

CURRICULUM

OF

HORTICULTURE

BS/B.Sc (Hons)

MS/M.Sc (Hons)

(Revised 2010)



HIGHER EDUCATION COMMISSION
ISLAMABAD

CURRICULUM DIVISION, HEC

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PREFACE

The curriculum of subject is described as a throbbing pulse of a nation. By viewing curriculum one can judge the stage of development and its pace of socio-economic development of a nation. With the advent of new technology, the world has turned into a global village. In view of tremendous research taking place world over new ideas and information pours in like of a stream of fresh water, making it imperative to update the curricula after regular intervals, for introducing latest development and innovation in the relevant field of knowledge.

In exercise of the powers conferred under Section 3 Sub-Section 2 (ii) of Act of Parliament No. X of 1976 titled “**Supervision of Curricula and Textbooks and Maintenance of Standard of Education**” the erstwhile University Grants Commission was designated as competent authority to develop review and revise curricula beyond Class-XII. With the repeal of UGC Act, the same function was assigned to the Higher Education Commission under its Ordinance of 2002 Section 10 Sub-Section 1 (v).

In compliance with the above provisions, the HEC undertakes revamping and refurbishing of curricula after regular intervals in a democratic manner involving universities/DAIs, research and development institutions and local Chamber of Commerce and Industry. The intellectual inputs by expatriate Pakistanis working in universities and R&D institutions of technically advanced countries are also invited to contribute and their views are incorporated where considered appropriate by the National Curriculum Revision Committee (NCRC).

To bring international compatibility to qualifications held from Pakistani universities/DAIs for promotion of students mobility and job seekers around the globe, a Committee comprising of Conveners of the National Curriculum Revision Committee of HEC met in 2009 and developed a unified template for standardized 4-years/8-semesters BS degree programmes. This unified template was aimed to inculcate broader base of knowledge in the subjects like English, Sociology, Philosophy, Economics etc in addition to major discipline of study. The Bachelor (BS) degree course requires to be completed in 4-years/8-semesters, and shall require qualifying of 130-140 credit hours of which 77% of the curriculum will constitute discipline specific and remaining 23% will comprise compulsory and general courses.

In line with above, NCRC comprising senior university faculty and experts from various stakeholders and the respective accreditation councils has finalized the curriculum for BS/B.Sc (Hons) and MS/M.Sc (Hons) in Horticulture. The same is being recommended for adoption by the universities/DAIs channelizing through relevant statutory bodies of the universities.

PROF. DR. ALTAF ALI G. SHAIKH
Member Academics

March 2010

CURRICULUM DEVELOPMENT

INTRODUCTION

The National Curriculum Revision Committee final meeting to finalize the draft curriculum for Horticulture at graduate and postgraduate levels was held on June 21-23, 2010 at HEC, Regional Centre, Karachi. The following attended:

1. Dr. Muhammad Amjad
Professor and Director
Institute of Horticultural Sciences
University of Agriculture,
Faisalabad
Convener
2. Dr. Noor-ul-Amin
Professor and Chairman
Department of Horticulture
NWFP Agriculture University,
Peshawar
Member
3. Dr. M. Jamil Ahmed
Professor and Chairman
Department of Horticulture
University of Azad Jammu & Kashmir
Faculty of Agriculture,
Rawalakot
Member
4. Dr. Muhammad Ayub Baloch
Associate Professor and Chairman
Department of Horticulture
Sindh Agriculture University,
Tandojam
Member
5. Prof. Dr. Faridullah Wazir
H # 20, Street # 5, Rahattabad
Palosai Road, Peshawar
Member
6. Dr. Nadeem Akhtar Abbasi
Professor and Chairman
Department of Horticulture
Member

PMAS-Arid Agriculture University,
Rawalpindi

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| 7. | Mr. Muhammad Hasham Laghari
Horticulture Specialist
Planning Commission, P-Block, 4 th Floor
Pak Secretariat, Islamabad | Member |
| 8. | Prof. Dr. Muhammd Saleem Jilani
Department of Horticulture
Gomal University, Dera Ismail Khan | Member |
| 9. | Mr. Sardar Waseem Baran
Assistant Professor and Head
Department of Horticulture
Balochistan Agriculture College
Chaman Road, Beleli,
Quetta | Member |
| 10. | Mr. Muhammad Nafees
Assistant Professor
Department of Horticulture
College of Agriculture and Environmental Sciences
Islamia University, Bahawalpur | Member |
| 11. | Dr. Saeed Ahmed Sheikh
Assistant Professor
Department of Environmental Sciences
Fatima Jinnah Women University,
Rawalpindi | Member |
| 12. | Dr. Muhammad Akbar Anjum
Professor of Horticulture and Head
Department of Food and of Horticultural Sciences
Bahauddin Zakariya University,
Multan | Member/Secretary |

The meeting started with recitation of few verses from the Holy Qur'an.

Prof. Dr. Altaf Ali G. Shaikh, Member Academics, HEC, Islamabad welcomed the participants on behalf of the Chairman, HEC and briefed them of the obligations of the Commission for review, revision and development of curricula. In his opening remarks, he informed the members that the Higher Education Commission is striving hard to enhance quality of education in public sector universities/institutions by making curriculum more compatible with international standard, job oriented and to match the needs of society. He

introduced the members of the committee to various Academic Programmes of the commission aimed at facilitating the universities in execution of their programmes including strengthening of laboratories, strengthening of libraries and institution of Ph.D. scholarships and Postdoctoral fellowships. It was noticed that the progress in vegetable research is not up to the mark.

Dr. M. Tahir Ali Shah, Deputy Director, Curriculum Division, HEC, Islamabad distributed the copies of Horticulture Courses of Colorado State University and Auburn University to use as a reference material and guidance.

The Committee agreed to continue Prof. Dr. Muhammad Amjad as its Convener and Prof. Dr. Muhammad Akbar Anjum as Secretary. The Committee after considering the template for 4-Year BS/B.Sc. (Hons.) Agriculture programme with specialization in different disciplines and the suggestions and comments received from the concerned departments in different universities and colleges of the country on the draft curriculum.

The Convener of the Committee informed that University of Agriculture, Faisalabad has recently revised its syllabi for B.Sc. (Hons.) Agriculture (Horticulture Major) and has introduced new courses especially on “Basics of Plant Tissue Culture”, “Organic Horticulture” and “Peri-Urban Horticulture”. Prof. Dr. Nadeem Abbasi argued that a course on “Arid Zone Horticulture” should also be included in the scheme of studies for undergraduate class. However, it was unanimously decided that the scheme of studies should be flexible and the universities / colleges may modify the title or the contents of courses and may offer an optional course in the final semester depending upon expertise of teachers, facilities available, agro-ecological conditions of the area, local and regional needs.

