Solapur University, Solapur

Faculty of Science

B.Sc.-I-BOTANY

Credit and Grading System

(June, 2014)

Solapur University, Solapur

Faculty of Science

Credit and Grading System

(W.e.f. June, 2014)

- **Title of the Course:**B.Sc.- I
- **Subject :** Botany
- **The Credit and Grading System :**
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With the view to ensure worldwide recognition, acceptability, horizontal as well as vertical mobility for students completing under graduate degree, the Solapur University is implementing Credit and grading system of Evaluation at Undergraduate level.

Credit is a numerical value that indicates student's work load (Lectures, Lab work, Seminars, Tutorials, Field work, etc.) to complete a course unit. In most of the universities 15 contact hours constitute one credit. The contact hours are transformed into Credits. As per present norms, there are 4 contact hours per paper (subject) per week which works out to be 60 contact hours per paper (subject) per semester.

In Solapur University, for B. Sc.-I, there are 4 optional subject and one (English) compulsory subject. For B. Sc.-I, there are 5 contact hours per paper (subject) per week for optional subject and 4 contact hours for English. Therefore, total contact hours per week are 24. Each subject has 75 contact hours, which are transformed into 5 credits. As there are 4 contact hours per week for English, 4 credits shall be assigned for English subject.

Moreover, the grading system of evaluation is introduced for B. Sc. course, wherein process of Continuous Internal Evaluation is ensured. The candidate has to appear for Internal Evaluation of 30 marks and University Evaluation for 70 marks. It is 70 + 30 pattern of evaluation. It is applicable for theory and practical as well. The details regarding this evaluation system are as under.

- **Conversion of marks into Grades :**

A table for the conversion of the marks obtained by a student in each paper (out of 100) to grade and grade points is given below.

Sr. No	Range of Marks	Grade	Grade Point
1.	80-100	O	10
2.	70-79	A+	9
3.	60-69	A	8
4.	55-59	B+	7
5.	50-54	B	6
6.	45-49	C+	5
7.	40-44	C	4
8.	<39	FC	0 (Failed in Term Exam)
9.	<39	FR	0 (Failed in Internal Assesment)

1. Grade Point Average at the end of the Semester (SGPA)

$$SGPA = \frac{(G_1 x C_1) + (G_2 x C_2) + \ldots\ldots}{\Sigma Ci}$$

(ΣCi- The total number of credits offered by the student during a semester)

2. Cumulative Grade Point Average (CGPA)

$$CGPA = \frac{(G_1 x C_1) + (G_2 x C_2) + \ldots\ldots}{\Sigma Ci}$$

ΣCi - the total number of credits offered by the student upto and including the semester for which CGPA is calculated.)

3. **Final Grade Point Average (FGPA)** will be calculated in the similar manner for the total number of credits offered for completion of the said course.

Where: Ci: Credits allocated for the ith course

Gi: Grade point scored in ith paper (Subject)

4. Conversion of average grade points into grades:

SGPA/CGPA/FGPA	Letter Grade
9.5 – 10	O
8.5 -9.49	A+
7.5 – 8. 49	A
6.5 – 7.49	B+
5.5 – 6. 49	B
4.5 – 5. 49	C+
4.0 – 4. 49	C
< 3.99	FC /F
	FR

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Credit System Structure for B.Sc.I Semester I

Abbreviations: L: lectures, T: Tutorials, P: Practicals; UA: University Assessment by End Semester

Class	Sem	Subject	No. of Papers/ practicals	Hrs/Week			Paper Marks	UA	CA	Credits	Total
				L	T	P					
B.Sc.I	I	English	English paper I (compulsory)	4	-	-	100	70	30	4	
		Botany 1	Paper I	5	-	-	100	70	30	5	
Grand Total				9			200			9	9 credits

Examination; CA: College assessment by Internal Continuous Examination

UA (University Assessment): University Theory paper shall be of 70 marks for 3.00 hrs duration

CA (College Assessment): The internal examination for Theory and Practical course.

