



GOVERNMENT
AUTONOMOUS
COLLEGE
ROURKELA

POST GRADUATE
DEPARTMENT OF BOTANY
PG SYLLABUS- 2023-2025

HOD, PG DEPARTMENT OF BOTANY,
GOVERNMENT AUTONOMOUS COLLEGE,
ROURKELA.

Lichita Palui
19/7/23

Nibedita Pradban
19/07/2023

R. K. Bhas
19.7.2023

Lily Praveen
19-7-23

Ruma Lakshmi
19-7-23

**SEMESTER-WISE COURSE STRUCTURE FOR THE TWO YEARS P.G. PROGRAMMES IN
GOVERNMENT AUTONOMOUS COLLEGE ROURKELA**

**EFFECTIVE FOR THE STUDENTS ADMITTED TO THE FIRST YEAR
POST GRADUATE COURSE DURING THE SESSION 2023-24 AND ONWARDS**

A. For Science Departments

Semester	Paper	Course Title	Credits	Marks		
				Mid Sem.	End Sem.	Total
I	AECC-I	Entrepreneurship Development	2	20+20(assignment)	60	100
	101	Microbial Diversity	4	20	80	100
	102	Diversity of Cryptogams and Gymnosperm	4	20	80	100
	103	Cell and Molecular Biology	4	20	80	100
	104	Analytical Techniques	4	20	80	100
	105	Practical	2	---	50	50
	106	Practical	2	---	50	50
	Total Credit /Marks for First Semester			22		
II	AECC-II	Environmental Studies And Disaster Management	2	20+20(assignment)	60	100
	201	Systematics of Angiosperms	4	20	80	100
	202	Ecology and Biostatistics	4	20	80	100
	203	Biochemistry	4	20	80	100
	204	Plant physiology and metabolism	4	20	80	100
	205	Practical	2	--	50	50
	206	Practical	2	--	50	50
	Total Credit /Marks for Second Semester			23 22		
III	IDC	Economic Botany (for non-core students)	3	20+20(assignment)	60	100
	301	Plant Embryology and Anatomy	4	20	80	100
	302	Genetics, Plant Breeding and Evolution	4	20	80	100
	303	Molecular Plant Pathology	4	20	80	100
	304	Environmental Biotechnology and Waste management	4	20	80	100
	305	Practical	2	--	50	50
	306	Practical	2	--	50	50
	307	MOOC's one paper from Swayam or others	3	-	-	-
	Total Credit /Marks for Third Semester			25 26		
IV	401	Advance plant Biotechnology	4	20	80	100
	402	Molecular stress Biology	4	20	80	100
	403	Environmental Laws	4	20	80	100
	404	Project (Project Work (50)+ Viva (30)+ Presentation(20))	4	50+30+20		100
	405	Practical	2	--	50	50
	406	Practical	2		50	50
	Total Credit /Marks for Fourth Semester			20		
Total Credit			90			2300

One Non-credit course will be taken by the students during the 2 year of study
NCC/NSS/Sports/Yoga/Gardening/ Socially Useful Productive Work (SUPW)

IDC – Inter Department Course or Open Elective

Members Present

- Nivedita Pradhan
19/07/2023
- R. B. B. B. B.
19.7.2023
- Loly Prerna Khosla
19.7.23
- Ruma Saha
19.7.23
- Chauhan Neeru
19.7.2023
- Lichita Palui
(Chairman)

SEMESTER I
PAPER: BOT 101
MICROBIAL DIVERSITY

100 marks (80+20)

4 CH

Unit-I:

Bacteria and Archaea: Classification, cell structure, nutrition, growth, reproduction, Economic importance. Bacterial genetics: plasmid and episome, conjugation, transduction and transformation. Cyanobacteria: Classification, cell structure, nutrition, reproduction, cellular differentiation, heterocyst and its function. Economic importance of cyanobacteria,

Unit-II:

Virus: General properties, structure, purification, cultivation, principle of viral taxonomy, classification, one step growth experiment and lifecycle, Animal virus and their reproduction, Plant virus and their transmission. Economic importance of viruses, Virioids and Prions, Bacteriophage

Unit-III:

Algae: Distribution (terrestrial, freshwater, marine); thallus organization; cell structure; criteria for classification of algae; pigments, reserve food, flagella, reproduction (vegetative, asexual, sexual). Salient features of Chlorophyta, Euglenophyta, Charophyta, Xanthophyta, Bacillariophyta, Phaeophyta and Rhodophyta. Economic importance of algae. Algal blooms and toxins, algae as biofertilizer, food, feed, and uses in industry.

