) [Specimen **I**: **Fruits** (Aggregate and compound)]

6. a. સબમીશન અને મૌખિક પ્રશ્નોત્તરી. [Submission and viva-voce.]

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- b. પ્રયોગપોથી [Journal].

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# B. Sc. Programme : Semester-IV

## Core Compulsory Course in BOTANY

CC-BOT-222

w.e.f. December 2012

(*Angiosperm Embryology, Biochemistry, Biophysics, Plant Physiology*)

Theory teaching hours: 3 Hours/week

Credits: 3.0

Practical teaching hours: 3 Hours/week

Credits: 1.5

### Unit-I :: ANGIOSPERM EMBRYOLOGY

- [A] **MICROSPORANGIUM** (Anther): Structure and development of a typical anther (B&B 16, 17). Anther wall: Structure and functions of various layers of mature anther wall (17-28), Microsporogenesis (28-32). Male gametophyte: Structure of Microspore (Pollen grain) (35), Formation of Male gametes in microspore (35-48).
- [B] **MEGASPORANGIUM** (Ovule): Types of Ovules (65-66). Structure of Ovule: (67-72). Definition of Megasporogenesis (75), Female gametophyte-Development of Embryo sac- *Polygonum* type (86-88), Mature embryo sac- Structure (91) and functions of its various components (92-100).
- [C] **FERTILIZATION AND EMBRYO DEVELOPMENT: Fertilization:** Definition (126) and double fertilization (145). **Embryo development** in *Capsella* (Dicot) (218-219) and Types of Endosperm: Nuclear, Cellular and Helobial (180-190), Functions of endosperm (198-199).

#### Reference:

B&B: Bhojwani S S & Bhatnagar S P (2001, 4<sup>th</sup> revised edition, reprint) **The Embryology of Angiosperms**. Vikas Publishing House Pvt. Ltd., New Delhi.

#### PRACTICALS:

##### Question 4 (D):

**Embryo:** Study of Embryo with endosperm haustoria from *Cucumis* and various developing stages of Embryo from Mustard and make temporary slide with proper stains.

##### Question 5 (E):

**Microsporogenesis:** Study of Anther Through Aceto-carmine/Aceto-orcine squash technique in following plants: *Aloe*, *Convolvulus* and Onion.

##### Question 6:

**Permanent slide/Chart/Microphotograph etc.:** Microsporogenesis, Megasporogenesis, Types and Structure of Ovule, Structure of Mature Embryo sac and Endosperm.

### Unit-II :: BIO-CHEMISTRY

- [A] **CARBOHYDRATES:** Definition, classification and nomenclature (M&G 54). Monosaccharides: Physical properties of Monosaccharide (M&G 59-60/SHS 156-157), structure of Glucose (56/ SHS 161-162) and Fructose (58). Disaccharides: Definition, structure (62) and properties of Sucrose (63) and Maltose (64/ SHS 163-164). Polysaccharides: Definition, structure (64) and properties of cellulose (64) and Starch (65/ SHS 166-168). Biological significance of Carbohydrates (SHS 169-170)
- [B] **LIPIDS:** Definition, biological functions of lipids (M&G 111/ SHS 190), alcohols, fatty acids: saturated and unsaturated (117-118). Classification of lipids: Simple, Compound and Derived lipids (112). **Simple lipids**-Structure and function of Triglycerides (113) and Wax (114).



[C] **AMINO ACIDS AND PROTEINS: Amino acids:** Structure (JL 61), electro-chemical properties (62) and classification of Amino acids [on the basis of composition of the side chain] (63-65), peptide bond (72), formation of dipeptide and polypeptide molecule (72-73). **Proteins:** General (Physical) properties: Colour and test (96), shape and size (96), Denaturation (99), amphoteric nature (100), Solubility (101) and structural level of organization of Proteins (79-87). Biological significance of Proteins (SHS 93-94).

**References:**

M&G: **Mukherji S and Ghosh A K** (2005, Revised) **Plant Physiology**. New Central Book Agency Pvt Ltd, Kolkatta.  
JL : Jain **J L** (1999, Reprint) **Fundamentals of Biochemistry**. S Chand & CO Ltd, New Delhi.  
SHS: **Srivastava H S** (2010-11, 5<sup>th</sup> revised edition). **Elements of Biochemistry**. Rastogi Publications, Meerut.

**PRACTICALS:**

**Question 1(A):** To determine Isoelectric point of Casein (Protein).

Estimation of Free Fatty acids by titration method.

**Question 2(B): Bio-Molecules:** Tests for detection of Carbohydrates: The following tests are to be performed to detect the nature of carbohydrates available in the supplied sample (Glucose, Fructose, Maltose, Sucrose and Starch).

1. Molisch's test, 2. Benedict's test, 3. Barfoed's test, 4. Seliwanoff's test, 5. Iodine test, 6. Cobalt chloride test.

Tests for detection of Lipids i.e., Fats and oils: Micro-chemical tests on sections of Plant materials- Sudan III stain, Solubility test.

