

RANCHI WOMEN'S COLLEGE, RANCHI

(AN AUTONOMOUS COLLEGE)

Constituent unit of Ranchi University, Ranchi



CHOICE BASED CREDIT SYSTEM

Course of Study

For

M.Sc. BOTANY

Supratim
Member Secretary
Academic Council
Ranchi Women's College

From 2021 onwards

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13.4.2021

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Abhinav Mallik
13.04.2021

Joti Kumar
13/4/2021

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Syllabus Revised by Board of Studies in Botany
Ranchi Women's College, Ranchi
(w.e.f. 2021 Onward)

S.N.		Name of Members		Signature
1	Head , Department of Botany	Dr. Shalini Mehta ,	Chairperson Cum convener	<i>Shalini Mehta</i> 13.04.2021
2	Faculty	Dr. Sushma Das Guru	Member	<i>Sushma</i>
		Dr. Snigdha Kumari	Member	<i>Snigdha</i>
		Ms. Anita Tudu	Member	<i>Anita</i>
		Mrs. Shashi Singh	Demonstrator	
3	Expert From Outside College	Prof. Jyoti Kumar Director HRDC, Dean & Head, University Department of Botany, Ranchi University , Ranchi	Subject Expert	<i>Jyoti Kumar</i>
		Dr. Manoj Kumar, Associate Professor, Department of Life Science, Central University of Jharkhand , Brambe, Ranchi	Subject Expert	<i>Manoj</i>
4	University Nominee	Prof. Dr. Ashok Kumar Choudhary Retired Dean & Head University Department of Botany	Vice chancellor Nominee	<i>Ashok Kumar</i> 13.4.2021
5	Representative from Industry/ Allied Field	Dr. Prakash Kumar Tiwari Retired Scientist CSB Bangalore At present Research consultant Ram Krishan Mission , Ranchi Centre Morhabadi	Member	<i>Prakash</i> 13.4.2021
6	Meritorious Student	Chandana Kumari Baitha	PG Topper (Session: 2019- 2021)	
7		MUSKAN KUMARI	UG TOPPER	

Manoj Kumar
Member Secretary
Academic Council
Ranchi Women's College

Shashi Singh
CHAIRPERSON
ACADEMIC COUNCIL
RANCHI WOMEN'S COLLEGE

PROGRAMME SPECIFIC OUTCOMES OPPORTUNITIES AFTER GRADUATION

An ocean of opportunities awaits students after successful completion of their masters. These range from pursuing higher education and research in their chosen discipline and areas of interest: pursuing employment avenues in public, private and social sectors ; pursuing their career as an entrepreneur /own business ; and pursuing vocational courses in their areas of interest. The Choice Based Credit System (CBCS) followed in University of Ranchi enables the students to explore their interests and widen their opportunities by pursuing education and employment avenues in various areas .

Placement Opportunities

A candidate after completing her master's education can look forward to working with some industry giants or being a part of good research teams. The amount of diversity in the field of Botany gives students to choose their specializations as per their choice aptitude and interests. There is huge scope of being a part of this industry merely keeping in mind the amount of diversity it has to offer. One can be part of any reputed organization as a plant explorer, conservationist, ecologist, environment consultant, horticulturist, plant biochemist, nursery manager, genetics, molecular biologist, taxonomist plant pathologist environmental consultant and farming consultant. Moreover the application of plant sciences improves the yield and supply of medicines, foods ,fibers, building materials and other plant products. The knowledge of plant sciences is essential for development and management of forests , parks, waste lands, sea wealth etc.

Few of the industries which one can work with are:

- Chemical Industry
- Food Companies
- Arboretum
- Forest Services
- Biotechnology firms
- Oil Industry
- Land management agencies
- Seed And Nursery Companies
- Plant Health Inspection services
- National Parks Biological supply houses
- Plant Resources laboratory
- Educational Institutes

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COURSE SPECIFIC OUTCOMES

- Comprehend and integrate theoretical and practical skills in basic and applied disciplines of Botany.
- Able to design new biotechnological products or processes by applying knowledge of different disciplines of botany in an integrated manner.
- Trained enough to take employment in diverse areas of biotechnology as well as for further higher studies.
- Having a clear understanding of professional and ethical responsibility.
- Ability to establish themselves as entrepreneur and independently develop the different firm for bioproducts formulations.
- Ability to write and present a substantial technical report/document.
- Able to demonstrate a degree of mastery in the area of botany to enable them in collaborative and multidisciplinary research.
- Recognize the need for continuous learning and will prepare oneself to create, select, learn and apply appropriate techniques, resources, and modern instrumentation to solve complex biotechnological activities with an understanding of the limitations.
- Demonstrate knowledge of botany and management principles and apply to manage projects efficiently and economically with intellectual integrity and ethics for sustainable development of society
- Ability to understand the indigenous ethnic groups and conceptualize ethnobotany as an inter disciplinary science.
- Ability to understand the new method and strategies to contribute mushroom production.

Jyoti Kumar

Aneesh

Pranav

Aravind

Shreyas

Adarsh

Pranav

COURSE OF STUDY

(The component of Examination)

The course of study for the M. Sc. Degree will be in Botany (CBCS) with internal assessment according to the Syllabi prescribed from time to time;

A. Theory Core Paper/ Skill enhancement

External	70 Marks
Internal	30
Total	100
Duration of examination	3 Hours

Internal test (Best of two out of three)	Marks
Theory Exam	20
Attendance, behavior and extra-curricular activities	10 (5+5)
Total	30

B. Internal Test

C. Practical Internal and External

External	80
Internal	20
Total	100
Duration of examination	6 Hours

D. Marks allotted for attendance

% of attendance	Marks
100-91%	05
90-81%	04
80-71%	03
70-61%	02
Below 60%	No marks

E. Grades, Grade points and Percentage Marks

Grade (G)	Grade points (GP)	% Marks
O= Outstanding	10	100
A+ = Excellent	9	90-99.99
A	8.0	80-89.99



A	7.5	75-79.99
B+	7.0	70-74.99
B	6.0	60-69.99
C+	5.5	55-59.99
C	5.0	50-54.99
P=Pass	4.5	45- 49.99
F	0.0	Less than 45%
Ab	0.0	--

F. Computation of Semester Grade Point Average (SGPA)

$$SPGA (Si) = \sum (Ci \times Gi) / \sum Ci$$

Where

Ci = No. of credits of i th course

Gi = No. of Grades of i th course

Example: SGPA

Course	Credit	Grade Letter	Grade point	Credit Point
Course 1	5	A	8	$5 \times 8 = 40$
Course 2	5	B+	7	$5 \times 7 = 35$
Course 3	5	B	6	$5 \times 6 = 30$
Course 4	5	O	10	$3 \times 10 = 30$
	20			135

Thus, $SGPA = 135/20 = 6.75$

G. Computation of Cumulative Grade Point Average (CGPA)

$$SPGA (Si) = \sum (Ci \times Si) / \sum Ci$$

Where,

Ci = No. of credits of i th of that semester

Si = No. of i th semester

Example: CGPA

	Semester 1	Semester 2	Semester 3	Semester 4	Total
Credit (C)	20	22	25	26	83
SPGA (G)	6.9	7.8	5.6	6	26.9
CxG	138	171.6	140	156	605.6

