

P.G.Diploma in  
Plant Tissue Culture

Prospectus No. 20111243

संत गाडगे बाबा अमरावती विद्यापीठ  
**SANT GADGE BABA  
AMRAVATI UNIVERSITY**

विज्ञान विद्याशाखा  
(FACULTY OF SCIENCE)

**PROSPECTUS**  
OF  
**P.G. Diploma (One Year) in  
Plant Tissue Culture**



2010

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## SANT GADGE BABA AMRAVATI UNIVERSITY

### SPECIAL NOTE FOR INFORMATION OF THE STUDENTS

- (1) Notwithstanding anything to the contrary, it is notified for general information and guidance of all concerned that a person, who has passed the qualifying examination and is eligible for admission only to the corresponding next higher examination as an ex-student or an external candidate, shall be examined in accordance with the syllabus of such next higher examination in force at the time of such examination in such subjects papers or combination of papers in which students from University Departments or Colleges are to be examined by the University.
- (2) Be it known to all the students desirous to take examination/s for which this prospectus has been prescribed should, if found necessary for any other information regarding examinations etc., refer the University Ordinance Booklet the various conditions/provisions pertaining to examination as prescribed in the following Ordinances.

Ordinance No. 1	: Enrolment of Students.
Ordinance No. 2	: Admission of Students
Ordinance No. 4	: National cadet corps
Ordinance No. 6	: Examinations in General (relevent extracts)
Ordinance No. 18/2001	: An Ordinance to provide grace marks for passing in a Head of passing and Improvement of Division (Higher Class) and getting Distinction in the subject and condonation of defficiency of marks in a subject in all the faculties prescribed by the Statute NO.18, Ordinance 2001.
Ordinance No. 9	: Conduct of Examinations (relevent extracts)
Ordinance No. 10	: Providing for Exemptions and Compartments
Ordinance No. 19	: Admission of Candidates to Degrees.
Ordinance No. 109	: Recording of a change of name of a University student in the records of the University.

- Ordinance No. 6/2008 : For improvement of Division/Grade.
- Ordinance No.19/2001 : An Ordinance for Central Assessment Programme, Scheme of Evaluation and Moderation of answerbooks and preparation of results of the examinations, conducted by the University, Ordinance 2001.

**Dineshkumar Joshi**  
Registrar  
Sant Gadge Baba  
Amravati University.

### PATTERN OF QUESTION PAPER ON THE UNIT SYSTEM.

The pattern of question paper as per unit system will be broadly based on the following pattern

- (1) Syllabus has been divided into units equal to the number of question to be answered in the paper. On each unit there will be a question either a long answer type or a short answer type.
- (2) Number of question will be in accordance with the unit prescribed in the syllabi for each paper i.e. there will be one question on each unit.
- (3) For every question long answer type or short answer type there will be an alternative choice from the same unit. However, there will be no internal choice in a question.
- (4) Division of marks between long answer and short answer type question will be in the ratio of 40 and 60
- (5) Each short answer type question shall contain 4 to 8 short sub question with no internal choice.

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**Syllabus prescribed for  
P.G. Diploma in Plant Tissue Culture  
Semester-I**

**Paper-I**

**1PTC1 : (Introduction to Basic Biology)**

- Unit-I (Cell Architecture and origin)**  
Discovery of Cell, Structure of Eukaryotic and Prokaryotic cell, Endosymbiotic origin of Eukaryotic cell.
- Unit-II (Cellular Organelles)**  
Ultra-structure and functions of Plasma Membrane, Golgi Complex, Endoplasmic Reticulum, Vacuoles, Lysosomes, Chloroplast, Mitochondria.
- Unit-III (Cell Structures)**  
Ultra-structure and functional aspects of Nuclear Envelope, Cytoskeletal structures, Chromosomal organization.
- Unit-IV (Cell Signaling)**  
Cell-Cell Interaction, G-protein coupled reactions, Secondary Messengers, Growth factors in cell signaling, Na-K Atpase pump.
- Unit-V (Cell Differentiation)**  
Phenomenon of Cell Differentiation, Totipotency, Factors affecting cellular Differentiation, Experimental basis of cell differentiation.

