



**CBCS CURRICULUM OF  
P.G. BOTANY PROGRAMME  
SUBJECT CODE=BOT**

FOR POSTGRADUATE COURSES UNDER NILAMBER PITAMBER UNIVERSITY

Members of Board of Studies of CBCS Post-Graduate Syllabus as per Guide lines  
of the Nilamber-Pitamber University, Medininagar.

## **Meeting of Board of Study**

### **Department of Botany, NPU** **Medininagar, Jharkhand**

On line meeting of Board of Study held on 12/03/2021 in the Department of Botany, NPU, Medininagar, Palamu, Jharkhand at 10:00 AM onwards Under Chairmanship of Dr. Rakesh Kumar, Department of Botany, NPU. The following members and external expert prof. Dr. A.K. Choudhary, Dept. of Botany, Ranchi University, Ranchi, and Prof. Dr. Jyoti Kumar, Ranchi University, Ranchi India have attended the meeting:

1. Dr. Rakesh Kumar (Chairman)
2. Prof. Dr. A.K. Choudhary (External Expert)
3. Prof. Dr. Jyoti Kumar (External Expert)
4. Dr. Jasbir Bagga(Member)
5. Mr. Sanjeev Singh (Member)
6. Mr. D.C. Dubey (Member)

At present, the syllabus for M.A. / M.Sc. and B.A. / B.Sc. (under choice based credit system) will be the same after the discussion of the member of the board of study.

## COURSE STRUCTURE FOR BOTANY PROGRAMME

**TableAI-1.1: Course structure for M.A./M.Sc. Botany Programme**

Semester	Subject (Core Courses)10Papers	Allied (Elective Courses)5Papers	Foundation Course(Compulsory Course)1 Paper	TotalCredits
Sem-I	C-1,C-2,C-3 (5+5+5=15Credits)		Foundation Course FC (05Credits)	<b>20 Credits</b>
Sem-II	C-4,C-5,C-6 (5+5+5=15 Credits)	EC1 (05Credits)		<b>20 Credits</b>
Sem-III	C-7,C-8, (5+5=10 Credits)	EC2, EC3 (5+5=10Credits)		<b>20 Credits</b>
Sem-IV	C-9 (5 Credits) C-10(Project) (05 Credits)	EC4, EC5 (5+5=10 Credits)		<b>20 Credits</b>
<b>Total = 80Credits</b>				

**Table AI-2 Subject Combinations allowed for Botany Programme (80Credits)**

Foundation Course <b>FC</b> <b>1Paper</b>	Core Subject <b>CC</b> <b>10 Papers</b>	Ability Enhancement Course <b>AE</b> <b>1 Paper</b>	Discipline Centric Elective/Generic Elective Course <b>DC/GE</b> <b>4Papers</b>
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**Table AI-2.1 Semester wise Examination Structure for Mid Sem & End Sem Examinations:**

Sem	Paper	Paper Code	Credit	Core, SE/GE/DC & Compulsory FCCourses Name of Paper	Examination Structure		
					Mid Semester Evaluation (F.M.)	End Semester Evaluation (F.M.)	End Semester Practical/Viva (F.M.)
I	Foundation	FCBOT101	5	Foundation Course	30	70	----
	Core	CCBOT101	5	Microbiology, Algae, Fungi and Plant Pathology	30	70	----
	Core	CCBOT102	5	Bryophytes, Pteridophytes, Gymnosperms and Fossils	30	70	----
	Core	CCBOT103P	5	Practical	---	----	70+30
II	Elective	ECBOT201	5	Biofertilizers	30	70	----
				Mushroom Cultivation			
	Core	CCBOT204	5	Cytogenetics, Taxonomy, Ethnobotany and Medicinal Plants	30	70	----
	Core	CCBOT205	5	Plant Physiology, Biochemistry, Biotechnology and Molecular Biology	30	70	----
Core	CCBOT206P	5	Cytogenetics, Taxonomy, Ethnobotany and Medicinal Plants-PR	---	----	70+30	
III	Core	CCBOT307	5	Fundamental and Applied Ecology	30	70	----
	Core	CCBOT308	5	Anatomy, Plant Embryology and Economic Botany	30	70	----
	Elective	ECBOT302	5	Algal Biotechnology-I	30	70	----
				Microbiology and Plant Pathology-I			
				Cytogenetics, Plant Breeding, Molecular Biology and Biotechnology-I			
				Plant Physiology, Biotechnology and molecular Biology-I			
Core	ECBOT303P	5	Practical: Ecology, Anatomy, Embryology & Economic Botany, Plant Taxonomy and Medicinal Plant	---	----	70+30	
IV	Core	CCBOT409	5	Bio chemicals and Molecular Techniques	30	70	----
	Elective	ECBOT404	5	Algal Biotechnology-II	30	70	----
				Microbiology and Plant Pathology-II			
				Cytogenetics, Plant Breeding, Molecular Biology and Biotechnology-II			
			Plant Physiology, Biotechnology and				

			molecular Biology-II				
			Plant Taxonomy, Ethnobotany and Medicinal Plants-II				
Elective	ECBOT403-P	5	Algal Biotechnology-P	30	70	---	
			Microbiology and Plant Pathology-P				
			Cytogenetics, Plant Breeding, Molecular Biology and Biotechnology-P				
			Plant Physiology, Biotechnology and molecular Biology-P				
			Plant Taxonomy, Ethnobotany and Medicinal Plants-P				
Core	CCBOT410	5	Project/Dissertation	----	----	70+30	



## Semester – 1

Marks 30 (MSE 20 1Hr + 5 Attd. + 5 Assign) + 70 (ESE : 3 Hrs) = 100

Pass Marks (MSE : 17 + ESE : 28) = 45

### MID SEMESTER EXAMINATION (MSE)

The Mid Semester Examination shall have three components: (a) Two Semester Internal Assessment Test (SIA) of 20 marks each. “Better of Two” shall be applicable for computation of marks for SIA. (b) Attendance / Regular Interactions of 05 marks and (c) Assignment of 05 marks.

### END SEMESTER EXAMINATION (ESE)

A total of **EIGHT** questions will be set in which Question 1 will be **Short Answer Type** and **COMPULSORY**. Any **four** questions shall have to be answered by the examinees out of the remaining seven questions. The questions will be of equal marks and will be so framed that the students are able to answer them within the stipulated time.

### Paper 1 Course Code – FCBOT101

Credits 5, Lecture - 75

Unit – I	15 - Lectures
Economic importance of Bacteria. Different type of life cycles found in Algae. Alternation of generation in Bryophytes & Pteridophyte.	
Unit – II	15 - Lectures
Origin of life. Geological time period. Types and process of fossilization. International code of Botanical Nomenclature – An Introduction.	
Unit – III	15 - Lectures
Plant systematics & its scope. Ethnobotany: Definition, Method of study. Biomolecules: Primary and Secondary metabolites, Structure and Function of Carbohydrates, Fats and Proteins.	
Unit – IV	15 - Lectures
Role of biotechnology in plant improvement. Ultrastructure of plant cell & cell division Introduction of Cancer Biology	
Unit – V	15 - Lectures
Biostatistics : Measure of central tendencies (Mean, Median, Mode) Vegetational belts of India Current global ecological issues: Global warming, Green house Gases, Sustainable Development and Ozone Depletion.	

#### Reference Books

- Pelczar, M.J. 2001. Microbiology. 5<sup>th</sup> ed., Tata Mc Graw- Hill Co, New Delhi.  
 Roger Y. Stanier 2019. General microbiology. 2nd ed. Oxford & IBH Publishing.  
 Lee, R.E. (2008). Phycology. 4<sup>th</sup> ed. Cambridge University Press, Cambridge.  
 Wiley J.M, Sherwood L. M, Woolverton C J 2013 .Prescott's Microbiology. 9<sup>th</sup> ed. .Mc Graw Hill International.  
 Singh JS Singh SP, Gupta ,SR. 2014 ..Ecology, Environmental Science and Conservation. S.Chand Publishing, New Delhi.

Webster J, Weber R.2007..Introduction to Fungi. 3<sup>rd</sup> ed.Cambridge University Press, Cambridge.  
 Vanderpoorten A.,Goffinet ,B.2009. Introduction to Bryophytes. Cambridge University Press.  
 Odum E P 2005..Fundamentals of ecology. 5<sup>th</sup> ed.Cengage Learning India Pvt.Ltd., NewDelhi.  
 Gilbert Morgia Smith 1955. Cryptogamic Botany. McGrow Hill Book Company, INC. New York.  
 K.U. Kramer, P. S. Green. Pteridophytes and Gymonsperms. Springer Science & Business Media.  
 A.V.V.S. Sambamurty 2006. A text book of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany.  
 I.K. International Publishing House.

## Semester – 1

Marks 30 (MSE 20 1Hr + 5 Attd. + 5 Assign) + 70 (ESE : 3 Hrs) = 100

Pass Marks (MSE : 17 + ESE : 28) = 45

### MID SEMESTER EXAMINATION (MSE)

The Mid Semester Examination shall have three components: (a) Two Semester Internal Assessment Test (SIA) of 20 marks each. “Better of Two” shall be applicable for computation of marks for SIA. (b) Attendance / Regular Interactions of 05 marks and (c) Assignment of 05 marks.

### END SEMESTER EXAMINATION (ESE)

A total of **EIGHT** questions will be set in which Question 1 will be **Short Answer Type** and **COMPULSORY**. Any **four** questions shall have to be answered by the examinees out of the remaining seven questions. The questions will be of equal marks and will be so framed that the students are able to answer them within the stipulated time.

### Paper 2

Course Code – CCBOT101

Microbiology, Algae, Fungi and plant Pathology

Credits 5, Lecture - 75  
15 Lectures

#### Unit – I

##### Microbiology

Structure and Reproduction in Bacteria.

Mechanism of bacterial recombination: Conjugation, transformation and transduction.

Bacteriophage – Structure and multiplication.

General account of Mycoplasma and its role in causing plant diseases.

#### Unit – II

##### Phycology

Classification of Algae by Fritsch

Range of thallus structures and reproduction in ;

a) Cyanophyta

30 Lectures

- b) Chloropyta
- c) Charophyta
- d) Phaeophyta
- e) Rhodophyta

Indian phycologists & their contribution.

Algal blooms.

Algal biofertilizers.

Algae as food, feed and uses in industry.

### Unit – III

15 Lectures

#### Fungi

Saprolegniales, Peronosporales, Mucorales with special reference to Evolution in asexual reproductive structures in class Phycomycetes.

Sexual reproduction and types of fructifications in Ascomycetes.

Plant Disease symptoms due to infection of different microbes.

General account of Deuteromycetes.