Thus, $CGPA = \frac{20 \times 6.9 + 22 \times 7.8 + 25 \times 5.6 + 26 \times 6}{83}$

83

$= 605.6/83 = 7.29$

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COURSE STRUCTURE OF M.Sc. UNDER CBCS, 2016				CREDIT	Hrs/Week
SEM	PAPER	COURSE CODE	COURSES		L + T
I	FC	Foundation Course (FCBOT)	Foundation course	5	5 + 1
	CC-1	Core Course-1 (CCBOT101)	Microbiology, Algae, Fungi and Plant Pathology	5	5 + 1
	CC-2	Core Course-2 (CCBOT102)	Bryophytes, Pteridophytes, Gymnosperms and Fossils	5	5 + 1
	CC-3	Core Course(P)-3 [CC (P)BOT103]	Practicals of paper 2 & 3	5	10
II	EC-1	Elective Course -1 (Skill enhancement) (ECBOT201)	Biofertilizer/ Mushroom Cultivation/ Cultivation and Post-harvest Technology of Medicinal Plants	5	5 + 1
	CC-4	Core Course -4 (CCBOT204)	Cytogenetics, Taxonomy, Ethnobotany and Medicinal Plants	5	5 + 1
	CC-5	Core Course -5 (CCBOT205)	Plant Physiology, Biochemistry, Biotechnology, Molecular Biology	5	5 + 1
	CC-6	Core Course (P)-6 (CC(P) BOT206)	Practical on paper 6 & 8	5	10
III	CC-7	Core Course-7 (CCBOT307)	Fundamental and Applied Ecology, Biodiversity	5	5 + 1
	CC-8	Core Course-8 (CCBOT308)	Anatomy, Embryology and Economic Botany	5	5 + 1
	CC-9	Core Course(P)-9 [CC (P)BOT309]	Practicals on Paper 9 & 10	5	10
	EC-2	Elective Course-2 (ECBOT302)	Special papers (A,C)*	5	5 + 1
IV	CC-10	Core Course -10 (CCBOT410)	Bioinstrumentation and Molecular Techniques	5	5 + 1
	EC-3	Elective course-4 (ECBOT403)	Special paper (A,C)*	5	5 + 1
	EC-4	Elective Course (P) -5 [EC (P) BOT404]	Special paper Practicals (A,C)*	5	5 + 1
		Project Work (PW) BOT	Project/ Dissertation	5	10
TOTAL				80	100 + 12

*Special Papers (12, 14 & 15)- A. Algal Biotechnology and C. Cytogenetics, Plant Breeding, Molecular Biology & Biotechnology

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Semester I
Paper 1
Course Code- FCBOT

Learning Outcomes

- △ On completion of this course, the students will be able to:
- △ Develop conceptual understanding concepts of importance of bacteria in industry & agriculture.
- △ Have basic conceptual understanding of all branches of Botany.
- △ Develop critical understanding of classification .
- △ Evaluate the implications of GHG, global warming & sustainable development.
- △ Apply advanced knowledge an Ethno Botany and methods of study.

Full Marks : 70

Credits 5

Time : 03 Hrs.

In all **TEN** questions are to be set covering entire course. Students are required to answer **FIVE** questions. All questions are of equal marks. Candidates are required to answer questions as far as practicable in their own words.

1. Economic importance of Bacteria. Agriculture + Industry
2. Classification of algae as proposed by F.E.Fritsch.
3. Thallus organization and economic importance of Algae..
4. Classification of Fungi as proposed by Gwynne-Vaughan & Barnes
5. Classification of Bryophytes and alternation of generation.
6. Classification of Pteridophytes K.R. Sporne and alternation of generation.
7. Geological time period. Types and process of fossilization.
8. Classification of Gymnosperms K.R. Sporne (1975) and alternation of generation.
9. International code of Botanical Nomenclature- an Introduction.
10. Taxonomy and its relevance.
11. Ethnobotany: Definition, Method of study.
12. **Biomolecules:** Structure and Function of Primary Metabolites-Carbohydrates, Fats, Amino Acids and Proteins.
13. Role of Plant Biotechnology in plant product improvement.
14. Green House Gases, Global warming and and sustainable development.
15. Cell division-A preliminary idea.
16. Introduction of Cancer Biology.
17. Biostatistics: Mean, Median, Mode.

Semester I

Paper 2

Course Code- CCBOT101

Microbiology, Algae, Fungi and Plant Pathology

Learning outcomes

On completion of this course, the students will be able to:

- ☐ Develop understanding on the concept of microbial world
- ☐ Develop critical understanding of plant diseases and their remediation.
- ☐ Examine the general characteristics of bacteria and their cell reproduction/recombination
- ☐ Increase the awareness and appreciation of human friendly viruses, bacteria, algae and their economic importance
- ☐ Identify true fungi and demonstrate the principles and application of plant pathology in the control of plant disease.
- ☐ Identify the common plant diseases according to geographical locations and device control measures

Full Marks : 70

Credits 5

Time : 03 Hrs.

In all **TEN** questions are to be set, five from each group, covering entire course. Students are required to answer **FIVE** questions, selecting not more than **TWO** from each group. All questions are of equal marks. Candidates are required to answer questions as far as practicable in their own words.

GROUP-A

Microbiology

1. Structure and Reproduction in Bacteria.
2. Mechanism of bacterial recombination: Conjugation, transformation and transduction.
3. Bacteriophage – Structure and its multiplication.
4. General account of Mycoplasma and its role in causing plant diseases.

Phycology

1. Classification of Algae by F E Round
2. Range of thallus structures and reproduction in

(a) Cyanophyta	(b) Chlorophyta	(c) Charophyta
(d) Phaeophyta	(e) Rhodophyta.	
3. General conception of life cycle pattern in algae.
4. Algal blooms.
5. Algal biofertilizers.
6. Algae as food, feed and uses in industry.

GROUP-B

Fungi

7. Saprolegniales, Peronosporales, Mucorales with special reference to Evolution in asexual reproductive structures in class Phycomycetes.
8. Sexual reproduction and types of fructifications in Ascomycetes.
9. Development of Basidium (Holobasidium, Phragmobasidium).

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GROUP- C**Plant Pathology:**

10. 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) Citrus canker
- (vi) Leaf curl of Papaya
- (vii) Leaf curl of Tomato

Suggested Readings

1. Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition.
2. Prescott, L.M., Harley J.P., Klein D. A. (2005). Microbiology, McGraw Hill, India. 6th edition.
3. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West Press, Delhi.
4. Sahoo, D. (2000). Farming the ocean: seaweeds cultivation and utilization. Aravali International, New Delhi.
5. Campbell, N.A., Reece J.B., Urry L.A., Cain M.L., Wasserman S.A. Minorsky P.V., Jackson R.B. (2008). Biology, Pearson Benjamin Cummings, USA. 8th edition.
6. Pelczar, M.J. (2001) Microbiology, 5th edition, Tata McGraw-Hill Co, New Delhi.
7. Agrios, G.N. 1997 Plant Pathology, 4th edition, Academic Press, U.K.
8. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley & Sons (Asia) Singapore. 4th edition.
9. Webster, J. and Weber, R. (2007). Introduction to Fungi, Cambridge University Press, Cambridge. 3rd edition.
10. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies, Macmillan Publishers India Ltd.
11. Sharma, P.D. (2011). Plant Pathology, Rastogi Publication, Meerut, India.