The Committee thoroughly reviewed the existing curricula and proposed necessary changes to update the existing courses and also recommended latest books for each course. In the light of the Template for 4-Year BS/B.Sc. (Hons.) Agriculture programme, pre-specialization courses (general courses) and their credit hours were reduced from 3 to two courses, each of 3 credit hours. The contents of the existing courses will be covered in proposed two courses. The contents of these pre-specialization courses will be same for all the universities / colleges in the country. As per Template for 4-Year BS/B.Sc. (Hons.) Agriculture programme, the credit hours of “Internship” were reduced to 4. However, keeping in view law order situation in different parts of the country and other constraints, it was agreed that the universities / colleges may offer Internship or Research Project in the final semester of the BS/B.Sc. (Hons.) Agriculture. This will be optional for institutions, not for students. The Committee proposed new courses in the final semester to fill the gap resulting in due to reduction of credit hours of “Internship”. Each University / College may give their own course codes / numbers depending upon their system and the semester in which these are offered. Further, to

provide better education, there should be about 25 students (not more than 30 in any case) in one Section of the class.

Template for 4-Year BS/B.Sc. (Hons) in Agricultural Disciplines

1. Compulsory Courses

	Credit Hours
Mathematics / Biology (2 courses)	6 (3-0) (2-1)
Statistics 1 & 2	6 (3-0) (3-0)
Computers / IT	3 (2-1)
Pakistan Studies	2 (2-0)
Islamic Studies	2 (2-0)
Communications Skills	3 (3-0)
English	3 (3-0)
Basic Agriculture	3 (2-1)
Sub-Total	28

2. Interdisciplinary Foundation courses

Agronomy	3 (2-1)
Plant Breeding & Genetics	3 (2-1)
Entomology	3 (2-1)
Plant Pathology	3 (2-1)
Food Technology	3 (2-1)
Horticulture	3 (2-1)
Soil Sciences	3 (2-1)
Agriculture Economics	3 (2-1)
Sub-Total	24

3. Supporting Courses {6 – 8 courses (3 Cr. Hr) amongst below}

Agriculture Extension	
Forestry & Range Management	
Animal Science	
Marketing & Agri. Business	
Rural Development	
Human Nutrition	
Agriculture Chemistry	
Agriculture Engineering	
Water Management	
Any other discipline recommended by the university	
Sub-Total	18-24

Sub-Total during the first four semesters	70 – 76
Semester 5, 6, 7 & 8	56-60
Project / Internship	4
Grand Total	130 – 140

- 1 credit of theory = one contact hour per week for 16-18 weeks and 1 practical/Lab hour = 3 contact hours per week for 16-18 weeks.
- In case of non availability of department of supporting courses, courses from foundation courses can be opted.

SCHEME OF STUDIES FOR BS/B.Sc (Hons) COURSES IN HORTICULTURE

GENERAL COURSES

Semesters 1 – 4

Hort. 401	Introductory Horticulture	3(2-1)
Hort. 402	Horticultural Crop Production	3(2-1)
		Total = 6

HORTICULTURE MAJOR GROUP

5th Semester

Hort. 501	Principles of Fruit Production	4(3-1)
Hort. 503	Principles of Vegetable Production	4(3-1)
Hort. 505	Principles of Ornamental Crop Production	3(2-1)
Hort. 507	Nursery Management and Certification System	4(2-2)
		Total = 15

6th Semester

Hort. 502	Commercial Fruit Production	4(3-1)
Hort. 504	Commercial Vegetable Production	4(3-1)
Hort. 506	Introductory Landscape Gardening	3(2-1)
Hort. 508	Post-Harvest Horticulture	4(3-1)
		Total = 15

7th Semester

Hort. 601	Research Methods in Horticulture	4(2-2)
Hort. 603	Minor Fruits	3(2-1)
Hort. 605	Commercial Flower Production	3(2-1)
Hort. 607	Breeding of Horticultural Crops	3(2-1)
Hort. 609	<i>In Vitro</i> Propagation	2(1-1)
		Total = 15

8th Semester

Hort. 602	Internship / Research Project	4(0-4)
Hort. 604	Vegetable and Flower Seed Production	3(2-1)
Hort. 606	Protected Horticulture	3(2-1)
Hort. 608	Medicinal and Aromatic Plants	3(2-1)
Hort. 610	Business Management in Horticulture	3(3-0)
Hort. 612	Any other course (Optional)	2(1-1)
		Total = 18

OPTIONAL COURSES

Hort. 612	Indoor Plant Culture / Arid Zone Horticulture / Organic Horticulture / Peri-Urban Horticulture / Project Planning and Scientific Writing / Temperate Fruits / Tropical and Subtropical Fruits / Soilless Horticultural Crop Production / Amenity Horticulture / Therapeutic Horticulture /	2(1-1)
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DETAIL OF COURSES FOR BS/B.Sc (HONS) IN HORTICULTURE

Hort. 401 INTRODUCTION HORTICULTURE

3(2-1)

Prerequisites:

F.Sc. (Pre-Medical)

Specific Objectives:

To enable the students to understand the basics of Horticulture.

Theory:

Introduction, history, importance and future scope, Definition and divisions of horticulture, Classification of horticultural crops, Plant parts, their modifications and functions, Plant environment; climate (temperature, light, humidity etc) and soil (structure, texture, fertility etc), Propagation of horticultural plants.

Practical:

Visit of nurseries, commercial gardens and public parks. Identification and nomenclature of important fruits, vegetables and ornamental plants; Garden tools and their uses, Media preparation. Techniques of propagation.

Books Recommended:

1. Arteca, R.N. 2006. Introduction to Horticulture. Delmar Learning Science Publishers, USA.
2. Brown, L.V. 1996. Applied Principles of Horticultural Science. Butterworth – Heinemann, Oxford, U.K.
3. Chadha, K.L. 2006. Handbook of Horticulture (6th Ed.). ICAR, New Delhi, India.
4. Hartmann, H.T., D.E. Kester, E.T. Davies and R.L. Geneve. 2009. Plant Propagation–Principles and Practices (7th Ed.). Prentice-Hall India Learning Pvt. Ltd., New Delhi, India.
5. Malik, M.N. 1994. Horticulture. National Book Foundations, Islamabad.
6. Reiley, H.E., C.L. Shry (Jr). 2004. Introductory Horticulture (6th Ed.). Delmar- Thomson Learning, Albany, USA.
7. Sharma, R.R. 2002. Propagation of Horticultural Crops: Principles and Practices. Kalyani Publishers, Ludhiana, New Delhi, India.
8. Singh, B. 2007. Horticulture at a Glance. Kalyani Publishers, Ludhiana, New Delhi, India.

Prerequisites:

Introductory Horticulture

Specific Objectives:

To make students familiar with production technology of important horticultural crops.