Unit-IV:

Fungi: General characters of fungi; substrate relationship in fungi; cell ultra-structure, unicellular and multicellular organization; nutrition (saprobic, biotrophic, symbiotic) reproduction (vegetative, asexual, sexual); heterothallism; heterokaryosis; parasexuality; recent trends in classification. Phylogeny of fungi. General account of Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina. Fungi in industry, medicine and food, Fungi as biocontrol agent, Mycorrhizae, Lichen.

Select text books for reading:

Prescott, L. M., Harley, J. P. and Klen, D. A. (1999). Microbiology, 7th Ed., McGraw-Hill, New York.

Pelczar, Jr., M. J., Chan E.C.S. and Krieg, N. R. (2005). Microbiology, 5th Ed, Tata McGraw-Hill. New Delhi.

Alexopoulos, C. J., Mims, C. W. and Blackwell, M. (1996). Introductory Mycology, John Wiley, New York. Kumar, H. D. (1988). Introductory Phycology. East-West Press, New Delhi.

Maloy, S. R., Cronan, J. E. Jr. and Freifelder, D. (2008). Microbial Genetics, 2nd Ed. Norosa, New Delhi.

Mehrotra, R. S. and Aneja, R. S. (1998). An Introduction to Mycology, New Age International, New Delhi.

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Nivedita Pradhan
19/07/2023

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Ruma Saha
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Laly Prerna
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PAPER: BOT 102

DIVERSITY OF CRYPTOGRAMS AND GYMNOSPERM

100 marks (80+20)

4 CH

Unit-I:

BRYOPHYTA: Morphology, origin, structure, reproduction and life history. Distribution, classification, Comparative study of Marchantiales, Jungermaniales, Anthocerotales, Sphagnales, Funariales and Polytrichales. Ecological importance, phylogeny of Bryophytes.

Unit- II:

PTERIDOPHYTA: Morphology, origin, anatomy and reproduction; classification; evolution of stele; heterospory and origin of seed habit. General account of morphology and reproduction of Psilopsida, Lycopsidea: Sphenopsida and Pteropsida.

Unit-III:

GYMNOSPERMS: General characteristic feature of Gymnosperms, Classification of Gymnosperms and their distribution in India. General account of Cycadales, Coniferales, Ephedrales, and Gnetales.

Unit- IV:

PALEOBOTANY: Geological time scale, origin and geological evidences; evolutionary time scale (eras, periods and epoch). Types of fossils, processes of fossilization, role of fossils in evolution. Brief account of fossil Pteridophytes and Gymnosperms. Cycadcooidales, Pentoxylales, Medullosales and Glossopteriodales.

Select text books for reading:

1. Bhatnagar, S. P. and Moitra, A. (1996). Gymnosperms. New Age International, New Delhi.

2. Parihar, N. S. (1991). Bryophyta. Central Book Depot, Allahabad.

3. Parihar, N. S. (1991). Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad. Chamberlin, C. J. (1935). Gymnosperms: Structure and Evolution. Dover Publications, New York Arnold Scott

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19.7.23
Lalvi Prerna Kish
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PAPER: BOT 103

CELL AND MOLECULAR BIOLOGY

100 marks (80+20)

4 CH

Unit-I:

Membrane structure and function (Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, membrane pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes).
Structural organization and function of intracellular organelles (Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility).

Unit-II:

Organization of genes and chromosomes (Operon, unique and repetitive DNA, interrupted genes, gene families, structure of chromatin and chromosomes, heterochromatin, euchromatin, transposons). Cell division and cell cycle (Mitosis and meiosis, their regulation, steps in cell cycle, regulation and control of cell cycle).
Microbial Physiology (Growth yield and characteristics, strategies of cell division, stress response)

Unit-III:

DNA replication, repair and recombination (Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, extrachromosomal replicons, DNA damage and repair mechanisms, homologous and site-specific recombination).
RNA synthesis and processing (transcription factors and machinery, formation of initiation complex, transcription activator and repressor, RNA polymerases, capping, elongation, and termination, RNA processing, RNA editing, splicing, and polyadenylation, structure and function of different types of RNA, RNA transport).

Unit-IV:

Protein synthesis and processing (Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, and translational proof-reading, translational inhibitors, Post-translational modification of proteins).
Control of gene expression at transcription and translation level (regulating the expression of phages, viruses, prokaryotic and eukaryotic genes, role of chromatin in gene expression and gene silencing).