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Semester I**Paper 3****Course Code- CC BOT102****Biology and Diversity of Bryophytes, Pteridophytes, Gymnosperms and Fossils****Learning outcomes**

On completion of this course, the students will be able to:

- ☐ Demonstrate an understanding of archegoniatae, Bryophytes, Pteridophytes and Gymnosperms
- ☐ Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms
- ☐ Understanding of plant evolution and their transition to land habitat.
- ☐ Demonstrate proficiency in the experimental techniques and methods of appropriate analysis of Bryophytes, Pteridophytes, Gymnosperms

Full Marks: 70**Credits 5****Time: 03 Hrs.**

In all **TEN** questions are to be set covering entire course. Students are required to answer **FIVE** questions, selecting not more than **TWO** questions from each group. All questions are of equal marks. Candidates are required to answer questions as far as practicable in their own words.

GROUP-A**Bryophytes**

1. Classification of Bryophytes.
2. Range of thallus structure in Bryophytes.
3. Evolution of Gametophyte and Sporophyte in Bryophytes.
4. Distribution of photosynthetic tissues in Bryophytes.

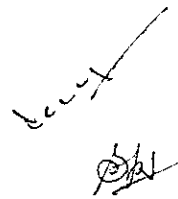
GROUP-B**Pteridophyta**

1. Classification of Pteridophytes by K.R. Sporne.
2. Evolution of stele in Pteridophytes
3. Origin and evolution of sporophyte in Pteridophytes – Telome Concept.
4. Heterosporous and Seed Habit.
5. Morphology, Anatomy and Life cycle of Psilopsida, Lycopsidea, Sphenopsida and Pteropsida with special reference to living members.

GROUP-C**Gymnosperms and Fossils**

1. Classification of Gymnosperms.






2. Fossil – Mode of preservation, Geological time table, Distribution and examples of Indian Fossils
3. Brief account of Structure and reproduction of Pentoxylales, Bennetiales, Cycadales, Coniferales (Family Pinaceae and Cupressaceae) Gnetales, Ephedrales, Welwitschiales
4. A general account of Ginkgoales.

Suggested Readings

1. Vashistha, P.C., Sinha, A.K., Kumar, A. (2010). Pteridophyta. S. Chand. Delhi, India.
2. Bhatnagar, S.P. & Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
3. Parihar, N.S. (1991). An introduction to Embryophyta: Vol. I. Bryophyta. Central Book Depot. Allahabad.
4. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R. (2005). Biology. Tata McGraw Hill, Delhi.
5. Vander-Poorteri 2009 Introduction to Bryophytes. COP.

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Semester I
Practical Paper 4
Course Code-CC BOT (P) 103

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

Full Marks: 80**Credits 10Time:****06Hrs**

- | | |
|--|----|
| 1. Staining of gram positive/gram negative bacteria. | 06 |
| 2. Identification viral/bacterial/fungi disease. | 06 |
| 3. Study of algal materials from the algal mixture (A) identification of at least 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. | 06 |
| 7. Practical records, herbarium, field report, charts etc. | 08 |
| 8. Viva-voce. | 10 |



Semester II

Paper 5

Course Code- EC(SE)BOT201 (A)

Skill Enhancement

Biofertilizers

Learning outcomes:

On the completion of this course, the students will be able to;

- ☐ Develop their understanding on the concept of bio-fertilizer
- ☐ Identify the different forms of biofertilizers and their uses
- ☐ Compose the Green manuring and organic fertilizers
- ☐ Develop the integrated management for better crop production by using both nitrogenous and phosphate bio fertilizers and vesicular arbuscular mycorrhizal (VAM).
- ☐ Interpret and explain the components, patterns, and processes of bacteria for growth in crop production

Full Marks : 100

Credits 5

Time : 03 Hrs.

(Theory 70+ Internal Assessment 30)

In all TEN questions are to be set covering entire course. Students are required to answer FIVE questions. All questions are of equal marks. Candidates are required to answer questions as far as practicable in their own words.

1. General account about the eco-friendly organic agro-input as biofertilizer – *Rhizobium* inoculant, *Nostoc*, *Anabaena*, *Azotobacter*. identification, mass multiplication, Actinorrhizal symbiosis.
2. Industrial Application of microalgae.
3. Cyanobacteria (blue green algae), and association of BGA, nitrogen fixation, factors affecting growth, blue green algae and *Azolla* in rice cultivation.
4. Mycorrhizal association, types of mycorrhizal association, phosphorus nutrition, growth and yield..
5. Organic farming – green manuring and organic fertilizers, Recycling of bio-degradable municipal, agricultural and Industrial wastes. Water treatment and its use in agriculture.

Suggested Readings

1. 1. Dubey, R.C. (2005). A Text book of Biotechnology S.Chand & Co, New Delhi.
2. 2. John Jothi Prakash, E. (2004). Outlines of Plant Biotechnology. Emkay Publication, New Delhi.
3. 3. Kumaresan, V.(2005). Biotechnology, Saras Publications, New Delhi.

5. 4. NIIR Board. (2012). The complete Technology Book on Biofertilizer and organic farming. 2nd Edition. NIIR Project Consultancy Services.
7. 5. Sathe, T.V. (2004) Vermiculture and Organic Farming. Daya publishers.
8. 6. Subba Rao N.S. (2017). Biofertilizers in Agriculture and Forestry. Fourth Edition.
9. Medtech.
10. 7. Vayas,S.C, Vayas, S. and Modi, H.A. (1998). Bio-fertilizers and organic farming. Akta Prakashan, Nadiad
11. Farming Akta Prakashan, Nadiad

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Mr. V. S. Modi

Dr. S. C. Vayas

Dr. H. A. Modi

Semester II
Paper 5
EC (SE) BOT 201 (B)
Skill Enhancement
Mushroom Cultivation

Learning outcomes:

On completion of this course, the students will be able to:

- ☐ Recall various types and categories of mushrooms.
- ☐ Demonstrate various types of mushroom cultivating technologies.
- ☐ Examine various types of food technologies associated with mushroom industry.
- ☐ Value the economic factors associated with mushroom cultivation
- ☐ Devise new methods and strategies to contribute to mushroom production.

Full Marks: 70

Credits 5

Time : 03 Hrs.

(Theory 70+ Internal Assessment 30)

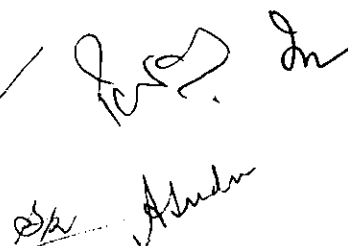
In all **TEN** questions are to be set covering entire course. Students are required to answer **FIVE** questions. All questions are of equal marks. Candidates are required to answer questions as far as practicable in their own words.

1. Nutritional and medicinal value of edible mushrooms; poisonous mushrooms. Types of edible mushrooms available in India – *Volvariella volvacea*, *Pleurotus citrinopileatus*, *Agaricus bisporus*.
2. 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.
3. 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.
4. Research Centers – National level and Regional level.









5. IPR- Introduction , types of IP, Patents

Bioethics- Agriculture biotechnology, Genetically engineered food,
environmental risk, protection of environment and biodiversity- biopiracy,
Plagiarism – Types and tools to check plagiarism.