Host defense mechanism: Structural and biochemical defense.

### Unit – IV

15 Lectures

#### Plant Pathology:

Symptoms, etiology and disease management of following diseases:

- i. Late blight of Potato
- ii. Powdery Mildews of Pea
- iii. Black rust of Wheat
- iv. Early blight of Potato
- v. Tikka disease of Groundnut
- vi. Leafcurl of Tomato

#### Reference Books

- Alexopoulos CJ, Mims CW, Blackwell M. 1996. Introductory Mycology. 4<sup>th</sup> ed. John Wiley & Sons (Asia) Singapore.
- C. Van Den Hoek, D.G. Mann, H.M. Jahns 1995. Algae. Cambridge Univ. Press
- Webster J, Weber R .2007. Introduction to Fungi .3<sup>rd</sup> ed.Cambridge Univ. Press Cambridge.
- Sethi, IK ,Walia, SK 2011.Text book of Fungi and Their Allies. Macmillan Publishers .India Ltd
- Vashistha P C ,Sinha A K, Kumar A.2010. . Fungi .S.Chand .Delhi, India.
- Vashistha P C , Sinha A K ,Kumar A.2010 .Algae . S.Chand.Delhi,India.
- Agrios G N 1997 Plant Pathology. 4<sup>th</sup> ed. Academic Press,U.K. ohnWiley&Sons(Asia)Singapore.4thedition.
- Sharma P D 2011. .Plant Pathology. Rastogi Publication, Meerut,I ndia. Wiley JM,Sherwood , JM & Woolverton CJ 2013, Prescott's Microbiology. 9<sup>th</sup> ed. McGraw Hill,International
- Gail Lynn. Cleora J., D'Arej 2006. Essential Plant Pathology.APS Press.
- John William Hashberger 2019. A Text Book of Mycology and Plant Pathology. Alpha edition .
- H. Duke 2020. Modern Plant Pathology. AGROBIOS.



**MID SEMESTER EXAMINATION (MSE)**

The Mid Semester Examination shall have three components: (a) Two Semester Internal Assessment Test (SIA) of 20 marks each. "Better of Two" shall be applicable for computation of marks for SIA. (b) Attendance / Regular Interactions of 05 marks and (c) Assignment of 05 marks.

**END SEMESTER EXAMINATION (ESE)**

A total of **EIGHT** questions will be set in which Question 1 will be **Short Answer Type** and **COMPULSORY**. Any **four** questions shall have to be answered by the examinees out of the remaining seven questions. The questions will be of equal marks and will be so framed that the students are able to answer them within the stipulated time.

**Paper 3****Course Code – CCBOT102****Biology and Diversity of Bryophytes, Pteridophytes, Gymnosperms and Fossils**

**Credits 5, Lecture - 75  
30 Lectures**

**Unit – I  
Bryophytes**

Classification of Bryophytes.  
Range of thallus structure in marchantiales, Jungermaniales, Anthocerotales, sphagnales and polytrichales.  
Vegetative propagation & Perennation in Bryophytes.  
Evolution of Sporophyte in Bryophytes.

**Unit – II  
Pteridophyta**

**10 Lectures**

Classification of Pteridophytes 1975 K.R.Sporne.  
Evolution of stele in Pteridophyte.  
Origin and evolution of sporophyte in pteridophyte – Telome Concept.  
Heterospory and Seed Habit.

**Unit – III  
Gymnosperms and Fossils**

**35 Lectures**

Classification of Gymnosperms.  
Fossil- Mode of preservation, Distribution and examples of Indian Fossils.  
Brief account of families of Pteridospermales, Pentoxylales, Glossopteridaceae and Caytoniaceae.  
Comparative study of families of Gentales : Gentaceae, Ephedraceae and Welwitschiaceae with reference to structure & reproduction.  
A general account of Ginkgoales.

**Reference Books**

- Vashistha P C., Sinha A K Kumar A. 2010 .Pteridophyta. S.Chand. Delhi, India.  
O. P. Sharma 2012. Pteridophyta. Tata Mc Graw Hill Education Pvt. Ltd.  
□ Bhatnagar S.P, Moitra A. 1996 .Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.  
Parihar, N.S. 1991 ..An introduction to Embryophyta: Vol.I. Bryophyta. Central Book Depot. Allahabad.

Raven,P.H.,Johnson,G.B.,Losos,J.B.,Singer,S.R.2005. .Biology.TataMcGrawHill,Delhi.

Vanderpoorten A.,Goffinet B.2009.Introduction to Bryophytes. Cambridge University Press.

Vashistha P.C., Sinha,A.K., Kumar,A.(2010). Bryophyta. S.Chand. Delhi,India.

Bernard Goffinet 2000. Bryophytes Biology. Cambridge University Press.

Bernard Goffinet, Alain Vanderpoorten 2009. Introduction to Bryophytes. Cambridge University Press.

Bill Malcolm 2006. Mosses and other Bryophytes. Micro- Optics Press.

Nancy G. Slack, Zottan Tuba, Lloyd R. Star 2011. Bryophyte Ecology and Climate Change. Cambridge University Press.

C. Biswas, B.M. Johari2014. The Gymnosperms. 7<sup>th</sup> ed.Springer.

Alok Moitra 2003. Gymnosperms. New Age International.

## Semester – 1

### Practical Paper 4

Course Code – CCBOT(P)103

### Practical on Microbiology, Algae, Fungi, Plant Pathology, Bryophytes, Pteridophytes, and Gymnosperms

Credits 5, Lecture - 75

- |   |    |
|---|----|
| 1. Staining of gram positive/ gram negative bacteria.   | 06 |
| 2. Identification viral/ bacterial/fungal disease.  | 06 |
| 3. Study of algal materials from the algal mixture (A) identification of atleast one genus giving diagnostic features.        | 10 |
| 4. Identify the provided Bryophyte (B) to you after thorough investigation made through temporary mounts.                     | 10 |
| 5. Write a monograph on provided Pteridophyte material (C) to you after thorough investigation made through temporary mounts. | 14 |

OR

Identify the gymnosperm material (D) provided to you after thorough investigation made through temporary mounts.

- |  |    |
|--|----|
| 6. Spots 1 – 5.  | 10 |
| 7. Practical records, herbarium, field report, charts etc. | 16 |
| 8. Viva-voce.  | 08 |

**Semester – II****Marks 30 (MSE 20 1Hr + 5 Attd. + 5 Assign) + 70 (ESE : 3 Hrs) = 100****Pass Marks (MSE : 17 + ESE : 28) = 45****MID SEMESTER EXAMINATION (MSE)**

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**END SEMESTER EXAMINATION (ESE)**

A total of **EIGHT** questions will be set in which Question 1 will be **Short Answer Type** and **COMPULSORY**. Any **four** questions shall have to be answered by the examinees out of the remaining seven questions. The questions will be of equal marks and will be so framed that the students are able to answer them within the stipulated time.

**Paper 5****Course Code – ECBOT201A****BIOFERTILIZERS****Credits 5, Lecture - 75****(Theory 70+ Internal Assessment 30)****Unit – I****20 Lectures**

General account about the eco-friendly organic agro-input as biofertilizer—*Rhizobium* inoculant, *Nostoc*, *Anabaena*, *Azotobacter*, identification mass multiplication, Actinorrhizal symbiosis.

**Unit – II****15 Lectures**

Industrial Application of microalgae.

Cyanobacteria (bluegreen algae) and association of BGA, nitrogen fixation, factors affecting growth, blue green algae and *Azolla* in rice cultivation.

**Unit – III****15 Lectures**

Mycorrhizal association, types of mycorrhizal association, phosphorous nutrition, growth and yield.

**Unit – IV****25 Lectures**

Organic farming—green manuring and organic fertilizers, Recycling of bio-degradable municipal, agricultural and Industrial wastes. Water treatment and its use in agriculture.

**Semester – II****Marks 30 (MSE 20 1Hr + 5 Attd. + 5 Assign) + 70 (ESE : 3 Hrs) = 100****Pass Marks (MSE : 17 + ESE : 28) = 45****MID SEMESTER EXAMINATION (MSE)**

The Mid Semester Examination shall have three components: (a) Two Semester Internal Assessment Test (SIA) of 20 marks each. “Better of Two” shall be applicable for computation of marks for SIA. (b) Attendance / Regular Interactions of 05 marks and (c) Assignment of 05 marks.

**END SEMESTER EXAMINATION (ESE)**

A total of **EIGHT questions** will be set in which Question 1 will be **Short Answer Type** and **COMPULSORY**. Any **four** questions shall have to be answered by the examinees out of the remaining seven questions. The questions will be of equal marks and will be so framed that the students are able to answer them within the stipulated time.

**Paper 5****Course Code – ECBOT201 B****Skill Enhancement****Mushroom Cultivation****(Theory 70+ Internal Assessment 30)****Credits 5, Lecture - 75**

Unit – I

**20 Lectures**

Nutritional and medicinal value of edible mushrooms; poisonous mushrooms, Types of edible mushrooms available in India– *Valvariella volvacea*, *Pleurotus citrinopileatus*, *Agaricus bisporus*.

Unit – II

**25 Lectures**

Cultivation Technology; Infrastructure: substrates (locally available), Polythene bag, vessels, inoculation hook, inoculation loop, low cost stove, sieves, culture rack, mushroom unit (Thatched house) water sprayer, tray, small polythene bag. Pure culture: Medium, sterilization, preparation of spawn, multiplication. Mushroom bed preparation–paddy straw, sugarcane trash, maize straw, banana leaves, factors affecting the mushroom bed preparation–Low cost technology, Composting technology in mushroom production.

Unit – III

**25 Lectures**

Storage and nutrition: Short – term storage (Refrigeration – upto 24 hours), Long term Storage (canning, pickles, papads), drying, storage in salt solutions. Nutrition – Proteins – amino acids, mineral elements nutrition – Carbohydrates, Crude fibre content – Vitamins.

Unit – IV

**5 Lectures**

Research Centers– National level and Regional level.

**Reference Books**

- SC Tewari, Pankaj Kapoor 2018. Mushroom Cultivation. Mittal Publication, Delhi .  
 Paul Stamets 2000. Growing Gourmet and Medicinal Mushroom. 3<sup>rd</sup> edition Ten speed Press.  
 Merlin Sheld 2020. Entangled Life. Bodley Head Penguin Random house.  
 Tavis Lynch 2018. Mushroom Cultivation. Quarry Books, Ill edition.

M.K.Rai 2006. Hand book of Microbial Biofertilizers. The Howorth Press. Inc. New York, London, Oxford.

Bhoopander Giri, Ram Prasad, Qiang-Sheng Wu, AjitVarma 2019. Biofertilizer for Sustainable Agriculture and Environment.Springer.

