



॥ सा विद्या या विमुक्तये ॥

# स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

'ज्ञानतीर्थ', विष्णुपुरी, नांदेड - ४३१ ६०६ (महाराष्ट्र राज्य) भारत

## SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

'Dnyanteerth', Vishnupuri, Nanded - 431 606 (Maharashtra State) INDIA

स्वामी रामानंद तीर्थ  
मराठवाडा विद्यापीठ, नांदेड

Established on 17th September, 1994, Recognized By the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'B++' grade

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विद्यापीठ अनुदान आयोगाने शैक्षणिक वर्ष २०२०-२१ पासून मान्यता दिलेल्या बी.व्होक कोर्सेसच्या II year चे अभ्यासक्रम शैक्षणिक वर्ष २०२१-२२ पासून लागू करणे बाबत.

### प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, विद्यापीठ अनुदान आयोगाने मान्यता दिलेल्या बी. व्होक. पदवी अभ्यासक्रमास अभ्यासमंडळानी केलेल्या शिफारशीनुसार द्वितीय वर्षाचे अभ्यासक्रम शैक्षणिक वर्ष २०२१-२२ पासून लागू करण्याबाबत मा. कुलगुरू महोदयानी मा. विद्यापरिषदेच्या मान्यतेच्या अधीन राहून मान्यता दिली आहे. त्यानुसार खालील अभ्यासक्रम लागू करण्यात येत आहेत.

1. B. Voc. Horticulture and Post-Harvest Technology. II year
5. B. Voc. Herbal Medicine II year
6. B. Voc. Agriculture/Commercial Aquaculture. II year
7. B. Voc. Food Processing/Food Processing Technology./Food Processing and Technology II year

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या [www.srtmun.ac.in](http://www.srtmun.ac.in) या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी. ही विनंती.

जा.क्र.:शैक्षणिक-१/परिपत्रक/व्होकेशनल अभ्यासक्रम/N-  
२०२१-२२/३६२

दिनांक : १९.०४.२०२२

प्रत माहिती व पुढील कार्यवाहीस्तव :

- १) मा. अधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
- २) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
- ३) प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
- ४) अधीक्षक, परीक्षा विभाग विज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
- ६) सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ. यांना देवून कळविण्यात येते की, सदरील परिपत्रक विद्यापीठ संकेतस्थळावर प्रसिध्द करण्यात यावे.

स्वाक्षरित  
सहा.कुलसचिव  
शैक्षणिक (१-अभ्यासमंडळ) विभाग

**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY,  
NANDED**

(NAAC Re-accredited with 'A' Grade)



**UGC Sanctioned Vocational Course**

**Syllabus for,**

**Certificate, Diploma, Advanced Diploma and B. Voc. Degree in**

**HERBAL MEDICINE**

**(CBCS Pattern)**

**SECOND YEAR  
(Semester III & IV)**

**FACULTY OF SCIENCE AND TECHNOLOGY**

**w.e.f.-2020-2021**

## **Introduction:**

Skills and knowledge are the driving forces of economic growth and social development for any country. Presently, the country faces a demand - supply mismatch, as the economy needs more 'skilled' workforce than that is available. In the higher education sphere, knowledge and skills are required for diverse forms of employment in the sector of education, health care manufacturing and other services. Potentially, the target group for skill development comprises all those in the labour force, including those entering the labour market for the first time, those employed in the organized sector and also those working in the unorganized sector.

Government of India, taking note of the requirement for skill development among students launched National Vocational Education Qualification Framework (NVEQF) which was later on assimilated into National Skills Qualifications Framework (NSQF). Various Sector Skill Councils (SSCs) are developing Qualification Packs (QPs), National Occupational Standards (NOSs) and assessment mechanisms in their respective domains, in alignment with the needs of the industry.

In view of this, the UGC implemented the scheme of Community Colleges from 2013-14 in pilot mode on the initiative of the MHRD. Thereafter, realizing the importance and the necessity for developing skills among students, and creating work ready manpower on large scale, the Commission decided to implement the scheme of Community Colleges as one of its independent schemes from the year 2014-15. The Commission also launched another scheme of B.Voc. Degree programme to expand the scope of vocational education and also to provide vertical mobility to the students admitted into Community Colleges for Diploma programmes to a degree programme in the Universities and Colleges. While these two schemes were being implemented, it was also realized that there is a need to give further push to vocational education on a even larger scale. Accordingly, 'Deen Dayal Upadhyay Centres for Knowledge Acquisition and Upgradation of Skilled Human Abilities and Livelihood (KAUSHAL)' was also incorporated. Since all these three provisions serve a common purpose, all these schemes are merged into a single scheme for providing skill based education under National Qualification Framework.

Swami Ramanand Teerth Marathwada University has several initiatives towards academic excellence, quality improvement and administrative reforms. In view of this priority and in keeping with Vision and Mission, process was already initiated towards introduction of semester system, grading system and credit system. University had implemented Choice Based Credit System (CBCS) pattern at UG level from the academic year 2016-2017 progressively.