Suggested Reading

1. Marimuthu, T., Krishnamoorthy, A.S., Sivaprakasam, K. and Jayarajan. R.(1991)
2. Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University Coimbatore.
3. Swaminathan, M. (1990). Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co.Ltd. No.88, Mysore Road, Bangalore- 560018
4. Tewari, P. and Kapoor, S.C., (1998). Mushroom Cultivation, Mittal Publications, Delhi.
5. Bhal, N. (1984-1988). Hand book of Mushrooms, II Edition, Vol,I & Vol. II

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Semester II

Paper 5

EC(SE)BOT201 (C)

Skill Enhancement

(Cultivation and Post-harvest technology of medicinal plants)

Learning outcomes:

On completion of this course, the students will be able to:

- ☐ Recognize the basic medicinal plants in Jharkhand
- ☐ Apply techniques of conservation and propagation of medicinal plants.
- ☐ Setup process of harvesting, drying and storage of medicinal herbs
- ☐ Ex-situ and in-situ conservation of threatened and endangered medicinal plants
- ☐ Restate the established methodology of ethnobotany studies
- ☐ Categories various indigenous ethnic groups and their environmental practices.

Full marks : 100

Credits 5

Time : 3 Hrs

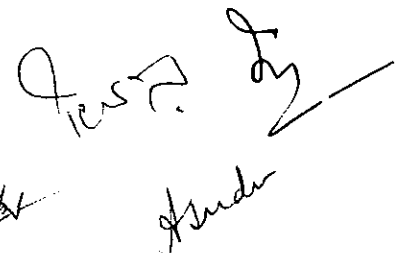
(Theory 50 + Practical 50)

In all TEN questions are to be set covering entire course. Students are required to answer FIVE questions. All questions are of equal marks. Candidates are required to answer questions as far as practicable in their own words.

1. Introduction, Origin , development and evolution of Medicinal plants
2. Origin, Historical background, Active principle, uses and cultivation practices of some medicinal plants viz. *Tinospora cordifolia*, *Phyllanthus embelica*, *Bacopa monneri*, *Aloe vera*, *Centella asiatica*
3. Origin, historical background, Active principle, uses and cultivation practices (including organic farming) of the some aromatic plants Viz. Mint, Tulsi, Motha grass, Lemon grass, Marigold
4. Post harvest management of medicinal plants: Drying/ Distillation ,grading, packing and storage
5. Conservation of medicinal plants, Threatened and endangered medicinal plants in-situ and ex-situ conservation
6. Preparation of crude drugs in different systems of medicine
7. IPR- Introduction , types of IP, Patents
Bioethics- Agriculture biotechnology, Genetically engineered food, environmental risk, protection of environment and biodiversity- biopiracy, Plagiarism – Types and tools to check plagiarism



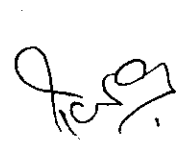


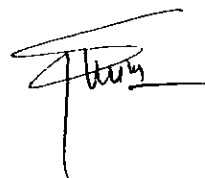
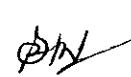
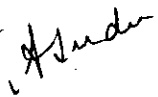




Suggested Reading

1. Chakraverty, A., Majumdar, A.S., Raghavam, G.S.V. and Ramaswamy, H.S. (2003)
2. Handbook of postharvest Technology: Cereals, fruits, Vegetables, Tea and Spices.
3. MarcelDekker Inc, NY.
4. Wills, R and Golding, J.(2016). Postharvest : an introduction to the physiology and handling of fruits and vegetables. UNSW Press.
5. Wills, R.B.H., Glasson, W.B and Mc. Graham, D. (2007). Postharvest : an introduction to the physiology and handling of fruits and vegetablesand Ornamentals., CABI pp227.
6. Ramaswamy, H. (2015) Post – Harvest Technologies of Fruits and Vegetables DEStech Publications Inc.,. pp311
7. Mathur ,G.K., Rathore, N.S.and Chasta, S.S.(2012). Post-Harvest Management and Processing of Fruits and Vegetables. The Energy And Resource Institue .pp250

Semester II
Paper 6
Course code- CCBOT204
Cytogenetics, Taxonomy, Ethnobotany and Medicinal Plants,

Learning outcomes

On completion of this course, the students will be able to:

- ☐ Comprehend the effect of chromosomal abnormalities in numerical as well as structural changes leading to genetic disorders.
- ☐ Interpret the molecular mechanism involved at various stages of cell cycle and its regulation
- ☐ Analyze the effect of mutations on gene functions and dosage.
- ☐ Interpret the molecular concept of DNA damage repair mechanism, oncogene, cancer and metasis.
- ☐ Assess terms and concepts related to Phylogenetic Systematics
- ☐ Generalize the characters of the families according to Bentham & Hooker's system of Classification
- ☐ Recognize the basic medicinal plants Jharkhand
- ☐ Apply techniques of conservation and propagation of medicinal plants.

Full Marks : 70

Credits 5

Time : 03 Hrs.

In all **TEN** questions are to be set selecting **FIVE** questions from each group covering entire course. Students are required to answer **FIVE** questions. Students are required to answer not more than **TWO** questions from each group. All questions are of equal marks.

GROUP- A

1. Chromatin Organization, Chromosome structure and packaging of DNA, Histones, Heterochromatin.
2. Cell division and cell cycle: Mitosis, Meiosis, their regulation, Overview of cell cycle, control mechanisms: role of cyclins and cyclin dependent kinases.
3. Protein sorting: Targeting of proteins to organelles.
4. Mutations: Types, Detection, Molecular basis of mutation, Physical and Chemical Mutagenesis.
5. DNA damage and repair mechanism.
6. Brief account of Proto-oncogenes, Oncogenes, tumor suppressor genes, cancer, metastasis.
7. Structure and numerical alterations in chromosomes: Origin, Occurrence and production of haploid. Introduction and characterization of monosomics, trisomics. Prigin and production of autopolyploids, allopolyploids.
8. Biostatistics: Standard deviation, Standard error, Chi square.

GROUP- B

1. **Systematics:** Outline, Classification of Angiosperms – Hutchinson, Takhtajan and Cronquist's system. Their merits and demerits.
2. **Botanical Nomenclature:** International code of Botanical Nomenclature – Principle, Rules of effective and valid publication. Retention and choice of names.

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3. **Biosystematics:** Concepts, Biosystematics categories, Methods in Experimental Taxonomy.
4. Diagnostic characteristics, systematic phylogeny and economic importance of families, Magnoliaceae, Apocynaceae, Asclepiadaceae, Convolvulaceae, Scrophulariaceae, Acanthaceae, Bignoniaceae, Lamiaceae, Verbenaceae, Polygonaceae, Euphorbiaceae, Rubiaceae, Orchidaceae, Poaceae, and Commelinaceae.
5. **Ethnobotany:** Definition scope and method of study, socio-cultural organization of the Ethnic tribes of Jharkhand.