Theory:

Establishment of orchards and vegetable & ornamental gardens; site selection, layout methods, wind breaks. Management practices; irrigation, fertilizers & manures, training and pruning. Climate, soil, propagation, rootstocks, cultivars, important pests, harvesting, post-harvest handling and marketing of important horticultural crops (fruits, vegetables and ornamentals) of the region.

Practical:

Practice in layout methods, Selection of plants from nursery, propagation methods. Planting and after care. Production techniques and identification of important cultivars of horticultural crops of the region.

Books Recommended:

1. Acquaah, G. 2009. Horticulture: Principles and Practices (4th Ed.). Prentice-Hall India Learning Pvt. Ltd. New Delhi, India.
2. Arora, J.S. 1992. Introductory Ornamental Horticulture. Kalyani Publishers, New Delhi.
3. Dhaliwal, M.S. 2008. Handbook of Vegetable Crop. Kalyani Publishers, Ludhiana, New Delhi, India.
4. Malik, M.N. 1994. Horticulture, National Book Foundation, Islamabad.
5. Singh, B. 2007. Horticulture at a Glance. Kalyani Publishers, Ludhiana, New Delhi, India.
6. Swaider, J.M., G.W. Ware and J.P. McCollum. 1992. Producing Vegetable Crops (4th Ed.), Interstate Publishers Printers and Publishers Inc., Danville, Illinois.
7. Chottopadhyay, T.K. 2000. A Textbook on Pomology, Vol: II. Kalyani Publishers, New Delhi.
8. Laurie, A. and V.H. Ries. 2004. Floriculture: Fundamentals and Practices. Agrobios (India), Jodhpur, India.
9. Pradeepkumar, T., B. Suma, Jyothibhaskar, K.N. Satheesan, K.V. Peter. 2008. Management of Horticultural Crops (Part 1). Horticulture Science Series Vol. 11. New India Publishing Agency, New Delhi, India.
10. Yadav, P.K. 2007. Fruit Production Technology. International Book Distributing Co. (Publishing Division), Lucknow, India.

Prerequisites:

Introductory Horticulture

Specific Objectives:

To make students aware of principles and physiology of fruit production.

Theory:

Introduction to fruit science, Source-sink relationship, Water relations, Fruit-bud formation; initiation, development and controlling factors, Pollination and fruit setting problems, Rest and dormancy, Biennial bearing; causes and control, Fruit thinning, Parthenocarpy and seedlessness, Harvesting methods, Use of plant growth regulators (PGRs), Bud variations and mutations.

Practical:

Identification of various developmental stages of buds, Fruit bearing habits, Training and pruning of important evergreen and deciduous fruit trees, Thinning of fruits, Practices to control irregular bearing. Preparation of PGR stock solutions and applications. Different methods to break seed dormancy.

Books Recommended:

1. Chottopadhyay, T.K. (Ed.). 2003. A Textbook on Pomology, Vol. I: Fundamentals of Fruit Growing. Kalyani Publishers, Ludhiana, New Delhi, India.
2. Chottopadhyay, T.K. 2000. A Textbook on Pomology, Vol. II: Tropical Fruits. Kalyani Publishers, New Delhi.
3. Yadav, P.K. 2007. Fruit Production Technology. International Book Distributing Co. (Publishing Division), Lucknow, India.
4. Dugger, B.M. 2009. Plant physiology with Special Reference to Plant Production. Biblio Bazaar, LLC.
5. Jackson, D.I., N.E. Looney (Eds.). 1999. Temperate and Subtropical Fruit Production (2nd Ed.). CAB International Publishing, Wallingford, U.K.
6. Singh, A. 2003. Fruit Physiology and Production. Kalyani Publication, Ludhiana, New Delhi, India.
7. Singh, N.P. 2004. Basic Concepts of Fruit Science. International Book Distribution Company (Publishing Division), Lucknow, India.
8. Gardener, V.R. 2001. The Fundamentals of Fruit Production (5th Ed.). McGraw Hill Book Company, USA.

Hort. 503 PRINCIPLES OF VEGETABLE PRODUCTION 4(3-1)

Prerequisites:

Introductory Horticulture

Specific Objectives:

To develop understanding among the students regarding principles and physiology of vegetable production.

Theory:

Introduction and importance, Classification of vegetables, Cropping systems; succession, relay and multiple cropping etc., Recent trends in vegetable production, Factors affecting vegetable production, Hardening, Pruning and staking, Bulb and tuber formation, Crop management and quality assurance, Parthenocarpy and seedlessness. Physiological disorders, Production problems and their management, Use of plant growth regulators.

Practical:

Identification and description of flower, fruit and seed of important cultivars of vegetables, Seed priming, Methods of sowing, Raising nursery, hardening and transplanting of seedlings, Pruning and staking practices, Visits to vegetable farms.

Books Recommended:

1. Dhaliwal, M.S. 2008. Handbook of Vegetable Crops. Kalyani Publishers, Ludhiana, New Delhi, India.
2. Fordham, R. and A.G. Biggs. 1985. Principles of Vegetable Crop Production. Collins, London.
3. Hazra, P. and M.G. Som. 2005. Vegetable Science. Kalyani Publishers, Ludhiana, New Delhi, India.
4. Bose, T.K., M.G. Som and J. Kabir. 1993. Vegetable Crops. Naya Prokash, Calcutta-Six.
5. Swaider, J.M., G.W. Ware and J.P. McCollum. 2002. Producing Vegetable Crops (5th Ed.), Interstate Publishers Printers and Publishers Inc., Danville, Illinois.
6. Singh, A.P. 2003. A Textbook of Vegetable Culture. Kalyani Publishers, Ludhiana, New Delhi, India.
7. Wein, H.C. 1997. The Physiology of Vegetable Crops. CAB International Publishing, Wallingford, UK.

**Hort. 505 PRINCIPLES OF ORNAMENTAL CROP
PRODUCTION 3(2-1)**

Prerequisites:

Introductory Horticulture

Specific Objectives:

To provide knowledge of basic principles and physiology of ornamental crop production to the students of Horticulture.

Theory:

Introduction and importance; present status and future scope, Raising of important annuals, Growing of flowering perennials, foliage plants, succulents and flowering bulbs with their propagation and crop management, Seed and bulb dormancy, Pruning, training and shaping, Use of growth regulators, Manipulation of growth and flowering. Concept of Bonsai and topiary, Outdoor and indoor decoration, Flower exhibition, Flower arrangements.

Practical:

Seeding, raising and transplanting of nursery, Identification of annuals, herbaceous perennials, foliage plants, succulents and flowering bulbs with their propagation methods and management practices (pinching, disbudding, deshooting etc.), Methods of breaking seed and bulb dormancy, Visits to ornamental nurseries, parks, cut flower shops, flower exhibitions and growing structures.