**Paper-II**

**1PTC2 : (Basic Plant Tissue Culture)**

- Unit-I (Introduction to Plant Tissue culture)**  
Introduction to Plant Tissue culture, Terms and definitions, Historical background, Laboratory organization, Tools and techniques, methods of sterilization. Laboratory contaminants- it's control and measures.
- Unit-II (Media and Culture Preparation)**  
Role of Micro and macro nutrients, Vitamins and carbon source in tissue culture, Media preparation- pH, Temperature, Solidifying agents, Slant Preparations etc. Maintenance of cultures, Environmental Conditions, explants characteristics.
- Unit-III (Culture techniques)**  
Explants selection, sterilization and inoculation; Various media preparations; MS, B5, SH PC L-2; Callus and cell suspension culture.
- Unit-IV (Initiation of Cultures)**  
Induction and growth parameters; Culture initiation, Callus

culture., Micropropagation through various explants (Leaf, Stem, Axillary bud, Tuber, Corms and Bulbills).

**Unit-V (In-vitro Fertilization)**

Role of Ovary and ovule in *In-vitro* Fertilization in production of agricultural and horticultural crops. Techniques and significance of Androgensis and Gynogenesis (ovary, ovule, egg, synergids culture).

**Paper-III**

**1PTC3 : (Plant Development, Ezymology and Metabolism)**

- Unit-I (Seed Germination and Dormancy)**  
Seed germination and seedling growth : Metabolism of nucleic acids and proteins and mobilization of food reserves. Dormancy : Importance and types of dormancy, seed dormancy, braking of seed dormancy, Bud dormancy.
- Unit-II (Shoot, Root and Leaf development)**  
Shoot development : Organization of vegetative and reproductive shoot apical meristems (SAM).  
Root development : Organization of root apical meristem, Vascular tissue differentiation, lateral roots, root hairs.  
Leaf growth and differentiation : Determination, phyllotaxy, differentiation of epidermis tissue and mesophyll.
- Unit-III (Enzymology)**  
General classification, mechanism of enzyme action, isozymes, factors affecting enzyme activity, Enzyme kinetics, Michaelis-Menton equation, competitive, uncompetitive and noncompetitive inhibitions.
- Unit-IV (Metabolism)**  
Metabolism of Phenolics (Lignins, Tannins), Flavonoids, Terpenoids (Steroids), Alkaloids, Plant Pigments.
- Unit-V (Macromolecular Metabolism)**  
Nitrogen, Sulphate, Amino acids, Carbohydrate and Fatty acid metabolism.

**Paper-IV**

**1PTC4 : (Instrumentation)**

- Unit-I (General Instruments)**  
Principals and applications of- Autoclave, Laminar Airflow, Hot Air Oven, Spectrophotometer.
- Unit-II (Microscopy)**  
Microscopy: Principals and applications of Simple, compound, Phase contrast, Fluorescence and Electron (SEM and TEM); Micrometry.

- Unit-III (Centrifugation)**  
Centrifugation: Rotors, Bench top, Low Speed, High Speed, Cooling Centrifuge. Principals and Application of Ultracentrifugation.
- Unit-IV (Electrophoresis)**  
Electrophoresis: Native, Denaturing, Isoelectric Focusing, 2-D Electrophoresis, SDS-PAGE electrophoresis.
- Unit-V (Chromatography)**  
Principals and applications of Paper, TLC, Colum, Gel Filtration, Affinity, Ion exchange, HPLC, HPTLC and Gas Chromatography.

### 1PTC5 : Practical I

#### (Basic Biology and Basic Plant Tissue Culture)

##### Laboratory Exercise:

1. Preparation of Squash- *Allium cepa*, *Allium sativa*, *Vicia faba* etc.
2. Preparation of smear- *Allium cepa*, *Allium sativa*, *Vicia faba*, Maize etc.
3. Differential staining of cell organelles.
4. Chromosomal banding techniques- G-banding, C-banding and Q-banding.
5. Isolation of salivary gland chromosome from insects.
6. Principle and applications of Autoclave, Hot air oven, Incubator, Laminar Air Flow, Sepctrophotometer and pH meter.
7. Preparation of microbial nutrient media and its sterilization.
8. Isolation of soil, Air and water microflora on media.
9. Identification of microflora from soil, Air and water.
10. Preparation of different stock solutions.
11. Tissue culture media preparation.
12. Sterilization of equipments.
13. Sterilization of Explants.
14. Aseptic inoculation and incubation.
15. Preparation of callus from various explants.
16. Plant propagation from callus.
17. Micropropagation of ornamental plants.
18. Anther and ovule culture.
19. Production of haploid plant.