Suggested Reading

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics. 8th edition. John Wiley & sons, India.
2. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. 10th edition. W. H. Freeman and Co., U.S.A.
3. Gupta, P.K. (2018) Genetics. 5th Edition, Rastogi Publications, Meerut.
4. Hartl, D.L. and Jones, E.W. (1999). Essential Genetics, 2nd Edition, Jones and Barlett Publishers, Boston.
5. Jain, H.K. (1999). Genetics: Principles, Concepts and Implications. Science Pub Inc.
6. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. 9th edition. Benjamin Cummings, U.S.A.
7. Singh, R. J. (2016). Plant Cytogenetics, 3rd Edition. CRC Press, Boca Raton, Florida, USA.
8. Singh, R.J. (2017). Practical Manual on Plant Cytogenetics. CRC Press, Boca Raton, Florida, USA.
9. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. 5th edition. John Wiley & Sons Inc., India.
10. Strickberger, M.W. (1985) Genetics, 3rd Edition. Pearson Printice Hall (printed in India by Anand Sons).
11. Singh, (2012). *Plant Systematics: Theory and Practice* Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition.
12. Jeffrey, C. (1982). An Introduction to *Plant Taxonomy*. Cambridge University Press, Cambridge.
13. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. (2002). *Plant Systematics-A Phylogenetic Approach*. Sinauer Associates Inc., U.S.A. 2nd edition.
14. Radford, A.E. (1986). *Fundamentals of Plant Systematics*. Harper and Row, New York.
15. Sambamurty A.V.S.S. (2005). *Taxonomy of Angiosperms*. I. K. International Pvt. Ltd., New Delhi. Singh, V., Pande, P. C. & Jain, D. K. (2008). *Taxonomy and Economic Botany*. Rastogi Publications, Meerut.
16. Pandey, B. P. (2009). *A Textbook of Botany Angiosperms*. S. Chand and Company Ltd., New Delhi.
17. Hall, B.G. (2011). *Phylogenetic Trees Made Easy: A How-To Manual*. Sinauer Associates, Inc. USA
18. Any local/state/regional flora published by BSI or any other agency

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Semester II

Paper 7

Course code- CCBOT205

Plant Physiology, Biochemistry, Biotechnology and Molecular Biology

Learning outcomes

On completion of this course, the students will be able to;

- ☐ Understand Water relation of plants with respect to various physiological processes.
- ☐ Explain chemical properties and deficiency symptoms in plants
- ☐ History structure, biosynthesis and mechanism of action of phytohormones.
- ☐ Classify aerobic and anaerobic respiration
- ☐ Explain the significance of Photosynthesis and respiration
- ☐ Assess dormancy and germination in plants
- ☐ Concept of plant tissue culture micropropagation and haploidy
- ☐ Develop conceptual understanding of molecular marker and genetic transformation.

Full Marks : 70

Credits 5

Time : 03 Hrs.

In all TEN questions are to be set covering entire course. Students are required to answer FIVE questions not more than TWO questions from each group. All questions are of equal marks. Candidates are required to answer questions as far as practicable in their own words.

GROUP- A: Plant Physiology

1. **Transpiration:** Types of Transpiration, Evaporation and Transpiration, Mechanism of Transpiration and Stomatal physiology, Factors Affecting the Rate of Transpiration, Significance of Transpiration, Antitranspirant, Measurement of Transpiration.
2. **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 – Electroosmosis, Protoplasmic Streaming, Contractile Protein Variants, Mass Flow Hypothesis, Factors Affecting Translocation.
3. **Phytohormone:** History, Structure, Biosynthesis, Physiological Responses and Mechanism of Action of Auxins, Gibberellins, Cytokinins, Ethylene and Abscissic Acid
4. **Physiology of Flowering:** Photoperiodism and Vernalization.
5. **Seed Dormancy and Germination:** Definition, Types, Mechanism and Method of Breaking the Dormancy.

GROUP-B: Plant Biochemistry

6. **Photosynthesis:** The Pigment System, Light Reaction. Dark (C_3 Cycle). Hatch and Slack Pathway (C_4 Cycle), Photorespiration and Factors Affecting Rate of Photosynthesis.
7. **Respiration:** Glycolysis, Fermentation, Krebs Cycle, Electron Transport System, Hexose Monophosphate Shunt, Theories of Phosphorylation – The Chemical Coupling Theory, The Conformational Coupling Theory, The Chemiosmotic Theory, Factors Affecting the Rate of Respiration.
8. **Enzymes:** Nomenclature and Classification, Nature, Properties, Enzyme Energetic, Mode and Mechanism of Action, Factors Affecting Enzyme Activities.
9. **Nitrogen Metabolism:** Nitrogen Fixation: Non-biological Fixation; Biological Fixation – Symbiotic Nitrogen Fixers, Non-symbiotic Nitrogen Fixers, Biochemistry of Nitrogen Fixation. Biosynthesis of Amino Acids and Proteins
10. **Lipid Metabolism:** Simple Lipids, Complex Lipids, Neutral Fats, Fatty Acids, Enzymatic Degradation of Fats, β -Oxidation of Fatty Acid and Oxidation of Fatty Acids, Biosynthesis of Fatty Acids.

GROUP-C: Biotechnology and Molecular Biology

11. Plant tissue culture and its significance
12. Micropropagation: Techniques, Multiplication by Axillary and Apical Shoots, Multiplication through Callus Embryoid Culture, Factors Affecting Shoot Multiplication.
13. Haploidy: Anther culture, pollen Culture and ovary culture and its role in crop improvement
14. Molecular Cytogenetics: Brief account of DNA replication in Prokaryotes and eukaryotes, Nuclear DNA content, C-value paradox, Introns and RNA splicing, repetitive DNA, Restriction mapping, Regulation of gene expression in Prokaryotes and eukaryotes
15. Molecular marker: RFLP, RAPD, AFLP and SSR
16. Genetic transformation: Biotic and abiotic methods

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Suggested Reading

- 1 Buchanan, B.B. and Gruissem, W. (2015). *Biochemistry and molecular biology of plants*. Willy Blackwell ASPB USA.
- 2 Campbell, M.K. and Farrell, S O. (2007). *Biochemistry*. Thomson Brooks/cole, USA.
- 3 Dey, P.M. and Harborne, J.B. (2000). *Plant biochemistry*. Academic Press, UK.
- 4 Goodwin, T.W. and Mercer, E.I. (2003). *Introduction to plant biochemistry*. CBS Publishers & Distributors, New Delhi, India.
- 5 Ross and Salisbury. (2009). *Plant Physiology*. Cengage Learning (Thompson), New Delhi, India.
- 6 Segel, I.H. and Segel, E. (1993). *Enzyme kinetics: Behavior and analysis of rapid equilibrium and steady-state enzyme systems*. Wiley-Interscience, USA.
- 7 Taiz, L., Zeiger, E. Mollar, I. M. and Murphy, A. (2015). *Plant physiology and Development* 6th edition. . Sinauer Associates Inc., USA. **Suggested Readings**
8. Hopkins, W.G. and Huner, A. (2008). *Introduction to Plant Physiology*. 4th edition. John Wiley and Sons. U.S.A.
9. Taiz, L., Zeiger, E., Møller, I.M. and Murphy, A (2015). *Plant Physiology and Development*. 6th edition. Sinauer Associates Inc. USA.
10. Harborne, J.B. (1973). *Phytochemical Methods*. John Wiley & Sons. New York.
- 11 Heldt, H. W. and Piechulla, B. (2010). *Plant Biochemistry*. 4th Edition. Paperback. Academic Press.
12. Buchanan, B., Gruissem, W. and Jones R. L. (Eds) (2015). *Biochemistry and Molecular Biology of Plants*. 2nd Edition. Paper back. Wiley-Blackwell.
13. Bhojwani, S.S. and Razdan, M.K., (1996). *Plant Tissue Culture: Theory and Practice*. Elsevier Science Amsterdam. The Netherlands.
13. Glick, B.R., Pasternak, J.J. (2003). *Molecular Biotechnology- Principles and Applications of recombinant DNA*. ASM Press, Washington.
- 14 Snustad, D.P. and Simmons, M.J. (2010). *Principles of Genetics*. John Wiley and Sons, U.K.
15. N. Santosh and A. Madhavi. (2010). *Practical Book of Biotechnology and Plant Tissue Culture*. S. Chand & Co.