Books Recommended:

1. Arora, J.S. 2003. Introductory Ornamental Horticulture (4th Ed.). Kalyani Publishers, New Delhi.
2. Larson, RA. 1980. Introduction to Floriculture. Academic Press, New York.
3. Chadha, K.L and B. Choudhary. 1986. Ornamental Horticulture in India. Indian Council of Agricultural Research, New Delhi.
4. Laurie, A. and Ries V.S. 2004. Floriculture: Fundamentals and Practices. Agrobios (India), Jodhpur, India.
5. Hessayon, D.G. 2007. The Flowering Shrubs Expert (3rd Ed.). Transworld Publishers, London, U.K.
6. Hessayon, D.G. 2007. The Flowering Bulbs Expert (3rd Ed.). Transworld Publishers, London, U.K.
7. Bhattacharjee, S.K. 2006. Advances in ornamental Horticulture. Eastern Book Corporation, Delhi, India.
8. McDaniel, C.L. 1979. Ornamental Horticulture. Prentice-Hall International Inc., Reston, Virginia.
9. Raj, D. 2002. Floriculture and Landscaping. Kalyani Publisher, New Delhi.

Hort. 507 **NURSERY MANAGEMENT & CERTIFICATION SYSTEM** 4(2-2)

Prerequisites:

Introductory Horticulture

Specific Objectives:

To impart technical knowledge about nursery management and certification procedures.

Theory:

Introduction and importance, Types of horticultural nurseries, Management practices (water, nutrient, weeds, diseases, insect-pests), Protection against temperature extremities and radiation, Important nursery operations, Propagation methods and their importance, Rootstocks for horticultural plants, Raising of stock seedlings, Pre-sowing treatments of seeds; Apomixis and polyembryony, Stionic interactions, Graft compatibility and incompatibility, Use of growth regulators for propagation, Certification systems; standards, rules & regulation and procedures, Certification of planting material and nursery plants, Marketing of nursery plants.

Practical:

Raising of rootstocks, Identification of rootstocks for different fruit plants, Selection and preparation of bud wood, Practices in seed collection, seed treatment and propagation methods, Plant growing structures, media and mixtures, Media sterilization, Management of progeny plants, Virus indexing, Visit to germplasm units.

Books Recommended:

1. Adriance, G.W., and F.R. Brison. 2000. Propagation of Horticultural Plants. Biotech Books, Delhi, India.
2. Bose, T.K., S.K. Mitra and M.K. Sadhu. 1986. Propagation of Tropical and Subtropical Horticultural Crops. Naya Prokash, Calcutta-Six, India.
3. Hartmann, H.T., D.E. Kester, E.T. Davies and R.L. Geneve. 2009. Plant Propagation: Principles and Practices (7th Ed.). Prentice-Hall India Learning Pvt. Ltd., New Delhi, India.
4. Sharma, R.R. 2002. Propagation of Horticultural Crops: Principles and Practices. Kalyani Publishers, Ludhiana, New Delhi, India.
5. Sharma, R.R. and M. Srivastav. 2004. Plant Propagation and Nursery management. International Book Distributing Co. (Publishing Division), Lucknow, India.
6. Sharma, V.K. 1996. Plant Nurseries: Techniques, Production and Management. Indus Publishing Company, New Delhi, India.

Prerequisites:

Principles of Fruit Production

Specific Objectives:

To accustom students with production technology of major fruits of Pakistan.

Theory:

Classification of fruits, Cultivation with reference to acreage, production, botany, cultivars, rootstocks, propagation, climate, soil, cultural practices (water, nutrition, weeds, diseases, disorders and pest management), Maturity, ripening, harvesting, quality assurance and marketing of major fruits of Pakistan.

Practical:

Practices in fruit health management, Pollination in commercial fruits, Cost of production, Description and identification of commercial cultivars of important fruits, Visit to research institutes and commercial orchards.

Books Recommended:

1. Bali, S.S. 2003. Fruit Growing, Kalyani Publishers, New Delhi.
2. Bose, T.K. and S.K. Mitra (Eds.). 1990. Fruits: Tropical and Subtropical. Naya Prokash, Calcutta-Six.
3. Mitra, S.K., D.S. Rathore, and T.K. Bose (Eds.). 1991. Temperate Fruits. Horticulture and Allied Publishers, Calcutta.
4. Barooh, S. 1998. Modern Fruit Culture. Kalyani Publishers, Ludhiana, New Delhi, India.
5. Chottopadhyay, T.K. (Ed.). 2006. A Textbook on Pomology, Vol: II. Tropical Fruits. Kalyani Publishers, Ludhiana, New Delhi, India.
6. Chottopadhyay, T.K. (Ed.). 2009. A Textbook on Pomology, Vol: IV. Temperate Fruits. Kalyani Publishers, Ludhiana, New Delhi, India.
7. Yadav, P.K. 2007. Fruit Production Technology. International Book Distributing Co. (Publishing Division), Lucknow, India.
8. Jackson, D.I., N.E. Looney (Eds.). 1999. Temperate and Subtropical Fruit Production (2nd Ed.). CAB International Publishing, Wallingford, U.K.
9. Nakasone, H.Y. and R.E. Paull. 1998. Tropical Fruits. Crop Production Science in Horticulture 7. CAB International Publishing, Wallingford, U.K.
10. Salunkhe, D.K., S.S. Kadam. 1995. Handbook of Fruit Science: production, composition, storage and processing. Marcel Dekker, Inc. New York

Hort. 504 **COMMERCIAL VEGETABLE PRODUCTION** 4(3-1)

Prerequisites:

Principles of Vegetable Production

Specific Objectives:

To accustom students with production technology of major vegetables of Pakistan.

Theory:

Types of vegetable farming, Cultivation of vegetables with reference to their acreage, production, botany, cultivars, climate, soil, cultural practices, maturity indices, harvesting, grading, packing, quality assurance, marketing, production problems, important weeds, insect-pests, diseases and their control, Mushroom growing.

Practical:

Practice in raising of vegetables including mushrooms, Eradication of weeds and control measures of insects and diseases, Harvesting, grading and packing of vegetables, Cost of production, Visits to vegetable farms and markets.

Books Recommended:

1. Bose, T.K., M.G. Som and J. Kabir. 1993. Vegetable Crops. Naya Prokash, Calcutta-Six, India.
2. Pandey, R.K. and S.K. Ghosh. 1996. A Handbook on Mushroom Cultivation. Emkey Publications, New Delhi.
3. Libner, N.S. 2006. Vegetable Production. Vedams Books Pvt. Ltd. New Delhi, India.
4. Rana, M.K. 2008. Scientific Cultivation of Vegetables. Kalyani Publishers, Ludhiana, New Delhi, India.
5. Decoteau, D.R. 2002. Vegetable Crops. Prentice-Hall of India, New Delhi, India.
6. Dhaliwal, M.S. 2008. Handbook of Vegetable Crops. Kalyani Publishers, Ludhiana, New Delhi, India.
7. Swaider, J.M., G.W. Ware and J.P. McCollum. 2002. Producing Vegetable Crops (5th Ed.), Interstate Publishers Printers and Publishers Inc., Danville, Illinois.
8. Das, P.C. 2003. Vegetable Crops of India. Kalyani Publishers, New Delhi.
9. Singh, A.P. 2002. Vegetable Growing in India. Kalyani Publishers, New Delhi.
10. Singh, D.K. 2007. Modern Vegetable Varieties and Production Technology. International Book Distributing Co. (Publishing Division), Lucknow, India.