### 1PTC6 : Practical-II

#### (Plant Development, Ezymology and Metabolism and Instrumentation)

1. Effect of plant growth regulators on the growth of young seedlings.
2. Study of living shoot apices by dissections using aquatic plant - *Ceratophyllum* or *Hydrilla*.

3. Study of cytohistological zonation in the shoot apical meristem in sectioned (through microtome) and double stained permanent slides of a suitable plant - *Coleus* / *Kalanchoe* / tobacco.
4. Examination of shoot apices in monocotyledon in both T.S. and L.S. to show the origin and arrangement of leaf primordia.
5. Study of alternate and superposed, opposite and superposed, opposite and decussate leaf arrangement through shoot apex.
6. Microscopic examination of vertical sections of leaves such as *Cannabis*, tobacco, *Nerium*, maize and wheat to understand the internal structure of leaf tissue and trichomes, glands etc.
7. Study of epidermal peels of leaves such as *Hibiscus* and *Tradescantia* to study the development and final structure and prepare stomatal index.
8. Examination of L.S. of monocot and dicot roots from prepared or permanent slides to understand the organization of root apical meristem (Use *Allium cepa* and *Helianthus*)
9. Study of seed dormancy and methods to break dormancy.
10. Separation seed of proteins by SDS-PAGE.
11. Separation of chlorophyll pigments by paper chromatography.
12. Separation of amino acids by TLC.
13. Separation of sugars by TLC.
14. Separation of plant secondary metabolites by HPLC.
15. Quantitative estimation of DNA by UV-spectrophotometer.

### Syllabus prescribed for

#### P. G. Diploma in Plant Tissue Culture (Semester-II)

##### Paper-V

#### (Plant Physiology)

- Unit-I (Plant Water Relation)**  
Ascent of sap, Donan's Equilibrium, Stomatal movements, Transpiration-Types and factors affecting transpiration.
- Unit-II (Solute Transport)**  
Diffussion, Osmosis, Membrane meditated transport systems, ATPase-driven active transport (Phloem loading and unloading).
- Unit-III (Photosynthesis)**  
Photosynthetic pigments, absorption and transformation of radiant energy, Light harvesting complexes, Photolysis of water, Emerson effect, Red drop effect, ETS, O<sub>2</sub> and CO<sub>2</sub> evolution, Calvin cycle, Role of RUBISCO, Photorespiration, C4 Pathways.

- Unit-IV (Respiration)**  
Overview of plant respiration, EMP pathway, TCA cycle, Cyanide resistance pathway, Gluconeogenesis, High energy compounds: synthesis and utilization (ATP, NADP,FAD).
- Unit-V (Plant Growth regulators)**  
Plant Growth regulators : Auxin, Cytokinin, Gibberlins, Ethylene, Abscisic acid- Their biosynthesis, translocation, bioassay, mode of action and physiological effects, Hormone receptors, signal Transduction and gene expression.

### Paper-VI

#### 2PTC2 : (Plant Propagation and Transformation)

- Unit-I (Organ Culture)**  
Anther, Pollen, Embryo and Endosperm culture, Hairy Root Culture and their applications. Organogenesis and Somatic embryogenesis- Techniques and Applications.
- Unit-II (Protoplast Culture)**  
Protoplast-Isolation regeneration and Viability test, Somatic hybridization and methods of protoplast fusion- chemical, Viral, electrofusion. Practical application of somatic hybridization and cybridization.
- Unit-III (Crop Improvement)**  
Somaclonal variation, its genetic basis and application in crop improvement. Cell/callus line selection for resistance to herbicide, stress and diseases. Role of tissue culture in rapid clonal propagation, production of pathogen - free plants and “synthetic seeds”
- Unit-IV (Transgenics)**  
Transgenic plants for crop improvement (dicot and Monocot including Maize, Rice, Wheat, Cotton, Brinjal etc. Resistance to herbicide, insecticide, virus and other diseases, Flavour save tomato etc. barnase and barstar). Transgenic plants for molecular farming.
- Unit-V (Plant transformation)**  
Methods of gene transfer in plants. Agrobacterium and CaMV mediated gene transfer; direct gene transfer using PEG, micro injection, electroporation, microprojectile (biolistics) method, liposome mediated DNA delivery ; Transposons as vectors.