## Semester – II

Marks 30 (MSE 20 1Hr + 5 Attd. + 5 Assign) + 70 (ESE : 3 Hrs) = 100

Pass Marks (MSE : 17 + ESE : 28) = 45

### MID SEMESTER EXAMINATION (MSE)

The Mid Semester Examination shall have three components: (a) Two Semester Internal Assessment Test (SIA) of 20 marks each. “Better of Two” shall be applicable for computation of marks for SIA. (b) Attendance / Regular Interactions of 05 marks and (c) Assignment of 05 marks.

### END SEMESTER EXAMINATION (ESE)

A total of **EIGHT** questions will be set in which Question 1 will be **Short Answer Type** and **COMPULSORY**. Any **four** questions shall have to be answered by the examinees out of the remaining seven questions. The questions will be of equal marks and will be so framed that the students are able to answer them within the stipulated time.

#### Paper 6

Course Code – CCBOT204

### CYTOGENETICS, TAXONOMY, ETHNOBOTANY AND MEDICINAL PLANTS

Credits 5, Lecture - 75

#### Unit – I

15 Lectures

Chromatin Organization, Chromosome structure and packaging of DNA, Histones, Heterochromatin and Euchromatin.

Cell division and cell cycle: Mitosis, Meiosis, their regulation, Over view of cell cycle, control mechanism: role of cyclins and cyclin dependent Kinases.

Protein sorting: Targeting of proteins to organelles.

Mutations: Types, Detection, Molecular basis of mutation, Physical and Chemical Mutagenesis.

#### Unit – II

20 Lectures

DNA damage and repair mechanism.

Brief account of Proto-oncogenes, Oncogenes, tumor suppressor genes, cancer, metastasis.

Structure and numerical alterations in chromosomes: Origin, Occurrence and production of haploid.

Introduction and characterization of aneuploids, Origin and production of autopolyploids, allopolyploids.

Biostatistics: Standard deviation, Standard error, Chi square test

#### Unit - III

15 Lectures

**Systematics:** Outline, Classification of Angiosperms– Takhtajan and Cronquist’s system. Their merits and demerits.

**Botanical Nomenclature:** International code of Algae, Fungi & Plants–Principle, Rules of effective and valid publication. Retention and choice of names.

**Biosystematics:** Concepts, Biosystematics categories, Methods in Experimental Taxonomy.

Diagnostic characteristics, systematic phylogeny and economic importance of families, Mangoliaceae, Apocynaceae, Asclepiadaceae, Convolvulaceae, Scrophulariaceae, Acanthaceae, Bignoniaceae, Lamiaceae, Verbenaceae, Polygonaceae, Euphorbiaceae, Rubiaceae, Orchidaceae, Araceae, Poaceae, Commelinaceae, cucurbitaceae, Asteraceae and leguminosae

**Ethonobotany** : With reference to socio-culture organization of the ethnic tribes of Jhrakhand.

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### Reference Books

- Padma Tirunilai 2012. Recent Trends in Cytogenetic Studies. In Tech.  
Felix Mitelman, Sverre Heim 1995. Cancer Cytogenetics: Chromosomal and Molecular Genetics Abberation of Tumor Cell. 2<sup>nd</sup> ed. Wiley.  
P. K. Gupta 2007. Cytogenetics. Rastogi Publication.  
Darbesh Roy 2009. Cytogenetics. Alpha Science International.  
G. Obe, Armin Basler 1987. Cytogenetics : Basic & Applied Aspect. Springer-Verlag.  
Stefano Mancuso 2018. The Revolutionary Genius of Plants. Black Stone Pub.  
James D. Watson, Andrew Berry 2004. DNA- The Secret of Life. Arrow.  
Matthew Alfs 2013. Edible and Medicinal Wild Plants of the Midwest. Old Theology Book House.  
Amritpal Singh Saroya 2017. Ethnobotany. ICAR.  
A.K. Ghosh 2013. Indigenous Knowledge on Ethnobotany. Daya Publishing House.

### Semester – II

Marks 30 (MSE 20 1Hr + 5 Attd. + 5 Assign) + 70 (ESE : 3 Hrs) = 100  
Pass Marks (MSE : 17 + ESE : 28) = 45

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### MID SEMESTER EXAMINATION (MSE)

The Mid Semester Examination shall have three components: (a) Two Semester Internal Assessment Test (SIA) of 20 marks each. "Better of Two" shall be applicable for computation of marks for SIA. (b) Attendance / Regular Interactions of 05 marks and (c) Assignment of 05 marks.

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### END SEMESTER EXAMINATION (ESE)

A total of **EIGHT** questions will be set in which Question 1 will be **Short Answer Type** and **COMPULSORY**. Any **four** questions shall have to be answered by the examinees out of the remaining seven questions. The questions will be of equal marks and will be so framed that the students are able to answer them within the stipulated time.

### Paper 7

Course Code – CCBOT205

**PLANT PHYSIOLOGY, BIOCHEMISTRY, BIOTECHNOLOGY AND  
MOLECULAR BIOLOGY**

**Transpiration:** Types of Transpiration, Mechanism of Transpiration and Stomatal opening (movement), Physiology, Factors Affecting the Rate of Transpiration, Significance of Transpiration, Antitranspirant, Measurement of Transpiration; Guttation.

**Translocation in Plant:** Phloem Transport; Phloem Sap Composition, Movement in Plant, Direction of Movement, Bidirectional Movement, Lateral Movement, Source–Sink relationship, Phloem loading, Phloem Unloading, Mechanism of Phloem Transport–Electro osmosis, Protoplasmic, Streaming, Contractile Protein Variants, Mass Flow Hypothesis, Factors Affecting Translocation.

**Phytohormone :** History, Structure, Biosynthesis Physiological Response and Mechanism of Action of Auxins & gibberellins

**Physiology of Flowering:** Photoperiodism and Vernalization.

**Seed Dormancy and Germination:** Definition, Types, Mechanism and Method breaking the Dormancy.

## Unit – II

25 Lectures

### Plant Biochemistry

**Photosynthesis:** The Pigment System, Light Reaction, Dark ( $C_3$  Cycle), Kranz anatomy, Hatch and Slack Pathway ( $C_4$  Cycle), CAM Pathway Photorespiration and Factors Affecting Rate of Photosynthesis.

**Respiration:** Glycolysis, Fermentation, Krebs Cycle, Electron Transport System, Hexose Monophosphate Shunt, The Chemiosmotic Theory & Factors Affecting the Rate of Respiration, Respiratory Quotient.

**Enzymes:** Nomenclature and Classification, Nature, Properties, Enzyme kinetics (Michaelis and Menten Constant), Mode and Mechanism of Action (Lock & Key model & Induced Fit model), Factors Affecting Enzyme Activities.

**Nitrogen Metabolism:** Nitrogen Fixation; Non-biological Fixation; Biological Fixation–Symbiotic Nitrogen Fixers, Non-symbiotic Nitrogen Fixers, Biochemistry of Nitrogen Fixation.

**Lipid Metabolism:** Simple Lipids, Complex Lipid, Neutral Fats, Fatty Acids, Enzymatic Degradation of Fats,  $\beta$ -Oxidation of Fatty Acid and Oxidation of Fatty Acids, Biosynthesis of Fatty Acids.

## Unit – III

25 Lectures

### Biotechnology and Molecular Biology

Plant tissue culture and its significance

**Micropropagation:** Techniques, Multiplication by Auxiliary and Apical Shoots, Multiplication through Callus Embryoid Culture, Factors Affecting Shoot Multiplication.

**Haploidy:** Anther culture, pollen culture and ovary culture and its role in crop improvement

**Molecular Cytogenetics:** Brief account of DNA replication in Prokaryotes, Nuclear DNA content, C-value paradox, Introns and RNA splicing, repetitive DNA, Restriction mapping, Regulation of gene expression in Prokaryotes & Eukaryotes

**Molecular marker:** RFLP, RAPD, AFLP and SSR

**Genetic transformation :** Biotic and abiotic methods; transgenic plants

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## Reference Books

Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5<sup>th</sup> ed., ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.

- Becker, W.M., Kleinsmith, L.J., Hardin, J. and Bertoni, G.P. 2009. The World of the Cell. 7<sup>th</sup> ed. Pearson Benjamin Cummings Publishing, San Francisco
- Campbell, M.K. 2012. Biochemistry, 7<sup>th</sup> ed., Published by Cengage Learning
- Campbell, P. and Smith, A.D. 2011. Biochemistry Illustrated, 4<sup>th</sup> ed., Published by Churchill Livingstone
- Tymoczko, J.L., Berg, J.M. and Stryer, L. 2012. Biochemistry: A short course, 2<sup>nd</sup> ed., W. H. Freeman
- Berg, J.M., Tymoczko, J.L. and Stryer, L. 2011. Biochemistry. W.H. Freeman and Company
- Nelson, D.L. and Cox, M.M. 2008. Lehninger Principles of Biochemistry, 5<sup>th</sup> ed., W.H. Freeman and Company.
- Hopkins, W.G. and Huner, A. 2008. Introduction to Plant Physiology. 4<sup>th</sup> ed. John Wiley and Sons, U.S.A.
- Taiz, L., Zeiger, E., Moller, I.M. and Murphy, A. 2015. Plant Physiology and Development. 6<sup>th</sup> ed. Sinauer Associates Inc. USA.
- Bajracharya, D. 1999. Experiments in Plant Physiology - A Laboratory Manual. Narosa Publishing House, New Delhi
- Bhojwani, S.S., Razdan, M.K. 1996. Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam, The Netherlands.
- Glick, B.R., Pasternak, J.J. 2003. Molecular Biotechnology - Principles and Applications of recombinant DNA. ASM Press, Washington.
- Snustad, D.P. and Simmons, M.J. 2010. Principles of Genetics. John Wiley and Sons, U.K. 5<sup>th</sup> ed.
- Stewart, C.N.J. 2008. Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A.