11. Maynard, D.N. and G.J. Hochmuth. 2007. Knott's Handbook of Vegetable Growers (5th Ed.). John Willey and Sons Inc., New York.

Hort. 506 INTRODUCTORY LANDSCAPE GARDENING 3(2-1)

Prerequisites:

Principles of Ornamental Horticulture

Specific Objectives:

To provide the students with opportunity to combine science of horticulture and their creative abilities in provision of aesthetically beautiful and functional environment.

Theory:

Classification of landscape plants, Growth habits, foliage and flowering effects, Propagation and maintenance of important landscape plants, Suitability of various plants for different purposes and locations, Principles, elements and types of landscape, Establishment and maintenance of lawn and turfs.

Practical:

Study of various soft and hard landscape designs, Aesthetic study of stem, branches, leaves, flowers and fruits, Practice in landscape designing, Visits to private and public landscape areas.

Books Recommended:

1. Arora, J.S. 2003. Introductory Ornamental Horticulture (4th Ed.). Kalyani Publishers, New Delhi.
2. Biondo, R.J., and C.B. Schroeder. 2006. Introduction to Landscaping Design, Construction and Maintenance (3rd Ed.). International Book Distributing Company (Publishing Division), Lucknow, India.
3. Bhattacharjee, S.K. 2004. Landscape Gardening and Design with Plants. Aavishkar Publishers, Distributors, Jaipur, India.
4. Raj, D. 2002. Floriculture and Landscaping. Kalyani Publishers, New Delhi.
5. Ingels, J.E. 1992. Landscaping: Principles and Practices. Delmar Publishing Inc. New York.
6. Gilmer, M. 2002. Water works. Contemporary Books McGraw Hill Companies, Sydney, Australia.
7. Hessayon, D.G. 2007. Expert Series. Transworld Publishers, London, U.K.

Prerequisites:

Introductory Horticulture

Specific Objectives:

To equip students with the techniques to prolong shelf-life of perishable horticultural produce.

Theory:

Introduction and importance, Pre- and post-harvest factors affecting quality, Climacteric and non-climacteric commodities, Indices of crop maturity / ripening, harvesting and pre-cooling, Curing and artificial ripening of horticultural commodities, Packing house operations; culling, grading, washing, cleaning, colouring, waxing and packaging of important horticultural commodities, Packing materials and containers, Storage; principles and types, storage life and factors determining it, International standards and quality assurance, Shipment for local and foreign markets.

Practical:

Machinery and equipment used for various operations, Demonstration of harvest indices, Practices in harvesting, curing, packing and preparation of different fruits, vegetables and cut flowers for marketing, Visits to the fruit, vegetable and floral markets, packing houses and cold storages etc.

Books Recommended:

1. Kader, A.A. 2002. Postharvest Technology of Horticultural Crops. University of California Press, California, USA.
2. Kays, S.J. 1998. Postharvest Physiology of Perishable Plant Products. CBS Publishers & Distributors, New Delhi, India.
3. Mitra, S.K. 1997. Post-Harvest Physiology and Storage of Tropical and Sub-tropical Fruits. CAB International Publishing, Wallingford, U.K.
4. Shewfelt, R.L. and S.E. Prussia (Eds.). 1993. Postharvest Handling: A Systems Approach. Academic Press, California, USA.
5. Thompson, A.K. 1996. Post-Harvest Technology of Fruits and Vegetables. Blackwell Science Ltd., Oxford.
6. Pandry, P.H. 2002. Principles and Practices of Postharvest Technology. Kalyani Publishers, New Delhi, India.
7. Wills, R.B.H., W.B. McGlasson, D. Graham, D.C. Joyce. 2007. Postharvest (5th Ed.). Printer Everbest China.

Hort. 601 RESEARCH METHODS IN HORTICULTURE 4(2-2)

Prerequisites:

All the Major courses of 5th and 6th semesters.

Specific Objectives:

To develop ability in the students to identify and address the researchable problems in different areas of Horticulture.

Theory:

Areas of research in Horticulture, Research methodology, Hypothesis and experimentation, Research parameters (morphological, physiological, biochemical, growth and yield characteristics), Sampling and data collection, Data processing, tabulation, analysis and interpretation of result, Computer application, word processing, graphics and data analysis packages.

Practical:

Practices in field layout of experimental design, Sampling and data collection, Laboratory practices in physico-chemical analyses, Use of computer (word processing, data processing and graphics) in horticultural research, Preparation of research proposal.

Books Recommended:

1. Redmond, W.A. 1992. Getting Started with Microsoft Windows. Version 3.1, One Microsoft Way 98052-6399 (1991-92), Microsoft Corporation, Washington.
2. Pearce, S.C. 1976. Field Experimentation with Fruit and Other Perennial Plants. Tech. Communication No. 23. Commonwealth Bureau of Horticulture and Plantation Crops. East Malling, Kent.
3. Petersen, R.G. 1994. Agricultural Field Experiments—Design and Analysis. Marcel Dekker, Inc., New York.
4. Little, T.M. and F.J. Hills. 1978. Agricultural Experimentation—Design & Analysis. John Wiley and Sons, New York.
5. Srivastav, M. and R.S. Yadav. 2007. Principles of Laboratory Techniques and Methods. International Book Distributing Company (Publishing Division), Ludhiana, India.

Hort. 603 MINOR FRUITS 3(2-1)

Prerequisites:

Introductory Horticulture
Principles of Fruit Production

Specific Objectives:

To create know how among the students about different fruits grown in different areas of Pakistan at small scale.

Theory:

Introduction and importance, Acreage, production, botany, composition and uses, climate, soil, propagation, rootstocks, cultural practices, cultivars, important insect-pests and diseases, harvesting, post-harvest handling and marketing of fruits such as ber, berries, chiku, currants, custard apple, fig, falsa, jaman, jack fruit, kiwi fruit, kronka, loquat, mulberry, papaya, pecan and quince.

Practical:

Identification of minor fruit plants and their fruits, layout systems, propagation methods, pruning, harvesting and handling techniques.

Books Recommended:

1. Alford, D.V. 2007. Pests of Fruit Crops. Manson Publishing Delhi, India.
2. Das, D.C. and S.N. Das. 2006. Cultivation of Minor Fruits. Kalyani Publishers, Ludhiana, New Delhi, India.
3. Philip, S. 2002. Fruit Crops. Kalyani Publishers, Ludhiana, New Delhi, India.
4. Singh, S.P. 2005. Commercial Fruits. Kalyani Publishers, Ludhiana, New Delhi, India.
5. Steferud, A. 2005. Diseases of Fruits and Nuts. Publisher Biotech Books, Delhi, India.