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Credit System Structure for B.Sc.I Semester II

Class	Sem	Subject	No. of Papers/ practicals	Hrs/Week			Paper Marks			Practical			Credits
				L	T	P		UA	CA	Marks	UA	CA	
B.Sc. I	II	English	English paper II (compulsory)	4	-	-	100	70	30				4
		Botany	Paper II	5	-	-	100	70	30		70	30	5
Total				9			200						9
		Practical I		-	-	4		70	30	100			4
Total				9		4	200			200			9
Grand Total										300			13
B.Sc.	Part I									300			9+4=13

Abbreviations: L: lectures, T: Tutorials, P: Practicals; UA: University Assessment by End Semester Examination; CA: College assessment by Internal Continuous Examination

UA (University Assessment): University Theory paper shall be of 70 marks for 3.00 hrs duration

CA (College Assessment): The internal examination for theory and Practical course.

General Guidelines for Credit and Grading System

1. The University follows Semester system
2. An academic year shall consist of two semesters

3. Each B.Sc. course shall consist of three years i.e. six semesters
4. B.Sc.Part-I shall consist of two semesters: Semester I and Semester II. In semester –I, there will be one theory paper of 100 marks for each subject. There shall be four optional science subjects and English paper-I compulsory for every student. Similarly, in semester –II there will be one theory paper of 100 marks for each subject. There shall be four optional science subjects and English paper-II compulsory for every student. The scheme of evaluation of performance of candidates shall be based on University assessment as well as College internal assessment as given below. For B.Sc.Part I Sem I&II the internal assessment will be based on Unit tests, Home assignment, viva, practicalsetc as given below. Practical course examination of 100 marks shall be conducted at the end of second semester. The practical examination of 100 marks shall also consist of 70 marks for University practical assessment and 30 marks for college internal assessment. For University practical examination out of two examiners, one examiner will be internal and another examiner will be External. Both examiners will be appointed by the University. The internal practical assessment shall be done as per scheme given below.

5. **Scheme of evaluation:**

As per the norms of the grading system of evaluation, out of 100 Marks, the candidate has to appear for College internal assessment of 30 marks and external evaluation (University Assessment) of 70 marks. The respective B.O.S. may decide the nature of College internal Assessment after referring to the scheme given below or may be used as it is.
The details are as follows:

Semester - I:
University Examination (70 Marks): No. of Theory papers: 1 Papers/Subject (Total 5 Papers)
Internal Continuous Assessment (30 Marks):
Scheme of Marking: 20 Marks: Internal Test
10 Marks: Home assignment/Tutorials/Seminars/ Group discussion/ Viva/Field visit/Industry visit.

Semester - II:

Theory:
University Examination (70 Marks): No of Theory papers: 1 Papers/Subject (Total 5 Papers)
Internal Evaluation (30 Marks):
Scheme of Marking: 20 Marks: Internal Test
10 Marks: Home assignment/Tutorials/ Seminars/ Group discussion/ Viva/ Field visit/Industry visit.

Practical
University Examination (70 Marks**)**: No of Practicals: 1 Papers/Subject (Total 4 Practicals)
Internal Evaluation (30 Marks):
Scheme of Marking: 20 Marks: Internal Test on any two practicals
10 Marks: Lab Journal/viva, attendance, attitude etc.

6. **Passing Standard**

The student has to secure a minimum of 4.0 grade points (Grade C) in each paper. A student who secures less than 4.0 grade point (39% or less marks, Grade FC/FR) will be declared fail in that paper (subject) and shall be required to reappear for respective paper. A student who

failed in University Examination (Theory) & passed in internal assessment of a same paper (subject) shall be given FC Grade. Such student will have to appear for University Examination only. A student who fails in Internal Assessment and passed in University examination (Theory) shall be given FR Grade. Such student will have to appear for both University examination as well as internal assessment. In case of year down candidates from the mark scheme the candidates shall appear for the same 70 marks paper of the external examination and his performance shall be scaled to 100 marks.