**Semester – II**  
**Practical Paper 8**  
**Course Code – CCBOT (P) 206**

**CYTOGENETICS, TAXONOMY, PLANT PHYSIOLOGY, BIOTECHNOLOGY AND  
MOLECULAR BIOLOGY LAB**

**Credits 5**

- |     |  |    |
|-----|--|----|
| 1.  | Problems based on Mendelian ratio and their modifications, statistics analysis and genetic explanation.                            | 10 |
| 2.  | Show two stages of mitosis from the given onion root tip.  | 08 |
| 3.  | Compare and comment on the floral characters of the local flora A and B provided and assign them to their respective families.     | 08 |
| 4.  | In a separate answer book provided, you have to write down botanical name family and used of plants C, D, E, F, G provided to you. | 08 |
| 5.  | Separation of chlorophyll pigments by Paper chromatography.  | 06 |
| 6.  | Phytochemical screening of secondary metabolites (alkaloids, phenols and saponins) : Any two.                                      | 06 |
| OR  |  |    |
| 7.  | Estimate the quality of carbohydrate/ Protein through standard curve from the given sample with the help of spectrophotometer.     |    |
| 8.  | Comment upon the spot 1 – 5.   | 10 |
| 9.  | Practical records, herbarium, Charts model, Ingenuity design etc.  | 16 |
| 10. | Viva-voce.   | 08 |



**Semester – III****Marks 30 (MSE 20 1Hr + 5 Attd. + 5 Assign) + 70 (ESE : 3 Hrs) = 100****Pass Marks (MSE : 17 + ESE : 28) = 45****MID SEMESTER EXAMINATION (MSE)**

The Mid Semester Examination shall have three components: (a) Two Semester Internal Assessment Test (SIA) of 20 marks each. “Better of Two” shall be applicable for computation of marks for SIA. (b) Attendance / Regular Interactions of 05 marks and (c) Assignment of 05 marks.

**END SEMESTER EXAMINATION (ESE)**

A total of **EIGHT** questions will be set in which Question 1 will be **Short Answer Type** and **COMPULSORY**. Any **four** questions shall have to be answered by the examinees out of the remaining seven questions. The questions will be of equal marks and will be so framed that the students are able to answer them within the stipulated time.

**Paper 9****Course Code – CCBOT307****FUNDAMENTAL AND APPLIED ECOLOGY****Credits 5, Lecture - 75  
15 Lectures****Unit – I**

Ecological factors; Climatic, Topographic, Edaphic and Biotic.

Population and Community ecology: population characteristics, Population dynamics, Community characteristics, composition, structure, origin and development of a community, methods of study of community.

**Unit – II****15 Lectures****Ecological succession:** Types and mechanisms of ecological successions (Hydrosere and Xerosere); Changes in ecological properties during succession.**Ecosystem organization:** Types, Structure and Function, Flow of energy; Bio-geochemical cycles of C, N, P, S; mineral cycles (Pathway, Processes); Primary production, Decomposition and Feed chain, Food web of different types of ecosystems; Terrestrial (Forest and Grassland) and Aquatic (Freshwater); and Ecological pyramids.**Unit – III****15 Lectures****Ecological adaptations:** Hydrophytes, Xerophytes and Halophytes.**Phytogeography:** Major plant communities of the world; Phytogeographic regions of the world; Floristic regions of India, vegetation of India.**Air, Water, Soil, Sound and Radiation Pollutions:** Kinds, Sources, Quality parameters, Effect on plants & Ecosystem and control measures.**Unit – IV****15 Lectures****Climate Change (Global Environmental Problems) :** Global warming, Green house Gases(CO<sub>2</sub>, CH<sub>4</sub>, O<sub>3</sub>, CFC<sub>5</sub>, N<sub>2</sub>O), Sources, Trends & Role); Ozone depletion, Damage to the Ozone layer & Hole, Health effects of Ozone depletion and increased UV Radiation, Saving the Ozone layer.**Non-conventional source of energy:** Solar, Wind, Nuclear, Biogas and Petroplants.**Unit – V****15 Lectures**Strategies of Plant conservation: *In situ* conservation – Sanctuaries, National parks and Sacred

groves and *Ex situ* conservation – Botanical gardens, Gene bank, Seed banks and tissue culture techniques.

Indian Biological Diversity Act. Convention of Biological Diversity (CBD), People's Biodiversity Register, Green Book, Red Book, Blue Book.

**Bioremediation:** Definition need and scope of bioremediation Phyto remediation, Micro remediation.

### Reference Books

Raziuddin, M., Mishra P.K. 2014. A Hand book of Environmental Studies. Akanaksha Publications, Ranchi. □

Mukherjee, B. 2011. Fundamentals of Environmental Biology. Silverline Publications, Allahabad. □

Carson, R. 2002. Silent Spring. Houghton Mifflin Harcourt.

Gadgil, M., Guha, R. 1993. This Fissured Land : An Ecological History of India. Univ. of California Press.

Gleeson, B. and Low, N. 1999. Global Ethics and Environment, London. Routledge.

Gleick, P.H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute. Oxford Univ. Press.

Groom, Martha J., Gary K. Meffe, Carl Ronald Carroll 2006.. Principles of Conservation Biology. Sunderland: Sinauer Associates.

Odum, E.P., Odum, H.T. & Andrews, J. 1971. Fundamentals of Ecology. Philadelphia: Saunders.

Pepper, I.L., Gerba, C.P., Brusseau, M.L. 2011. Environmental and Pollution Science. Academic Press.

Singh, J.S., Singh, S.P., Gupta, S. 2006. Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi, India.

Sharma, P.D. 2010. Ecology and Environment. 8<sup>th</sup> ed. Rastogi Publications, Meerut, India..

Wilkinson, D.M. 2007. Fundamental Processes in Ecology: An Earth Systems Approach. Oxford University Press. U.S.A.

### Semester – III

**Marks 30 (MSE 20 1Hr + 5 Attd. + 5 Assign) + 70 (ESE : 3 Hrs) = 100**

**Pass Marks (MSE : 17 + ESE : 28) = 45**

### MID SEMESTER EXAMINATION (MSE)

The Mid Semester Examination shall have three components: (a) Two Semester Internal Assessment Test (SIA) of 20 marks each. "Better of Two" shall be applicable for computation of marks for SIA. (b) Attendance / Regular Interactions of 05 marks and (c) Assignment of 05 marks.

### END SEMESTER EXAMINATION (ESE)

A total of **EIGHT** questions will be set in which Question 1 will be **Short Answer Type** and **COMPULSORY**. Any **four** questions shall have to be answered by the examinees out of the remaining seven questions. The questions will be of equal marks and will be so framed that the students are able to answer them within the stipulated time.

### Paper 10

**Course Code – CCBOT308**

**ANATOMY, PLANT EMBRYOLOGY AND ECONOMIC BOTANY**

**Credits 5, Lecture - 75**

**30 Lectures**

**Unit – I**

**Anatomy**

Shoot Development and theories of shoot Apex organization, Organization of root, Apical Meristem.

Mechanical Tissue and their Distribution

Cambium, periderm

Ecological adaptation with reference to Anatomy

Anomalous Secondary growth with reference *Dracaena* stem, *Tinospra* root, *Bignonia* and *Strychnos* stems.

## Unit – II

45 Lectures

### Embryology and Economic Botany

Microsporogenesis and Microgametophyte.

Megasporogenesis and Megagametophyte.

Fertilization.

Endospermytype, Physiology and cytology of endosperm.

Polyembryony – Types, adventative embryony, false embryony, twins & triplets,

Sexual incompatibility.

Apomixis, Embryology in relation to taxonomy.

Experimental Embryology: Anther, Ovary, Ovule, Endosperm and Embryo Culture.

Common name, Botanical name, Family and uses of plants of following: (a) Fibre yielding (b) Timber yielding (c) Oil Yielding (d) Drug yielding.

### Reference Books

Kochhar, S.L. 2012. Economic Botany in Tropics. MacMillan & Co. New Delhi, India.

Wickens, G.E. 2001. Economic Botany: Principles & Practices. Kluwer Academic Publishers. The Netherlands.

Chrispeels, M.J. and Sadava, D.E. 1994. Plants, Genes and Agriculture. Jones & Bartlett Publishers

Bhojwani, S.S. and Bhatnagar, S.P. 2011. The Embryology of Angiosperms, 5<sup>th</sup> ed. Vikas Publishing House. Delhi.

Shivanna, K.R. 2003. Pollen Biology and Biotechnology. Oxford and IBHP Publishing Co. Pvt. Ltd. Delhi.

□ Raghavan, V. 2000. Developmental Biology of Flowering plants. Springer, Netherlands.

□ Johri, B.M. 1984. Embryology of Angiosperms. Springer-Verlag, Netherlands.

□ Dickison, W.C. 2000. Integrative Plant Anatomy. Harcourt Academic Press, USA.

□ Fahn, A. 1974. Plant Anatomy. Pergamon Press, USA.

□ Mauseth, J.D. 1988. Plant Anatomy. The Benjamin/Cummings Publisher, USA.

□ Evert, R.F. 2006. Esau's Plant Anatomy: Meristems, Cells and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons Inc.

**Semester – III****Marks 30 (MSE 20 1Hr + 5 Attd. + 5 Assign) + 70 (ESE : 3 Hrs) = 100****Pass Marks (MSE : 17 + ESE : 28) = 45****MID SEMESTER EXAMINATION (MSE)**

The Mid Semester Examination shall have three components: (a) Two Semester Internal Assessment Test (SIA) of 20 marks each. “Better of Two” shall be applicable for computation of marks for SIA. (b) Attendance / Regular Interactions of 05 marks and (c) Assignment of 05 marks.

**END SEMESTER EXAMINATION (ESE)**

A total of **EIGHT** questions will be set in which Question 1 will be **Short Answer Type** and **COMPULSORY**. Any **four** questions shall have to be answered by the examinees out of the remaining seven questions. The questions will be of equal marks and will be so framed that the students are able to answer them within the stipulated time.

**Paper 12****Course Code – ECBOT 301A****Special Theory Paper : ALGAL BIOTECHNOLOGY****Credits 5, Lecture - 75****20 Lectures****Unit – I**

Principles and systems of classification by Fritsch &amp; Chapman.

Cyanophyceae: Cell structure and thallus organization, heterocyst and akinete development and their role chromatic adaptation and reproduction.

Chlorophyceae: Range of thallus organization, methods of reproduction and perennation and lifecycle.

**Unit – II****20 Lectures**

Life cycle patterns and alternation of generation with particulars reference to Pheophyceae and Rhodophyceae.

Nuclear characteristics of green algae &amp; blue green algae.

A detailed idea of algae causing diseases of plants and animals.

Algae and water pollution: Physico-chemical analysis of water bodies, pollution indices and pollution indicators and steps to control pollution.

**Unit – III****10 Lectures**

Cyanobacteria in human welfare: Production of fine chemicals polysaccharides bioactive molecules pigments and lipids.

Recent Biotechnological developments with algae as experimental material.

**Unit – IV****25 Lectures**

Role of algae in biological nitrogen fixation.

Culture of algae: Media preparation.

Methods of collection, isolation and cultural procedure for green algae and bluegreen algae.

Economic importance of Algae as:

a) Food

b) Feed

- c) Bio-fertilizer
- d) Algae in agriculture and industry.  
Molecular biotechnology with special reference to bluegreen algae.