Hort. 605 COMMERCIAL FLOWER PRODUCTION 3(2-1)**Prerequisites:**

Introductory Horticulture
Principles of Ornamental Horticulture

Specific Objectives:

To accustom students with production technology of economically important flowers.

Theory:

Introduction, Environmental simulation, Climate and soils, propagation, crop management practices, harvesting, post harvest handling and marketing of important floral crops such as carnation, chrysanthemum, roses, snapdragon, marigold, jasmine (motia), gypsophylla, calendula, orchids, gerbera, nemesia, statice, stock, geranium, sweet pea, zinnia, dahlia, amaryllis, anemone, freezia, gladiolus, crocus, iris, liliun, daffodil (narcissus), tulip, tuberose.

Practical:

Identification, nursery raising, planting and cultural operations, harvesting and packing of important flowers for commercial production and marketing, Visit of commercial production areas and floral markets.

Books Recommended:

1. Armitage, A.M. and J.M. Laushman. 2003. Specialty Cut Flowers (2nd Ed.). Timber Press, Windsor, Australia.
2. Bose, T.K., L.P. Yadav, P. Pal, V.A. Parthasarathy and P. Das. 2003. Commercial Flowers (2nd Ed.). Naya Udyog, Calcutta, India.
3. Banerjee, U. 2001. Commercial Flower Production. Mangal Deep Publications, Jaipur, India.
4. Larson, RA. 1980. Introduction to Floriculture. Academic Press, New York, USA.
5. Prasad, S. and U. Kumar. 2005. Commercial Floriculture. Agrobios (India), Jodhpur, India.
6. Rees, A.R. 1992. Ornamental Bulbs, Corms and Tubers. Crop Production Science in Horticulture 1. CAB International, Wallingford, U.K.
7. Dole, J.M. and H.F. Wilkins. 1999. Floriculture: Principles and Species. Ball Publishing, USA.
8. Yadav, I.S. and M.L. Choudhry. 1997. Progressive Floriculture—Production Technologies of Important Commercial Flower Crops. The House of Sarpan, Bangalore.
9. Laurie, A. 2004. Floriculture: Fundamentals and Practices. McGraw Hill Book Company, New York.

Hort. 607 BREEDING OF HORTICULTURAL CROPS 4(3-1)

Specific Objectives:

To teach breeding methods for improvement of horticultural crops for quality and yields as per requirements of the growing population.

Theory:

Principles of plant breeding, Reproductive systems in horticultural crops, Self incompatibility and male sterility; centres of origin, Cytological basis of breeding, Heterosis, Theories of heterosis, Role of mutation and polyploidy in breeding, Somatic selection and chimeras, Apomixes, Breeding objective, Methods of breeding of self and cross pollinated crops, Improvement in fruit varieties, Germplasm conservation, Concept of genetic manipulation and transgenic plants.

Practical:

Description of flowers of important fruits, vegetables and ornamentals. Emasculation, selfing and crossing techniques, Polyembryony tests. Pollen viability tests, Inducing polyploidy by chemicals.

Books Recommended:

1. Eliot, E.C.1982. Plants Breeding and Cytogenetics. McGraw Hill Book Co., New York, USA.

2. Fageria, M.S., P.S. Arya and Choudhary, A.K. 2000. Vegetable Crops (Vol. 1): Breeding and Seed Production. Kalyani Publisher, Ludhiana, New Delhi, India.
3. Moore, J.N. and J. Janick, 1983. Methods in Fruit Breeding. Purdue University Press, West Lafayette, Indiana.
4. Simmonds, N.W. 1981. Principles of Crop Improvement. Longman and Co., London.
5. Bassett, M.J. 1986. Breeding Vegetable Crops. Avi Publishing Co. Inc., Westport, Connecticut.
6. Shukla, A.K., A.K. Shukla and B.B. Vashishtha. 2004. Fruit Breeding: Approaches and Achievements. International Book Distributing Company (Publishing Division), Lucknow, India.
7. Singh, A.P. 2003. Vegetable Breeding and Seed Production (1st Ed.). Kalyani Publisher, Ludhiana, New Delhi, India.
8. Ram, H.H. 2005. Vegetable Breeding, Principles and Practices. Kalyani Publisher, Ludhiana, New Delhi, India.

Hort. 609

IN VITRO PROPAGATION

2(1-1)

Specific Objectives:

To acquaint the students with modern techniques of plant multiplication.

Theory:

Introduction and importance; Basic terminology, application and constraints of plant tissue culture, Preparation of synthetic seed; Nutritional components of culture media (nutrients, carbohydrates, vitamins, growth regulators, amino acids and antibiotics), their types & functions; aseptic techniques; Initiation and maintenance of cultures; Physical factors for growth; transplanting and acclimatization; concepts of plant biotechnology and its role in improvement of horticultural crops.

Practical:

Laboratory safety precautions, sanitation, equipment; Calculations (preparation of molar, percent, normal, ppm etc solutions); Preparation of stock solutions & media, disinfection, inoculation and culture of explants, Acclimatization & transplanting.

Books Recommended:

1. Trigiano, R.N. and J.G. Dennis. 2000. Plant Tissue Culture Concepts and Laboratory Exercises. CRC Press LLC, USA.
2. Defergh, P.C. and R.H. Zimmerman. 1991.
3. Hartmann, H.T., D.E. Kester, E.T. Davies and R.L. Geneve. 2009. Plant Propagation: Principles and Practices (7th Ed.). Prentice-Hall India Learning Pvt. Ltd., New Delhi, India.
4. Lindsey, K. (Ed). 2007. Plant Tissue Culture Manual. Springer-Kluwer Academic Publishers New Delhi, India.

5. George, E.F., M.A. Hall and G.J. De Klerk. 2008. Plant Propagation by Tissue Culture. 3rd Ed. Springer, Dordrecht, Netherlands.
6. Kumar, U. 2002. Methods in Plant Tissue Culture. 2nd Ed. Agrobios. (India) Agro House, Chopasani Road, Jodhpur 342 002.
7. Razdan, M.K. 2003. Introduction to Plant Tissue Culture. Science Publishers Inc. (ISBN: 1-57808-237-4).
8. Margit, L. and W. Rucker. 2004. Plant Tissue Culture: Plant Tissue Culture – 100 years since Gottlieb Haberlandt. CPL Scientific Publishers, (ISBN: 3211838392).
9. Chandra, R. and M. Mishra (Eds). 2005. Comprehensive Micropropagation of Horticultural Crops International Book Distributing Co. (Publishing Division), Lucknow, India.

