Syllabus and Marking Scheme for M.Sc. (Botany) Third Semester

Session 2020-2021

Paper No.	Title of the Paper	Marks Allotted in Theory		Marks Allotted in Internal Assessment		Credits
		Max	Min	Max.	Min.	
I	Plant development and plant resources	80	16	20	04	05
II	Plant ecology	80	16	20	04	05
III	Biotechnology and genetic engineering of plants	80	16	20	04	05
IV	Microbial ecology {elective – I}	80	16	20	04	05
V	Lab Course I - based on paper I and II	100	33			04
VI	Lab Course II - based on paper III and IV	100	33			04
	Total	520		80		28

04 Theory papers - 320

04 Internal Assessments - 80

02 Practical - 200

Total Marks - 600

Note: 1. 20 marks = 01 credit in Theory Papers and 25 Marks = 01 Credit in Practical/Project work

M.Sc. (BOTANY) SCHEME 2020-2021

SEMESTER –III rd LAB COURSE

LAB COURSE-1 (4 Hrs) **Max. M.100**

Part – I Practical based on Plant development and plant resources **25**

Part – II Exercise based on Plant ecology **25**

Part – III Spotting **15**

Part – IV Field study **15**

Part – V Viva- Voce **10**

Part – VI Sessional **10**

LAB COURSE-2 (4 Hrs) **Max. M.100**

Part – I Exercise based on Biotechnology and genetic engineering of plants **25**

Part – II Exercise based on Microbial ecology {elective – I} **25**

Part – III Spotting **15**

Part – V Assignment/ Field study **15**

Part – IV Viva- Voce **10**

Part – VI Sessional **10**

Name and Signatures of Members Board of Studies

S. N	Category	Name of Nominated Members	Signature
1.	Chairperson	**Dr. Ranjana Shrivastava**	
2.	Members	1. Prof. Smt. Gayatri Pandey	
		2. Dr. K. I. Toppo	
		3. Dr. G. S. Thakur	
		5. Dr. Shriram Kunjam	
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3.	Subject specialist	1. **Dr. J.N. Verma**(Govt. D.B. Girls PG College, Raipur C.G.)	
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7.	Subject expert from other Department	Dr. Anil Shrivastava (Govt. V.Y.T.PG. Autonomous College Durg C.G.)	

Govt. V.Y.T.PG. Autonomous College Durg (C.G.)

M.Sc. – BOTANY SEMESTER – III

SESSION - 2020-2021

PAPER – I

PLANT DEVELOPMENT AND PLANT RESOURCES

Max. M. 80 **Min. M. 16**

UNIT-I

- **Introduction**: Unique features of plant development.
- **Seed germination and Seedling growth**, metabolism of nucleic acids, proteins and mobilization of food reserves hormonal control of seedling growth.
- **Seed dormancy**, overcoming of seed dormancy, Bud dormancy.
- **Root development**: Organization of root apical meristem (RAM), Vascular tissue differentiation of root, lateral roots, Root hairs, Root microbe interaction.

UNIT-II

- **Shoot Development**: Organization of shoot apical meristem (SAM). Control of tissue differentiation; especially Xylem and Phloem.
- **Secretory ducts and laticifers**,
- **Wood development** – Formation of annual ring, heart wood and sap wood, porous and non porous, autumn & spring wood, periderm, lenticels, tylosis,

UNIT-III

- **Leaf growth and differentiation**: Development; phyllotaxy; differentiation of epidermis (with special reference to stomata and trichome) and Mesophyll..
- **Senescence**, influences of hormones and environmental factors on sensescence.
- **Flower development**: Genetics of Floral organ differentiation: Homeotic mutant in *Arabidopsis* and *Antirrhinum.*

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UNIT-IV

- **Plant resources**: Introduction, cultivation and uses of

    - **Food / Fodder crops**: Wheat, Rice, Sugarcane, Berseem, Black gram & Bengal gram.

    - **Vegetable Oil Yielding Crops**: Groundnut and Soyabean.
    - **Fiber Crops:** Cotton and Jute.
    - **Timber And Fire Wood Plants**:
    - Sal, Teak, Shisham, Deodar, Pines,
    - Babul, Amaltas, Emli, Bija, Jamun.
    - **Non Wood Forest Products (NWDPS):** Bamboos, Gums & Dyes (Sindoori, Heena).