### Paper-VII

#### 2PTC3 : (Applied Plant Tissue Culture)

- Unit-I (Micropropagation)**

Micropropagation and its Applications; Types, Stages, Establishment of propagated plants, micropropagation for large scale multiplication of crop plants, forest trees, medicinal plants and ornamentals.

- Unit-II (Germplasm preservation)**  
Germplasm preservation- Definition, Importance and Methods, *In-situ* and *Ex-situ* conservation, Centers of germplasm preservation in India.
- Unit-III (Hardening)**  
Hardening: Hardening stages, Role of Polyhouse, Net House, Compost, Chemical fertilizer, Cocopit, Soil in hardening.
- Unit-IV (Commercial Floriculture)**  
Floriculture – commercial floriculture – Production of cut flowers and home floriculture.  
Disease and pest control in gardening- Fungicides and pesticides.Plant growing problems and their control, cold house storage.
- Unit-V (Commercial Horticulture)**  
Propagation of Horticultural crops by tissue culture techniques such as Banana, Sugarcane, Papaya, Mango and some Medicinal and Aromatic plants.

### Paper-VIII

#### 2PTC4 : (Plant Biotechnology)

- Unit-I (Genome organization)**  
Plant genome - Nuclear, Chloroplast and Mitochondrial - their structure, organization and expression.
- Unit-II (Genomics)**  
Genomic and organelle DNA isolation, methods of gene identification, DNA amplification - vector mediated and vectorless methods - Polymerase chain reaction (PCR). Restriction, digestion and ligation; restriction mapping, genomic and cDNA libraries.
- Unit-III (Genome Analysis)**  
Analysis and expression of cloned genes - DNA sequencing, DNA markers; Restriction fragment length polymorphism (RFLP) ; Random amplified polymorphic DNA (RAPD). Amplified fragment Length polymorphism (AFLP), Ligase chain reaction (LCR).
- Unit-IV (Techniques in Molecular Biology)**  
DNA sequencing methods of Sanger and Maxam and Gilbert, nucleic acid hybridization and Cot curves. Blotting

techniques – Southern, northern and western blotting, DNA finger printing and foot printing.

**Unit-V (Applications of Genetic Engineering)**

Application of gene cloning and transformation techniques in plants- Genetically modified organisms and foods (GMO/ GMF) – Social, Legal and ethical considerations in Indian Scenario.

**Semester-II**

**2PTC5 : Practical III**

**(Plant Physiology, Plant Propagation and Transformation, Applied Plant Tissue Culture and Plant Biotechnology)**

1. Preparation of various Tissue culture media (MS, B5, Gamber's etc.)
2. Effect of Growth Hormones on organogenesis.
  - a) Shoot differentiation.
  - b) Callus differentiation.
  - c) Root differentiation.
3. Single cell culture.
4. Shoot tip, auxillary bud, Meristem culture.
5. Propagation of horticultural.
6. Propagation of Medicinal plants.
7. Propagation of Aromatic plants.
8. Hardening methods and their utility.
9. Agrobacterium mediated gene transfer.
10. Protoplast fusion by PEG.
11. Preparation of artificial seeds.
12. Liposome mediated gene transfer.
13. Effect of Auxins and Gibberellins on seed germination.
14. Studies on enzyme amylase.
15. Effect of temperature and alcohol on permeability of cell membrane.
16. Test for starch, Glucose, Tannins and Alkaloids.
17. Isolation of DNA and RNA from Plants.
18. Estimation of Ascorbic acid from germinating seeds.
19. Estimation of tannin from given sample.
20. Amplification of plant DNA by using random primer.
21. Determination of specific activity of the enzyme.
22. Separation of DNA by agarose gel electrophoresis.

