Bhagat Phool Singh Mahila Vishwavidyalaya Khanpur Kalan

Scheme and Syllabus of **Botany** Subject for 4 Year UG Programme
Bachelor of Life Science (Multidisciplinary)
W.e.f. Academic session 2025-26

Scheme of Examination for 3rd Semester

Second Year: Third Semester												
Sr. No.	Course Code	Course Type	Course Title	Workload			Credits	Division of Marks				
				L	P	T		Internal Marks		External Marks		Total Marks
								T	P	T	P	
1	B-BOT-301	DSC	Diversity of Archegoniate and Seed Plants-I	3	2	0	4	20	10	50	20	100
2	B-BOT-302	MIC	Microbiology	3	2	0	4	20	10	50	20	100
3	B-BOT-303	MDC	Horticulture	2	2	0	3	15	10	35	15	75

Scheme of Examination for 4th Semester

Second Year: Fourth Semester												
Sr. No.	Course Code	Course Type	Course Title	Workload			Credits	Division of Marks				
				L	P	T		Internal Marks		External Marks		Total Marks
								T	P	T	P	
1	B-BOT-401	DSC	Plant Anatomy and Reproduction	3	2	0	4	20	10	50	20	100
2	B-BOT-402	MIC (VOC)	Organic Farming	3	2	0	4	20	10	50	20	100

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Scheme of Examination for 5th Semester

Third Year: Fifth Semester												
Sr. No.	Course Code	Course Type	Course Title	Workload			Credits	Division of Marks				
				L	P	T		Internal Marks		External Marks		Total Marks
								T	P	T	P	
1	B-BOT-501	DSC	Plant Taxonomy	3	2	0	4	20	10	50	20	100
2	B-BOT-502	MIC (VOC)	Gardening & Floriculture	3	2	0	4	20	10	50	20	100

Scheme of Examination for 6th Semester

Third Year: Sixth Semester												
Sr. No.	Course Code	Course Type	Course Title	Workload			Credits	Division of Marks				
				L	P	T		Internal Marks		External Marks		Total Marks
								T	P	T	P	
1	B-BOT-601	DSC	Plant Physiology	3	2	0	4	20	10	50	20	100
2	B-BOT-602	MIC	Economic Botany	3	2	0	4	20	10	50	20	100
3	B-BOT-603	MIC (VOC)	Mushroom Cultivation	3	2	0	4	20	10	50	20	100

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Diversity of Archegoniates & Seed Plants-I
B-BOT-301

Total Credits: 4
L–T–P
3 0 2

External Marks: 50
Internal Marks: 20
Time allowed: 3hrs

Course Outcomes:

CO-1 Students will be able to understand the general characteristics of Bryophytes.
CO-2 Students will develop a conceptual understanding of Pteridophytes.
CO-3 Students will develop a conceptual understanding of Gymnosperms.
CO-4 Knowing diversity and Systematics of seed plants students will be able to give specific examples of the physiological adaptations, development, reproduction and behavior of Gymnosperms.

UNIT- I

Bryohpyta: General characters and classification (up to classes), Amphibians of Plant kingdom displaying alternation of generations, Economic importance.
Structure and Reproduction: *Marchantia* (Hepaticopsida), *Funaria* (Bryopsida).

UNIT- II

Pteridophyta: General characteristics of Pteridophytes (First vascular Plants) and classification (up to classes), Alternation of generation, Economic importance.

Structure and Reproduction: *Selaginella* (Lycopsida), *Pteris* (Pteropsida).

UNIT- III

Characteristics of Seed plants; evolution of seed habit.
Gymnosperms (Seed plants without fruits): General characteristics of gymnosperms, Evolution & diversity of gymnosperms, Classification of gymnosperms (up to classes), Distribution and Economic importance of Gymnosperms.

UNIT- IV

Cycas: Morphology of vegetative & reproductive parts; Anatomy of root, stem & leaf; Reproduction and life cycle of *Cycas.*

Pinus: Morphology of vegetative & reproductive parts; Anatomy of root, stem & leaf; Reproduction and life cycle of *Pinus.*

Instructions for External Theory Paper Setter/Examiner:
The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking Course Outcomes (CO) into consideration. The compulsory question (Question No. 1) will contain ten parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question.

Recommended Readings:

1. Parihar, N. S. (1972). An introduction to Embryophyta Vol. Bryophyta Central Book Ltd Allahabad.
2. Waston, E.V. 1982. Structure and Life of Bryophytes B.I. Publishers.
3. Smith, G.M. 1971. Cryptogamic Botany. Vol. 11. Bryophytes and Pteridophytes. Tata Mc Graw Hill Publishing Co., New Delhi.
4. Sharma O. P. 1990. Text Book of Pteridophyta, Mcmillan, India Ltd.
5. Puri, P. 1980, Bryophyta Atma Ram & Sons Delhi.
6. Sporne, K.R., 1982. The Morphology of Pteridophytes. B.I.Gifford, E.H. and Heyweed, V.H., 1963. Morphology and Evolution of Vascular Plants, W.H. Freeman & Company

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Bhatnagar, S.P. and Moirtra, A., 1996. Gymnosperms, New Age International Limited, New Delhi., New York.
7. Sporne, K.R., 1965. The morphology of Gymnosperms, Hutchinson & Co.,(Publishers) Ltd., London.
8. Stewart, W.M., 1983. Paleobotany and The Evolution of Plants, Cambridge University Press, Cambridge.
9. Bierhorst, D.W. (1971). Morphology of Vascular Plants. MacMillian Company Ltd. New York.
10. Sporne K.R., 1982. The Morophology of Gymnosperms. B.I. Publishers.

Practical

External Marks: 20
Internal Marks: 10
Time Allowed: 2hrs

Course Outcomes:
CO-1 Students will gain the knowledge of practical aspects of Bryophytes, Pteridophytes.
CO-2 Students will gain the knowledge of practical aspects of Gymnosperms.