### Reference Books

Faizal Bux, Yusuf Chistri 2016. Algae Biotechnology. Springer.  
 P.C.Trivedi 2001. Algal Biotechnology. Pointer Publishers.  
 Clemens Posten, Christaian Walter. 2022. Microalgal Biotechnology. DE Gruyter GmbH, Birlin, Boston.  
 E. Wolfgang Becker. 1994. Microalgae :Biotechnology and Microbiology. Cambridge University Press.  
 Kathiresan Shanmugam, Muthu Arumugam. 2020.Applied Algal Biotechnology. Nova Science Publishers.

### Semester – III

**Marks 30 (MSE 20 1Hr + 5 Attd. + 5 Assign) + 70 (ESE : 3 Hrs) = 100**

**Pass Marks (MSE : 17 + ESE : 28) = 45**

#### MID SEMESTER EXAMINATION (MSE)

The Mid Semester Examination shall have three components: **(a)** Two Semester Internal Assessment Test **(SIA)** of 20 marks each. “Better of Two” shall be applicable for computation of marks for SIA. **(b)** Attendance / Regular Interactions of 05 marks and **(c)** Assignment of 05 marks.

#### END SEMESTER EXAMINATION (ESE)

A total of **EIGHT** questions will be set in which Question 1 will be **Short Answer Type** and **COMPULSORY**. Any **four** questions shall have to be answered by the examinees out of the remaining seven questions. The questions will be of equal marks and will be so framed that the students are able to answer them within the stipulated time.

### Paper 12

**Course Code – ECBOT 301B**

### Special Theory Paper : MICROBIOLOGY AND PLANT PATHOLOGY

**Credits 5, Lecture - 75**

**12 Lectures**

#### Unit – I

General symptoms of Plant Diseases caused by Bacteria, Mycoplasma and Virus.  
Koch's Postules and its importance in identification of plant disease.

#### Unit – II

Classification of Gram+ve and gram-ve bacteria.  
Microbial mechanism of pathogenicity.

**13 Lectures**

#### Unit – III

Mechanism of Attack: Mechanical forces exerted by the pathogenon host tissues.  
Chemical weapons of pathogens:

**25 Lectures**

- e) Enzymes:Role of Enzymes in pathogenesis  
f) Toxins:Types of toxins and their role in pathogenesis .

Defense mechanism in plants:

- g) Structural defence mechanism
- h) Chemical defence mechanism
- i) Phenolic compounds role defence
- j) Phytoalexins

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### Reference Books

- H. D. Kumar, Introductory Phycology, Affiliated East-West Press, Delhi.  
Lee, R.E. 2008, Cambridge Univ. Press, Cambridge, 4<sup>th</sup> ed.  
Palczar, MJ 2001, Microbiology, Tata McGraw Hill Co, New Delhi.  
Wiley JM, Sherwood, JM & Woolverton CJ 2013, 9<sup>th</sup> ed. Prescott's Microbiology, McGraw Hill, International  
Gail Lynn. Cleora J., D'Arcy 2006. Essential Plant Pathology. APS Press.  
John William Hashberger 2019. A Text Book of Mycology and Plant Pathology. Alpha edition.  
H. Duke 2020. Modern Plant Pathology. AGROBIOS.



**Semester – III****Marks 30 (MSE 20 1Hr + 5 Attd. + 5 Assign) + 70 (ESE : 3 Hrs) = 100****Pass Marks (MSE : 17 + ESE : 28) = 45****MID SEMESTER EXAMINATION (MSE)**

The Mid Semester Examination shall have three components: (a) Two Semester Internal Assessment Test (SIA) of 20 marks each. “Better of Two” shall be applicable for computation of marks for SIA. (b) Attendance / Regular Interactions of 05 marks and (c) Assignment of 05 marks.

**END SEMESTER EXAMINATION (ESE)**

A total of **EIGHT** questions will be set in which Question 1 will be **Short Answer Type** and **COMPULSORY**. Any **four** questions shall have to be answered by the examinees out of the remaining seven questions. The questions will be of equal marks and will be so framed that the students are able to answer them within the stipulated time.

**Paper 12****Course Code – ECBOT 301C****Special Theory Paper : CYTOGENETICS, PLANT BREEDING, MOLECULAR BIOLOGY AND BIOTECHNOLOGY****Credits 5, Lecture - 75****15 Lectures****Unit – I**

Introduction to Cytogenetics and Cytological methods: pretreatment, fixation, stain & mechanism of staining.

Structural organization of eukaryotic Chromosomes, Histones Nucleosome concept, Importance of Telomeres and Centromeres, Heterochromatin.

**Unit – II****15 Lectures**

Different forms of Chromosomes: Somatic metaphase (Salivary gland chromosomes), Meiotic prophase (Lamp brush), B-Chromosomes or Supernumerary Chromosomes.

Karyotype Analysis and Karyotype evolution.

Mechanism of cell division: Mitosis, Meiosis, Cell-cycle, Regulation of cellcycle.

**Unit – III****15 Lectures**

Molecular basis of Chromosome pairing.

Mechanism of Genetic Recombination.

Alterations in Chromosome Structure: Deletion, Duplication, Translocation, Inversion.

**Unit – IV****15 Lectures**

Variations in Chromosome numbers, Aneuploidy, Trisomics (primary secondary tertiary), Monosomics, Nullisomics Euploidy: Haploidy,

Autopolyploidy, Allopolyploids and origin of cultivated plants: Wheat, Brassica, Cotton, Tobacco.

Theory of centre of origin of crop plants.

Self-incompatibility System.

**Unit- V****15 Lectures**

Inbreeding & Heterosis.

Male sterility and its significance.

Analysis of variance, co-relation co-efficient.

**Reference Books**

- Becker, WM., Kleinsmith LJ., Hardin J. & Bertoni, GP. 2009. The world of the Cell. 7<sup>th</sup> Pearson Benjamin Cumming Publishing, San Francisco.
- Campbell, MK 2012, Biochemistry. 7<sup>th</sup> ed. Cengage Learning.
- Cooper, G.M. & Hausman, R.R., 2009, The Cell: A Molecular Approach, ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
- Hardin, J., Becker, G. Skliensmith, L.J., 2012, Becker's World of The Cell. 8<sup>th</sup> ed. Pearson Education Inc. U.S.A.
- Karp, G. 2010 Cell Biology. 6<sup>th</sup> ed. John Wiley & Sons, U.S.A.
- Nelson DL & Cox MM, 2008. Lehninger Principles of Biochemistry 5<sup>th</sup> ed. W.H. Freeman & Company.
- Ram Singh 2017. Cytogenetics. 3<sup>rd</sup> ed. CRC Press.
- Morgan Key 2015. Cytogenetics: Technique and Application. Callisto Reference.
- Sundara S. Rajan 2004. Cytogenetics. Anmol Publication Pvt.
- Albert Johnson, Levis Morgan Raff, Roberts Walter 2014. Molecular Biology of the Cell. 6<sup>th</sup> ed. W.W. Norton & Company.
- James D. Watson 1968. The Double Helix. Scribner.
- David P. Clark 2019. Molecular Biology. Academic Press.
- George Acquah 2012. Principles of Plant genetics and Breeding. Wiley Publication.
- Yunbi Xu 2010. Molecular Plant Breeding. CAB International.
- G.S. Cahal, S.S. Gosal 2002. Principles and Procedures of Plant Breeding. Nosra.
- U. Satyanarayana 2020. Biotechnology. Books and Allied Ltd.
- Bernard R. Glick, Jack J. Pasternak 2017. Molecular Biotechnology: Principles and Applications of Recombinant DNA. 5<sup>th</sup> ed. Wiley Publishers.



**Semester – III****Marks 30 (MSE 20 1Hr + 5 Attd. + 5 Assign) + 70 (ESE : 3 Hrs) = 100****Pass Marks (MSE : 17 + ESE : 28) = 45****MID SEMESTER EXAMINATION (MSE)**

The Mid Semester Examination shall have three components: (a) Two Semester Internal Assessment Test (SIA) of 20 marks each. “Better of Two” shall be applicable for computation of marks for SIA. (b) Attendance / Regular Interactions of 05 marks and (c) Assignment of 05 marks.

**END SEMESTER EXAMINATION (ESE)**

A total of **EIGHT** questions will be set in which Question 1 will be **Short Answer Type** and **COMPULSORY**. Any **four** questions shall have to be answered by the examinees out of the remaining seven questions. The questions will be of equal marks and will be so framed that the students are able to answer them within the stipulated time.

**Paper 12****Course Code – ECBOT 301D****Special Theory Paper : PLANT PHYSIOLOGY, BIOTECHNOLOGY AND MOLECULAR BIOLOGY****Credits 5, Lecture - 75  
15 Lectures****Unit – I**

Definition of growth, development and differentiation.

Phototropism.

Geotropism.

**Unit – II**

Nastic Movements.

Photomorphogenesis.

Circadian Rythm.

**15 Lectures****Unit – III**

Growth regulators (Phytohormones): History, structure, biosynthesis, physiological responses and mechanism of action of Auxins, Gibberellins; Cytokinins; Ethylene; Abscisic acid; Brassino steroids and Jasmonic acid.

Apical dominance and various theories.

Transport of phytohormones.

**15 Lectures****Unit – IV**

Polarity.

Phytochrome: History of its discovery, isolation, purification and its biological roles.

Physiology of flowering: Photoperiodism and Vernalization.

Seed dormancy: Definition, types, mechanism and method of breaking the dormancy.

Seed Germination.

**30 Lectures****Reference Books**

William G. Hopkins, Norman P.A. Hurner 2004. Introduction to Plant Physiology. Wiley

Mohammad Pessaraki 2021. Hand Book of Plant and Crop Physiology. 4<sup>th</sup> ed. CRC Press, London, New York.

V.K. Jain 2017. Fundamentals of Plant Physiology. 19<sup>th</sup> ed. S Chand Publishing.

Sally S Smith Hughes 2011. Genentech; The beginnings of Biotech. University of Chicago Press.

Frank S. David, Seth Robey, Andrew Matthew 2017. The Pharagellon Guide to Biotech Forecasting and Valuation. Pharmagellan.

James D. Watson, Tania A. Baker 2008. Molecular Biology of Gene. 3<sup>rd</sup> ed, Pearson Education.

David Baltimore, Harvel Lodish 2021. Molecular Cell Biology. 9<sup>th</sup> ed. Macmillon learning.

### Semester – III

**Marks 30 (MSE 20 1Hr + 5 Attd. + 5 Assign) + 70 (ESE : 3 Hrs) = 100**

**Pass Marks (MSE : 17 + ESE : 28) = 45**

#### MID SEMESTER EXAMINATION (MSE)

The Mid Semester Examination shall have three components: (a) Two Semester Internal Assessment Test (SIA) of 20 marks each. “Better of Two” shall be applicable for computation of marks for SIA. (b) Attendance / Regular Interactions of 05 marks and (c) Assignment of 05 marks.