Laboratory

- Study of alternate, opposite, opposite and superposed, opposite and decusscate, spiral leaf arrangement.
- Microscopic examination of V.S. of leaves (such as Nerium, Maize, Grass) to understand the internal structuure of the leaf tissues, trichome and glands etc.
- Study of epidermal peels of leaves of different plants; to study the structure of stomata and stomatal index.
- Microscopic examination of root (monocot, dicot, aerial root{Banyan}, hygroscopic {Vanda root}, assimilatary root {Tinospora}).
- Anatomy of stem (monocot and dicot). Study of stem modification.

{Field Survey}

- Listing of firewood and timber yielding trees of local origin. {Local name, Scientific name, Family, Properties}.
- Study of live or herbarium specimens or other visual materials to become familiar with these resources.
- Micro chemical tests for stored food material.

Recommended Books

- Fahn, A.1982, Plant Anatomy. (3rd Edi.). Pergamon Press, Oxford.
- Tayal, M.S. Plant Anatomy, Rastogi Pub.
- Vashista, P.C. Plant Anatomy, S. Chand.
- Pandey, B.P., Plant Anatomy.
- Chandurkar, Plant Anatomy.
- Emes, J. Plant Anatomy.
- Bendre, A. and Kumar, 2004 A. Rastogi pub. Meerut, India.
- Santra, S.C., Chattergee, T.P. and Das. 2005 A.P. College Botany Practical Vol. II New central pub. India.
- Botany of field crops, J.S. Nanda, P. K. Agarwal.
- Economic Botany in the tropics S. L. Kochhar.
- Hill's economic botany Dr. O.P, Sharma.

Question Paper Format and Distribution of Marks for PG Semester Examination

Question paper format for the Post-Graduate Examination has been revised from the Session 2018-19. The revised format will be applicable for all the question papers of Semester I, II, III & IV. The following are the main points of the new format:

1. The question paper will be of **80 marks** (as before)
2. Questions will be asked Unit-wise in each question paper.
3. From each Unit, the questions will be asked as follows :

Q.1	Very short answer type question **(Answer in one or two sentences)**	**(02 Marks)**
Q.2	Very short answer type question **(Answer in one or two sentences)**	**(02 Marks)**
Q.3	Short answer type question **(Answer in 200-250 words)**	**(04 Marks)**
Q.4	Long answer type questions **(Answer in 400-450 words)**	**(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	**2 x 2 = 4 Marks**	**2 x 2 = 4 Marks**	**2 x 2 = 4 Marks**	**2 x 2 = 4 Marks**
Short (1 Question) 200-250 words	**1 x 4 = 4 Marks**	**1 x 4 = 4 Marks**	**1 x 4 = 4 Marks**	**1 x 4 = 4 Marks**
Long answer (1 Question) 400-450 words	**1 x 12 = 12 Marks**	**1 x 12 = 12 Marks**	**1 x 12 = 12 Marks**	**1 x 12 = 12 Marks**

Note:

1. Question no. 1 and Question 2 will be compulsory.
2. Question no. 3 and 4 will consist of 2 optional questions of which one has to be attempted.
3. As mentioned above, two compulsory very short answer type questions (2+2 marks), one short answer type question with internal choice (4 marks) and one long answer type question with internal choice (12 marks) will be asked from each unit. Thus there will be questions of 20 marks from each unit and of total 80 marks from all the four units of the syllabus/syllabi.
4. Internal Assessment Examination will be as follows:
   i. Internal Test in each paper (20 marks)
   ii. Seminar (Power point presentation) in any one of the paper (20 marks)
   iii. Assignment in each of the remaining papers (excluding the paper of Seminar. (20 marks)
   iv. Average of marks obtained in internal test + seminar in any one paper and marks obtained in internal test + assignment in rest of the papers will be calculated and taken into consideration.