- **ATKT**

Candidate passed in all the papers except 5 (five) heads including theory as well as practicalstogether of the semester I and Semester II of B.Sc. Part I examination shall be permitted to enter upon the course of Semester III of B.Sc.Part II

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Nature of Question Paper for Credit-Grading Semester Pattern

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(w.e.f. June 2014)

Time: - 3.00 hrs. Total Marks- 70

Section - I

Q. No.1) Multiple choice questions(5)

1) ----------

a)b) c)d)

2)

3)

4)

5)

Q.No.2) Answer any five of the following(10)

i)

ii)

iii)

iv)

v)

vi)

vii)

Q.No.3 A) Write short notes on any Two of the following (10)

i)

ii)

iii)

B) Answer any one of the following (10)

i)

ii)

Section - II

Q. No.1) Multiple choice questions.(5)

1) ----------

a)b) c)d)

2)

3)

4)

5)

Q.No.2) Answer any five of the following(10)

i)

ii)

iii)

iv)

v)

vi)

vii)

Q.No.3 A) Write short notes on any Two of the following (10)

i)

ii)

iii)

B) Answer any one of the following (10)

i)

ii)

List of Practicals:

1) Study of Nostoc
2) Study of Spirogyra
3) Study of Mucor
4) Study of Lichens
5) Study of Riccia
6) Study of Plant Diseases-
   i) Yellow vein mosaic of Bhendi ii) Citrus canker.
   iii) Little leaf of Brinjal iv) White rust.
7) Study of ***Selaginella*** : Morphology of sporophyte, stem anatomy and structure of strobilus.
8&9) Study of ***Cycas***- Systematic position, Morphology of Sporophyte, anatomy of leaflet, coralloid root (permanent slide), Male cone, microsporophyII, pollen grains, MegasporophyII, and V.S.of ovule (permanent slide)
10,11 and 12) Study of Angiosperm families- as per theory syllabus
13) Study of cell structure in Onion peel (cataphyII), it's staining and mounting.
14) Study of means of Vegetative Propagation-Sucker, Offset, Stolon, Runner.
15) Study of means of Vegetative Propagation-Tuber, Bulb, Rhizome, Bulbil.
16) Study of Cut flowers-Gladiolus, Gerbera, Rose
17) Techniques of potting and repotting (Demo.)
18) Propagation of Horticultural plants by Air-Layering and Whip grafting
19) Propagation of Horticultural plants by budding methods-'T' shaped(Shield) and Patch budding.
20) Study of Mitosis.
21) Genetic problems based on monohybrid and dihybrid ratio
22) Study of enzyme activity-Catalase and Dehydrogenase
23) Study of vegetative growth analysis.
24) Study of deficiency symptoms of –N, K, Mg, (Either using specimens./photographs)
25) Effect of Biofertilizers-BGA, on seed germination.
26)Identification of Mendelian traits (Using-either specimens/photographs).

SOLAPUR UNIVERSITY, SOLAPUR.
B.Sc. Part-I: Practical Examination in Botany.
March/April 2014.

Total -70 Marks

Q-1 **14 Marks**
A-Nostoc/Spirogyra/Mucor.
B-Riccia/Selaginella
C-Cycas Microsporophyll (mounting of pollens)/Cycas pinna.