SUGGESTED READING (PAPER-11)

1. Lewin. B.2000, Genes VII, Oxford Univ Press, New York.
2. Alberts B. Bray D, Lewis J. Raff M. Roberts K. Watson J.D. 1999 Molecular Biology of the cell.
3. Wolfe S.L., 1993, Molecular and Cellular Biology, Wadsworth Pub. Co. California, USA.
4. Cucharaw BB Gruissem 4. W. Jones R.L. 2000 Biochemistry and Molecular Biology of Plant, American Society of Plant Physiologists.
4. Kleinsmith L...J. and Kish VM 1995, Principles of cell and Molecular Biology, harp and Collins College Pub. New York, USA
5. Lodish H. Berk A. Zipursky S.L. Matsudaira P. Baltimore D. and Darnell J.2000,
6. Molecular Biology, W.H. Freeman & Co.
7. Alberts B. Bray D. Lewis J. Raff M. Roberts K. & Watson J.D. 1989 Molecular Biology of Cell,

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19.7.23

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19.7.2023
Nibedita Pradhan
19/07/2023
Rumma Saha
19.7.23
Lily Prasad
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Garland Pub. Inc. New York.

8. Khush G.S. 1973 Cytogenetics of Aneuploids, Academic Press New York.
9. Karp G. 1999, Cells and Molecular Biology, Concepts and experiments, John Wiley & Sons Inc. USA.
10. Lewin B. 2000 Genes VII, Oxford University Press New York, USA.
11. Russell P.J. 1998 Genetics, The Benjamin Cummings Pub. Co. USA.
12. Snustad DP and Simmons M.J. 2000 Principles of Genetics, John Wiley and Sons Inc. USA.

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Nivedita Pradhan
19/07/2023

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19.7.23

Laly Pradhan
19.7.23

ANALYTICAL TECHNIQUES

100 marks (80+20)

4 CH

Unit-I:

Microscopic techniques: Visualization of cells and subcellular components by light microscopy, resolving powers of different microscopes, microscopy of living cells, scanning and transmission microscopes, different fixation and staining techniques for EM, freeze-etch and freeze-fracture methods for EM, image processing methods in microscopy.

Unit- II:

Radiolabeling techniques: Detection and measurement of different types of radioisotopes normally used in biology, incorporation of radioisotopes in biological tissues and cells, molecular imaging of radioactive material, safety guidelines.

Unit-III:

Molecular analysis using UV/visible, fluorescence, circular dichroism, NMR and ESR spectroscopy
Molecular structure determination using X-ray diffraction and NMR, Molecular analysis using light scattering, different types of mass spectrometry and surface plasma resonance methods.

Unit- IV:

Chromatography: Principle, Paper Chromatography, Ion exchange chromatography, Thin layer chromatography, gas chromatography, Electrophoresis technique, Autoradiography. Centrifugation: general principles, types of centrifuges, differential and density gradient centrifugation.

SUGGESTED READING (PAPER-III)

1. Instrumental Analysis for Science & Technology. W. Ferren, Agro Botanical Publication.
2. Biophysical Chemistry-Upadhyay & Nath.
3. Useful techniques for plant scientists by Dhopte.
4. Methods of soil physics by S.K. Jalota, R. Khera & B.S. Ghuman.
5. An Introduction to plant Taxonomy- C. Jeffrey
6. An Introduction of Systematic Botany & Ecology- J.N. Mishra
7. Ecology & Environment-P.D. Sharma, Rastogi Pub.
8. Plant Ecology- W.D. Bellings.
9. Fundamentals of Ecology - Wever & Clements.
10. Fundamental of Ecology-E.P. Odum.

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Nivedita Pradhan
19/07/2023

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19.7.2023

Laly Pradhan
19.7.23

PAPER: BOT 105

PRACTICAL

50 + 50
= 100 marks

4 CH + 2 CH

DETAILED SYLLABUS SEMESTER-1

(PRACTICAL-IV)