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M.Sc. – BOTANY SEMESTER – III
SESSION - 2020-2021
PAPER – II
PLANT ECOLOGY

Max. M. 80 **Min. M. 16**

UNIT-I

- **Ecosystem Organization**:
  - Structure – Structure of ecosystem (Abiotic, biotic components & ecological pyramids), Function of ecosystem (Productivity, food chain, food web, Nutrient cycles & Energy flow), Primary production (Methods of measurement, global pattern, controlling factors), Energy dynamics (tropic organization, energy flow pathways, ecological efficiencies).
  - Litter fall and decomposition (mechanism, substrate quality and climatic factors).
  - Global biogeochemical cycles of C, N, P and S mineral cycles (pathways and processes) in terrestrial and aquatic systems.

UNIT-II

- **Ecosystem stability and management**:
  - Concept (resistance and resilience), Ecological perturbations – Natural (flood, drought, fire, Volcano, landslide, earthquake, & cyclone) and anthropogenic (deforestation, desertification, usage of pesticide, insecticide, chemical fertilizers and plastics, water, air, soil, noise & nuclear pollutions and their impact on plants and ecosystems.
  - Ecology of plant invasion, environment impact assessment, ecosystem restorations.
  - Concept, Strategies, Principle and threats of Sustainable development, Causes of unsustainability, Sustainable development-international & national efforts, Sustainability indicators.

UNIT-III

- **Vegetation and organization**:
  - Concepts of community and continuum, analysis of communities (analytical – quantitative (frequency, density, abundance, cover and basal area), qualitative (physiognomy, phenology, stratification, abundance, sociability, vitality & life forms), synthetic characters (presence & constantance, fiedality, dominance, interspecific associations, index of similarity, species diversity, diversity index).

  - Community coefficients, inter specific associations (Positive interaction & Negative interaction), ordination and concept of ecological niche.

UNIT-IV

Vegetation development:

- Temporal changes (cyclic and non cyclic).
- Types of ecological succession – hydrosere and xerosere, mechanism of ecological succession (relay floristic and initial floristic composition, facilitation and tolerance), change in ecosystem properties during succession.
- Climax concept in succession – monoclimax and polyclimax theory.

Laboratory Exercise

- To determine minimum size and number of quadrat required for reliable estimate of biomass in grassland.
- To compare protected and unprotected grassland using community coefficients (similarity indices).
- To determine relative density of the species in a woodland using point centred quarter method.
- To determine relative frequency of the species in a woodland using point cantered quarter method.
- To estimate IVI of the species in a woodland using point cantered quarter method.
- To calculate mean, variance, standard deviation, standard error, coefficient of variations and to use t test for comparing two means related to ecological data.
- To find out the relationship between two ecological variables using correlation and regression analysis.
- To find out important grassland species using chi square test.

Recommended Books

- Shukla, R.S. and Chandel P.S. A text book of Plant Ecology including Ethno Botany and Soil Science.S.Chand and Company LTD.
- Dash, M.C., Fundamentals of Ecology, Tata McGraw Hill Company LTD.
- Sharma, P.D., Ecology and Environment, Rastogi Pub.
- Sharma, P.D., Environmental Biology, Rastogi Pub.
- Ambasht, R.S., A text book of Plat Ecology, Dev Jyoti Press, Varanasi.
- Arora, M. P., Ecology, Himalaya Pub. House.
- Tansley, A.G., An introduction to Plant Ecology, Discovery pub. House.
- Kochhar P.L. Plant Ecology , Genetics and Evolution, Jalandher.
- Arora Mohan p. , Ecology , Himalaya Pub. House.
- Weaver John E., Clements, E., Plant Ecology, Tata McGreaw Hill Company LTD.
- Odum Eugene, P. Fundamentals of Ecology, W.B. Sauneds Company.
- Kumar, H. S. General Ecology, Vikas Pub. House.
- Mishra, K.C. Manual of Plant Ecology , 3rd Ed. Oxford Pub. Company.
- Rana, S.V.S., Environmental Studies, Rastogi Pub.
- Benjamin cummings Publication Company, California.
- Chapman, J.L. and Reiss, M.J. 1988. Ecology principles and applications, Cambridge University press, Cambridge, U.K.