List of Practicals:
1. Study of Specimens of Bryophytes (as per syllabus).
2. Study of Specimens of Pteridophytes (as per syllabus).
3. Identification and classification of the specimens from Gymnosperms and with a note on features for identification (as per syllabus).
4. Identification of permanent slides of bryophytes, pteridophytes and gymnosperms (as per theory Syllabus).
5. Permanent and double stained slide preparations of gymnosperms (as per syllabus).
6. Field Tour of an area rich in diversity of bryophytes, pteridophytes and gymnosperms (Hill Station) and Preparation of Herbarium and Survey Report.
7. Practical Record and Viva-voice.

Instructions for External Practical Paper Setter/Examiner:

The examiner will set 2/3 Experiments at the time of practical examination by taking course outcomes (CO) into consideration. Equal weight age will be given to the Experiments. The evaluation will be done on the basis of practical record, viva-voice, write up and experimental results.

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Microbiology
B-BOT-302

Total Credits: 4
L – T – P
3 0 2

External Marks: 50
Internal Marks: 20
Time allowed: 3hrs

Course Outcomes:

CO1. Identifying and describing the parts of a microscope and their functions.
CO2. Students can learn how microorganisms interact with each other, with plants and animals and with their environments.
CO3. Students can learn how microorganisms interact with each other, with plants and animals and with their environments.
CO4. Students will learn about microbial ecology.

UNIT- I

Microscopy: Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM), Phase Contrast Microscope, Fluorescence Microscope.
Sterilization techniques: Autoclave, Hot Air Oven, Laminar Flow Inoculation Chamber, BOD Incubator.

UNIT-II

Diversity of Microorganisms:
General characteristics of different groups: Acellular microorganisms (Viruses, Viroids, Prions) and cellular microorganisms (Prokaryotes: Archaebacteria and eubacteria; Eukaryotes: Algae, Fungi and Protozoa).
Protozoa: Cellular structure, nutrition, locomotion, reproduction and life cycle of *Amoeba*, *Paramecium* and *Plasmodium*.

UNIT-III

Microorganisms and their Habitats
Terrestrial Environment: Soil profile and soil microflora; **Aquatic Environment:** Microflora of fresh water and marine habitats; **Atmosphere:** Aero-microflora and dispersal of microbes,

Extremophiles: Microbes thriving at high & low temperatures, pH, high hydrostatic & osmotic pressures, salinity & low nutrient levels.

Microbial succession in decomposition of plant organic matter.

UNIT-IV

Microbial Interactions: Mutualism, synergism, commensalism, competition, amensalism, parasitism, predation. Microbes in/on human body & animal (ruminants) body. Plant-microbe interactions (symbiotic and non-symbiotic interactions).
Industrial Microbiology: Definition and types of fermentation; Fermenters; Role of microbes in producing important: industrial products, dairy and non-dairy based fermented food products and probiotics. Microorganisms in food spoilage and food borne infections (cite examples).

Instructions for External Theory Paper Setter/Examiner:
The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course outcomes (COs) into consideration. The compulsory question (Question No. 1) will contain ten parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question.

Suggested Readings:

1. Tortora GJ, Funke BR and Case CL (2008). Microbiology: An Introduction. 9th edition. Pearson Education.
2. Madigan MT, Martinko JM, Dunlap PV and Clark DP (2014). Brock Biology of Microorganisms. 14th edition. Pearson International Edition.

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3. Cappucino J and Sherman N (2010). Microbiology: A Laboratory Manual. 9th edition. Pearson Education Limited.
4. Wiley JM, Sherwood LM and Woolverton CJ (2013). Prescott's Microbiology. 9 th Edition. McGraw Hill International.
5. Atlas RM (1997). Principles of Microbiology. 2nd edition. WM.T.BrownPublishers.
6. Pelczar MJ, Chan ECS and Krieg NR (1993). Microbiology. 5th edition. McGrawHill Book Company.
7. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR (2005). GeneralMicrobiology. 5th edition. McMillan.
8. Willey JM, Sherwood LM, and Woolverton CJ (2013). Prescott's Microbiology. 9th edition. McGraw Hill Higher Education.

Practical

External Marks: 20

Internal Marks: 10

Time Allowed: 2hrs

Course Outcomes:

CO-1 Students will learn about microbiology laboratory practices and bio-safety measures.

CO-2 Students will learn about aseptic techniques and develop the skill of media preparation for culturing the microbes.

CO-3 Students will learn about different types of microscopy techniques.

List of Practicals:

1. Microbiology good laboratory practices and biosafety measures.
2. To study the principle and applications of important instruments (autoclave, BOD incubator, hot air oven, light microscope, pH meter) used in the microbiology laboratory.
3. Sterilization of medium using Autoclave and assessment for sterility.
4. Sterilization of glassware using Hot Air Oven and assessment for sterility
5. To acquire the knowledge on aseptic techniques and develop the skill of media preparation for culturing the microbe.
6. Demonstration of the presence of microflora in the environment by exposing nutrient agar plates to air.
7. Study of the following protozoans using permanent mounts/photographs: *Amoeba*, *Entamoeba*, *Paramecium* and *Plasmodium*.
8. Demonstration of alcoholic fermentation.

Instructions for External Practical Paper Setter/Examiner:

The examiner will set 2/3 Experiments at the time of practical examination by taking course outcomes (CO) into consideration. Equal weightage will be given to the Experiments. The evaluation will be done on the basis of practical record, viva-voice, write up and experimental results.

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Horticulture
B-BOT-303

Total Credits: 3
L – T – P
2 0 2

External Marks: 35
Internal Marks: 15
Time Allowed: 2 hrs

Course Outcomes:

CO-1 Students can learn to comprehend the interdisciplinary science of horticulture, agriculture and plantation science.

CO-2 Students will be able to understand methods of plant disease management.

CO-3 Students will be able to learn about post-harvest management.