Q-2:-D-Polypetalae/Gamopetalae/Apetalae/Monocot-Family. **08 Marks**

Q-3 'E' - Physiology experiments. **08 Marks**

OR

Q-3:- E-'Mitotic stages - - **08 Marks**

Q-4:- 'F' Horticultural Techniques-Layering/budding/grafting **06Marks**

Q 5: Problem on Genetics **06marks**

Q-6:- Identifications: **16Marks**

G) Any one plant disease /Lichen specimen. **04**

H) Detection of enzyme activity/ Cell structure (Onion peel). **04**

I) Natural methods of veg.propagation any one specimen/ Cut flower -any one. **04**

J) Expt. on Biofertilizer /Mineral deficiency/Mendelian traits. **04**

Q7 a) Journal. **06**

b) Tour report. **06**

Term: SEM-I separate passing Head: No, Min. Papers: Max. Papers: Max:

The papers under Sem- I are as follows:

Paper Name: Botany Paper I Paper Code: CSSC1BO1 Min: 0 Max 100												
TLM	Hrs	Credits	AM	Min	Max	AT	Min	Max	AT	Min	Max	Evaluation
Lectures	5	5	Theory	--	100	UA	28	70	CA	12	30	Marks system

Term: Sem-II Separate passing Head: No, Min. Papers: Max. Papers: Max:

The papers under Sem-II are as follows:

Paper Name: Botany Paper II Paper Code: CSSC2 BO2 Min: 0 Max 100												
TLM	Hrs	Credits	AM	Min	Max	AT	Min	Max	AT	Min	Max	Evaluation
Lectures	5	5	Theory	--	100	UA	28	70	CA	12	30	Marks system

Sem II Practical Examination

Paper Name: Botany Practical Paper Code: CSSC2 BTPR Min: 0 Max 100												
TLM	Hrs	Credits	AM	Min	Max	AT	Min	Max	AT	Min	Max	Evaluation
Laboratory	4	4	Practical	--	100	UA	28	70	CA	12	30	Marks system

Syllabus of B.Sc. Part – I (Botany) Semester System

(With effect from June2014)

Semester – I

Paper – I Microbiology and Cryptogam,Plant Physiology and Horticulture.75 Lectures

Section-I

(Microbiologyand Cryptogam)

Microbiology

Unit-1 –Viruses:-

General characters, structure, classification (plant, animal and bacterial viruses) and economic importance of viruses.(07)

Characteristics of bacteria, size, forms (Shapes), ultra structure of bacterial cell, Economic importance.(Useful and harmful).

— (Phytoplasma and Spiroplasma) Characters, Structure, classification and significance-

Cryptogams

Unit-2 General characters and classification of Cryptogams (as per G.M.Smith1955) up to class. (10)

2.1 General characters and classification of algae (As per Smith-1955) up to class.

2.2-Study of ***Nosto***and ***Spirogyra*** with respect to –classification, distribution, thallus structure and reproduction.

2.3 Brief account of economic importance of algae **–**

Unit-3–Fungi

3.1-General characters and classification of fungi up to class (as per Ainsworth) (09)

3.2-Study of ***Muco***rand ***Albugo***–with respect to-Classification, occurrence, thallus Structure and reproduction.

3.3-Brief account of economic importance of fungi.

3.4 Lichens-Characters, types, morphology, anatomy and economic importance.

Unit-4-Bryophytes:-

4.1 General characters and economic importance. (05)

4.2 Study of ***Riccia***with respect to classification, distribution, thallus organization and reproduction. (Development of sex organs and sporophyte not expected), alternation of generation

Unit-5–Pteridophytes:- (06)

5.1 General characters and economic importance.

5.2 Study of ***Selaginella***–with respect to-Systematic position with reasons, occurrence, morphology of sporophyte, anatomy of stem, reproductive structure (Development of sex organs and embryo not expected).

Section-II

Plant Physiology and Horticulture

Unit-6 -Plant Growth(09)

6.1 Vegetative growth: - Definition, phases of growth, Kinetics of growth.
6.2 Reproductive growth: - Physiology of flowering with respect to photoperiodism

(Definition and classification of plants based on photoperiod)
6.3 Role of phytochrome in flowering
6.4 Vernalisation (definition and mechanism)

6.5 Plant growth regulators:--Definition and classification (Growth promoters and Retardants.
a) Growth promoters: - Auxins (IAA), Gibberellins.

b) Growth retardants: - CCC.