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Semester II
Practical Paper- 8
Course code- CC BOT (P) 206

**Cytogenetics, Taxonomy, Plant Physiology, Biotechnology and
Molecular Biology**

Full Marks : 80

Credit: 10

Time : 06 Hrs.

1. Problems based on Mendelian ratio and their modifications, statistical analysis and genetic explanation. 10
2. Show two stages of mitosis from the given onion root tip. 10
3. Compare and comment on the floral characters of the local flora A and B Provided and assign them to their respective families.
4. In a separate answer book provided, you have to write down botanical name family and uses 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
7. Estimate the quantity of carbohydrate/ Protein through standard curve from the given sample with the help of spectrophotometer.
8. Comment upon the spots 1-5. 10
9. Practical records, herbarium, Charts model, Ingenuity design etc. 10
10. Viva-voce. 08

Semester III**Paper 9****Course code- CCBOT307****Fundamental and Applied Ecology****Learning outcomes**

On completion of this course, the students will be able to:

- ☐ Understand core concepts of biotic and abiotic
- ☐ Classify the soils on the basis of physical, chemical and biological components
- ☐ Analysis the phytogeography & phytogeographical division of India
- ☐ Evaluate energy sources of ecological system
- ☐ Assess the adaptation of plants in relation to light, temperature, water, wind and fire.

Full Marks: 70**Credits 5****Time: 03 Hrs.**

In all **TEN** questions are to be set covering entire course. Students are required to answer **FIVE** questions. All questions are of equal marks. Candidates are required to answer questions as far as practicable in their own words.

1. **Ecological factors;** Climatic, Topographic, Edaphic and Biotic.
2. **Population and Community ecology:** population characteristics, Population dynamics, Community characteristics, composition, structure, origin and development of a community, methods of study of community.]
3. **Ecological succession:** Types and mechanisms of ecological successions (Hydrosere and Xerosere); Changes in ecological properties during succession.
4. **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.
5. **Ecological adaptations:** Hydrophytes, Xerophytes and Halophytes.
6. **Phytogeography:** Major plant communities of the world; Phytogeographic regions of the world; Floristic regions of India, vegetation of India.
7. **Air, Water, Soil, Sound and Radiation Pollutions:** Kinds, Sources, Quality parameters, Effect on plants & Ecosystem and Control measures.
8. **Climate Change (Global Environmental Problems):** Global warming, Green house Gases (CO_2 , CH_4 , O_3 , CFCs, N_2O), Sources, Trends & Role); Environmental effects of Global warming, Ozone depletion, Damage to the Ozone layer & Hole, Health effects of Ozone depletion and increased UV Radiation, Saving the Ozone layer.

9. **Non-conventional source of energy:** solar, wind, Nuclear, Biogas and petroplants
10. **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..
11. **Natural resources and their Management:** Land resource, water resource, Air resource, agriculture and forestry resources and their management.
12. **Indian Biological Diversity Act, Convention of Biological Diversity (CBD), People's Biodiversity Register.** Green Book, Red Book, Blue Book.
13. **Bioremediation:** definition, need and scope of bioremediation; Phytoremediation, Microremediation.

Suggested Readings

1. Kormondy, E.J. (1996). Concepts of Ecology. Prentice Hall, U.S.A. 4 edition. Hall, U.S.A.
2. Sharma, P.D. (2010). Ecology and Environment. Rastogi Publications, Meerut, India.
3. Singh, J.S., Singh, S.P. and Gupta, S. (2006). Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi, India.
4. Ambast R. S. and Ambast P. K. (1999) Environment and Pollution. C. B. S. Publishers & Distributors, New Delhi.
5. Dash, M. C. (2007). Fundamentals of Ecology. Tata Mc Graw Hill Publishing Company Limited.
6. Verma, P.S. and Agrawal, V. K. (2010). Environmental Biology. S. Chand and Company Ltd., New Delhi.
7. Simpson, M.G. (2006). *Plant Systematics*. Elsevier Academic Press, San Diego, CA, U.S.A.
8. Singh, G. (2012). *Plant Systematics: Theory and Practice*. 3rd edition. Oxford & IBH Pvt. Ltd., New Delhi.
9. Sambamurty A.V.S.S. (2005). Taxonomy of Angiosperms. I. K. International Pvt. Ltd., New Delhi.
10. Singh M. P. & Abbas S. G. Essentials of Plant Taxonomy and Ecology. Daya Publishing House, New Delhi.
11. Singh, V., Pande, P. C. & Jain, D. K. (2008). Taxonomy and Economic Botany. Rastogi Publications, Meerut.
12. Pandey, B. P. (2009). A Textbook of Botany Angiosperms. . S. Chand and Company Ltd., New Delhi.

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Semester III

Paper 10

Course code- CC BOT 308

Anatomy, Plant Embryology and Economic Botany**Learning outcomes**

On completion of this course, the students will be able to:

- ☐ Understand the fundamental concepts of plant anatomy and embryology
- ☐ Develop an understanding of concepts and fundamentals of plant anatomy
- ☐ Examine the internal anatomy of plant systems and organs
- ☐ Develop critical understanding on the evolution of concept of organization of shoot and root apex.
- ☐ Evaluate the adaptive and protective systems of plants
- ☐ Analyze and recognize the different organs of plant and secondary growth.
- ☐ Evaluate the structural organization of flower and the process of pollination and Fertilization
- ☐ Solve Self-incompatibility in Pollination and fertilization & relate between Embryo, Endosperm and Seed
- ☐ Comprehend the causes of Polyembryony and apomixes with its classification

Full Marks : 70**Credits 5****Time : 03 Hrs.**

In all **TEN** questions are to be set covering entire course. Students are required to answer **FIVE** questions selecting not more than **TWO** questions from each group. All questions are of equal marks.

Questions of the preceding years may be repeated to the tune of 25%.

GROUP-A: Anatomy

1. Shoot Development and theories of shoot Apex organization, Organization of root Apical Meristem,
2. Mechanical Tissue and their Distribution
3. Cambium,
4. Ecological adaptation
5. Anomalous Secondary growth with reference *Dracaena* stem, *Tinospra* root, *Bignonia*, and *Strychnos* stems. Ecological Anatomy.

GROUP-B: Embryology and Economic Botany

6. Microsporogenesis and Microgametophyte
7. Megasporogenesis and Megagametophyte
8. Fertilization.
9. Endosperm type, Physiology and cytology of endosperm.
10. Polyembryony - Types, adventative embryony, false embryony, twins & triplets. Sexual incompatibility.
11. Apomixis. Embryology in relation to taxonomy.