Revision and updating of the curriculum is the continuous process to provide an updated education to the students at large. In view of this priority and in-keeping with Vision and Mission, process of revision and updating the curriculum is initiated and implemented at UG level from the academic year 2019-2020 progressively. Presently there is wide diversity in the curriculum of different Indian Universities which inhibited mobility of students in other universities or states. The CBCS provides choice for students to select from the prescribed courses. The choice based credit system provides a 'cafeteria' type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning. Our university has already introduced the choice based credit system. The semester system accelerates the teaching-learning process and enables vertical and horizontal mobility in learning.

### **Type of Courses and Awards:**

There will be full time credit-based modular programmes, wherein banking of credits for skill and general education components shall be permitted so as to enable multiple exit and entry. The multiple entry and exit enables the learner to seek employment after any level of Award and join back as and when feasible to upgrade qualifications / skill competencies either to move higher in the job profile or in the higher educational system. This will also provide the learner an opportunity for vertical mobility to second year of B.Voc. degree programme after one year diploma and to third year of B.Voc degree programme after a two year advanced diploma. The students may further move to Masters and Research degree programmes mapped at NSQF Level 8 – 10.

### **Aims and Objectives:**

The aims and objectives of the scheme of Vocational programme under NSQF are;

- (i) To provide judicious mix of skills relating to a profession and appropriate content of general education.
- (ii) To ensure that the students have adequate knowledge and skills, so that they are work ready at each exit point of the programme.
- (iii) To provide flexibility to students by means of pre-defined entry and multiple exit points.

- (iv) To integrate NSQF within the undergraduate level of higher education in order to enhance employability of the graduates and meet industry requirements.
- (v) Such diploma graduates apart from meeting the needs of local and national industry are also expected to be equipped to become part of the global workforce.
- (vi) To provide vertical mobility to students coming out of 10+2 with vocational subjects and Community Colleges.

## **OBJECTIVES OF THE COURSE**

1. To provide an updated education to the students at large in order to know the importance and scope of the discipline and to provide mobility to students from one university or state to other.
2. To update curriculum by introducing recent advances in the subject and enable the students for current opportunities.
3. To provide knowledge of Herbal medicine as the basic objective of Education
4. To develop a scientific attitude to make students open minded, critical and curious
5. To develop an ability to work on their own and to make them fit for the society
6. To expose the students to contribute in different pharmaceutical industries and research institutes.
7. To develop skill in practical work, experiments, equipments and laboratory use along with collection and interpretation of herbal products and their utilization.
8. To make aware of natural resources and herbal remedies and its importance.
9. To develop ability for the application of the acquired knowledge in the fields of life so as to make our country self-reliant and self-sufficient.

## **OUTCOME OF THE COURSE**

1. This program will help to the students about the importance and need of Herbal medicine.
2. This program will help the students for their career development.
3. This program shall train and orient the students for Herbal medicine skills and serve as human resource for the industries, pharmaceutical sector and other organizations.
4. The programme also has a strong interdisciplinary component. Emphasis is given on the experimental learning through hands-on laboratory exercises, field trips and assignments.
5. This skill oriented course will provide job opportunities.

**Table: Indicating Eligibility, Duration, Total Credits.**

<b>Exit Points /Awards</b>	<b>Eligibility</b>	<b>Normal Duration</b>	<b>Skill Component Credits</b>	<b>General Education Credits</b>	<b>Total Credits for Award</b>	<b>NSQF Level</b>	<b>Medium of instruction</b>
B. Voc. Degree	<b>12<sup>th</sup> pass or Diploma in relevant field after 10<sup>th</sup></b>	Six semester	108	72	180	7	English
Advanced Diploma		Four semester	72	48	120	6	
Diploma		Two semester	36	24	60	5	
Certificate		One semester	18	12	30	4	

**Swami Ramanand Teerth Marathwada University, Nanded**  
**Syllabus structure for**  
**B.Voc. Degree in Herbal Medicine (Second Year)**

	Course Number	Course Title	Hr/Week	Type of Course	Credits	Marks		Total
						ESA	CIA	
<b>Sem. III</b>	<b>General Education Component</b>							
	BAAGE -119	ICT-Skill	4	GE	4	75	25	100
	BAAGE -120	Entrepreneurship Development	4	GE	4	75	25	100
	BAAGE -121	Activity based on BAAGE -119 & 120 *	1	GE	1	-	25	25
	<b>Skill Courses</b>							
	HMED -122	Fundamental of Pharmacognosy	4	CC	4	75	25	100
	HMED -123	Plant metabolism and development	4	CC	4	75	25	100
	HMED -124	Diversity of Cryptogams	4	CC	4	75	25	100
	<b>Practical Skill Courses</b>							
	HMED -125	Practical based on HMED-122	3	PR	3	50	25	75
	HMED -126	Practical based on HMED-123	3	PR	3	50	25	75
	HMED -127	Practical based on HMED-124	3	PR	3	50	25	75
<b>Sem. IV</b>	Course Number	Course Title	Hr/Week	Type of Course	Credits	Marks		Total
	<b>General Education Component</b>							
	BAAGE -128	Extension studies	4	GE	4	75	25	100
	BAAGE -129	Agriculture Business Management	4	GE	4	75	25	100
	BAAGE -130	Field Visit*	1	GE	1	-	25	25
	<b>Skill Courses</b>							
	HMED -131	Natural plant Product	4	CC	4	75	25	100
	HMED -132	Medicinal plant Biotechnology	4	CC	4	75	25	100
	HMED -133	Fermentation technology	4	CC	4	75	25	100
	<b>Practical Skill Courses</b>							
	HMED -134	Practical based on HMED-131	3	PR	3	50	25	75
	HMED -135	Practical based on HMED-132	3	PR	3	50	25	75
HMED -136	Practical based on HMED-133	3	PR	3	50	25	75	

\*Indicate that the activity should be related to general education components of that particular semester. The institute level coordinator shall decide about the execution.