Tests for detection of Proteins: Biuret test, Xanthoprotic test. (SHS 321-323).

**Unit-III :: BIO-PHYSICS**

[A] pH scale (SHS 22-24), Buffers (SHS 25) and their importance to living organisms (M&G 9/K&K 35-37). The laws of Thermodynamics: definitions of first and second laws (M&G 17-18/(SHS 32-35), entropy (M&G 18) and free energy (M&G 20/SHS 35) with units.

[B] **CHEMICAL BONDS** (M&G 23-26): Ionic bond (SHS 7), Covalent bond (SHS 9), Polar covalent bond (SHS 10) and Hydrogen bond (SHS 12-14). Significance of polar covalent and hydrogen bonds in biological systems (SHS 14).

[C] **RADIATIONS:** Radiations and their types (RAVSS 5-6). Definition and units of radioactivity (M&G 9/RAVSS 5-6). Biological effects of radiation (PV&G 23). Artificial radioactivity (RAVSS 7). Radioactive isotopes and their applications in biology (M&G 9/PV&G 23).

**References:**

M&G: **Mukherji S and Ghosh A K** (2005, Revised) **Plant Physiology**. New Central Book Agency Pvt Ltd, Kolkatta.  
RAVSS: **Rama Rao A V S S** (1984, 4<sup>th</sup> edition, reprint) **Text Book of Biochemistry**. L K & S Publishers, Tanuku.  
K&K: **KOchhar P L and Krishnamoorthy H N** (1985, 16<sup>th</sup> edition) **A Textbook of Plant Physiology**. Atma Ram & sons, New Delhi.  
SHS: **Srivastava H S** (2010-11, 5<sup>th</sup> revised edition). **Elements of Biochemistry**. Rastogi Publications, Meerut.  
PV&G: **Pattabhi Vasantha and Gautham N.** (2002) **Biophysics**. Narosa Publishing House, New Delhi.

**PRACTICALS:**

**Question 3(C):**

Preparation of solutions and plant juices to determine their pH using pH paper / Universal indicator.

Preparation of buffer solutions.

## Unit-IV :: PLANT PHYSIOLOGY

- [A] **ABSORPTION OF WATER BY LAND PLANTS:** Organ of water absorption (M&G 163) and path of water movement through root (167), Factors affecting absorption of water : External (167-168) and Internal factors (168).
- [B] **ASCENT OF SAP:** Definition (M&G 248), Mechanism of Ascent of sap: Vital-force theories (249-250), Root-pressure theory (250-251), Cohesion-tension theory (251).
- [C] **WATER LOSS:** Guttation (D&W 74-76), Transpiration: Introduction (M&G 189), types of transpiration (189), evaporation and transpiration (189), structure of stomata (189-190). Stomatal mechanism of opening and closing: Photosynthesis in guard cells (190), Starch-sugar hypothesis (190-192), Modern concept (192-193), factors affecting stomatal movement (D&W 81-86), significance of transpiration (M&G 200-201).

### References:

M&G: Mukherji S and Ghosh A K (2005, Revised) **Plant Physiology**. New Central Book Agency Pvt Ltd, Kolkatta.  
D&W: Devlin R M and Witham F H (1986, First Indian Edition) **Plant Physiology** (Fourth Edition). CBS Publishers & Distributors, New Delhi.

### PRACTICALS:

#### Question 1(A):

The following Physiological experiments are to be performed by the students:

1. To show the phenomenon of Ascent of sap.
2. To show unequal transpiration from the leaf surfaces using Cobalt chloride paper.
3. To show four leaf experiment for process of transpiration.

#### Question 6 (H and I):

The following Physiological experiments are to be demonstrated to the students:

1. Demonstration of Path of water through xylem by Ringing experiment.
2. Demonstration of transpiration by Bell-jar method.
3. Demonstration the rate of transpiration between upper and lower epidermis of leaf using Garreau's apparatus.
4. Demonstration of rate of transpiration using Ganong's potometer.
5. Demonstration of rate of transpiration using Farmer's potometer.
6. To determine the amount of water absorbed and transpired by a plant.

Hemchandracharya North Gujarat University, Patan  
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**Botany Practical:: PC BOT-222**  
[Based on: CC-BOT-222]

(Angiosperm Embryology, Biochemistry, Biophysics, Plant Physiology)

[In force from December 2012]