UNIT-I

Importance of horticulture and its scope; preparation of field and pits; methods of propagation of fruit plants and pruning of fruit trees; manuring, irrigation, weeding, harvesting and plant protection measures.

Importance of vegetables and their role in nutrition. Types of vegetable gardening (kitchen/Nutrition gardening, commercial gardening). Cultivation of important vegetables (tomato, okra, peas, cauliflower, radish and leafy vegetables): Preparation of nursery beds and nursery management, irrigation, manuring, weeding, harvesting and plant protection.

UNIT-II

Principles and methods of plant disease management, Integrated Plant disease management Fungicides classification based on chemical nature; commonly used insecticides, fungicides, bactericides and nematicides. Preparation of fungicidal solutions, slurries, pastes and their application.

UNIT-III

Post-harvest management, its importance and scope; methods of determining maturity indices; post-harvest operation like harvesting, sorting, grading, packaging, storage, marketing and transportation of important fruit and vegetable crops.

Instructions for External Theory Paper Setter/Examiner:

The examiner will set 7 questions asking two questions of 9 marks from each unit and one compulsory question by taking course outcomes (COs) into consideration. The compulsory question (Question No. 1) will be of 8 marks covering entire syllabus. The examinee will be required to attempt 4 questions, selecting one question from each unit and the compulsory question.

Recommended Readings:

1. Chadha, K. L. 2002. Hand book of Horticulture. ICAR, New Delhi.
2. Denisen, E. L. 1957. Principles of Horticulture. Macmillan Publishing Co., New York.
3. Edmond, J. B., Sen, T. L., Andrews, F. S. and Halfacre, R. G. 1963. Fundamentals of Horticulture. Tata Mc Graw Hill Publishing Co., New Delhi.
4. Hooker. J.R., 1957. Fundamentals of Fruit Production. Mac Graw Hill Book Co., New York.
5. Kumar, N. 1990. Introduction to Horticulture.. Rajyalakshmi Publications, Nagarcoil, Tamilnadu
6. Misra, K.K. and Kumar, R. 2014. Fundamentals of Horticulture. Biotech Books.
7. Peter, K. V. 2009. Basics Horticulture. New India Publishing Agency
8. Prasad, S. and Kumar, U. 2010. A Handbook of Fruit Production. Agrobios (India).
9. Prasad, S. and Kumar, U. 2019. Principles of Horticulture (2nd Edt.). Agrobios (India).
10. Salunkhe, D. K. and Kadam, S. S. 2013. A handbook of Fruit Science and Technology. CRC Press.
11. Singh, J. 2002. Basic Horticulture. Kalyani Publishers, Hyderabad.
12. Singh, J. 2011. Basic Horticulture. Kalyani Publications, New Delhi.
13. Singh, N. P. 2005. Basic Concepts of Fruit Science (1 stEdt.). IBDC Publishers.

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Practical

External Marks: 15

Internal Marks: 10

Time Allowed: 2hrs

Course Outcomes:

CO-1 Students will understand technologies like preparation of nursery bed, pruning etc. in horticulture.

CO-2 Students will learn basis of plant propagation and nursery management techniques.

CO-3 Students will learn advanced propagation methods of horticultural crops.

List of Practicals:

1. Identification of rocks and minerals and identification of chemical fertilizers and fertilizer application methods.
2. Examination of soil profile in the field- determination of soil texture, bulk density, particle density, pH, EC, porosity of soil and organic carbon of soil.
3. Identification of crops and their varieties and weeds.
4. Different weed control methods.
5. Study of seed viability and germination test.
6. Identification and description of important fruit, flowers and vegetables crops.
7. Study of different garden tools, preparation of nursery bed; practices of pruning and training in some important fruit crop

Instructions for External Practical Paper Setter/Examiner:

The examiner will set 2/3 Experiments at the time of practical examination by taking course outcomes (CO) into consideration. Equal weightage will be given to the Experiments. The evaluation will be done on the basis of practical record, viva-voice, write up and experimental results.

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Plant Anatomy and Reproduction
B-BOT-401

Total Credits: 4
L – T – P
3 0 2

External Marks: 50
Internal Marks: 20
Time allowed: 3hrs

Course Outcomes:

CO-1 The practical study of anatomical structures helps to reveal the relationships between structure, functions, taxonomy, ecology and developmental genetics.

CO-2 Anatomical characters of vegetative and floral parts of flowering plants have been successfully employed to solve taxonomic problems and for the elucidation of phylogenetic relationships.

CO-3 Students will get knowledge about reproduction, pollination, pollinating agencies, about differentiation of reproductive organs of flowering plants.

CO-4 They will know about structure and formation of endosperm, seed and fruit.

UNIT- I

Diversity in plant forms in annuals, biennials and perennials, Body parts of Flowering plant and Modular growth.

Tissues: Types of tissues in flowering plants. Cambium & its functions.

The Shoot System: Shoot Apical Meristem (SAM) & its histological organization; Secondary growth in xylary and extraxylary region. A general account of wood structure and its characteristics. Anomalous Secondary growth in *Boerhaavia* and *Dracaena*.

UNIT- II

Leaf: Origin, development, arrangement & diversity in size & shape, internal structure in relation to photosynthesis & water loss. Adaptations to water stress; Senescence and abscission.

The Root System- Types of root system; Root Apical Meristem (RAM); Differentiation of Primary & Secondary tissues and their roles; Structural modifications in roots for: storage, respiration, propagation and perennation. Root nodules. Vegetative propagation and its economic aspects.

UNIT- III

Flower: A modified shoot; structure & functions of various floral parts, types of Inflorescence. Structure of Microsporangium and dehiscence mechanism, Microsporogenesis, Pollen grains and its structure, Pollination (Types and Agencies).

Microgametogenesis: Pollen germination, Development of male Gametophyte. Pollen-Pistil interaction; Self – Incompatibility.