**ESA:** End Semester Assessment,

**CIA:** Continues Internal Assessment,

**GE:** General Education Component,

**CC:** Core Skill Courses,

**PR:** Practical Skill Courses,

**CIA of 25 Marks (Theory):** 15 Marks for college level internal test & 10 Marks for Assignment,

**CIA of 25 Marks (Practical):** 15 Marks for college level internal practical test & 10 Marks for Record Book and Field Note Book submission

## **B.VOC. DEGREE PROGRAMME IN HERBAL MEDICINE**

### **B.VOC. SECOND YEAR**

#### **HERBAL MEDICINE**

#### **SEMESTER-III**

#### **BAAGE -119: ICT-Skill**

**Periods: 45**

**Credits: 04**

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#### **Learning Objectives:**

1. To study the different IT tools, computer fundamentals and language.
2. To gain the knowledge of programming- algorithms and different Operating Systems.
3. To study the Audio-visual aids and databases.

#### **Learning Outcomes:**

1. Students will be able to understand the basic of computer hardware and software.
2. Students will be able to understand programming- algorithms and types of operating Systems.
3. This course will be able to students for how to use Audio visual aids for communication processes.
4. Students will be able to understand concept of database and their types.

**Unit I:** IT and its importance. IT tools, IT-enabled services and their impact on society; computer fundamentals; hardware and software; input and output devices; Types of Memory, Units used for measurement of memory. Features of machine language, assembly language, high-level language and their advantages and disadvantages;

**Unit II:** Principles of programming- algorithms and flowcharts; ER diagram. Operating Systems, definition and types; introduction to WINDOWS and LINUX Operating Systems;

**Unit III:** Audio visual aids - definition, advantages, classification and choice of A.V aids; cone of experience and criteria for selection and evaluation of A.V aids; video conferencing. Communication process, feedback and barriers to communication.

**Unit IV:** Database, concepts and types, uses of DBMS/RDBMS in Agriculture Database design. Smartphone Apps in Agriculture for farm advises, market price, postharvest management etc; Geospatial technology for generating valuable agri information Decision support systems, concepts, components and applications in Agriculture, Agriculture Expert

System, Soil Information Systems etc. for supporting Farm decisions Communication process, feedback and barriers to communication.

**Reference books:**

1. Gurvinder Singh, Rachhpal Singh & Saluja KK. 2003. Fundamentals of Computer Programming and Information Technology. Kalyani Publishers.
  2. Harshawardhan P. Bal. 2003. Perl Programming for Bioinformatics. Tata McGraw-Hill Education.
  3. Kumar A 2015. Computer Basics with Office Automation. IK International Publishing House Pvt Ltd.
  4. Rajaraman V & Adabala N. 2015. Fundamentals of Computers. PHI.
  5. *e-reading*: <http://ecourses.iasri.res.in/>
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## **B.VOC. DEGREE PROGRAMME IN HERBAL MEDICINE**

### **B.VOC. SECOND YEAR**

#### **HERBAL MEDICINE**

#### **SEMESTER-III**

#### **BAAGE -120: Entrepreneurship Development**

**Periods: 45**

**Credits: 04**

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#### **Learning Objectives:**

1. To study the concept of entrepreneurship and role of entrepreneurship.
2. To study the forms of ventures & social responsibility and business ethics.

#### **Learning Outcomes:**

1. Students will be able to understand the role and concept of entrepreneurship.
2. This course will be able to students for preparation of projects and use for Government schemes and incentives for promotion of entrepreneurship.

#### **Unit-I: Concept of entrepreneurship:**

Entrepreneurship, functions of entrepreneur. Entrepreneurial characteristics, Distinction between an entrepreneur and a manager, Agri-entrepreneurship- concept, need and scope. Assessing overall business environment in Indian economy. globalization, and implications of social, political and economic systems on entrepreneurship. Entrepreneurship development programmes (EDPs) - objectives, phases, problems of EDPs, Criteria for assessment or evaluation of EDPs.

#### **Unit-II: Role of entrepreneurship:**

Generation, incubation and commercialization of business ideas. Role of entrepreneurship in economic development, Motivation and entrepreneurship development, Managing an enterprise. Importance of planning, budgeting, monitoring, evaluation and follow up in running an enterprise. Researching / managing competition- ways to define possible competitors, competitive information, SWOT analysis-concept, meaning and advantages

#### **Unit-III: Forms of Ventures:**

Venture capital- concept, aims, features, financing steps sources, criteria to provide venture capital finance, Export & Import policies relevant to agriculture sector. Forms of business- contract farming, joint venture and public private partnership. An overview of agricultural input industry in India; fertilizer, pesticide, seed and farm machinery industry. Over view of Indian agricultural processing industry.