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   - Q.1 Very short answer type question **(Answer in one or two sentences) (02 Marks)**
   - Q.2 Very short answer type question **(Answer in one or two sentences) (02 Marks)**
   - Q.3 Short answer type question **(Answer in 200-250 words) (04 Marks)**
   - Q.4 Long answer type questions **(Answer in 400-450 words) (12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	**2 x 2 = 4 Marks**	**2 x 2 = 4 Marks**	**2 x 2 = 4 Marks**	**2 x 2 = 4 Marks**
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Note:

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M.Sc. – BOTANY SEMESTER – III

SESSION - 2020-2021

PAPER – III

BIOTECHNOLOGY AND GENETIC ENGINEERING OF PLANTS

Max. M. 80 **Min. M. 16**

UNIT – I

- **Biotechnology**: Basic concepts, principles and scope.
- **Plant cell and tissue culture**: General introduction, history, scope, concept of cellular differentiation, cellular totipotency.
- **Cell Culture**: Single cell culture, suspension culture and application.
- **Culture media:** Types, constituents, Selection of media and media preparation.

UNIT – II

Application of plants tissue culture:

- Clonal propagation (Micropropagation) – Shoot culture, Apical meristem culture,
- Production of hybrids, soma clones and somaclonal variations,
- Artificial seed
- Production of secondary metabolites/natural products: Morphological and chemical differentiation, Media composition.

Strategies for plant conservation:

- *Ex-situ*: Genetic resource centre, Gene bank, Seed banks, in vitro repositories and Cryo banks, the department of Biotechnology (DBT) for conservation and non formal conservation efforts.
- *In-situ* conservation: National park, Sanctuaries, National reserve, Biosphere reserve, Natural monuments.

UNIT – III

Organogenesis and adventives embryogenesis: Fundamental aspects of morphogenesis, organogenesis via callus formation.

- Somatic embryogenesis (zygotic embryo, non zygotic embryos, somatic embryos, parthenogenetic embryo, androgenic embryo).
- Somatic androgenesis (direct and indirect), mechanisms, techniques and utility.

Somatic hybridization: Methods of Protoplast isolation, Spontaneous and induced methods of protoplasm fusion, identification and selection of hybrid cell, regeneration of hybrid plants; possibilities, achievements and limitations.

UNIT – IV

Genetic engineering of plants:

- Aims, Strategies and development of transgenic.
    - Gene transfer methods: Vector mediated gene transfer - Agro bacterium: the natural genetic engineer, Virus mediated gene transfer, Vectorless or Direct DNA transfer.
- Chloroplast transformation and its utility.
- Molecular maps of plant Genomes.

Laboratory Exercise

- To prepare plant tissue culture media.
- To prepare explants and its sterilization.
- To surface sterilization of plant material.
- To isolate protoplast from the plant tissues.
- To demonstrate callus culture technique.
- To demonstrate cell suspension culture.
- To demonstrate androgenesis in Datura.
- To demonstrate somatic embryogenesis.
- To demonstrate organogenesis.

Recommended Books

- Bhojwani, S.S. and Razdan, M.K. 1996. Plant Tissue Culture: Theory and Practice (a revised edition). Elsevier Science Publishers, New York, USA
- Bhojwani, S.S. 1990. Plant Tissue Culture: Applications and Limitations. Elsevier Science Publishers, New York, USA.
- Kumar, U. 2002. Methods in Plant tissue culture, 2nd Ed., Agrobios India
- Prakash, M. and Arora, C.K. 2003. Cell and Tissue culture, Anmol Pub, New Delhi.
- Jogdand, S.N.Industrial Biotechnology, , Himalaya Pub. House, Delhi.
- Elements of Biotechnology, P.K. Gupta, Rastogi Pub. Meerut 2003.
- Biotechnology, B.D. Singh, Kalyani Pub. New Delhi 2005.
- A text book of Biotechnology, R.C. Dubey, S.Chand Pub. New Delhi

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(Answer in one or two sentences) **(02 Marks)**

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M.Sc. – BOTANY SEMESTER – III
SESSION - 2020-2021
PAPER-IV {Elective-I}