6.6 Role of plant growth regulators (IAA, GA and CCC) in Agriculture.

Unit -7- Mineral nutrition(05)

7.1 Introduction, macro and micro elements
7.2 Role and deficiency symptoms of Macro elements-N, P K,Ca and Mg and micro elements-Fe, Cu &Mn.

Unit-8 Enzymes. (05)

8.1 Definition and physicochemical structure of enzymes.
8.2 Properties of enzymes, Coenzymes, Co-factors and Isoenzymes.
8.3 Mechanism of enzyme action-Lock and key hypothesis.

Unit-9- Horticulture (08)

9.1 Introduction and Scope of horticulture.
9.2 Branches of Horticulture**- a)** Olericulture: **b**) Pomoculture**c**) Floriculture.
9.3 Cultivation practices of Rosewith respect to Climate, soil type, varieties, planting, pruning, manures, irrigation, Pest and disease management.

Unit-10- Propagation of horticultural plants **(**11)

10.1 Sexual propagation – Merits and Demerits.

10.2 Vegetative propagation.

A) Natural methods of vegetative propagation:-

i) Runners ii).Suckers, iii). Bulbs, iv) Tubers, v) Rhizomesvi). Bulbils, vii)-Offset, viii) Stolon

B) Artificial methods of vegetative propagation:-

i) **Cutting**– Definition, Types (listing), Stem cutting – Soft wood,Semi hard wood and

Hardwood cuttings.

ii) **Layering** – Definition, Types (listing), Simple and Air layering.

iii) **Grafting** – Definition, Stock and scion relationship, Types (listing),Whip and Approach

Grafting.
iv) **Budding**– Definition, Types – "T" (Shield) and Patch budding.

10.3 Merits and Demerits of vegetative propagation.

Reference Books

1) General Microbiology-Vol-II, C B Powar, H F Daginawala, Himalaya Publishing HouseMumbai, 400004.

2) Virology: P Saravanan, MJP, Publishers, Chennai, 600005.

3) Understanding Microbiolgy, S K Prasad, Discovery Publishing House, Pvt.Ltd. New Delhi,110002.

4) An introduction to Viruses,S B Biswas,andAmitaBiswas,Vikas Publishing House,Pvt.Ltd.New

Delhi,110002.

5) Botany for Degree Students- Algae- B.R.Vasistha (1994) S.Chand and Company,Ramnagar New delhi.110055.

6) A Text Book of Algae,R M Johari,SnehaLata,Sandhya Sharma, Dominant Publishersand Distributors, New Delhi,110020.

7) A Text Book on Algae, D Kumar and N Singh, Affiliated East-west Press, PvtLtd.Uravashi Press, Press, Meerut, 250002.

8) Introduction to Algae, SudaraRajan, Anmol Publications, Pvt.Ltd. New Delhi, 110002.

9) An Introduction to Algae, Suresh Kumar, Campus Books International, Daryaganj, NewDelhi, 110002.

10) Cryptogrammic Botany-Smith G.M. (1973) Vol. I –Algae and Fungi, Tata McGrawHIILL,

Book, Company INC, Tokyo, Japan.

11) Introduction to fungi –Dube H.C. (1990).Vikas Publishing House Ltd. New Delhi.

12) The Fungi-Mehrotra B.S. (1980).Oxford and IBH Publishing Co.66, Janapath New Delhi, 110020.

13) Introductory Mycology –Alexopoulos C.J. and C.W.Mims. (1962) Wiley Western Ltd.Ansari Road, Daryaganj, New Delhi, 110020.

14) Botany for Degree students- Fungi - B.R.Vasistha. ,-S.Chand and Company, Ramnagar New Delhi.110055.

15) A Text Book of Fungi:-G L Chopra, and V Verma, Pradeep Publishing, Pratap Road, Jalandahr City, 144008.

16) Introductory Mycology, Sung Huang Sun-Wiley Eastern Ltd.Ansari Road, Daryaganj, New Delhi, 110020.