#### **Unit-IV: Social responsibility and business ethics:**

Project- meaning, importance, components & preparation. Government schemes and incentives for promotion of entrepreneurship and government policy on small and medium enterprises. Supply chain management- meaning, advantages, stages, process, drivers and scope of agri-supply chain management, Women entrepreneurship-concept, problems and development of women entrepreneurs.

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**B.VOC. DEGREE PROGRAMME IN HERBAL MEDICINE**

**B.VOC. SECOND YEAR**

**HERBAL MEDICINE**

**SEMESTER-III**

**HMED -122: FUNDAMENTAL OF PHARMACOGNOSY**

**Periods: 45**

**Credits: 04**

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**Learning Objectives:**

1. To study the different sources of drugs and Classification of drugs
2. To gain the knowledge of types of soils, cultivation, processing and storage of plant drugs.
3. To study the quality control of crude drugs
4. To study systematic Pharmacogenetic study of carbohydrates & lipids derived products

**Learning Outcomes:**

1. Students will be able to understand the sources of drugs and their classification.
2. Students will be able to understand cultivation, processing of plant drugs.
3. This course will be able to demonstrate actual the quality control of crude drugs.
4. Students will be able to understand Pharmacogenetic study of carbohydrates & Lipids derived products

**UNIT-I: INTRODUCTION OF PHARMACOGNOSY (12 Periods)**

Definition, history, scope and development of Pharmacognosy, Sources of drugs: Biological, marine, mineral and plant tissue culture as sources of drugs, Classification of natural drugs: Chemical, Therapeutical and Chemo-taxonomical classification of drugs.

**UNIT-II: CULTIVATION OF DRUG PLANTS (11 Periods)**

Cultivation, collection, processing and storage of plant drugs: Factors influencing, cultivation of medicinal plants. Types of soils and fertilizers of common use, Pest management and natural pest control agents.

**UNIT-III: QUALITY CONTROL OF CRUDE DRUGS (11 Periods)**

General methods, Adulteration of crude drugs, and their detection by microscopic, physical, chemical and biological, methods of evaluation, General introduction to secondary metabolites of plant origin with their properties.

**UNIT-IV: PHARMACOGNOSTIC STUDY OF PLANT BIOMOLECULES**

**(11 Periods)**

Systematic Pharmacogenetic study of the following: (a) Carbohydrates and derived products: Agar, Guar gum, Acacia, Honey, Isabgol, Pectin, Starch and Tragacanth. (b) Lipids: Bees wax, Castor oil, Cocoa butter, Cod-liver oil, Hydnocarpus oil, Kokum, Linseed oil.

**Reference Books:**

1. Pharmacognosy - G. E. Trease and W.C. Evans. Saunders Edinburgh, New York.
2. Pharmacognosy-Tyler, Brady, Robbers.
3. Modern Methods of Plant Analysis- Peach & M.V. Tracey, Vol. I & II.
4. Textbook of Pharmacognosy by T.E. Wallis.
5. Textbook of Pharmacognosy, C. K. Kokate, Purohit, Ghokhale, Nirali Prakasshan.
6. C.S. Shah and J.S. Quadry. A Text book of Pharmacognosy 13th edition. Published by B.S. Shah Prakashan, Ahmedbad, 2008.

**B.VOC. DEGREE PROGRAMME IN HERBAL MEDICINE**

**B.VOC. SECOND YEAR**

**HERBAL MEDICINE**

**SEMESTER-III**

**HMED -123: PLANT METABOLISM AND DEVELOPMENT**

**Periods: 45**

**Credits: 04**

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**Learning Objectives:**

1. To study of different pathways in Photosynthesis, respiration
2. To gain the knowledge of basic aspects of nature of enzyme and nitrogen metabolism

**Learning Outcomes:**

1. Students will be able to understand the various metabolic processes such as photosynthesis, respiration, concept of enzyme, Nitrogen metabolism etc. which are important for life.

**UNIT-I: PHOTOSYNTHESIS**

**(12 periods)**

Photosynthesis: Introduction, significance, ultra structure of chloroplast, photosynthetic pigments, concepts of two Photo systems, Mechanism of photosynthesis, Light reaction, Hill reaction, Cyclic and Non cyclic photophosphorylation, Dark phase, Calvin cycle (C3) and Hatch and Slack (C4) pathway, CAM pathway.

**UNIT-II: RESPIRATION**

**(11 periods)**

Respiration: Introduction, significance, ultra structure of mitochondria, structure and functions of ATP, Types of respiration: Aerobic respiration- Glycolysis, Krebs's cycle, Electron Transport System. Anaerobic respiration- Fermentation (alcoholic and lactic acid).

**UNIT-III: ENZYMES AND NITROGEN METABOLISM**

**(11 periods)**

Enzymes: Introduction, nomenclature and classification (IUB), mechanism of enzyme action (lock and key model, induced fit model), Concept of holoenzyme, mechanism of regulation of enzyme activity-Feedback and allosteric regulation.