UNIT- IV

Megasporogenesis and Megagametogenesis: Structure of Megasporangium (Ovule); Types of ovule; megasporogenesis; Development of female gametophyte & its Types (Mono, Bi & tetrasporic); Double fertilization. **Endosperm:** Types and its biological importance.

Embryogenesis in Dicot and monocot; Polyembryony.

Seed & Fruit- Formation of seed; seed structure; types of seed; germination; ecological; adaptations, dispersal strategies. Formation of fruit & types of fruit.

Instructions for External Theory Paper Setter/Examiner:

The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course outcomes (COs) into consideration. The compulsory question (Question No. 1) will contain ten parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question.

Recommended Readings:

1. Cutter, E.G. (1969). Part I, Cells and Tissues, Edward Arnold, London.
2. Cutter, E.G. (1971). Plant Anatomy: Experiment and Interpretation, Part II, Organs, Edward Arnold, London.
3. Esau, K. (1977). Anatomy of Seed Plants, (2nd Edition), John Wiley & Sons, New York.

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4. Eames, A.J. and Mac Daniels L.H. (1947). An introduction to Plant Anatomy. Mc. Graw Hill Book Co. New York.
5. Esau, K. (1985). Plant Anatomy, Wiley-Eastern, New Delhi.
6. Fahn, A. (1974). Plant Anatomy, (2nd Edition), Pergamon Press, Oxford.
7. Hartmann, H.T., and Kestler, D.E. (1976). Plant Propagation: Principles and Practices, (3rd Edition), Prentice Hall of India Pvt. Ltd., New Delhi.
8. Mauseth, J.D. (1988). Plant Anatomy, The Benjamin/Cumming Publishing Company Inc., Menlo Park, California, U.S.A.
9. Bier horst, D.W. (1971). Morphology of Vascular Plants. MacMillian Company Ltd. New York.
10. Bhojwani. S.S.and Bhatnagar S.P. (1985). The Embrylogy of Angiosperms. Vani Educational Books , New Delhi.
11. Bhojwani , S.S. and Bhatnagar, S.P. (2000). The Embryoligy of Angiosperms, 4th Revised and Enlarged Edition, Vikas Publishing House, Delhi.
12. Fageri, K., and Van Der Pijl (1979). The Principles of Pollination Ecology, Pergamon Press, Oxford.
13. Proctor, M. and Yeo, P. (1973). The Pollination of Flowers, William Collins Sons London.
14. Raven, P.H., Evert, R.F. and Eichhorn, S.E. (1999). Biology of Plants, 5th Edition , W.H., Freeman and Co., Worth Publishers, New York.
15. Thoms, P. (2000): Trees: Their Natural History, Cambridge University Press, Cambridge.
16. Mukundan, U. (1997). Botany A New Approach . Agrobios , India.
17. Purohit, S.S. (2002). Flowering Physiological, Biochemical and Molecular Aspects. Agrobios, India.
18. Good, R. (2006). Flowering Plants and their evolution . Agrobios, India.
19. Shivanna, K.R., Johris,B.M. (1985). Angiosperm Pollens. Narosa.
20. Dey , S.C. 2005. Fruits growing in Pots Agrobios , India.

Practical

External Marks: 20
Internal Marks: 10
Time Allowed: 2hrs

Course Outcomes:

CO-1 Students will get the practical knowledge of anatomical aspects of plants.

CO-2 Students will get the practical knowledge of reproductive aspects of plants.

List of Practicals:

1. Identification of permanent slides of anatomical parts of angiospermic plants giving reasons (as per theory syllabus).
2. Identification of angiospermic parts with a note on features of identification (as per theory syllabus).
3. Permanent and double stained slide preparations of angiosperms (as per theory syllabus).
4. Identification of slides (from Angiosperms), & development & embryology) giving reasons.
5. Embryo study by dissecting out the globular/heart shaped embryo from the given plant material.
6. Note Book.
7. collection & collection report/Model
8. Viva-voice.

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Instructions for External Practical Paper Setter/Examiner:

The examiner will set 2/3 Experiments at the time of practical examination by taking course outcomes (CO) into consideration. Equal weightage will be given to the Experiments. The evaluation will be done on the basis of practical record, viva-voice, write up and experimental results.

Organic Farming
B-BOT-402

Total Credits: 4
L- T- P
3 0 2

External Marks: 50
Internal Marks: 20
Time Allowed: 3 hrs

Course Outcomes:

CO-1 Students will learn the skills required for organic farming practices.
CO-2 Students can develop a critical understanding of agronomy, including the application of nutrients to plants, cropping methods and crop rotation.
CO-3 Students will be able to learn about methods of weed management.
CO-4 Students will learn about crops physiology and storage of field crop.

UNIT--I

Organic Farming: Introduction; Need of Organic Farming; Benefits of Organic Farming; Social aspects of Organic Farming; Market aspects of Organic Farming.
Characteristics and quality of seeds, seed treatment and its objectives; methods of sowing seeds.

UNIT-II

Organic Fertilizers: Introduction; Need of Organic Fertilizer; Benefits of Organic Fertilizer; Preparation of Organic Fertilizer; Demonstration & land preparation.
Sources of nutrients for Organic Agriculture: Organic Manure – FYM/Rural compost, City compost, Oil cakes, Animal wastes, Vermi-composts; Green Manure – Green Manure with Leguminous crops in crop rotation. In-situ incorporation of crop residues –Benefits; Liquid Manure.

UNIT-III

Weed management
Weeds, its definition, characteristics of weeds, demerits of weeds, meaning of crop weed competition, Allelopathic effect of weeds.
Principles and methods of weed management viz., cultural, mechanical, chemical, biological weed control methods and integrated weed management

UNIT-IV

Crop rotation: Definition, principles and advantages of crop rotation. Crop harvesting, Signs of maturity in different field crops; physiology of crop maturity. Methods of threshing crops, cleaning, drying and storage of field crops.

Instructions for External Theory Paper Setter/Examiner:
The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course outcomes (COs) into consideration. The compulsory question (Question No. 1) will contain ten parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question.