Hort. 602 INTERNSHIP (OPTION I) 4(0-4)

Specific Objectives:

To strengthen the practical knowledge of students and their involvement in various horticultural projects.

Practical:

Placement of students at various public and private organizations. Study, discussion and their practical involvement in ongoing programs/projects. Performance of practical managerial duties or practical demonstration of important operations in the concerned gardens, Submission of report and oral presentation at the end of the semester.

Hort. 602 RESEARCH PROJECT (OPTION II) 4(0-4)

Specific Objectives:

Training of the student in study and evaluation of problems of horticultural industry and to find their solutions through research.

Practical:

Identification of research problem, Consulting the relevant literature, Planning and essentials of research plan. Execution of project; data collection, analysis, formulation of tables & figures and interpretation of results & discussion, conclusion, recommendations, Report writing, submission and presentation.

Books Recommended:

1. Anonymous. 1999. Instructions to Authors. Amer. Soc. Hort. Sci. Alexandria, Virginia.
2. Day, R.A. 1983. How to write and publish a scientific paper (2nd Ed.). ISI Press, Philadelphia.

3. Petersen, R.G. 1994. Agricultural Field Experiments–Design and Analysis. Marcel Dekker, Inc., New York.
4. Sears, D.A. 1973. Harbrace Guide to the Library and the Research Paper (3rd Ed.). Horcourt Brace Javanovich Inc., New York.

Hort. 604 VEGETABLE AND FLOWER SEED PRODUCTION

4(3-1)

Specific Objectives:

To provide technical knowledge about pure and hybrid seed production of annual horticultural crops.

Theory:

Introduction and Importance, Principles of seed production, Seed classes, Pre-basic, basic, registered and certified seed, Reproductive systems, modes of pollination and seed production, Pure and hybrid seed production, Methods and procedures for seed production of important vegetables and flowers, Seed handling technology, Seed testing and storage, Seed certification and registration.

Practical:

Pollination techniques, Maintenance of self and cross pollinated lines, Methods of seed collection; Seed desiccation for storage, Seed treatments for storage, Seed testing techniques.

Books Recommended:

1. Desai, B.B., P.M. Kotecha and D.K. Salunkhe. 1997. Seeds Handbook – Biology, Production, Processing and Storage. Marcel Dekker Inc., New York.
2. McDonald, M.B. and L.O. Copeland. 1998. Seed Production – Principles and Practices. CBS Publishers and Distributors, New Delhi.
3. Salunkhe, D.K., B.B. Desai and N.R. Bhat. 1987. Vegetable and Flower Seed Production. Agricole Publishing Academy, New Delhi.
4. Singh, A.P. 1999. Vegetable Seed Production Principles (1st Ed.). Kalyani Publisher, Ludhiana, New Delhi, India.
5. Khare, D., M.S. Bhale. 2005. Seed Technology. Scientific Publishers, New Delhi, India.
6. Singh, P. and B.S. Asati. 2008. Seed Production Technology of Vegetables. Daya Publishing Home, Delhi, India.
7. Singh, N., D.K. Singh, Y.K. Singh and V. Kumar. 2006. Vegetable Seed Production Technology. International Book Distributing Company (Publishing Division), Lucknow, India.
8. Singh, P.K., S.K. Dasgupta and S.K. Tripathi. 2005. Hybrid Vegetable Development, CRC Press Boca Raton, USA.

Specific Objectives:

To make student familiar with modern technology for production of high quality horticultural commodities round the year.

Theory:

Introduction and economic importance, Different structures and their construction, Selection of site and orientation, Environment control and maintenance, Seed and nursery raising, Crops suitable for forcing, Production technology of different crops, Soilless culture, Media, soil mixtures, containers, fertigation and irrigation systems, Pruning, training and staking, Insects, diseases, disorders and problem management.

Practical:

Structural demonstration of greenhouses, plastic tunnels and other structures, Preparation of growing media, Tools and types of containers, Raising of crops, Pollination techniques, Visits to commercial greenhouses and plastic tunnels.

Books Recommended:

1. Abbasi, N.A. and U. Habib. 2008. Protected Horticulture. Dept. of Horticulture, PMAS-Arid Agriculture University Rawalpindi, Pakistan.
2. Ashraf, M., M.S.K. Rana and M.A. Khan. 1989. Lecture Manual on Protected Vegetable Production. PARC, Islamabad.
3. Manohar, K.R. and C. Igathinathane. 2007. Greenhouse Technology and Management (2nd Ed.). BS Publications, Hyderabad, India.
4. Mastalerz, J.W. 1997. Greenhouse Environment. John Willey and Sons, New York.
5. Prasad, K. and U. Kumar. 2005. Greenhouse Management for Horticultural Crops (2nd Ed.). Agrobios (India) Jodhpur, India.
6. Resh, H.M. 1989. Hydroponic Food Production. Westbridge Press Publishing Company, Santabarbra, California, USA.

Specific Objectives:

To provide information about medicinal and aromatic values of different plants.

Theory:

Importance, origin and habitat, classification and botany, Climatic requirements, Cultivation and production, Chemical and pharmacological properties, Products and medicinal uses, Methods of plant collection and extraction, Processing, marketing and export potential.

Practical:

Identification, collection and description, Introduction, acclimatization and multiplication of economically important plants, Parts used and important ingredients, Processing and extraction methods, Visit to various herbal institutions, "Pansari" markets, herbal gardens.

Books Recommended:

1. Bhattacharjee, S.K. 1999. Handbook of Medicinal Plants. Pointer Publishing Co. India.
2. Joshi, S.G. 2000. Medicinal Plants. Oxford and IBH, India.
3. Farooqui, M.L.H. 2000. Medicinal Plants of Prophet Muhammad (PBUH). Sidrah Publishers, Lukhnow.
4. Grieve, M. 1992. A Modern Herbal. Tiger Book International, U.K.
5. Serdar, O. and M. Milan. 2007. Medicinal and Aromatic Crops. Haworth Food & Agric. Products.
6. Bogers, R.J., L.E. Craker and D. Lange. 2006. Medicinal and Aromatic Plants. Haworth Food & Agric. Products.
7. Raju, R.A. 2000. Wild Plants of Indian Sub-Continent and Their Economic Use. CBS Publishers and Distributors, New Delhi.

Hort. 610 BUSINESS MANAGEMENT IN HORTICULTURE**3(3-0)****Specific Objectives:**

To promote entrepreneurship and business management capabilities of horticulture graduates.

Theory:

Introduction and importance of horticultural enterprise, Classified business management for fruits, vegetables and ornamental crops, Marketing channels in Pakistan, Market demand and quality control, Export prospects, International standards and product handling for export, Processing industry and marketing of value added commodities, Pricing, policy and market regulations, Global trade and Pakistan, W.T.O., Opportunities and challenges.