12. Experimental Embryology: Anther, Ovary, Ovule, Endosperm and Embryo Culture.
13. Fibre yielding plants; Timber yielding plants; Oil Yielding plants and Drug yielding plants

Suggested Readings

1. Bhojwani, S.S. and Bhatnagar, S.P. (2011). Embryology of Angiosperms. Vikas Publication House Pvt. Ltd. New Delhi.
2. Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/Cummings Publisher, USA

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Semester-III

Paper- 11

CCBOT (P) 309

Full Marks: 80

Credit:10

Time : 06 Hrs.

Practical on Ecology, Anatomy, Embryology and Economic Botany

1. Cut T.S. section of the given material, make temporary mount, draw a well labeled diagram and describe ecological adaptation. 10
2. Determination of frequency/ density/ abundance of plants in the local field by quadrat method. 14
3. Cut T.S. section of the given material, make temporary mount, draw a well labeled diagram and describe anomalous structure. 10
4. Isolation of at least two stages of embryo from *Abelmoschus esculentum* or stigma squashing 06
5. Give botanical names and families of plants and mention their economic importance. 06
6. Comment upon spots 1-5. 10
7. Practical record, chart and models etc. 16
8. Viva voce. 08

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Semester III

Paper 12

Course code- EC BOT 302(A)

Special Theory Paper: Algology/Algal Biotechnology

Learning outcomes:

On completion of this course, the students will be able to;

- ☐ Understand core concepts and fundamentals of various levels of algal growth
- ☐ Have conceptual understanding of cyanophyceae and chlorophyceae.
- ☐ Translate various algal technologies for benefit of ecosystem
- ☐ Demonstrate algal growth in different types of natural water.
- ☐ Analyze emerging areas of Algal Biotechnology for identifying commercial potentials of algal products & their uses.

Full Marks : 70

Credits 5

Time : 03 Hrs.

In all TEN questions are to be set covering entire course. Students are required to answer FIVE questions. All questions are of equal marks. Candidates are required to answer questions as far as practicable in their own words.

1. Principles and systems of classification by Fritsch & Chapman.
2. Cyanophyceae: Cell structure, thallus organization and reproduction.
3. Chlorophyceae: Range of thallus organization, methods of reproduction and life cycle.
4. Nuclear characteristics of blue green algae & green algae.
5. A detailed idea of algae causing diseases of plants and animals.
6. Algae and water pollution: Physico-chemical characteristics of freshwater, pollution indices and algal pollution indicators.
7. Recent Biotechnological developments with algae as experimental material.
8. Methods of collection, isolation, media preparation and cultural procedure for blue green algae and green algae.
9. Economic importance of Algae as:
 - (i) Food
 - (ii) Feed
 - (iii) Bio-fertilizer
 - (iv) Algae in agriculture and industry.

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Suggested Readings

1. Krishnamurthy, K.V. (2004). An Advanced Text Book of Biodiversity - Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi
2. Singh, J.S., Singh, S.P. and Gupta, S. (2006). Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi, India.
3. Reddy, K.V. and Veeraiah, S. (2010). Biodiversity and Plant Resources. Aavishkar publication, New Delhi.
4. Heywood, V. H. and Watson, R. T. (1995). Global biodiversity and Assessment. Cambridge University Press.

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Semester III

Paper 12

Course code- EC BOT 302 (C)

**Special Theory Paper: Cytogenetics, Plant Breeding,
Molecular Biology and Biotechnology**

Learning outcomes

On completion of this course, the students will be able to:

- ☐ Understand the fundamental of cytogenetics and cytological methods
- ☐ Understand the structural organization of eukarotic as well different forms of chromosomes.
- ☐ karyotype analysis and evaluation
- ☐ Comprehend the effect of chromosomal abnormalities in numerical as well as structural changes leading to genetic disorders.
- ☐ Interpret the molecular mechanism involved at various stages of cell cycle and its regulation
- ☐ Familiarize with genetic basis of heterosis.
- ☐ Reflect upon the role of various non- conventional methods used in crop improvement

Full Marks : 70**Credits 5****Time : 03 Hrs.**

In all TEN questions are to be set covering entire course. Students are required to answer FIVE questions. All questions are of equal marks. Candidates are required to answer questions as far as practicable in their own words.

1. Introduction to Cytogenetics and Cytological methods: pretreatment, fixation, stains & mechanism of staining.
2. Structural organization of enkaryotic Chromosomes, Histones Nucleosome concept, Importance of Telomeres and Centromeres, Heterochromatin.
3. Different forms of Chromosomes: Somatic metaphase (Salivary gland chromosomes), Meiotic prophase (Lamp brush), B-Chromosomes or Supernumerary Chromosomes.
4. Karyotype Analysis and Karyotype evolution.
5. Mechanism of Cell division: Mitosis, Meiosis, Cell-cycle, Regulation of Cell cycle.
6. Molecular basis of Chromosome pairing.
7. Mechanism of Genetic Recombination.
8. Alterations in Chromosome Structure: Deletion, Duplication, Translocation, Inversion.
9. Variations in Chromosome numbers. Anenploidy, Trisomics (primary secondary, tertiary), Monosomics, Nullisomics Euploidy: Haploidy,

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

10. Theory of centre of origin of crop plants.
11. Self – incompatibility System.
12. Inbreeding & Heterosis.
13. Male sterility and its significance.
14. Analysis of Variance, Co-relation co-efficient.

Suggested Readings

1. Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding. Oxford – IBH. 2nd edition.
2. Das, L.D. Vijendra (2006) Plant Breeding. New Age International Publishers, New Delhi.
3. Sharma, J.R.(1994) : Principles and practices of Plant Breeding. Tata McGraw-Hill Publishing Company Ltd. , New Delhi
4. Singh, B.D. (2012). Plant Breeding: Principles and Methods. Kalyani Publishers. 9th edition.
5. Singh, Phundan (1996): Essentials of Plant Breeding. Kalyani Publishers, New Delhi-2

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Semester IV
Paper 13
Course code- CCBOT410

Bioinstrumentation and Molecular Techniques

Learning outcomes

On completion of this course, the students will be able to:

- ☐ Understand the basic concept of spectrophotometer ,electron microscope and chromatography
- ☐ Elementry concept of electrophoresis and blotting
- ☐ Develop critical understanding of DNA sequencing and finger printing.
- ☐ Analyse the effect of DNA silencing
- ☐ Have conceptual understanding of PCR technique

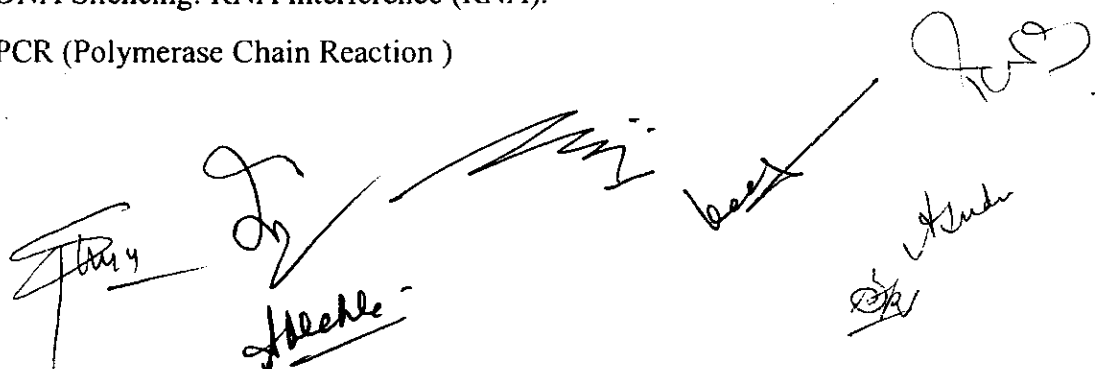
Full Marks : 70

Credits 5

Time : 03 Hrs.