Recommended Readings:

1. Arun K. Sharma. 2002. A Hand book of organic farming. Agrobios, India. 627p.
2. Palaniappan, S.P and Annadurai, K.1999. Organic farming-Theory and Practice. Scientific publishers, Jodhpur,India. 257p.
3. Mukund Joshi and Prabhakarasetty, T.K. 2006. Sustainability through organic farming. Kalyani publishers, New Delhi. 349p.
4. Balasubramanian, R., Balakishnan, K and Siva Subramanian, K. 2013. Principles and practices of organic farming. Satish Serial Publishing House. 453p
5. Tarafdar, J.C., Tripathi, K.P and Mahesh Kumar, 2009. Organic agriculture. Scientific Publishers, India. 369p.

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6. Tiwari, V.N., Gupta, D.K., Maloo; S.R and Somani, L.L. 2010. Natural, organic, biological, ecological and biodynamic farming. Agrotech Publishing Academy, Udaipur. 420p.
7. DushyentGehlot. 2005. Organic farming- standards, accreditation, certification and inspection. Agrobios, India. 357p.

Practical

External Marks: 20
Internal Marks: 10
Time Allowed: 2 hrs

Course Outcomes:

CO-1 To provide a skill set of Organic farming to students to help them become self-reliant.

CO-2 Students will learn about cropping methods and crop rotation, which can improve soil health and break disease and pest cycles.

CO-3 Students will get knowledge about various weed management practices.

CO-4 Students will learn about different aspects of crop harvesting.

List of Practicals:

1. Study of organically grown field crops through nutrient, diseases and pest management; vermi-composting; macro quality analysis, grading, packaging and post-harvest management; quality of various composts made from different raw materials; green manure.
2. Study of various types of greenhouse/poly house and their suitability for different crops.
3. Equipment used in the greenhouses, growing media used in raising of greenhouse crops and their preparation and pasteurization/sterilization; light, humidity and temperature management in greenhouse; calculation of nutrient requirement for different crops;
4. Post-harvest handling of greenhouse crops.
5. Study of profitable utilization of agricultural wastes.
6. Visit to commercial greenhouses and flower markets.
7. Visits to organic farm to study various components and utilization; study of degraded lands.
8. Visit to urban waste recycling unit.

Instructions for External Practical Paper Setter/Examiner:

The examiner will set 2/3 Experiments at the time of practical examination by taking course outcomes (CO) into consideration. Equal weightage will be given to the Experiments. The evaluation will be done on the basis of practical record, viva-voice, write up and experimental results.

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Plant Taxonomy
B-BOT-501

Total Credits: 4
L – T – P
3 0 2

External Marks: 50
Internal Marks: 20
Time allowed: 3hrs

Course Outcomes:

CO-1 By knowing diversity and systematic of seed plants students will be able to give specific examples of the physiological adaptations, development, reproduction and behavior of Angiosperms.

CO-2 Students will be able to know about species diversity of Angiosperms.

CO-3 Students will study about the botanical nomenclature and criteria of classification.

CO-4 Students will learn the use of cytology, phytochemistry and taximetrics in studying angiospermic taxonomy.

UNIT-I

Taxonomy and Systematic: Aims & fundamental components of taxonomy (identification, classification, nomenclature, description and phylogeny), taxonomic literature. Role of chemotaxonomy, cytotaxonomy and taximetrics in relation to taxonomy.

UNIT- II

Botanical Nomenclature: Principles and rules, Principle of priority, Type concept, Taxonomic ranks. Keys for plant identification- Herbarium, Botanical gardens, Dichotomous keys.

UNIT- III

Classification of Angiosperms: Salient features of the system proposed by Bentham & Hooker and Engler & Prantle. Origin of angiosperms and relationship of major groups.

Diversity of flowering plants as illustrated by members of the families. Ranunculaceae, Brassicaceae, Malvaceae.

UNIT- IV

Euphorbiaceae, Rutaceae, Fabaceae, Apiaceae, Asclepediaceae, Lamiaceae, Solanaceae, Asteraceae, Liliaceae and Poaceae.

Instructions for External Theory Paper Setter/Examiner:

The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course outcomes (COs) into consideration. The compulsory question (Question No. 1) will contain ten parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question.

Recommended Readings:-

1. Sivarajan, V.V. (1985). Introduction to Principles of Plant Taxonomy .Oxford & IBH Publ. Co., New Delhi.
2. Mathur, R.C. and Chauhan, S.V.S. (1989). Systematic Botany, Agra Book Store, Agra.
3. Davis, P.H. and Heywood, V.H., 1963. Principles of Angiosperm Taxonomy, Oliver and Boyd, London.
4. Heywood, V.H. and Moore, D.M. (eds.), 1984. Current Concepts in Plant Taxonomy, Academic Press, London.
5. Jeffrey, C., 1982. An introduction to Plant Taxonomy, Cambridge University Press London.
6. Jones, S.B., Jr. and Luchsinger A.F., 1986. Plant Systematics (2nd Edition), McGrawHill Book co., New York.
7. Maheshwari, J.K., 1963. Flora of Delhi, CSIR, New Delhi.
8. Radford, A.E., 1986. Fundamentals of Plant Systematics, Harper and Row, New York.
9. Stace, C.A., 1989. Plant Taxonomy and Biosystematics (2nd Edition), Edward Arnold, London.

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10. Willis, K.J. and Mc Elwaine, J.C. (2002). The evolution of plant, Oxford University Press.
11. Singh , G. (2004). Plant systematics- Theory and Practice (2nd ed.) Oxford of IBH Publishing Co. Pvt. Ltd New Delhi.
12. Gurcharan Singh. Plant Taxonomy.

Practical

External Marks: 20

Internal Marks: 10

Time Allowed: 2 hrs

Course Outcomes:

CO-1 Students will learn about the Identification of Plants.

CO-2 Students will learn about the herbarium preparation.