17). Biology of Lichens –Hale I.E. (1967) Edward Arnold, London.

18) Plant diseases –Singh R.S. (1963) Oxford and IBH Publishing Company Pvt.Ltd.New Delhi, 110001.

19) Disease s of crop plants in India –.Rangaswami and Mahadevan, Prentice Hallof India,Pvt.Ltd.,New Delhi,110001.

20) Botany for Degree Students –Bryophyte- B.R.Vashishta.S.Chand Company, Ramnagar New delhi.110055.

21) An Introduction to Embryophyta-Bryophyta, NS.Parihar, Vol-I, Central Book Depot, Allahabad.

22) A Text Book of Bryophyte, R M Johari, SnehaLata, and Kavitatyagi, Dominant

Publishers and Distributors, New Delhi, 110020.

23) Botany for Degree Students- Pteridophyte, P.C.Vasishta. S.Chand and Company, Ramnagar New Delhi.110055.
24) Introductions to Pteridophytes-Rashid A. (1978).Vikas Publishing house,Pvt.Ltd.Sahibabad, UP.

25). Cryptogrammic Botany-Smith G.M. (1973) Vol. II –Bryophyte and Pteridophyte, TataMcGraw HIILL, Book, Company INC, Tokyo, Japan.

26) Plant Physiology, P.S. Gill. Publisher .S Chand and Company Limited,Ramnagar New Delhi.110055.

27) Fundamentals of Plant Physiology. , J L Jain. .S Chand and CompanyLimited, RamNagar New Delhi.110055.

28) Plant Physiology V. Verma, EMKAY Publications. B-19, East Krishnanagar Delhi.110051.

29) Introductory Plant Physiology .G Ray Noggle&Frtiz.Prentice Hall of India.PvtLtd.New Delhi.110001.

30) Plant Physiology. Salisbury and Ross, CBS Publishers and Distributors. Jain Bhavan Bholanathnagar, Shahadara-Delhi.110032.

31) Plant Physiology, V I Palladin, Arihant Publications, Jaipur. (INDIA).

32) Physiology of Crop plants, F P Gardner B Pearce, R L Mitchell. Scientific Publishers Ratanada Road, P O Box 91, Jodhpur.342001.

33) Fundamentals of Horticulture –J.B.Edmond and J.L.Senn, Tata McGrawHill publishing Company Ltd –New Delhi.

34) Manual of Gardening –W.Burns (Edn)-Saeed International (Regd.)E-9-Jungpura (Extn).New Delhi-110014.
35) Gardening in India-T.K.Bose and D.Mukhargee, Oxford andIBH-Publishing Co.Pvt.Ltd.Culcutta.

36) The Culture of Vegetables and flowers-Martin-Sutton-Ambey-Publications Delhi.

37) PlantPropagation-M.K.Sadhi,WileyEasternLimited,4835/29,AnsariRoad, Daryaganj, New Delhi -110002.

38) Floriculture in India, G.S, Randhava and A. Mukhopadhyay.Allied Publishers, Pvt.Ltd, Mumbai, 40001.

Semester – II

Paper – II Gymnosperms and Angiosperms, Cell Biology, Genetics and Plant Biotechnology.

75 Lectures

Section-I

(Gymnosperms and Angiosperms)

Gymnosperms

Unit-.1 Introduction and salient features of Gymnosperms.(13)

Unit-.2 Classification of gymnosperms up to orders (According to Sporne1965).

Unit-3-Study of Cycas with respect to , occurrence ,Systematic position with reasons, External morphology of sporophyte, anatomy of leaflet and coralloid root,, Reproductive structures – structure of male cone and microsporophyll, Structure of megasporophyll and ovule (L. S.).

Unit-.4 Brief account of economic importance of Gymnosperms.

Angiosperms

Unit-5 Introduction and salient features of angiosperms. (05)
5.1- Outline of Bentham and Hooker's system of classification, Merits andDemerits.
5.2 Principles of International Code of Botanical Nomenclature (ICBN).