HOURS: 06

Marks: 100

(PRACTICAL RELATED TO THEORY PAPERS) - 101 & 102

1. Collection, Identification and Preservation of common infected plants of the locality
2. Symptomology study of diseased specimens.
3. Collection of algae from various habitat of locality, either separation, preparation temporary and permanent mounts and identification.
4. Microbiological Method: Measurement of length, breadth and diameter of algal/fungal cells and spores using ocular and stage micrometer.
5. Preparation and sterilization of media for the culture of Bacteria and Fungi.
6. Gram staining of Bacteria. PRACTICAL - V BOT-106 2 CH
7. Identification of fungal cultures- Rhizopus, Mucor, Aspergillus, Pencillium, Fusarium.
8. Temporary and permanent preparation of slides of important genera belonging to all important classes of fungi.
9. Study of morphology, anatomy and reproductive structures of representative members of Bryophytes, Pteridophytes and Gymnosperm.
10. Study of Mitosis and Meiosis by squashing technique. Drawing the chromosomes and different stages of Mitosis and Meiosis by using camera Lucida.
11. Biometry
12. Viva-Voce
13. Practical record duly certified by the concerned teacher.

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R. U. B. S.
19.7.2023

S. Palus
19.7.23

Nivedita Pradban
19/07/2023

Lily Prerna
19.7.23
R. U. B. S.
19.7.23

SEMESTER II

PAPER: BOT 201

SYSTEMATICS OF ANGIOSPERM

100 marks (80+20)

4 CH

Unit I: Taxonomic Structure:

Taxonomic hierarchy; Concept of species, genus and family, Plant Nomenclature: Salient features of International Code of Nomenclature (ICN) for Algae, Fungi and Plants: priority, effective and valid publications and author citation. Type concept, Taxonomic Tools: Field and Herbarium techniques; Floras and Botanic Gardens, Computer and Taxonomy.

Unit II: Systems of Angiosperm classification

Major contributions of Theophrastus, Bauhin, Tournefort, Linnaeus, Adanson, de Candolle, Bessey, Hutchinson, Takhtajan and Cronquist; Classification systems of Bentham and Hooker (upto series) and Engler and Prantl (upto series), Hutchinson; Brief reference of Angiosperm Phylogeny Group (APG III) classification.

Unit III Range of floral structures and comparative study of important orders.

Dicots: Ranales, Urticales, Umbelliferae, Rosales, Asterales. Monocots: Glumiflorae, Scitamineae, Microspermae. Brief account of flora of Odisha.

Unit IV: Numerical taxonomy and Taxonomic evidences

Angiospermic cladistic, Variations, OTUs, Phenograms, Cladograms, Terms and concepts (Primitive and advanced, Homology and Analogy, Parallelism and convergence, monophyly, paraphyly, polyphyly and cladodes). Evidences: Anatomy, Palynology, Cytology, Phytochemistry, Evolution of Angiosperm (Phylogenetic tree).

SUGGESTED READINGS:

1. Principles of Angiosperms Taxonomy by Davis, P. H. and Heywood, V. H., Robert E. Kreiger, New York.
2. Current Concepts in Plant Taxonomy by Heywood, V. H. and Moore, D. M., Academic press, London.
3. Principles and Methods Plant Biosystematics by Solbrig, O. T., MacMillan, London.
4. Plant taxonomy and Biosystematics by Stace, C. A., Edward Arnold, London.
5. Diversity and Classification of Flowering Plants by Takhtajan, A. L. Columbia University Press.
6. Contemporary Plant Systematics by Woodland, D. W. Prentice-Hall, New Jersey, USA

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R. U. B. S.
19.7.23
N. Bedita Pradha
19/07/2023

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100 marks (0hr 2hr)

Unit-I:

Water relations: Properties of water, Types of solutions, Water potential
 Photosynthesis: Light harvesting complexes, mechanisms of electron transport, photorespiration
 mechanisms, C₃ fixation C₄ and CAM pathway, Respiration and photorespiration - Citric acid cycle,
 plant mitochondrial electron transport and ATP synthesis, alternate oxidase, photorespiratory pathway

Unit-II:

Nitrogen metabolism - Nitrate and ammonium assimilation, amino acid biosynthesis
 Plant hormones - Biosynthesis, storage, breakdown and transport, physiological effects and mechanisms of
 action
 ATP Synthesis - Mechanism of ATP synthesis, substrate level phosphorylation and oxidative
 phosphorylation, Chemiosmotic Mechanism (ETC), ATP synthesis, Boyer's conformational change model,
 role of uncouplers

Unit-III:

Sensory photobiology - Structure, function and mechanisms of action of phytochromes, cryptochromes
 and phototropins; stomatal movement; photoperiodism and biological clocks
 - uptake, transport and translocation of water, ions, solutes and macromolecules from soil, through cells,
 across membranes, through xylem and phloem; transpiration; mechanisms of loading and unloading of
 photoassimilates.