List of Practicals:

1. Describe and compare the given flowers a & b in semi technical language giving V.S. of flower, T.S. of ovary & floral diagrams with floral formulae. Identify & assign them to their respective families giving reasons
2. Morphological note on the specimens from Angiosperms
3. Identification of slides from Angiosperms giving reasons.
4. Collection of wild Angiospermic plants and preparation of Herbarium and their identification.
5. Practical File and Viva-voice.

Instructions for External Practical Paper Setter/Examiner:

The examiner will set 2/3 Experiments at the time of practical examination by taking course outcomes (CO) into consideration. Equal weightage will be given to the Experiments. The evaluation will be done on the basis of practical record, viva-voice, write up and experimental results.

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Gardening and Floriculture
B-BOT-502

Total Credits: 4
L – T – P
3 0 2

External Marks: 50
Internal Marks: 20
Time Allowed: 3 hrs

Course Outcomes:

CO-1 Students will be able to describe and differentiate between the types of gardens.
CO-2 Students will learn different methods for propagation of plants.
CO-3 Students will be able to understand general requirements of floriculture.
CO-4 Students will learn about important diseases and insects- pests of floricultural crops.

UNIT-I

Garden and its components, adornments, description and design of garden structures; styles of garden – Formal & Informal; Types of gardens – Persian gardens, Mughal gardens, English gardens, French gardens, Spanish gardens, Japanese gardens. Lawn establishment and maintenance. Popular gardens in India.

UNIT-II

Seed bed preparation and method of plant propagation. Handling and maintenance of garden equipments.

Special types of gardens (indoor and outdoor) and key features of gardens – Temple garden, Healing/Therapeutic garden, water garden, Vertical gardens, Roof gardens, Terrace garden, Rock garden (methods of designing rockery, layout of rockery), Clock garden, moonlight garden, garden for blind persons, bog garden, sunken garden, miniature garden, Table garden, dish/bowl or bottle garden, terrariums, window garden, indoor gardens, Parks and public gardens, etc.

UNIT-III

Classification of flowers, their nursery production, study of different type of herbs and shrubs for hedge purpose. Commercial Flower production– Commercial varieties, water and nutrient management, fertilization, weed management, crop specific practices, ratooning, training and pruning, pinching, deshooting, bending, desuckering, disbudding. Use of growth regulators, physiological disorders and remedies. Flower regulation: Flower forcing and year round/ offseason flower production through physiological interventions, chemical regulation, environmental manipulation.

UNIT-IV

Important diseases and insect pests of floricultural crops of economic importance- Rose, Gladiolus, Gerbera, Carnation, Orchids, Tuberose, Chrysanthemum, Anthurium, China Aster, Crossandra, Jasmine, Marigold. Flower arrangement, Culture and art of making bonsai.

Instructions for External Theory Paper Setter/Examiner:

The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course outcomes (COs) into consideration. The compulsory question (Question No. 1) will contain ten parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question.

Recomended Readings:

1. Arora, J.S. 1998, Kalyani Publishers, Ludhiana- Introductory Ornamental Horticulture –.
2. Littlepage, R., Littlepage, R. (2017). Fundamentals of Garden Design: An Introduction to Landscape Design. (n.p.): CreateSpace Independent Publishing Platform.
3. Bose, T.K. and L.P. Yadav (Eds) 1988. Naya Prokash Calcutta- Commercial Flowers
4. Swarup,V. 1997. Mac Millan, Indian Ltd. Delhi- Ornamental Horticulture
5. Yadav,I.S. and M.L.Choudhary, 1997. The House of Sarpan, Bangalore- Progressive Floriculture
6. Udyan Vigyan – Dr.Shyam Sundar Shrivastava, Central Book House, Raipur. (in Hindi)
7. Floriculture in India – G.S.Randhawa

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8. Floriculture and Landscaping: T.K.Bose , R.G. Maiti, R.S. Dhua & P. Das. Naya Prakash, Calcutta.
9. Shyam Sundar Shrivastava, Central Book House, Sadar Bazar, Raipur- "Udyan Vigyan" (in Hindi).
10. Hartman H.T. & D.E. Kester, Prentice Hall of India, New Delhi- Plant propagation: principles & Practices.

Practical

External Marks: 20

Internal Marks: 10

Time Allowed: 2 hrs

Course outcomes:

CO-1 Students will be able to execute several nursery and gardening operations.

CO-2 Students will be able to assess growth conditions of different horticultural plants.

List of Practicals

1. Preparation of nursery and seed bed of different flowers and plants and after care.
2. Practice in manuring, sowing, transplanting various flowers and plants.
3. Familiarization of horticultural tools and their uses. Handling and maintenance of gardening equipments.
4. Study and practice of different propagation methods viz., cutting, layering, division, grafting and budding.
5. Demonstration of different composting methods for Bio-fertilizers.
6. Preparation of compost mixture and manuring practice in nursery and pots.
7. Practice in trimming, pruning and thinning.
8. Identification of pests and diseases of flower plants and fruit trees.
9. Practice of flower arrangements.
10. Visit to nurseries.

Instructions for External Practical Paper Setter/Examiner:

The examiner will set 2/3 Experiments at the time of practical examination by taking course outcomes (CO) into consideration. Equal weightage will be given to the Experiments. The evaluation will be done on the basis of practical record, viva-voice, write up and experimental result.

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Plant Physiology
B-BOT-601

Total Credits: 4
L – T – P
3 0 2

External Marks: 50
Internal Marks: 20
Time allowed: 3 hrs

Course Outcomes:

CO-1 It imparts an insight in to the various plant processes.
CO-2 Students study about various metabolic processes like water absorption, mineral nutrition, stomatal functioning, transpiration, plant movements and flowering etc.
CO-3 Students study about photosynthesis, growth and development etc.
CO-4 It gives proper knowledge about agriculture and horticulture practices.