**UNIT-IV: NITROGEN METABOLISM**

**(11 Periods)**

Nitrogen metabolism: Introduction, sources and forms of nitrogen, types of nitrogen fixation- physical and biological (symbiotic and asymbiotic), Ammonification, nitrification and denitrification.

**Reference Books:**

1. Biondi, F. Tree-ring Analysis of Environmental Change: Principles and Applications of Biotechnology. Published by S.Chand and Company Pvt. Ltd., 7361 Ram Nagar.



2. Bray, C. M. Nitrogen metabolism in Plants. Longman, 1983.
3. Beevers, L. Nitrogen metabolism in Plants. William and Sons Ltd., London, 1976.
4. Berg, J.M., Tymoczko, J.L., Stryer, L. (2011). Biochemistry. New York, NY: W. H. Freeman and Company.
5. Bhatla, S.C., Lal, M.A. (2018). Plant Physiology, Development and Metabolism. Singapore: Springer Nature, Singapore Pvt. Ltd.
6. Campbell, P.N., Smith, A.D. (2011). Biochemistry Illustrated, 4th edition. London, Co., California, USA.

**B.VOC. DEGREE PROGRAMME IN HERBAL MEDICINE**

**B.VOC. SECOND YEAR**

**HERBAL MEDICINE**

**SEMESTER-III**

**HMED -124: DIVERSITY OF CRYPTOGRAMS**

**Periods: 45**

**Credits: 04**

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**Learning Objectives:**

1. To study and impart knowledge about the occurrence, distribution, structure and life history of algae, Bryophytes and Pteridophytes.

**Learning Outcomes:**

1. Differentiate between various groups of Algae, Bryophytes and Pteridophytes.
2. Learn the life cycles of individuals belonging to Algae, Bryophytes and Pteridophytes

**UNIT-I: ALGAE-I**

**(12 periods)**

General characters of algae, classification of algae (as per F.E. Fritsch, 1935), systematic position, occurrence, thallus structure, reproduction and graphic life cycle with alternation of generation of *Oedogonium* and *chara*.

**UNIT-II: ALGAE-II**

**(11 periods)**

Systematic position, occurrence, thallus structure, reproduction and graphic life cycle with alternation of generation of *Ectocarpus* and *Batrachospermum*. Economic importance of algae.

**UNIT-III: BRYOPHYTA**

**(11 periods)**

General characters of Bryophytes, classification of bryophytes ( as per N. S. Parihar), systematic position, occurrence, thallus structure (external and internal), reproduction and graphic life cycle with alternation of generation of *Riccia* and *Funaria*. Economic importance of Bryophytes.

**UNIT-IV: PTERODOPHYTA**

**(11 periods)**

General characters of Pteridophytes, classification of Pteridophyte (as per N. S. Parihar), systematic position, occurrence, Structure of sporophyte (external and internal), reproduction and graphic life cycle with alternation of generation of *Equisetum* and *Marsilea*. Economic importance of Pteridophytes.

**Reference Books:**

1. Vashishta, B. R. Sinha A.K. and Singh V. P. (2014). Botany for Degree Students – Algae. S. Chand and Co.Ltd., New Delhi.

2. Vashishta, B. R. *et al.* (2014). Botany for Degree Students – Bryophytes. S. Chand and Co.Ltd., New Delhi.
3. James Graham – Lee W. Wilcox - Linda E. Graham (2008). Algae (2nd edition)
4. Kumar, H. D. (1989). Introductory Phycology. East-West Press, Madras.
5. Round, F. E. (1981). The Ecology of Algae. Cambridge University Press, London.
6. Sharma. O.P. (1990): Textbook of Pteridophyta, MacMillan India Ltd., NewDelhi.
7. Sundara Rajan. S (1994) Introduction to Pteridophyta. New Age International Publishers Ltd., Wiley Eastern Ltd., New Delhi.
8. Rashid A (1999) An Introduction to Pteridophyta. Vikas Publishing Co., New Delhi.

**B.VOC. DEGREE PROGRAMME IN HERBAL MEDICINE**

**B.VOC. SECOND YEAR**

**HERBAL MEDICINE**

**SEMESTER-IV**

**HMED -131: NATURAL PLANT PRODUCT**

**Periods: 45**

**Credits: 04**

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**Learning Objectives:**

1. To study the different sources of resins and tannins
2. To gain the knowledge of volatile oils.
3. To study the various methods of isolation and preliminary phytochemical screening methods.
4. To study sources, preparation, identification tests and uses of enzymes.

**Learning Outcomes:**

1. Students will be able to understand the sources of resins and tannins.
2. Students will be able to understand methods of extraction of volatile oils from plants.
3. This course will be able to demonstrate actual the microchemical test of drugs.
4. Students will be able to understand the actual biosynthetic and metabolic pathways of enzymes.