#### END SEMESTER EXAMINATION (ESE)

A total of **EIGHT questions** will be set in which Question 1 will be **Short Answer Type** and **COMPULSORY**. Any **four** questions shall have to be answered by the examinees out of the remaining seven questions. The questions will be of equal marks and will be so framed that the students are able to answer them within the stipulated time.

### Paper 12

**Course Code – ECBOT 301E**

### **Special Theory Paper : PLANT TAXONOMY, ETHNO BOTANY AND MEDICINAL PLANTS**

**Credits 5, Lecture - 75**

**08 Lectures**

#### **Unit – I**

The species concept: Taxonomic hierarchy, species, genus family and other categories, principles used in assessing relationship, delimitation of taxa and attribution of rank.

Outline of classification : Bentham & Hooker and Hutchinson system. Merits and demerits.

Recent trends in taxonomy with special reference to: Morphology, Anatomy, Phytochemistry, Cytology and Embryology.

#### **Unit – II**

**10 Lectures**

Botanical nomenclature: International code of Algae, Fungi & Plants, Principles, Rules and Recommendations, Priority, Typification, Rules of effective and valid publications, Retention and choice of names.

#### **Unit – III**

**25 Lectures**

Taxonomical features and economic importance of the dominant Angiospermic families of Jharkhand: Magnoliaceae, Apocynaceae, Rubiaceae, Verbenaceae, Convolvulaceae, Asclepiadaceae, Scrophulriaceae, Acanthaceae, Bignoniaceae, Lamiaceae, Euphorbiaceae, Orchidaceae, Zingiberaceae, Araceae, Cyperaceae and Poaceae.

#### **Unit – IV**

**20 Lectures**

Contribution of ethnic communities on traditional medicinal knowledge of plants.

Herbarium & Herbarium Techniques : Important herbarium of world.

**Unit – V****12 Lectures**

Ethnomedicinal plants used in the following diseases:

- Diabetes
- Jaundice
- Malaria
- Skin diseases
- Gynaecological Problems

**Reference Books**

- Singh, 2012. Plant Systematics: Theory and Practice Oxford & IBH Pvt. Ltd., New Delhi. 3<sup>rd</sup> ed..
- Jeffrey, C. 1982. An Introduction to Plant Taxonomy. Cambridge University Press, Cambridge.
- Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. 2002. Plant Systematics-A Phylogenetic Approach. 2<sup>nd</sup> ed. Sinauer Associates Inc., U.S.A.
- Maheshwari, J.K. 1963. Flora of Delhi. CSIR, New Delhi.
- Radford, A.E. 1986. Fundamentals of Plant Systematics. Harper and Row, New York.
- Singh D., Manivannan, S. 2009. Genetic Resources of Horticultural Crops. Ridhi International, Delhi, India.
- Swaminathan M.S., Kochhar, S.L. 2007. Groves of Beauty and Plenty: An Atlas of Major Flowering Trees in India. Macmillan Publishers, India.
- NIIR Board 2005. Cultivation of Fruits, Vegetables and Floriculture. National Institute of Industrial Research Board, Delhi.
- Kader, A.A. 2002. Post-Harvest Technology of Horticultural Crops. UCANR Publications, USA.
- Capon, B. 2010. Botany for Gardeners. 3<sup>rd</sup> ed. Timber Press, Portland, Oregon.
- Andrew Pengelly 2021. The constituents of medicinal plants, 3<sup>rd</sup> edition CABI.
- Lisa M. Rose 2017. Midwest Medicinal Plants, Timber Press Inc.
- K.V. Krishnamurthy, T. Pullaiah, Bir Bahadur, 2017. Ethnobotany of India, Apple Academic Press.

**Semester – III****Course Code – ECBOT(P) 303**

**Practical on Ecology, Anatomy, Embryology and Economic Botany, Plant taxonomy & Medicinal Plant**

**Credits 5**

- Workout Specimen A and identify family and find out the Botanical name of the specimen with the help of flora. 10
- Determination of frequency/ density/ abundance of plants in the local field by quadrat method. 14
- Cut T.S. section of the given material, make temporary mount, draw a well labeled diagram and describe anomalous structure/ Ecological adaptation. 10
- Isolation of at least two stages of embryo from *Abelmoschus esculentum* 06
- Give botanical names and families of plants and mention their Medicinal importance. 06
- Comment upon spots 1 – 5. 10
- Practical record, chart and models etc. 16
- Viva voce. 08

**Semester – IV****Marks 30 (MSE 20 1Hr + 5 Attd. + 5 Assign) + 70 (ESE : 3 Hrs) = 100****Pass Marks (MSE : 17 + ESE : 28) = 45****MID SEMESTER EXAMINATION (MSE)**

The Mid Semester Examination shall have three components: (a) Two Semester Internal Assessment Test (SIA) of 20 marks each. “Better of Two” shall be applicable for computation of marks for SIA. (b) Attendance / Regular Interactions of 05 marks and (c) Assignment of 05 marks.

**END SEMESTER EXAMINATION (ESE)**

A total of **EIGHT questions** will be set in which Question 1 will be **Short Answer Type** and **COMPULSORY**. Any **four** questions shall have to be answered by the examinees out of the remaining seven questions. The questions will be of equal marks and will be so framed that the students are able to answer them within the stipulated time.

**Course Code – CCBOT409****BIOCHEMICALS AND MOLECULAR TECHNIQUES****Credits 5, Lecture - 75****Unit – I****15 Lectures**

Principle Mechanism of Spectrophotometry and Electron microscopy.

Concept of Chromatography and its different types: Paper, capillary, column, HPLC, HPLC-MS, GLC (Principles), TLC.

**Unit – II****25 Lectures**

Elementary concepts of Electrophoresis: Polyacryl amide gel electrophoresis (PAGE), agarose gel electrophoresis.

Isolation and Purification:

- a) Genomic and plasmid DNA
- b) RNA

**Unit – III****10 Lectures**

Blotting: Principles, types of blotting, blotting membranes, immune blotting–Southern, Northern, Western and Dot blots.

**Unit – IV****25 Lectures**

DNA sequencing : Various methods of DNA sequencing and DNA fingerprinting.

DNA Silencing: RNA interference (RNA).

PCR

**Reference Books**

- Watson J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M., Losick, R. 2007. Molecular Biology of the Gene. 6<sup>th</sup> ed. Pearson Benjamin Cummings, CSHL Press, New York, U.S.A.
- Snustad D.P., Simmons M.J. 2010. Principles of Genetics. 5<sup>th</sup> ed. John Wiley and Sons Inc., U.S.A.
- Klug, W.S., Cummings, M.R., Spencer, C.A. 2009. Concepts of Genetics. 9<sup>th</sup> ed. Benjamin Cummings. U.S.A.
- Russell, P.J. 2010. Genetics- A Molecular Approach. 3<sup>rd</sup> ed. Benjamin Cummings, U.S.A.
- Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. 2010. Introduction to Genetic Analysis. 10<sup>th</sup> ed. W.H. Freeman and Co., U.S.A.
- Raziuddin, M. & Mishra PK. 2014. A Handbook of Environmental Studies, Akanaksha Publication, Ranchi. 1.

**Semester – IV****Marks 30 (MSE 20 1Hr + 5 Attd. + 5 Assign) + 70 (ESE : 3 Hrs) = 100****Pass Marks (MSE : 17 + ESE : 28) = 45****MID SEMESTER EXAMINATION (MSE)**

The Mid Semester Examination shall have three components: (a) Two Semester Internal Assessment Test (SIA) of 20 marks each. “Better of Two” shall be applicable for computation of marks for SIA. (b) Attendance / Regular Interactions of 05 marks and (c) Assignment of 05 marks.

**END SEMESTER EXAMINATION (ESE)**

A total of **EIGHT** questions will be set in which Question 1 will be **Short Answer Type** and **COMPULSORY**. Any **four** questions shall have to be answered by the examinees out of the remaining seven questions. The questions will be of equal marks and will be so framed that the students are able to answer them within the stipulated time.

**Paper 14**  
**Course Code – ECBOT404A**  
**Special Theory Paper : Algal Biotechnology**

Credits 5, Lecture - 75

**Unit – I****12 Lectures**

- Traditional use of in land algae.
- Isolation and identification of filamentous algae from local sample (upto Sps. level).
- Mass cultivation of microalgae.

**Unit – II****13 Lectures**

- Phytoplanktons sampling and identification from local pond.
- The role of microalgae in liquid waste treatment and reclamation.
- Photo-biological nitrogen fixation:
- Introduction genetic structure of N<sub>2</sub> fixation system, heterocyst differentiation nitrate, nitrite and ammonia assimilation.

**Unit – III****25 Lectures**

- Biochemical and molecular aspects of abiotic stresses:
  - a) UV radiation
  - b) Temperature and desiccation stress
- Photo protective Mechanisms – Habitat diversity and significant physiological properties.
- Cyanobacterial Genetics:
  - c) Modes of propagation in cyanobacteria and nature of genetic material.

**Unit – IV****25 Lectures**

- Nutrient regulated phytoplankton growth: Common methods for mass cultivation of microalgae.
- Eutrophication: Casual factor, algae blooms.
- Commercial production of *Spirulina*, *Scenedesmus*, *Chlorella*.

**Reference Books**

- Bhumi Nath Tripathim Dhananjay Kumar 2017. Prospects and Challenges in Algal Biotechnology. Springer.
- B.D. Kaushik, Dinabandhu Sahoo 2013. Algal Biotechnology and Environment. I. K. International Publishing House Pvt. Ltd.
- Leila Q, Zepka, Maria Isabel Queiroz, Eduardo Jacob-lopes 2018. Microalgal Biotechnology. BoD (Books on Demand).
- Md. Asraful Alam, Zhongming Wang, Jing Liang Xu 2020. Microalgae Biotechnology for food, health and high value products. Springer Nature.
- Mihir Kumar Das 2021. Algal Biotechnology. Daya Publishing House.
- Ozean Konur 2020. Hand Book of Algal Science, technology and Medicine. Academic Press.
- PeerSchenk, R.Sarada, Ajam Shekh 2021. Microalgal Biotechnology: Recent Advances, Market Potential and Sustainability. Royal Society of Chemistry.