UNIT-I

Plant Water Relations: Importance of water to plant life, physical properties of water, diffusion, osmosis, imbibitions and plasmolysis. Absorption and transport of water; Transpiration: Introduction, types, Physiology of stomata, factors affecting transpiration, importance of transpiration.

UNIT-II

Mineral nutrition: Essential macro and microelements and their role; mineral uptake, deficiency and toxicity symptoms.
Transport of organic substances: Mechanism of phloem transport, source-sink relation, factors affecting translocation.

UNIT-III

Photosynthesis: Significance, Historical aspects, photosynthetic pigments, absorption and action spectra, enhancement effect, Concept of two photosystems , Z- Scheme, Photophosphrylation, Calvin cycle, C-4 pathway, CAM plants, Photorespiration.
Plant movements, Concept of photoperiodism, physiology of flowering, florigen concept.

UNIT-IV

Seed: Seed dormancy, Seed germination, Factors regulating seed germination. Fruit ripening. Physiology of senescence.
Respiration: ATP as biological energy currency, aerobic and anaerobic respiration, Kreb's cycle, electron transport mechanism (chemi-osmotic theory), redox potential, oxidative phosphorylation, pentose phosphate pathway.

Instructions for External Theory Paper Setter/Examiner:
The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course outcomes (COs) into consideration. The compulsory question (Question No. 1) will contain ten parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question.

Recommended Readings:

1. Hopkins, W.G. (1999), Introduction to Plant Physiology. John Wiley and Sons, New York.
2. Krishanamoorthy, H.N. (1993) Physiology of Plant Growth and Development, Atma Ram & Sons: Delhi .
3. Kumar, H.D. and Singh, H.N. (1993) . Plant Metabolism (22nd edition), Affiliated East-West Press Pvt. Ltd., New Delhi.
4. Noggle, G.Ray and Fritz, George, J. (1976) Introductory Plant Physiology. Prentice Hall of India Pvt. Ltd., New Delhi.
5. Salisbury, Frank, B. and Ross, Clean, (1974). Plant Physiology Prentice Hall of India Pvt, Ltd., New Delhi.
6. Wilking, M.B. (editer) (1969). Physiology of Plant Growth and Development, Tata McGraw Hill, India.
7. Galston, A.W. 1989. Life Processes in Plants , Scientific American Library, Springer Verlag, New York.

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Practical

External Marks: 20
Internal Marks: 10
Time Allowed: 2 hrs

Course Outcomes:

CO-1 Students will learn the plant processes by performing various physiological experiments.

CO-2 Students will learn about the various types of movements in plants.

List of Practicals:

1. Study of plasmolysis and deplasmolysis. Study of osmotic pressure of cell sap and DPD by plasmolytic method.
2. Demonstration of imbibition by plaster of Paris method, study of osmotic phenomenon by potato osmoscope.
3. To measure stomatal frequency and stomatal index by using epidermal peels of leaf.
4. Comparison of stomatal and cuticular transpiration by four leaf /cobalt chloride method.
5. Demonstration of transpiration by Ganongs potometer/ farmers potometer.
6. Separation of plant pigments by paper chromatography/thin layer chromatography.
7. Effect of kind of light intensity and conc. of CO2 on oxygen evolution during photosynthesis using Wilmot's bubbler.
8. Demonstration of aerobic and anaerobic respiration.
9. Evolution of heat during respiration.
10. Demonstration of phenomena of fermentation.
11. Experiment on plant movements and growth.
12. Practical File and Viva-voice.

Instructions for External Practical Paper Setter/Examiner:

The examiner will set 2 or 3 Experiments at the time of practical examination by taking course outcomes (CO) into consideration. Equal weightage will be given to the Experiments. The evaluation will be done on the basis of practical record, viva-voice, write up and experimental results.

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Economic Botany
B-BOT-602

Total Credits: 4
L – T – P
3 0 2

External Marks: 50
Internal Marks: 20
Time Allowed: 3 hrs

Course Outcomes:

CO-1 Knowledge about economic botany increases understanding that how domestication may have changed a plant species over time.
CO-2 Students will understand about human plant interactions.
CO-3 Students will understand the use of spices and condiments, beverages and medicinal plants.
CO-4 Students will understand about the sustainable use of plants, and also for that will understand about the conservation of plants.

UNIT- I

Food Plants: Rice, Wheat, Maize, Potato, Sugarcane, their origin and distribution, growing regions, Botanical description, uses , Evolution, improved varieties.
Fibers: Cotton & Jute, Origin and Distribution, Botanical description, Cultivation, uses, processing, improved varieties.

UNIT-II

Vegetable oils (Groundnut, mustard and coconut): Origin and distribution, cultivation, Botanical description, uses & pests, improved varieties.
Timber Yielding Plants (Teak, Sal, Shisham, Chir, Bamboo): Distribution, Botanical description, Cultivation, uses, seasoning of wood, Characteristics of wood.

UNIT-III

Spices: General Account of Ginger, Turmeric, Coriander, Clove.
Drugs and Medicinal Plants: General Account of Sarpagandha, Neem, Belladonna, Cannabis and Opium.

UNIT-IV

Beverages: Tea & Coffee, Origin and Distribution, Cultivation, Botanical description, Uses, Preparation techniques.
Rubber: Origin and distribution, Cultivation, Botanical description, Uses, Processing of rubber.

Instructions for External Theory Paper Setter/Examiner:
The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course outcomes (COs) into consideration. The compulsory question (Question No. 1) will contain ten parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question.

Recomended Readings:

1. Kochhar, S.L.1998. Economic Botany in Tropics, 2nd Edition . Macmillan India Ltd New Delhi.
2. Sambamurthy, A.V.S.S. and Subramnyan, N.S. 1989. A Textbook Economic Botany. Wiley Eastern Ltd., New Delhi.
3. Sharma , O.P. 1996. Hill's Economic Botany . Tata McGraw Hill Co. Ltd., New Delhi.
4. Simpson, B.B. and Conner-Oghorzaly, M. 1986. Economic Botany-Plants in Our World. McGraw Hill , New York.
5. Trivedi, P.C. 2006. Medicinal Plants: Ethnobotanical Approach. Agrobios India.
6. Singh, V.P. 2006. An Introduction to Modern Economic Botany. Agrobios India.