Unit-IV:

Phytohormones- Discovery, chemical nature, transport and physiological role of Auxin, Gibberellins,
 Cytokinins, ABA, Ethylene, Brassinosteroids, Jasmonic Acids.
 Secondary metabolites - Biosynthesis of terpenes, phenols and nitrogenous compounds and their roles.
 Stress physiology - Responses of plants to biotic (pathogen and insects) and abiotic (water, temperature
 and salt) stresses.

SUGGESTED READINGS:

1. Plant Physiology by Taiz and Zieper
2. Plant Physiology by Frank B. Salisbury, Cleon W. Ross

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Nivedita Pradban
19/07/2023

Ruma Lata Lalit Pradhan
19.7.23

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PAPER: BOT203
BIOCHEMISTRY

100 marks (80+20)

4 CH

Unit-I:

Structure of atoms, molecules and chemical bonds. Composition, structure and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins).

Unit- II:

Conformation of nucleic acids (helix (A, B, Z), t-RNA, micro-RNA). Stability of proteins and nucleic acids. Metabolism of carbohydrates, lipids, amino acids nucleotides and vitamins.

Unit-III:

Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers. Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes, Conformation of proteins (Ramachandran plot, secondary structure, domains, motif and folds).

Unit- IV:

Stabilizing interactions (Vander Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.). Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties).

SUGGESTED READINGS:

1. Lehninger Principles of Biochemistry
2. Harper's Illustrated Biochemistry
3. Biochemistry by U.Satyanarayan

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19.7.23

Nivedita Pradhan

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Unit-I:

The Environment: Physical environment, biotic environment, biotic and abiotic interactions. Habitat and Niche: Concept of habitat and niche, niche width and overlap, fundamental and realized niche, resource partitioning, character displacement.
Population Ecology: Characteristics of a population, population growth curves, population regulation, life history strategies (r and K selection), concept of metapopulation - demes and dispersal, interdemnic extinctions, age structural populations.

Unit-II:

Species Interactions: Types of interactions, interspecific competition, herbivory, carnivory, pollination, symbiosis. Community Ecology: Nature of communities, community structure and attributes, levels of species diversity and its measurement, edges and ecotones. Ecological Succession: Types; mechanisms, changes involved in succession, concept of climax.
Ecosystem Ecology: Ecosystem structure; ecosystem function; energy flow and mineral cycling (Carbon, N, P); primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, estuarine).

Unit-III:

Biogeography: Major terrestrial biomes; theory of island biogeography; biogeographical zones of India.
Applied Ecology: Environmental pollution; global environmental change; biodiversity: status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches. Conservation Biology: Principles of conservation, major approaches to management, Indian case studies on conservation/management strategy (Project Tiger, Biosphere reserves).

Unit-IV:

Biostatistics: Statistics, data, population, samples, variables, parameters, Representation of Data: Tabular, Graphical; Measures of frequency and central tendency: Arithmetic mean, mode, median, Measures of dispersion: Range, mean deviation, variance, standard deviation; Chi-square test for goodness of fit. Test of significance: comparison of large, small and paired samples (t-Test) and Correlation.

SUGGESTED READINGS:

- 1 Fundamentals of Ecology E.P. Odum
- 2 Ecology by M.C. Dash
- 3 Ecology by Sadabha
- 4 Biostatistics by Mishra and Mishra

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Ruma Sethi
19.7.23
Nivedita Pradhan
19/07/2023

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100marks

1. Description and Identification of Angiosperms family, genus and species level flora.
2. Herbarium techniques.
3. Microscopic study of ovules.
4. Determination of rate of photosynthesis
5. Preparation of Buffers.
6. Quantitative estimation of protein (Lowry methods/Bradford Method), Sugar (Anthrone Method), Lipids (Bligh and Dryer Method).
7. Quantitative estimation of Amino acids (Ninhydrin methods)
8. Estimation of Pigments (Chlorophylls and carotenoids) from plant and algal materials.
9. Isolation of plant DNA and quantification of extracted DNA by spectrophotometric methods.
10. Soil Nitrogen estimation.
11. Soil Carbon estimation.
12. Measurement of Central tendency
13. Measurement of Dispersion
14. Student t-Test
15. Chi-Square Test

BOT-205 - Practical Related to Paper 201 & 202
 BOT-206 - " " Paper 203 & 204.

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19.7.23

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19.7.23

Nivedita Pradhan
19/07/2023

Lily Prerna Misra
19.7.23

Ruma Saha
19.7.23