Unit-6-General account of morphology of Angiosperms with respect to inflorescence, flower, fruit, Concept of floral formula and floral diagram. (12)

Unit-7 Study of the following families of Angiosperms –with respect to Systematic position with reasons, morphology of vegetative and reproductive parts, diagnostic features and economic importance:-
i) Annonaceae ii) Caesalpinaceae iii) Solanaceae
iv) Convolvulaceae v) Nyctaginaceaeiv) Amaryllidaceae(06)

Section-II

Cell Biology, Genetics and Plant Biotechnology

Unit-1.The cell
1.1) Definition and Ultra Structure of Prokaryotic and Eukaryotic cell.(02)

Unit 2. Cell division
2.1) **Mitosis** – Definition, Various stages of mitosis and significance. (02)

Unit-3 Study of plant cell organelles- with respect to Occurrence, structure and functions of:- (5)
3.1) Nucleus
3.2) Chloroplast
3.3) Mitochondrion.

Unit 4.Microbodies **(5)**
Study of Microbodies with respect to Occurrence, Structure and functions of:-
4.1) Peroxisomes
4.2) Glyoxysomes

Unit 5 Cell wall **(5)**
5.1) Origin and Ultra structure of cell wall.
5.2) Chemical composition and functions of cell wall.

Unit 6- Cell membrane **(8)**
6.1) Ultra structure of cell membrane
6.2) Model of cell membrane (Singer – Nicholson's Fluid – Mosaic Model).
6.3) Chemical composition of cell membrane.
6.4) Functions of cell membrane.

Unit 7- Genetics **(10)**
7.1). Mendel's work on Pea
a) Introduction and history
b) Selection criteria for Pea plant
c) Genetic terminology (Factors, allels, parent generation, filial generation, self breeding, phenotypes, genotypes, homozygous, heterozygous, Purline , dominant, recessive, Monohybrid cross, Dihybrid cross, Polyhybrid cross , Back cross, Test cross)

d) Monohybrid and Dihybrid Cross.

7.2) **Mendel's laws of inheritance**- a) Law of Dominance
b) Law of segregation
c) Law of independent assortment.

7.3) Interaction of genes-
A) Complementary genes (9:7),
B) Supplementary genes (9:3:4)
C) Inhibitory genes (13:3)

Unit-8. Biotechnology **(1)**

8.1) Introduction, definition and Scope of biotechnology.
8.2) Multidisciplinary nature of biotechnology

Unit 9. Biotechnology in Agriculture **(1)**

9.1) **Tissue culture** – General techniques, Applications of tissue culture in Agriculture (04)
9.2) **Biofertilizers**– Definition, Necessity, Types – BGA (02)

Reference Books

01) Botany for Degree Students-Gymnosperms-P C Vashishta (1976). S Chand and Company Limited, Ramnagar New Delhi.110055.

02). Gymnosperms Structure and Evolution J Chamberlain, CBS Publishers and Distributors, Bholanath Nagar, New Delhi.32.

03). Morphology of Gymnosperms-Coulter and Chamberlain (1978).

04) Gymnosperm and Palaeobotany, S.K.Singh, Campus Book International, Ansari Road, Daryaganj, New Delhi.110002.

05) A Text Book of Bryophyte, Pteridophyte, Gymnosperm and Palaeobotany, AVSS, Sambamurty, IK International, Uphar Cinema Market, New Delhi.110016.

06) Morphology of Angiosperms, J M Coulter and C J Chamberlain, Pointer Publishers, Jaipur.

07) Taxonomy of Angiosperm R Pandey, S Chand and Co. Ltd, Ramnagar New Delhi.110055.

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13) Plant cell Biology –Structure and function-Gunning B.E.S and Steer M.W. (1996).

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20)-Genetics, M.P Arora, G.S Sandhu, Himalaya Publishing House, Girgaon Mumbai-40004.

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