In all **TEN** questions are to be set covering entire course. Students are required to answer **FIVE** questions. All questions are of equal marks. Candidates are required to answer questions as far as practicable in their own words.

1. Basic concept of Spectrophotometer and Electron microscope.
2. Chromatography: Paper, capillary, column, HPLC, HPLC-MS, GLC – basic concept, NMR.
3. Elementary concepts of electrophoresis: Polyacrylamide gel electrophoresis (PAGE), agarose gel electrophoresis.
4. Isolation and Purification: (a) Genomic and plasmid DNA (b) RNA.
5. Blotting: Principles, types of blotting, blotting membranes, immunoblotting – Southern, Northern, Western and Dot blots.
6. DNA sequencing: Various methods of DNA sequencing and finger printing.
7. DNA Silencing: RNA interference (RNA).
8. PCR (Polymerase Chain Reaction)

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Semester IV

Paper 14

Course code- EC BOT403-A

Special Theory Paper: Algal Biotechnology/Algology

Learning outcomes:

On completion of this course, the students will be able to;

- ☐ Understand core concepts and fundamentals of various levels of algal growth
- ☐ Have conceptual understanding of pheophyceae and rhodophyceae
- △ Translate various algal technologies for benefit of ecosystem
- ☐ Demonstrate algal growth in different types of natural water.
- △ Understanding of common method of mass cultivation of microalgae and commercial production of spirulina, chlorella and scenedesmus
- ☐ Analyze emerging areas of Algal Biotechnology for identifying commercial potentials of algal products & their uses.

Full Marks: 70

Credits 5

Time : 03 Hrs.

In all TEN questions are to be set covering entire course. Students are required to answer FIVE questions. All questions are of equal marks. Candidates are required to answer questions as far as practicable in their own words.

1. Phytoplankton sampling and identification upto Genus level.
2. Isolation and identification of filamentous algae from local samples (upto Genus level).
3. Life cycle patterns and alternation of generation with particular reference to Pheophyceae and Rhodophyceae
4. Biological nitrogen fixation : with special reference to Cyanobacteria
5. Biochemical and molecular aspects of abiotic stresses:
 - (a) UV radiation
 - (b) Temperature and desiccation stress.
6. Nutrient regulated phytoplankton growth: Common methods for mass cultivation of micro-algae.
7. Commercial production of *Spirulina*, *Scenedesmus*, *Chlorella*.
8. The role of microalgae in liquid waste treatment and reclamation.
9. Eutrophication: Causal factor, algal blooms

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Course code- EC BOT 403 - C

- ☐ Critically analyze the major concerns and applications of transgenic technology

plast culture and Somatic Hybridization technique, Factors, Limitations
its role ex crop improvement.

Semester IV

Paper 15

EC BOT(P)404 - A

Special Practical Paper – Algal Biotechnology

Full Marks : 80

Credits 10

Time : 06 Hrs.

Practicals is 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 of Ranchi. 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, Chats, Models etc. 16
10. Viva -voce. 08

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Semester IV

Paper 15

EC BOT(P)404 – C

**Special Practical Paper –Cytogenetics, Plant Breeding,
Molecular Biology & Plant Biotechnology**

Full Marks : 80

Credits 10

Time : 06 Hrs.

Three questions are compulsory carrying following marks: Spotting-10; Practical record Chart and Model- 16 and Viva 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*/ *Lens culinaris*
2. Study of meiotic chromosomes : *Allium cepa*, *Rheo discolor*/ *Tradescantia*.
3. Pollen study : Pollen fertility and sterility of *Allium cepa*, *Rheo discolor*, *Pisum sativum*/ *Portulaca*
4. Schedule for Plant Breeding experiment :
 - (a). Floral morphology and Emasculation.
 - (b). Bagging.
 - (c). Records and labelling.
5. Biostatistics : Chi square test, 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-voce.

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Semester IV
Paper 16
PWBOT (A,B,C,D,E)
Project Work

Full Marks: 100

Credits 10

Time : 06 Hrs.

Learning outcomes:

On completion of this course, the students will be able to;

△ Demonstrate and understanding of the slandered laboratory techniques , methodology and process of biological research and basics of scientific thesis writing specially in three biological sub – disciplines within the general areas of i) algal biotechnology ii) cellular & molecular biology iii) tissue culture

△ Develop conceptual understanding to locate, critically analyse , interpret and discuss primary and pervious research literatures in one or more sub – disciplines within the biological science.

△ Present the result of their independent research clearly and effectively in both written and oral forms.

A.

PROJECT THESIS

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, Ranchi University, Ranchi. The distribution of marks will be as follows:

1. Describe in brief your work on project with its significance.
2. Eminent Scientists related to your project work Scientific Journals related to your project work.
3. Viva voce on Project.

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FORMAT OF QUESTION PAPER FOR MID SEM EXAMINATION

20 MARKS



Ranchi University, Ranchi

Mid Sem No.

Exam Year

Subject/ Code

F.M. =20

Time=1Hr.

General Instructions:

समान्य निर्देश :

- Group A carries very short answer type compulsory questions.
(खंड 'A' में अत्यंत लघु उत्तरीय अनिवार्य प्रश्न हैं।)
- Answer 3 out of 5 subjective/ descriptive questions given in Group B.
(खंड 'B' के पाँच में से किन्हीं तीन विषयनिष्ठ/ वर्णनात्मक प्रश्नों के उत्तर दें।)
- Answer in your own words as far as practicable.
(यथासंभव अपने शब्दों में उत्तर दें।)
- Answer all sub parts of a question at one place.
(एक प्रश्न के सभी भागों के उत्तर एक साथ लिखें।)
- Numbers in right indicate full marks of the question.
(पूर्णांक दायीं ओर लिखे गये हैं।)

Group A

-
-
-
-
-

[5x1=5]

Group B

-
-
-
-
-

[5]

[5]

[5]

[5]

[5]

Note: There may be subdivisions in each question asked in Theory Examination.

FORMAT OF QUESTION PAPER FOR END SEM EXAMINATION

70 MARKS



Ranchi University

End Sem No.

Exam Year

Subject/ Code

F.M. =70

P.M.=28

Time=3Hrs.

General Instructions:

- i. Group A carries very short answer type questions.
- ii. Answer 4 out of 6 subjective/ descriptive questions in Group B.
(खंड 'B' के छः में से किन्हीं चार विषयनिष्ठ/ वर्णनप्रश्नों का उत्तर दें।)
- iii. Answer in your own words as far as possible.
(यथासंभव अपने शब्दों में उत्तर दें।)
- iv. Answer all sub parts of a question at once.
(एक प्रश्न के सभी भागों के उत्तर एक साथ लिखें।)
- v. Numbers in right indicate full marks.
(पूर्णांक दायी ओर लिखे गये हैं।)

1.

[5x1=5]

- i.
- ii.
- iii.
- iv.
- v.

2.

[5]

3.

[15]

4.

[15]

5.

[15]

6.

[15]

7.

[15]

8.

[15]

Note: There may be subjective questions in the Theory Examination.

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