**UNIT-I: RESINS AND TANNINS**

**(11 periods)**

Resins: Study of Drugs Containing Resins and Resin Combination like colophony, Podophyllum, jalap, cannabis, capsicum, myrrh, asafoetida, balsam of tolu, balsam of Peru, benzoin, turmeric, ginger; Tannins: Study of tannins and tannin containing drugs like gambir, black catechu, gall and myrobalan.

**UNIT-II: VOLATILE OILS**

**(11 periods)**

General methods of extraction of volatile oils from plants, Study of biological source, chemical constituents, chemical tests and uses of volatile oils of Mentha, Lemon peel, Orange peel, Lemon grass, Citronella, Caraway, Dill, Nutmeg, Chenopodium, Palmarosa, Gaultheria Detailed Pharmacognosy of Clove, Coriander, Fennel, Sandal wood, Cardamom, Cinnamon and Eucalyptus.

**UNIT-III: DRUG GROUPS**

**(12 periods)**

General methods of isolation and preliminary phytochemical screening of glycosides. Study of biological source, cultivation, collection, chemical constituents, adulterants, uses, microscopic features and chemical tests of following drug groups

Drug containing Saponin: Liquorices, ginseng, Dioscorea, Sarsaparilla.

Drug containing Cardio active sterols: Digitalis, squill and strophanthus,

Drug containing Anthraquinone cathartics: Aloes, senna, rhubarb and cascara,

#### **UNIT-IV: ENZYMES**

**(11 periods)**

Biological sources, preparation, identification tests and uses of the following Enzymes: Diastase, papain, pepsin, trypsin. General techniques of biosynthetic studies and basic metabolic pathways. Biogenesis of aromatic amino acids, steroidal glycosides, tropane, alkaloids and indole alkaloids.

#### **Reference Books:**

1. Medicinal plants of India, 1st edn, by S.N.Yoganarasimhan, Interline publication Pvt.Ltd., 2000.
2. Medicinal natural products (a biosynthetic approach), 1st edn, by Paul M.Dewick, John Wiley and sons Ltd., England 1998.
3. Natural Products from plants, 1st edn, by Peter B. Kaufman, CRC press, Newyork, 1998.
4. Glimpses of Indian Ethanopharmacology by P. Pushpangadam, UIF Nyman, V.George, Tropical botanic Garden and research institute., 1995.
5. Natural Products:A lab guide by Raphael Ikan, 1st edn, academic press, 1991.
6. Modern methods of Plant analysis by Peach and M.V.Tracey, Volume I and II.

**B.VOC. DEGREE PROGRAMME IN HERBAL MEDICINE**

**B.VOC. SECOND YEAR**

**HERBAL MEDICINE**

**SEMESTER-IV**

**HMED -132: MEDICINAL PLANT BIOTECHNOLOGY**

**Periods: 45**

**Credits: 04**

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**Learning Objectives:**

1. To study the basic of Genetics and Molecular biology.
2. To study the Gene transfer in plants, crop quality improving methods, basic plant tissue culture methods and secondary metabolite and its medicinal properties.

**Learning Outcomes:**

1. Students will be able to understand the basic of Genetics and Molecular biology.
2. Students will be able to understand methods of Gene transfer in plants and basic plant tissue culture methods and production of secondary metabolites with its medicinal uses.

**UNIT-I: INTRODUCTION TO MOLECULAR BIOLOGY (11 periods)**

Introduction to Genetics and Molecular Biology: structural, molecular and chromosomal organization of cell, cytogenetics, cell cycle, mitosis and meiosis, genetic code and gene mutation, genetic engineering.

**UNIT-II: GENE TRANSFER (12 periods)**

Gene transfer in plants: Using vectors of Agro bacterium, Ti, Ri, Co-integrative and intermediate plasmid, DNA mediated gene transfer techniques of electroporation, liposome, ultra sonication and localization of transferred gene in genetically modified plants.

**UNIT- III: CROP QUALITY IMPROVEMENT (11 periods)**

Crop quality improving methods: Chemo-demes, Hybridization, Mutation & Polyploidy  
Applications of transgenic plants: Resistance to physiological stress, insects, fungi, viruses and herbicides, Production of Phyto-pharmaceuticals.

**UNIT- IV: TISSUE CULTURE (11 periods)**

Tissue culture: Laboratory organization, Media, Aseptic Manipulation. Culture methods: Organogenesis, Embryogenesis, Micro propagation, Haploid culture and Synthetic seeds; Strategies for Production of secondary metabolites. Production of important secondary

metabolites and medicinal importance (Shikonin, Artemicin, Cinnamic acids, Flavonoids and Anthraquinones).

**Reference Books:**

1. Introduction to plant tissue culture by M.K. Razdan
2. Molecular biology & Biotechnology by J.M. Walker & E.D. Gingo
3. Advanced methods in plant breeding & biotechnology by David R Mirray
4. Experiments in plant tissue culture by John, H.D. & Lorin W.R.
5. Plant cell & tissue culture by Jefferey. W. Pollard & John. M. Walker
6. Breeding field crops by John M.P. & David. A.S.
7. Pharmaceuticals Biotechnology S.P. Vyas & V.K. Dixit
8. Biotechnology theory & technique vol. I by Jack. G. C.