**Semester – IV****Marks 30 (MSE 20 1Hr + 5 Attd. + 5 Assign) + 70 (ESE : 3 Hrs) = 100****Pass Marks (MSE : 17 + ESE : 28) = 45****MID SEMESTER EXAMINATION (MSE)**

The Mid Semester Examination shall have three components: (a) Two Semester Internal Assessment Test (SIA) of 20 marks each. “Better of Two” shall be applicable for computation of marks for SIA. (b) Attendance / Regular Interactions of 05 marks and (c) Assignment of 05 marks.

**END SEMESTER EXAMINATION (ESE)**

A total of **EIGHT** questions will be set in which Question 1 will be **Short Answer Type** and **COMPULSORY**. Any **four** questions shall have to be answered by the examinees out of the remaining seven questions. The questions will be of equal marks and will be so framed that the students are able to answer them within the stipulated time.

**Paper 14****Course Code – ECBOT404B****Special Theory Paper : MICROBIOLOGY AND PLANT PATHOLOGY****Credits 5, Lecture - 75****Unit – I****15 Lectures**

Characteristic features of plant pathogenic bacteria.

General characteristics of plant viruses:

- a) Classification of plant virus
- b) Structure and composition of virus
- c) Virus replication

**Unit – II****15 Lectures**

Transmission of plant viruses.

Antigen and antibody-the immune response.

Antibiotics and their general mode of action an overview.

**Unit – III****10 Lectures**

Management of plant diseases:

- d) Cultural methods
- e) Chemical methods
- f) Quarantine
- g) Biological control

**Unit – IV****35 Lectures**

Symptoms, etiology and methods of control of the following plant disease caused by fungi:

- a) Downy mildew of maize
- b) Powdery mildew of peas (*Pisum sativum*)
- c) Loose smut of wheat
- d) Covered smut / Bunt of wheat
- e) Black stem rust of wheat
- f) Tikka disease of groundnut
- g) Wilt of arhar

- h) Red rot of sugarcane
- i) Early blight of potato
- j) Bacterial blight of paddy
- k) Tundu disease of wheat
- l) Leaf spot of tomato
- m) Citrus canker
- n) Bacterial stalk rot of maize
- o) Blackrot/ bacterial wilt of crucifers
- p) Yellow vein mosaic of bhindi
- q) Tobacco mosaic
- r) Rice tungro disease
- s) Sugar cane mosaic disease
- t) Leaf curl of papaya

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### Reference Books

- Gerard J. Tortora, Berdell R. Funke, Christina L. Case 2016. Microbiology : An Introduction. Pearson Education.
- Burton E. Pierce , Michael J. Lehofe 2015. Microbiology : Laboratory Theory and Application. Morton Publishing company.
- Miskevich Frank 2016. Microbiology. Lam Crd ed. Barchart.
- George Agrior 2012. Plant Pathology. Elsevier.
- Anne Marte Tronsma, David B. Collinge, Annika Djurle, Lisa Munk, Jonathan Yuen, Arne 2020. Plant Pathology and Plant Diseases. CABI.
- Gail Lynn. Cleora J., D'Arej 2006. Essential Plant Pathology. APS Press.
- John William Hashberger 2019. A Text Book of Mycology and Plant Pathology. Alpha edition .
- H. Duke 2020. Modern Plant Pathology. AGROBIOS.

### Semester – IV

**Marks 30 (MSE 20 1Hr + 5 Attd. + 5 Assign) + 70 (ESE : 3 Hrs) = 100**

**Pass Marks (MSE : 17 + ESE : 28) = 45**

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### MID SEMESTER EXAMINATION (MSE)

The Mid Semester Examination shall have three components: (a) Two Semester Internal Assessment Test (SIA) of 20 marks each. “Better of Two” shall be applicable for computation of marks for SIA. (b) Attendance / Regular Interactions of 05 marks and (c) Assignment of 05 marks.

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### END SEMESTER EXAMINATION (ESE)

A total of **EIGHT** questions will be set in which Question 1 will be **Short Answer Type** and **COMPULSORY**. Any **four** questions shall have to be answered by the examinees out of the remaining seven questions. The questions will be of equal marks and will be so framed that the students are able to answer them within the stipulated time.

### Paper 14

**Course Code – ECBOT404C**

**Special Theory Paper : CYTOGENETICS, PLANT BREEDING, MOLECULAR**



**BIOLOGY AND BIOTECHNOLOGY****Credits 5, Lecture - 75  
15 Lectures****Unit – 1**

DNA replication in Eukaryotes.

RNA Processing, RNA splicing, RNA Editing and ribozymes.

**Unit – II**

Insertion elements and Transposons: Transposons in prokaryotes, mechanism of transposition, genetic organisation of Tn3 and its role in transposition.

Mutation: Molecular basis of mutation, Induced mutagenesis, Environmental mutagens.

DNA damage and repair.

**Unit – III**

General concept of genetic engineering and Recombinant DNA technology.

Restriction endonuclease I, II, III. DNA ligase reverse transcriptase, Gene cloning, Vectors, Plasmids, Cosmids, Phagemids.

Southern, Northern, Western Blotting. Gene amplification.

**Unit – IV**

Principle of Plant Tissue Culture.

Endosperm culture.

Micropropagation: Techniques, Factors, Limitations and Significance.

**Unit – V**

Transgenic plants for crop improvement.

Somaclonal variation, significance and application.

Protoplast culture and Somatic Hybridization technique, Factors. Limitations and its role in crop improvement.

**Reference Books**

- J. Hardin, Gregory Paul Bertoni, Lewis J. Kleinsmith 2013. Becker's World of the Cell, Pearson Education..
- C.B. Powar 2010. Cell Biology, Himalaya Publishing House.
- David L. Nelson, Michael M. Cox 2021. Lehninger Principle Biochemistry. 8<sup>th</sup> ed. W.H. Freeman and Co Ltd.
- Michael J. Barresi, Scott F. Gilbert 2020. Development Biology. 12<sup>th</sup> ed. OUP USA.
- Albert 1997. Essential Cell Biology, Garland Science
- Geoffrey Cooper 2013. The- Cell Molecular Approach. 6<sup>th</sup> ed. Sinauer Associates Inc.
- Ben Hui Liu 2017. Statistical Genomics : Linkage, mapping & QTL Analysis, CRC press.
- Hugo A. Campos, Jack Brown, Peter Caligari 2014. Plant Breeding Wiley Black Well.
- Lee Young Byeong 2009. Hybrid : The History and Science of Plant Breeding. Noel Kingsbury, The University of Chicago Press.
- Gardner 2006. Principles of genetics . 8th ed. Wiley Publications.
- Levin 2004. Gene VI to Gene VIII, Oxford Pub
- George M. Malacinski 2015. Friefelder's Essentials of Molecular Biology. Jones & Bartlett.
- T. A. Brown 2017. Genome-4. 4<sup>th</sup> ed. Garland Science.
- S.B. Primrose 2014. Principle of Gene Manipulation and Genomics . John Wiley Blackwell Pub.
- R. Weaver 2011. Molecular Biology. Mc Graw Hill Education.
- T. A. Brown 2010. Gene Cloning and DNA Analysis. 6<sup>th</sup> ed. John Wiley and Sons Ltd.
- Colin Ratledge, Bjorn Kristiansen 2006. Basic Biotechnology. Cambridge University Press.

**Semester – IV****Marks 30 (MSE 20 1Hr + 5 Attd. + 5 Assign) + 70 (ESE : 3 Hrs) = 100****Pass Marks (MSE : 17 + ESE : 28) = 45****MID SEMESTER EXAMINATION (MSE)**

The Mid Semester Examination shall have three components: (a) Two Semester Internal Assessment Test (SIA) of 20 marks each. “Better of Two” shall be applicable for computation of marks for SIA. (b) Attendance / Regular Interactions of 05 marks and (c) Assignment of 05 marks.

**END SEMESTER EXAMINATION (ESE)**

A total of **EIGHT** questions will be set in which Question 1 will be **Short Answer Type** and **COMPULSORY**. Any **four** questions shall have to be answered by the examinees out of the remaining seven questions. The questions will be of equal marks and will be so framed that the students are able to answer them within the stipulated time.

**Paper 14****Course Code – ECBOT404D****Special Theory Paper : PLANT PHYSIOLOGY, BIOTECHNOLOGY AND MOLECULAR BIOLOGY****Credits 5, Lecture - 75****Unit – I****15 Lectures**

History of plant tissue culture, significance and its present status in India.  
 Pathway of differentiation: Embryogenesis and Organogenesis.  
*In vitro* pollination and fertilization and their significance.

**Unit – II****15 Lectures**

Suspension culture and single cell culture.  
 Haploidy: Anther culture, Pollen culture, Ovary culture and its significance.  
 Endosperm culture.

**Unit – III****15 Lectures**

Protoplast culture and Somatic hybridization - technique, factors, limitation and its role in crop improvement.  
 Micropropagation : Technique, factors, limitation and its significance.  
 Recombinant DNA technology – gene cloning principle and techniques.

**Unit – IV****15 Lectures**

DNA finger printing, polymerase chain reaction.  
 Genetics of *Agrobacterium tumefaciens* and *A. rhizogenes*.  
 Plasmid mediated and DNA Mediated Genetic Transformation (DMGT) and production of transgenic plants.

**Unit – V****15 Lectures**

Transgenic plants.  
 Secondary metabolite enhancement through tissue culture technique.  
 Molecular markers and its application. Industrial application of plant tissue culture.

**Reference Books**

- William Hopkins 2006. Photosynthesis and Respiration. Chelsea House Publishers.  
 M.Devlin 1983. Plant Physiology. 4<sup>th</sup> ed. PWS.  
 N.S. Pandey, Pramila Pandey 2016. Text Book of Plant Physiology. Daya Publishing House.  
 Nancy L.Craig, Oma Colean Fix, Rachel Green, Carol Weider, Gisela Storz, Cynthia Wolberger 2014. Molecular Biology: Principles of Genomic Function 2<sup>nd</sup> ed. OUP Oxford.  
 Sally S Smith Hughes 2011. Genentech; The beginnings of Biotech. University of Chicago Press.  
 Frank S. David, Seth Robey, Andrew Matthew 2017. The Phragellon Guide to Biotech Forecasting and Valuation. Pharmagellan.  
 James D. Watson, Tania A. Baker 2008. Molecular Biology of Gene. 3<sup>rd</sup> ed, Pearson Education.  
 David Baltimore, Harvel Lodish 2021. Molecular Cell Biology. 9<sup>th</sup> ed. Macmillon learning.

**Semester – IV**

**Marks 30 (MSE 20 1Hr + 5 Attd. + 5 Assign) + 70 (ESE : 3 Hrs) = 100**

**Pass Marks (MSE : 17 + ESE : 28) = 45**

**MID SEMESTER EXAMINATION (MSE)**

The Mid Semester Examination shall have three components: (a) Two Semester Internal Assessment Test (SIA) of 20 marks each. "Better of Two" shall be applicable for computation of marks for SIA. (b) Attendance / Regular Interactions of 05 marks and (c) Assignment of 05 marks.