MICROBIAL ECOLOGY

M.M. – 80 **Min. - 16**

UNIT - I

- **Methods in Microbial Ecology:**
  - Methods of cleaning, sterilization (Disinfection, incineration, physical method and chemical method), media preparation (Liquid and solid)**.**
  - Enrichment and isolation methods, pure culture techniques (Pour plate, Streak plate, serial dilution). Identification and quantification (Micrometry).
- **Instrumentation (Principle, Structure and Functions):**
  - Autoclave, Colony counter, Hot air oven, Incubator, Laminar air flow,
  - Microscopy {Light microscope, Bright field microscope, Dark-field microscope, Phase-Contrast microscope, Fluorescent microscope, Electron microscope (Transmission and Scanning), Spectrophotometry.

UNIT - II

[Microbial interaction]

- **Clay-Humus-Microbe interaction.**
- **Plant-Microbe interaction**:
  - Interaction of above ground part - Destructive associations (diseases) - and beneficial association (symbiosis)
  - Interaction on below ground parts Destructive associations (diseases)
  - Beneficial association {Cyanobacterial (Cyanobacteria with Azolla and cycas)
  - Bacterial- associative symbiont, PGPR, Rhizobium, Actinomycetes, and
  - Fungal symbiosis - Mycorrhiza and their types).
- **Animal-Microbe interaction**:
  - Destructive association; Neutralism (normal microbiota of human body),
  - Symbiotic association (ectosymbiosis of protozoa, bacteria and fungi with insects and birds, endosymbiosis of bacteria and fungi with birds and insects, ruminant symbiosis).
- **Microbe-Microbe interaction:** Symbiosis, Antagonism, Ammensalism, Competition, Parasitism and Predation.

UNIT – III

- **Nutritional types** (Autotrophs, Heterotrophs, Phototrophs, Chemotrophs),
- **[Extremophiles] Physiology, molecular, adaptation and application:**
    - **Acidophiles** – Enzyme, bioremediation,
    - **Alkalophiles** - Enzyme,
    - **Halophiles** - Bacteriorhodopsin, polysaccharides, cancer detection, drug screening, liposomes, microbial enhanced oil recovery (MEOR), gas vacuoles
    - **Psychrophiles** - Source of pharmaceuticals, bacterial ice-nucleating agents, fermentation industry, microbial leaching, bioremediation, denitrification of drinking water sources, anaerobic digestion of organic wastes
    - **Barophiles** - Fermenters,
    - **Thermophiles** - Enzymes, chaperons
    - **Hyperthermophiles** Enzymes, chaperons,

UNIT – IV

[Soil Microbiology]

- **Soil as a habitat for microorganisms:** Soil quality, Physico-chemical properties of soil (Organic matter; Soil, water &air; Soil microbes: algae, bacteria, actinomycetes, bacteriophages, protozoa, nematode and fungi), Microbial balance;
- **Rhizosphere and rhizoplane microorganisms**; the rhizosphereic effect.
- **Organic matter decomposition:**
    - Composition of litter (cellulose, hemi cellulose, lignin, water soluble components, ether and alcohol, soluble components and proteins)
    - Carbon assimilation and immobilization,
    - Microorganisms associated with organic matter decomposition(cellulose decomposers, hemicellulose decomposers, lignin decomposers);
    - Factors affecting organic matter decomposition (litter quality, temperature, aeration, soil pH, inorganic chemicals,moisture);
    - Microbial biomass as an index of soil fertility.
- **Biogeochemical cycling:** Carbon cycle, Nitrogen cycle (nitrogen fixation, ammonification, nitrification, denitrification); Phosphorous cycle, Sulphur cycle**.**

Laboratory Exercise

- ❖ Methods in Microbial Ecology.
- ❖ Calibration of microscope: determination of dimensions of microorganisms (micrometery)
- ❖ Cultivation media for autotrophic and heterotrophic microorganisms (cleaning ofglasswares, mineral media, complex media, solid media, sterilization).
- ❖ Isolation of microorganisms: spread plate/pour plate method/streaking on agar plates&preservation.
- ❖ Microscopic observation of root colonization by VAM fungi.