**B.VOC. DEGREE PROGRAMME IN HERBAL MEDICINE**

**B.VOC. SECOND YEAR**

**HERBAL MEDICINE**

**SEMESTER-IV**

**HMED -133: FERMENTATION TECHNOLOGY**

**Periods: 45**

**Credits: 04**

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**Learning Objectives:**

1. To study the properties and kinetics of enzymes.
2. To study the microbial growth, basic structure of reactor and different separation techniques

**Learning Outcomes:**

1. Students will be able to understand the enzymes and used in industries.
2. Students will be able to understand microbial growth in reactor and biomass isolation, purifications techniques.

**UNIT-I: PRINCIPLES OF ENZYME CATALYSIS**

**(11 periods)**

Proteins as enzymes; Michaelis - Menten kinetics; Inhibition; Effect of pH and temperature; Enzymology; methods of Immobilized enzymes; Industrial enzymes and uses.

**UNIT-II: MICROBIAL GROWTH**

**(11 periods)**

Introduction to metabolism; Nutrient transport; Glycolysis; TCA cycle and other pathways; Factors affecting microbial growth; Growth kinetics; Measurement of growth.

**UNIT-III: BIOREACTORS**

**(11 periods)**

Introduction to bioreactors; Batch and Fed-batch bioreactors, Continuous bioreactors; Immobilized cells; Bioreactor operation; Sterilization; Aeration; Sensors; Instrumentation; Culture-specific design aspects of reactors.

**UNIT-IV: BIO SEPARATIONS**

**(12 periods)**

Biomass removal; Biomass disruption; Membrane-based techniques; Extraction; Adsorption and Chromatography Adsorption and chromatography: size, charge, shape, hydrophobic interactions, Biological affinity; Process configurations. Description of industrial processes; Process flow sheeting; Sedimentation; Flocculation; Microfiltration; Sonication; Bead mills; Homogenizers; Chemical lysis; Enzymatic lysis Membrane based purification: Ultrafiltration etc.

**Reference Books:**

1. Stanbury P.F., Whittaker A., Hall S.J., Principles of Fermentation Technology 2nd Edition.



2. Operational Modes of Bioreactors, (1992) BIOTOL series, Butterworths Heinemann.
3. Pepler H. J. and D. Perlman (1970) Microbial Technology Volume 1 and 2, Academic Press New York
4. Wiseman A. (1985) Topics in Enzyme and Fermentation - Biotechnology, Vol. 1 and 2, John Wiley and Sons, New York.
5. Industrial Microbiology by A. H. Patel
6. Industrial Microbiology by L. E. Casida.
7. Prescott and Dunns Industrial microbiology by Gerald Reed.

**B.VOC. DEGREE PROGRAMME IN HERBAL MEDICINE**

**B.VOC. SECOND YEAR**

**HERBAL MEDICINE**

**SEMESTER-III**

**HMED-125: PRACTICAL BASED ON HMED-122**

**(FUNDAMENTAL OF PHARMACOGNOSY)**

**Periods: 75**

**Credits: 03**

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1. Identification of crude drugs containing Carbohydrate by morphological characters.
2. Identification of crude drugs containing Lipids by morphological characters.
3. Identification of crude drugs containing Glycosides by morphological characters.
4. Identification of crude drugs containing Volatile Oils by morphological characters.
5. Identification of crude drugs containing Alkaloids by morphological characters.
6. Microscopic studies of Senna leaf, Rauwolfia root, Cinamon bark, Datura flower and stem.
7. Measurement of length and width of different constituents (starch grains, oxalate crystals, phloem fibers) in powdered crude drugs.
8. Determination of ash value of different powdered crude drugs.
9. Determination of Antibacterial activities of different powdered crude drugs.
10. Determination of Antifungal activities of different powdered crude drugs.

**B.VOC. DEGREE PROGRAMME IN HERBAL MEDICINE**

**B.VOC. SECOND YEAR**

**HERBAL MEDICINE**

**SEMESTER-III**

**HMED-126: PRACTICAL BASED ON HMED-123**

**(PLANT METABOLISM AND DEVELOPMENT)**

**Periods: 75**

**Credits: 03**

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1. Determination of osmotic potential of plant cell sap by plasmolytic method.
2. Study of the effect of various environmental factors on transpiration in an excised twig/leaf.
3. Calculation of the stomatal index, stomatal frequency and percentage of leaf area open through stomata in a mesophyte and a xerophyte.
4. Study of the mechanism of stomatal opening and closing
5. Study of seed dormancy and methods to break seed dormancy.
6. Detection of the presence of plant enzymes amylase, catalase, nitrate reductase, urease in various sources.
7. To study the effect of different substrate concentration on the activity of catalase enzyme.
8. To study the effect of different temperature on the activity of catalase enzyme.
9. To study the effect of pH on the activity of catalase enzyme.
10. To study the effect of inhibitor on the activity of catalase enzyme.
11. Demonstration of dye reduction by isolated chloroplasts.
12. Study the effect of different factors on oxygen evolution during photosynthesis.
13. Chemical separation of chloroplast pigments and determination of their absorption spectra.