**Distribution of Marks in university Practical Examination**

Time : 8 Hrs.	Max.Marks. : 50
Q.1 Setting and working of one major experiment	10 Marks

Q.2 Perform two minor experiments	10 Marks
Q.3 Comments on spots	10 Marks
Q.4 Practical Record	05 Marks
Q.5 Viva-voce	05 Marks
Q.6 Internal Assessment	10 Marks

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Total : 50 Marks

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**2PTC6 : Practical IV : (Project)**

(1) Project	:	40 Marks
(2) Internal Assessment	:	10 Marks

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Total : 50 Marks

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**Note :-**

- (1) Project to student will be distributed at the beginning of first semester with the consent of H.O.D. and shall be examined during the period of practical examination in second semester.
- (2) One visit to Scientific Laboratories /Institutions / Universities will be made during tenure of course.
  - Internal Assessment marks shall be based performance, class attendance, assignment, class test, project assignments, seminar, industrial visits.

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**Infrastructure and other facilities required:**

**a) Laboratory facilities :**

- a) Culture Room
- b) Working Laboratory
- c) Inoculation Chamber
- d) Washing facilities.
- e) Green House, etc.

**b) Major Equipments :**

1. B.O.D. Incubator
2. Laminar Flow Cabinet
3. Shaking Incubator cum BOD
4. Glass Distillation Apparatus
5. Microprocessor based pH meter
6. Refrigerated Liquid Bath
7. Hot Air Oven
8. Deep Freezer
9. Bacteriological Incubator
10. Tissue Culture Racks
11. Rotary Flask Shaker
12. Autoclave Vertical
13. Serological Water Bath
14. Test Tube Rotator
15. Electronic Digital Balance
16. Tissue Floation Bath
17. Digital pH Meter
18. Magnetic Stirrer
19. Tissue Homogenizer
20. UV-VIS Spectrophotometer
21. Tissue Culture Hood.
22. Autoclave Portable
23. Research Micro centrifuge
24. Water Deioniser
25. Micropipette multi channel
26. Tissue processing Unit
27. Trionocular Microscope
28. Thermal Cyclor
29. Gel-Documentation System.

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**Direction**

No. : 25 / 2010

Date : 24/6/2010

**Subject : Examinations leading to the Post Graduate Diploma in Plant Tissue Culture, Direction, 2010.**

Whereas, the Under Secretary, University Grants Commission, Bahadur Shah Zafar Marg, New Delhi vide its letter No.F.14-7/2009 (Inno/ASIST.), Dt. 16 November, 2009 has granted approval for release in grants-in-aid for starting of Post Graduate Diploma (One-Year) at Deptt. of Botany, Smt.R.Sarda College of Arts & Commerce, Anjangaon Surji under Innovative Programme – Teaching and Research in Interdisciplinary & Emerging Areas.

AND

Whereas, the Ad-hoc Committee appointed by Vice-Chancellor in its meeting held on 9<sup>th</sup> April, 2010 has prepared a draft syllabus, Scheme of Examination, Eligibility Criteria, Draft Ordinance with other details by the faculty of Science in its emergent meeting held on 11.5.2010.

AND

Whereas, the Academic Council in its emergent meeting held on 28.5.2010 has resolved to accept the draft syllabi and draft ordinance for one year P.G. Diploma course in Plant Tissue Culture, vide item No.35 C) R-1.

AND

Whereas the matter for admission of the students at the examinations is required to be regulated by an Ordinance, and making of an Ordinance is time consuming process.

AND

Now, therefore, I, Dr. Kamal Singh, Vice Chancellor of Sant Gadge Baba Amravati University, in exercise of powers conferred upon me under sub-section (8) of section 14 of the Maharashtra Universities Act., 1994, do hereby direct as under:

- 1) This Direction may be called “Examinations leading to the Post Graduate Diploma in Plant Tissue Culture, Direction, 2010”.
- 2) This direction shall come into force from the date of its issuance.
- 3) Following shall be the Examinations leading to the Post - Graduate Diploma in-
  - (i) Post Graduate Diploma in Plant Tissue Culture, Semester-I - Examination
  - (ii) Post Graduate Diploma in Plant Tissue Culture, Semester-II - Examination
- 4) Duration of each of the above semester shall be six months with an examination at the end of each semester.4) Duration of each of the above semester shall be six months with an examinations at the end of each semester.