**END SEMESTER EXAMINATION (ESE)**

A total of **EIGHT questions** will be set in which Question 1 will be **Short Answer Type** and **COMPULSORY**. Any **four** questions shall have to be answered by the examinees out of the remaining seven questions. The questions will be of equal marks and will be so framed that the students are able to answer them within the stipulated time.

**Paper 14**

**Course Code – ECBOT404E**

**Special Theory Paper : PLANT TAXONOMY, ETHNOBOTANY AND  
 MEDICINAL PLANTS**

**Credits 5, Lecture - 75**

**Unit – I**

**10 Lectures**

1. Outline of classification of angiosperms with their merits and demerits:
  - (a) Cronquist system of classification
  - (b) Allphylogenetic groups (APG) system of classification.
2. Origin and evolution of Angiosperms.

**Unit – II**

**15 Lectures**

3. Molecular approaches in plant taxonomy: Application of DNA markers in angiosperm taxonomy, molecular phylogeny.
4. Remotesensing–GIS.
5. Ethnic community of world. Biological conservation of ethnic society of world.

**Unit – III**

**10 Lectures**

6. Role of some Govt. and other organization involved in the promotion of ethnobotany in India.
7. Some important National Botanical Gardens .National Parks and Herbarium Centres of India
8. Phytochemistry and standardization of herbal drugs.

9. Study of the following Nutraceutical and Under-utilized plants used by ethnic communities of Jharkhand state: Taxonomy with floral formula and floral diagram, Nutritional and medicinal values;

*Centella asiatica, Moringo oleifero, Madhuca longifolia, Pisidium guajava, Syzgium cumini, Annona squamosa, Carica papaya, Emblica officinalis, Boerhavia diffusa, Aegel marmelos, Cassia tora, Ficus hispida, Dolichos biflorus, Cucumis sativus, Bauhinia purpurea*

Unit – V

20 Lectures

10. Detailed study of the following ethnomedicinal plants used by ethnic communities with floral formula, floral diagram, mode of drug preparation, dose and bioactive compounds.

*Andrographis paniculata, Asparagus recemosus, Rawolfia serpentina, Azadirachta indica, Achyranthes aspera, Catharanthus roseus, Tinospora cordifolia, Mimosa pudica, Scoparia dulsis, Ocimum sanctum, Curcurma longa, Gymnema sylvestre, Bacopa monneri, Vitex negundo, Calotropis procera.*

Reference Books

- Steven Foster, James A. Duke. 2000. Medicinal plants and Herbs. Houghton Mifflin Company, Boston. New York.  
Coreypine Shane 2021. Southeast Medicinal Plants. Timber Press.  
Ben- Erik Van Wyk, Michael Wink 2006. Medicinal Plants of the World. Briza Publications.  
Briana Wiles 2018. Mountain states Medicinal Plants. Timber Press Inc.  
Daniel E. Modrman 2010. Native American Ethno Botany. Tmber Press, Inc.  
Richard Evans Schulter, Siri Von Reis 2008. Ethnobotany evolution Discipline. Timber Press..  
Jose L. Martinez, Amner Munoz-Aceredo, Mahendra Rai 2018. Ethnobotany application of Medicinal Plants. CRC Press.  
Tod F. Stuessy 2009. Plant Taxonomy. 2<sup>nd</sup> Edition, Columbia University Press. New York.  
Clive A. Stace 2000. Plant Taxonomy and Biosystematics. 2<sup>nd</sup> edition Cambridge University Press.  
A. K. Pandey, Jun Wen, J.V.V. Dogra 2006. Plant Taxonomy : Advances and Relevance. CBS Publishers & Distributers. New Delhi.

Semester – IV

Paper 15

Course Code – ECBOT(P)405A

Special Practical Paper : ALGALBIOTECHNOLOGY

Full Marks : 80

Credits 5

Time : 03 Hrs.

Practical are to be based on special theory paper 12 & 14, Questions in the practical paper may be asked as per the given model.

1. Taxonomy of fresh water algae. Identification & slide preparation of the given material. 06
2. Ocular and micrometer: Measurement and calibration. 06
3. Draw camera lucida sketches of vegetative & reproductive structure of given material. Measure and draw the scale of magnification. 06
4. Study of the chromosome structure: Pretreatment fixation, Staining, squash technique and preparation of a temporary mount of the supplied material. 08
5. Development, location and identification of components/pigments by paper chromatography (TLC). 08
6. Estimation of protein by Lowry's method/determination of soluble sugar/ carbohydrates.

	07
7. Environmental Biotech: Preparation of pure culture medium (Pringsheem/molisch).	05
8. Comment upon the spots from 1-5.	10
9. Records, collections, charts, modelsetc.	16
10. Viva-voice.	08

## Semester – IV

### Paper 15

Course Code – ECBOT(P)405B

## Special Practical Paper: MICROBIOLOGY & PLANT PATHOLOGY

Full Marks : 80

Credits 5

Time : 03 Hrs.

Practical are to be based on special theory paper 12 & 14, Questions in the practical paper may be asked as per the given model given below:

1. Make suitable stained preparations of material "A". Study the symptoms of the disease and comment upon the host parasite relationship. Identify the pathogen giving suitable diagrams and reasons. Leave your preparation for examination. 10
2. Determine the value of one small division of ocular micrometer in microns. Measure ten spores of the given material "B". Find out the average size of the material given. 06
3. Make suitable stained temporary preparations of materials "C" to exhibit the structure of the pathogen in it. Identify the pathogen giving suitable diagrams and reasons. Leave your preparation for examination. 06
4. Prepare slide of bacterial specimen "D" stain it with the Gram stain and state whether it is gram positive or gram negative. 07
5. Isolate the pathogen from the given material "E" from culture plate. 06
6. Describe the structure, make an illustrative diagrams of given apparatus and describe its principle of working and uses. 06
7. Give the name of the disease and the causal organism of the specimen 1-5. 05
8. Comment upon the spots 1-5. 10
9. Practical records, Charts, Model etc. 16
10. Viva-voice. 08

**Semester – IV****Paper 15****Course Code – ECBOT(P)405C****Special Practical Paper : CYTOGENETICS, PLANT BREEDING, MOLECULAR BIOLOGY & PLANT BIOTECHNOLOGY****Full Marks : 80****Credits 5****Time : 03 Hrs.**

Three questions are compulsory carrying following marks: spotting – 10; Practical record Chart and Model – 16 and Vice voce-10. Questions of 46 marks are to be set covering entire syllabus as mention below.

1. Mitotic chromosome in plant material: Karyotype study of *Allium cepa*, *A. sativum* and *Vicia faba*.
2. Study of meiotic chromosomes :*Allium cepa*,*Rheo discolor*, *Tradescantia*.
3. Pollenstudy: Pollen fertility and sterility of *Allium cepa*, *Rheo discolor*, *Pisum sativum*.
4. Schedule for Plant breeding experiment:
  - (a) Floral morphology and Emasculation.
  - (b) Bagging.
  - (c) Records and labelling.
5. Biostatistics: Chi squaretest, t-test, Standard deviation and Standard Error.
6. Preparation of culture media.
7. Inoculation:Culture of plant tissue or organs on a suitable media.
8. Techniques: Isolation of DNA.
9. Study of mitotic and meiotic abnormalities from permanent slides and photographs.
10. Comment upon spots 1-5.
11. Class records, charts, models etc.
12. Viva-voice.

**Semester – IV****Paper 15****Course Code – ECBOT(P)405D****Special Practical Paper : PLANT PHYSIOLOGY, BIOTECHNOLOGY & MOLECULAR BIOLOGY****Full Marks : 80****Credits 5****Time : 03 Hrs.**

Practicals are to be based on theory paper 12 & 14. Questions in the practical paper may be asked as per model given below:

1. Preparation of 250 cc of MS medium supplemented with 2mg/L of 2,4-D and dispensing into 25 cc tubes containing 10cc each. 08
2. Inoculation of seeds/embryo/ apical meristem/ axillary buds. 05
3. Identify Auxin through proper Bioassay. 10
4. Isolation of bacterial culture by streaking method. 05
5. Separation of chlorophyll pigments by paper chromatography. 06
6. Electrophoretic system for separation of DNA. 06

7.Preparation of synthetic seeds.	06
8.Comment upon spots 1-5.	10
9.Practical records, Models and charts etc.	16
10.Viva-voice.	08

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**Semester – IV**  
**Paper 15**  
**Course Code – ECBOT(P)405E**  
**Special Practical Paper : PLANT TAXONOMY, ETHNOBOTANY AND**  
**MEDICINAL PLANTS**

**Full Marks : 80****Credits 5****Time : 03 Hrs.**

Practical's are to be based on theory paper 12 & 14. Questions in the practical paper may be asked as per model given below:

1. Workout Specimen A and identify the family and find out the botanical name of the specimen with the help of any flora. 10
  2. Prepare suitable preparation of Specimen B and find out stomatal index. Draw suitable diagram and comment on your observation. 10
  3. Prepare a key with suitable diagram for identification of specimen C,D and E. 06
  4. Identify atleast two different cell tissue from macerated material F supplied to you. Comment on your observation. 04
  5. Comment on active principles of specimen G,H and I. 06
  6. Spotting Identify herbarium 1-5 (Plants of medicinal value). 05
  7. Identify the angiospermic plants on spots 6-10 (only botanical names and family). 05
  8. Spotting–Give botanical name family and uses of Specimens 11-15 (Plants of Ethnomedicinal Values). 10
  9. Practical record, Charts, Model, Specimen, Field report etc. 06
  10. Viva-voice. 08
- 

**Semester – IV**  
**Paper 16**  
**Course Code – CCBOT410(A, B, C, D, E)**  
**PROJECT WORK**

**Full Marks : 100****Credits 5****Time : 03 Hrs.****A. PROJECT THESIS – FORMAT**

A Project should be completed on a given topic from the concerned special paper.

The topic of project should be completed under following heads:

1. Introduction
2. Review literature
3. Materials and Methods
4. Results
5. Discussion
6. Reference

The practical of project should be completed either in the Departmental laboratory/Institution.

## B. EXAMINATION

The practical examination of the project will be conducted in the Department of Botany, NP University, Medininagar. The distribution of marks will be as follows:

- |  |    |
|--|----|
| 1. Assessment of project Thesis.   | 70 |
| 2. Describe in brief your work on project with its significance.                                     | 10 |
| 3. Eminent Scientists related to your project work scientific Journals related to your project work. | 10 |
| 4. Viva voce.  | 10 |