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Practical

External Marks: 20
Internal Marks: 10
Time Allowed: 2 hrs

Course Outcomes:

CO-1 Students will have the knowledge of various economically important plants like cereals, fibers, oil yielding as well as spices.

CO-2 Students will have the knowledge of various economically important plants like medicinal, timber and rubber yielding etc.

List of Practicals:

1. Identification and classification of the various food articles, fibers, oils, timber articles, spices, medicinal plants, rubber plant with reference to their morphology, economic importance and plant part used.
2. Identification and classification of the various fibers with reference to their morphology, economic importance and plant part used.
3. Identification and classification of the various oil yielding plants with reference to their morphology, economic importance and plant part used.
4. Identification and classification of the various timber plants with reference to their morphology, economic importance and plant part used.
5. Identification and classification of the various spices with reference to their morphology, economic importance and plant part used.
6. Identification and classification of the various medicinal plants with reference to their morphology, economic importance and plant part used.
7. Identification and classification of the rubber yielding plant with reference to their morphology, economic importance and plant part used.
8. Collection | Project report.
9. Viva- Voice and practical file.

Instructions for External Practical Paper Setter/Examiner:

The examiner will set 2/3 Experiments at the time of practical examination by taking course outcomes (CO) into consideration. Equal weightage will be given to the Experiments. The evaluation will be done on the basis of practical record, viva-voice, write up and experimental results.

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Mushroom Cultivation
B-BOT-603

Total Credits: 4
L – T – P
3 0 2

External Marks: 50
Internal Marks: 20
Time Allowed: 3 hrs

Course Outcomes:

CO-1 Students will learn about the types of mushrooms, including edible and poisonous and their morphology.

CO-2 Students will learn how to cultivate different types of mushrooms, including preparation of spawn, compost and casing material.

CO-3 Students will learn about the diseases and pests that affect mushrooms and how to manage them.

CO-4 Students will learn how to prepare value-added products from mushrooms.

UNIT- I

Introduction to Mushroom, History and Scope of Mushroom Cultivation; Taxonomical rank of Mushroom; Vegetative characters of edible and poisonous mushrooms.
Common edible Mushrooms: Button Mushroom (*Agaricus bisporous*), Oyster mushroom (*Pleurotus sajorcaju*), paddy straw mushroom (*Volvariella volvacea*), Milky Mushroom (*Calocybe indica*); Other economically important and medicinal mushroom- Shiitake Mushroom (*Lentinula edodes*), Kabul Dhingri (King Oyster) Mushroom.

UNIT- II

Structure and construction of mushroom house; Sterilization and sanitation of mushroom house; Spawn production, culture media preparation, Preparation of mother spawn, production of planting spawn, storage/transportation of spawn, Criteria for selection of good quality spawn. Cultivation of Button mushroom, *Volvariella volvacea* (paddy straw mushroom) and *Pluerotus sajorcaju* (oyster mushroom).

UNIT- III

Disease and Pest Management in cultivated mushrooms: Major diseases of cultivated mushroom- Dry Bubble and wet bubble; Major insect pests, Mushroom flies / nematodes / mites.

UNIT- IV

Preservation of mushrooms- freezing, dry freezing, drying, canning, quality assurance and entrepreneurship. Value added products of mushrooms.

Nutritional and health benefits of mushrooms. Therapeutic aspects- anti-tumor effects.

Value added products / recipes, Quality assurance, Packaging. Marketing of mushroom: market demand; market channels; direct marketing and wholesale marketing.

Instructions for External Theory Paper Setter/Examiner:
The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course outcomes (COs) into consideration. The compulsory question (Question No. 1) will contain ten parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question.

Recommended Readings:

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1. Pandey, R.K. and Ghosh, S.K. (1996). A handbook of Mushroom Cultivation. Emkey Publication.

2. Pathak, V.N. and Yadav, N. (1998). Mushroom Production and Processing Technology. Agrobios, Jodhpur.

3. Nita, B. (2000). Handbook of Mushrooms. Vol 1. & 2. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

4. Tewari, P. and Kapoor S.C. (1998). Mushroom Cultivation, Mittal Publication, New Delhi.

5. Marimuthu, T. et al. (1991). Oster Mushroom. Department of Plant Pathology. Tamil Nadu Agricultural University, Coimbatore.

6. Tripathi, D.P. (2005) Mushroom Cultivation, Oxford & IBH Publishing Co. PVT.LTD, New Delhi.

7. V.N. Pathak, Nagendra Yadav and Maneesha Gaur, Mushroom Production and Processing Technology/ Vedams Ebooks Pvt Ltd., New Delhi (2000).

Practical

External Marks: 20

Internal Marks: 10

Time Allowed: 2 hrs

Course Outcomes:

CO-1 Students will learn how to harvest mushrooms and the post-harvesting processes.

CO-2 Students will become self-reliant and employable.

CO-3 Students will be able to develop a business plan for mushroom cultivation.

List of Practicals:

1. Sterilization of glassware, equipment and culture media used in mushroom cultivation.
2. Preparation of culture media: Potato Dextrose medium, Richards medium.
3. Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves.
4. Demonstration of Button and Oyster cultivation.
5. Identification of edible and poisonous wild Mushrooms.
6. Mushroom cultivation and harvesting techniques
7. Disease identification in Mushroom.
8. Hands on training in Mushroom cultivation farm.
9. Field trip to commercial mushroom farms and scientific institutions.

Instructions for External Practical Paper Setter/Examiner:

The examiner will set 2/3 Experiments at the time of practical examination by taking course outcomes (CO) into consideration. Equal weightage will be given to the Experiments. The evaluation will be done on the basis of practical record, viva-voice, write up and experimental results.

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