- 5) (i) The examinations specified in paragraph 3 above shall be held twice a year at such places and on such dates as may be appointed by the Board of Examinations.5). (i) T h e examinations specified in paragraph 3 above shall be held twice a year at such places and on such dates as may be appointed by the Board of Examinations.
  - (ii) Main Examination of Semester-I shall be held in Winter and Supplementary Examination in Summer. (ii) M a i n Examination of Semester-I & Semester-III, shall be held in Winter and Supplementary Examination in Summer.
  - (iii) Main Examination of Semester-II shall be held in Summer and Supplementary Examination in Winter. (iii) M a i n Examination of Semester-II & Semester-IV shall be held in Summer and Supplementary Examination in Winter.
- 6) Subject to his/her compliance with the provisions of this Direction and of other Ordinances in force from time to time, the following candidates shall be eligible for admission to the Post-Graduate Diploma in Plant Tissue Culture [Semester Pattern.....One Year (Full Time) P.G Diploma Course] Examinations namely:-  
Bachelor Degree in any discipline in Life Science subjects or B.Sc. (Agri.)
- 7) Subject to his/her compliance with the provisions of this Direction and of other Ordinances (Pertaining to examination in General) in force from time to time, the applicant for admission to examination at the end of the course of study of a particular Semester shall be eligible to appear at it, if:
  - (i) he/she satisfied the conditions in the table and the provisions thereunder :-

**TABLE**

Sr. No.	Name of examination	The student should have completed the term satisfactorily	The student should have passed following examination
1	2	3	4
1	Diploma in Plant Tissue Culture Semester-I	Semester-I	As indicated in Para 6.
2	Diploma in Plant Tissue Culture Semester-II	Semester-II	_____

(Note- Subjects prescribed and numbered in the scheme of Examinations shall be treated as separate subjects, however,

- the theory and practical, if any, of the subject shall be treated as separate Head of Passing.)
- (ii) He/She has complied with provisions of Ordinance pertaining to Examination in general.
  - (iii) He/She has prosecuted a regular course of study in University Department/College affiliated to the University.
  - (iv) He/She has in the opinion of the Head of the Department/Principal, shown satisfactory progress in his/her studies.
- 8) Papers and the Practicals in 'which an examinee is to be examined, maximum marks for these and the minimum pass mark which an examinee must obtain in order to pass in the subject and the examination are detailed in the Examination Scheme appended herewith as Appendix-A with this Direction.
  - 9) Examination fees for each semester of the examination and also the practical examination shall be as prescribed by the University from time to time.
  - 10) An examinee who is successful at Semester-I, Semester-II examinations under this Direction and who obtained 75% or more marks in aggregate of Semester-I, Semester-II Examinations shall be placed in the First Division with Distinction, those obtaining 60% or more but less than 75% shall be placed in the First Division and all other successful examinees shall be placed in the Second Division.
  - 11) (i) Scope of the subjects shall be as indicated in the syllabus.  
(ii) Medium of instruction and examination shall be English.
  - 12) Provision of Ordinance No.18 of 2001 relating to an Ordinance to provide grace marks for passing in a head of passing and Improvement of Division (Higher Class) and getting distinction in the subject and condonation of deficiency of marks in a subject in all the faculties prescribed by the Statute No.18 and of Ordinance No.10 relating to Providing for Exemptions and Compartments shall apply to the examination under this Direction.
  - 13) An examinee who does not pass or who fails to present himself/herself for the examination shall be eligible for readmission to the same examination on payment of fresh fees and such other fees as may be prescribed.
  - 14) As soon as possible after the examination, the Board of Examinations shall publish a result of the examinees. The result of the examinations shall be classified as above and merit list shall be notified as per Ordinance No. 6
  - 15) Notwithstanding anything to the contrary in this Direction no one shall be admitted to an examination under this Direction, if he/she has already passed the same examination or an equivalent examination of any Statutory University.

- 16) Examinees who have passed in all the subject prescribed for Semester-I, Semester-II of the examination of the Diploma course shall be eligible for award of the Post-Graduate Diploma in Plant Tissue Culture [Semester Pattern.....One Year (Full Time) P.G. Diploma Course].

Amravati

Date : 21/6/2010

Sd/-  
(Dr.Kamal Singh)  
Vice-Chancellor

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