- ❖ Isolation of *Rhizobium* from soil/root nodules.
- ❖ Isolation and enumeration of rhizospheric microorganisms. Estimation of R:S ratio and assessment of Rhizospheric effect.
- ❖ Demonstration of bacterial antagonism.
- ❖ Isolation and enumeration of fungi from soil.
- ❖ Isolation of bacteria from soil.
- ❖ Demonstration/Isolation and identification of Cyanobacteria from soil.
- ❖ Soil Test.

Recommended Books

- ➢ A text book of Microbiology, R.C. Dubey and D.K. Maheshwari.
- ➢ Microbiology and Plant Pathology, P. D. Sharma.
- ➢ Microbiology. M. Pelczar, Chan and Krieg.
- ➢ A text book of Microbiology. R.M. Johri, Snehlata.
- ➢ Experiments in Microbiology, Plant Pathology and Biotechnology.

Question Paper Format and Distribution of Marks for PG Semester Examination

Question paper format for the Post-Graduate Examination has been revised from the Session 2018-19. The revised format will be applicable for all the question papers of Semester I, II, III & IV. The following are the main points of the new format:

1. The question paper will be of **80 marks** (as before)
2. Questions will be asked Unit-wise in each question paper.
3. From each Unit, the questions will be asked as follows:

Q.1 Very short answer type question
(Answer in one or two sentences) **(02 Marks)**

Q.2 Very short answer type question
(Answer in one or two sentences) **(02 Marks)**

Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**

Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	**2 x 2 = 4 Marks**	**2 x 2 = 4 Marks**	**2 x 2 = 4 Marks**	**2 x 2 = 4 Marks**
Short (1 Question) 200-250 words	**1 x 4 = 4 Marks**	**1 x 4 = 4 Marks**	**1 x 4 = 4 Marks**	**1 x 4 = 4 Marks**
Long answer (1 Question) 400-450 words	**1 x 12 = 12 Marks**	**1 x 12 = 12 Marks**	**1 x 12 = 12 Marks**	**1 x 12 = 12 Marks**

Note:

1. Question no. 1 and Question 2 will be compulsory.
2. Question no. 3 and 4 will consist of 2 optional questions of which one has to be attempted.

3. As mentioned above, two compulsory very short answer type questions (2+2 marks), one short answer type question with internal choice (4 marks) and one long answer type question with internal choice (12 marks) will be asked from each unit.

Thus there will be questions of 20 marks from each unit and of total 80 marks from all the four units of the syllabus/syllabi.

4. Internal Assessment Examination will be as follows:

xiii. Internal Test in each paper (20 marks)

xiv. Seminar (Power point presentation) in any one of the paper (20 marks)

xv. Assignment in each of the remaining papers (excluding the paper of Seminar. (20 marks)

xvi. Average of marks obtained in internal test + seminar in any one paper and marks obtained in internal test + assignment in rest of the papers will be calculated and taken into consideration.

Name and Signatures of Members Board of Studies

S. N	Category	Name of Nominated Members	Signature
1.	Chairperson	**Dr. Ranjana Shrivastava**	
2.	Members	1. Prof. Smt. Gayatri Pandey	
		2. Dr. K. I. Toppo	
		3. Dr. G. S. Thakur	
		4. Dr. Shriram Kunjam	
		5. Dr. Vijay Laxmi Naidu	
		6. Dr. Satish Kumar Sen	
3.	Subject specialist	1. **Dr. J.N. Verma**(Govt. D.B. Girls PG College, Raipur C.G.)	
		2. **Dr. N.B. Singh** (Govt. N.PG. Science College Raipur C.G.)	
4.	VC Nominated member	**Dr. Usha Chandel** (Govt. W.W. Patankar Girls College Durg C.G.)	
5.	Corporate/ Industrial area Representative	Shri Rajesh Agarwal (Kusum Rice Mill Kadambari Nagar Dhamdha Road Durg)	
6.	Ex Meritorious Student PG	Goukaran (Govt. V.Y.T. PG Autonomous College, Durg C.G.)	
7.	Subject expert from other Department	Dr. Anil Shrivastava (Govt. V.Y.T.PG. Autonomous College Durg C.G.)	