**B.VOC. DEGREE PROGRAMME IN HERBAL MEDICINE**

**B.VOC. SECOND YEAR**

**HERBAL MEDICINE**

**SEMESTER-III**

**HMED-127: PRACTICAL BASED ON HMED-124**

**(DIVERSITY OF CRYPTOGAMS)**

**Periods: 75**

**Credits: 03**

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1. Study of Algae-Systematic position and external features of *Oedogonium*.
2. Study of Algae-Systematic position and external features of *Chara*
3. Study of Algae-Systematic position and external features of *Ectocarpus*
4. Study of Algae-Systematic position and external features of *Batrachospermum*
5. Study of Bryophytes- Systematic position, external and internal features of *Riccia*
6. Study of Bryophytes- Systematic position, external and internal features of *Funaria*
7. Study of Pteridophytes- Systematic position, external features of adult sporophyte *Equisetum*.
8. T.S. of stem of *Equisetum*.
9. systematic position, external features of adult sporophyte of *Marsilea*
10. T.S. of stem and petiole of *Marsilea*

**B.VOC. DEGREE PROGRAMME IN HERBAL MEDICINE**

**B.VOC. SECOND YEAR**

**HERBAL MEDICINE**

**SEMESTER-IV**

**HMED-134: PRACTICAL BASED ON HMED-131**

**(NATURAL PLANT PRODUCT)**

**Periods: 75**

**Credits: 03**

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1. Identification of Resin containing crude drugs.
2. Study of pharmaceutical aids.
3. Micro chemical tests of Tannin containing crude drugs
4. Identification tests of Enzymes
5. Specific identification tests for protein crude drugs
6. Phytochemical screening of glycosides
7. Identification of drug containing Saponin
8. Identification of drug containing Cardio active sterols
9. Identification of drug containing Drug containing Anthraquinone
10. Extraction of volatile oils from plants

**B.VOC. DEGREE PROGRAMME IN HERBAL MEDICINE**

**B.VOC. SECOND YEAR**

**HERBAL MEDICINE**

**SEMESTER-IV**

**HMED-135: PRACTICAL BASED ON HMED-132**

**(MEDICINAL PLANT BIOTECHNOLOGY)**

**Periods: 75**

**Credits: 03**

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1. Study of design and organization of plant tissue culture laboratory
2. Preparation of Plant Tissue Culture media
3. Establishment of callus culture
4. Micro propagation of endangered medicinal plant
5. Immobilization techniques
6. Establishment of callus culture for isolation of various secondary metabolites
7. Establishment of suspension culture
8. Isolation of Protoplast and fusion
9. Anther Culture
10. Quantitative estimation of DNA
11. Gene transfer by rDNA technology

**B.VOC. DEGREE PROGRAMME IN HERBAL MEDICINE**

**B.VOC. SECOND YEAR**

**HERBAL MEDICINE**

**SEMESTER-IV**

**HMED-136: PRACTICAL BASED ON HMED-133**

**(FERMENTATION TECHNOLOGY)**

**Periods: 75**

**Credits: 03**

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1. Study of design of a batch type of fermenter.
2. Study of design of a continuous type of fermenter.
3. Calculation of Mathematical derivation of growth kinetics.
4. Ethanol production using fruit juice
5. Solvent extraction of metabolites from media culture.
6. Analysis of a metabolite from a bacterial culture.
7. Enzyme assay demonstration
8. Sterilization techniques

**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED**

Choice Based Credit System (CBCS) (Semester Pattern)

**Theory Examination**

**Question Paper Pattern (B.Voc.)**

**Maximum Marks: 75**

**Time: 3.00 Hrs**

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**Q1.** Long Answer Type Question .....(15 Marks).

**OR**

(a) Short Answer Type Question .....(8 Marks)

(b) Short Answer Type Question .....(7 Marks).

**Q2.** Long Answer Type Question .....(15 Marks).

**OR**

(a) Short Answer Type Question .....(8 Marks)

(b) Short Answer Type Question .....(7 Marks).

**Q3.** Long Answer Type Question .....(15 Marks).

**OR**

(a) Short Answer Type Question .....(8 Marks)

(b) Short Answer Type Question .....(7 Marks).

**Q4.** Long Answer Type Question .....(15 Marks).

**OR**

(a) Short Answer Type Question .....(8 Marks)

(b) Short Answer Type Question .....(7 Marks).

**Q5.** Write a short note on (**Any three** of following); (15 Marks)

(a) .....(5 Marks)

(b) .....(5 Marks)

(c) .....(5 Marks)

(d) .....(5 Marks)

(e) .....(5 Marks).

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**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED**

Choice Based Credit System (CBCS) (Semester Pattern)

**Practical Examination**

**Question Paper Pattern (B.Voc.)**

**Maximum Marks: 50**

**Time: 4.00 Hrs**

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**Q1.** Perform the Major Experiment .....(20 Marks).

**Q2.** (a) Perform the Minor Experiment .....(10 Marks).

(b) Describe procedure and working of the Minor Experiment .....(10 Marks).

**Q3.** (a) Viva -voce .....(5 Marks).

(b) Submission of Field Collection and Samplings during Field Visits  
and Excursions. ....(5 Marks).

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