**Date:**        /        /20  
**Time: 4 Hours]**

**Place:**  
**[Maximum Marks: 50**

1. તમને આપવામાં આવેલ દેહધર્મવિદ્યા/જૈવ-રાસાયણિક પ્રયોગ **A** કરો. તમારા અવલોકનોની કોઠામાં નોંધ કરો. જરૂરી જણાય તો આલેખ દોરો. તમારા પરિણામ અને તારણ પરિક્ષકને બતાવો.  
[Perform Physiological/Biochemical experiment **A** assigned to you. Tabulate your observations and result. Draw graph if necessary. Show your result and conclusion to the examiner.] 8
2. આપેલ નમૂના **B** માંથી જૈવ-અણુની પરખ માટેની કસોટીઓ કરો. તમારા પરિણામ પરિક્ષકને બતાવો.  
[Perform tests for detection of organic molecule given in sample **B**. Show your result to the examiner.] 7
3. આપેલ નમૂના **C** નું pH માપો. તેની પ્રકૃતિ દર્શાવો અને ત્યારબાદ પરિક્ષકને બતાવો.  
[Measure the pH of the given sample **C**. Mention its nature and then show to the examiner.] 3
4. આપેલ નમૂના **D** માંથી ભૂણ / ભૂણપોષ યૂષક સહિત ભૂણ ખૂલ્લું કરી અને આસ્થાપન તૈયાર કરો. જરૂર જણાય તો અભિરંજીત કરો. પરીક્ષકને તમારી તૈયાર કરેલી સ્લાઈડ બતાવો.  
[Expose and Mount **Embryo / Embryo with endosperm haustoria** from the given material **D**. Stain if necessary. Show your prepared slide to the examiner.] 7
5. આપેલ નમૂના **E** માંથી ડાયડ / ટેટ્રાડ / પોષકસ્તર (ટેપેટમ) ખૂલ્લા કરો અને આસ્થાપન તૈયાર કરો. જરૂર જણાય તો અભિરંજીત કરો. પરીક્ષકને તમારી તૈયાર કરેલી સ્લાઈડ બતાવો.  
[Expose and Mount **Diad / Tetrad / Tapetum** from the given material **E**. Stain if necessary. Show your prepared slide to the examiner.] 5
6. a. ભૂણવિદ્યાની સ્લાઈડ/ચાર્ટ/માઈક્રોફોટોગ્રાફ **F** અને **G** ઓળખો અને વર્ણવો.  
[Identify and describe the embryology slide/chart/micro photograph **F** and **G**.] 6  
b. પ્રયોગો **H** અને **I** એ કઈ દેહધાર્મિક ક્રિયા દર્શાવે છે? વર્ણવો.  
[Which Physiological process do experiments **H** and **I** demonstrate? Describe.] 6
7. a. સબમીશન અને મૌખિક પ્રશ્નોત્તરી. [Submission and viva-voce.] 5  
b. પ્રયોગપોથી [Journal]. 3

**HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN**

**Under CBCS - Semester - Grading Pattern**

**B.Sc. :: SEMESTER-III & IV :: BOTANY**

**Elective Course (Subject) :: ES BOT-211**

**DNA-a molecule of Life**

(in force from June 2012)

**Teaching Hours per Week: 2**

**Credits-2**

**Unit-I :: STRUCTURE OF DNA**

1. Introduction, definition, Brief History of DNA
2. Double Helical Structure of DNA and its Components
3. Form of DNA and its unusual structure
4. Physical properties of DNA and DNA denaturation

**Unit-II :: FUNCTIONS OF DNA**

1. DNA as a genetic material
2. DNA Replication is semiconservative
3. DNA Transcription
4. Applications of DNA in Modern techniques

**HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN**

**Under CBCS - Semester - Grading Pattern**

**B.Sc. :: SEMESTER-III & IV :: BOTANY**

**Elective Course (Subject) :: ES BOT-212**

**Water quality analysis**

(in force from June 2012)

**Teaching Hours per Week: 2**

**Credits-2**

**Unit-I**

1. Introduction(1-6) – Definition, Types, demand, Sources
2. General impurities in water(7-9)
3. Classification of water on the basis of hardness, Incrustation and Corrosion(10-12)
4. Morphometry, Sampling of liquid system(27-29)

**Unit-II**

1. Physical Parameters – movement, colour, odour, temperature, transparency, turbidity (55-76)
2. Electrical conductance, Total dissolved solids, Dissolved Oxygen (77-109)
3. Biochemical Oxygen demand, Chemical Oxygen demand(110-120)
4. Bacteriological parameters – Most probable number (MPN), Fecal coliform count, *E.coli* count.(215-223)

**REFERENCE:**

**Trivedi P R and Gurdeepraj (2005) Environmental water and soil analysis.** Akashdeep Publishing House, New Delhi.

**HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN**

**Under CBCS - Semester - Grading Pattern**

**B.Sc. :: SEMESTER-III & IV :: BOTANY**

**Elective Course (Subject) :: ES BOT-213**

**Biodiversity**

(in force from June 2012)

**Teaching Hours per Week: 2**

**Credits-2**

**Unit-I**

1. Introduction – Definition: genetic, species and ecosystem diversity
2. Bio-geographical classification of India
3. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values
4. Biodiversity at global, national and local levels

**Unit-II**

1. India as a mega-diversity nation, Hot-spots of biodiversity
2. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts
3. Endangered and endemic species of India and Gujarat
4. Conservation of biodiversity: *in-situ* and *ex-situ* conservation of biodiversity