Book Recommended:

1. Meena, R.K. and J. Yadav. 2001. Horticulture Marketing and Post-harvest Management. Pointer Publisher, Jaipur, Rajasthan.

Hort. 612 INDOOR PLANT CULTURE**3(2-1)****Prerequisites:**

Principles of Ornamental Horticulture

Specific Objectives:

To impart knowledge about interiorscaping by using foliage plants inside the building for making the environment pleasing.

Theory:

Introduction and importance, The indoor environment: light, temperature, humidity, oxygen, carbon dioxide and air pollutants, Cultural requirements, Production of flowering and foliage plants for shade and semi-shade area, Growing media; essential nutrients, watering, pests and diseases, Acclimatization, Planters, Terrarium, management practices for important indoor plants.

Practical:

Identification of indoor plants. Practices in watering and fertilization, Propagation, preparation of soil mixtures, potting and re-potting, Diagnosis of problems and solutions. Visit of nurseries and garden centres.

Books Recommended:

1. Dole, J.M. and H.F. Wilkins. 1999. Floriculture: Principles and Species. Ball Publishing, USA.
2. Hessayon, D.G. 2007. House Plant Expert. Transworld Publishers, London, U.K.
3. Hessayon, D.G. 2007. Indoor Plant Spotter. Transworld Publishers, London, U.K.
4. Davidson, W. 1991. House Plants. Tiger Books International, London.
5. Manaker, G.H. 1981. Interior Plant Scape Installation: Maintenance and Management. Prentice-Hall Inc., New Jersey.
6. Pyenson, L.L.P. 1981. Plant Health Handbook. A Guide to Better Gardening: Indoors and Outdoors. Avi Publications, Westport, Connecticut.
7. Rice, L.W. and R.P. Rice. 1986. Practical Horticulture—A Guide to Growing Indoor and Outdoor Plants. Prentice-Hall, New Jersey.
8. Schjenk, G. 1984. The Complete Shade Gardeners. Houghton Mifflin and Co., Boston.

Hort. 612**ARID ZONE HORTICULTURE****2(1-1)****Specific Objectives:**

To impart knowledge to the students for utilization of arid areas for sustainable production of horticultural crops.

Theory:

Economic aspects of arid zone horticulture, Formulation of rainfall distribution models for arid zone, Arid ecology, Agrotechniques for horticultural crops, Physiology and drought tolerance in horticultural crops. Suitable crops for arid areas and their production technologies. Dry climate landscape.

Practical:

Canopy management in arid fruits, evaluation of moisture conservation techniques like organic and inorganic mulches, studies of critical stages of irrigation in various arid horticultural crops, studies of irrigation systems (drip and sprinkle) and their impact on productivity of arid fruits and vegetables, integrated nutrient management in arid fruits and vegetables.

Books Recommended:

1. Saroj, P.L., B. Vashishtha and D.G. Dhandar. 2004. Advances in Arid Horticulture. Vol I: Present Status. International Book Distribution Co. Lucknow, India.
2. Saroj, P.L., B. Vashishtha and D.G. Dhandar. 2004. Advances in Arid Horticulture. Vol II: Present Status. International Book Distribution Co. Lucknow, India
3. Chandra, A., A. Chandra and I.C. Gupta. 1994. Arid Fruit Research. New Delhi, India.
4. Chundawat, B.S. 1990. Arid Fruit Culture. Pub. Oxford and IBH Co. Ltd. New Delhi, India.

Hort. 612**ORGANIC HORTICULTURE****2(1-1)****Specific Objectives:**

To impart training to the students for producing safe and other chemicals-free horticultural produce.

Theory:

Introduction and importance of organic farming, Principles of organic horticulture, Selection and use of materials and resources, Managing physical and chemical properties of growing substrate, Organic Manure production, Sustainability and environmental impact, Integrated farming system, Organic crop production of selected fruits, vegetables and flowering crops, Certification of organic produce.

Practical:

Identification and production of organic fertilizers, Developing organic fertilizer application programme for different horticultural crops, Integrated weed and pest management, Organic crop production techniques in greenhouse and field, Permaculture and organic lawn care, Vists to organic and non-organic progressive gardens.

Books Recommended:

1. Davies, F. and L. Margi. 2006. Organic Vegetable Production: A Complete Guide. Henry Doubleday Research Association Publications, U.K.

2. Gehlot, D. 2005. Organic Farming Standards, Accreditation, Certification and Inspection. Agrobios (India), Agro House, Jodhpur, India.
3. Gillman, J. 2008. The Truth about Organic Gardening: Benefits, Drawbacks and the Bottom Line. Timber Press.
4. Lind, G., K. Lafer, K. Scholfer and G. Innerhofer. 2003. Organic Fruit Growing. CAB International Publishing, Wallingford, U.K.
5. Lampkin, N. 2002. Organic Farming. Old Pond Publishing 104 Valley Road Ipswich, IPI 4 PA UK.
6. Reddy, P. 2008. Organic Farming for Sustainable Horticulture. Jodhpur, Scientific

Hort. 612 PERI-URBAN HORTICULTURE

2(1-1)

Theory:

Introduction and historical background, Present status of peri-urban horticulture in the world, Recent trends in peri-urban horticulture, Need for changing the scenario, Crop production (Vegetables, Flowers, Fruits) on small scale, Soil and water management, Organic farming, Health and food safety, Marketing, Strategies to develop peri-urban horticulture.

Practical:

Visits of peri-urban horticulture farms and waste recycling projects, Practice in layout of peri-urban farms, Use of solid waste as growing media, Practice in nursery raising and transplanting, Management of cultural practices.

Books Recommended:

1. Allen, A. and N.L.A. Da Silva and E. Corubolo. 1999. Environmental Problems and Opportunities of the Peri-Urban Interface and Their Impact upon the Poor. Development Planning Unit. University College, London, U.K..
2. Baud, I.S.A., J. Post and C. Furedy. 2004. Solid Waste Management and Recycling. Kluwer Academic Publishers, Netherland.
3. Duncan, M., D. Simon and D. Thompson. 2005. The Peri-Urban Interface. Approaches to Sustainable Natural and Human Resource Use. Royal Holloway, University of London, London, UK.
4. Fall, S. Toure and Y. Akinbamijo. 2000. Integrated Peri-Urban Systems: Horticulture and Livestock in West African Cities. International Trypanotolerance Center Annual Technical Report Year II, June 1999 - June. (Centre File 03934-97-0021-01).
5. Mukherjee, N. and M. Jayaswal. 2006. Chained by Food : Marginalized Voices from Peri-Urban India : Poor Households as Food Producers and Consumers in Peri-Urban India. Vedams eBooks (P) Ltd. Pitampura, New Delhi, India.
6. Smit, J., A. Ratta, and J. Nasr. 1996. Urban agriculture: Food, Jobs and Sustainable Cities. UNDP, Urban Development Unit, New York, U.S.A.

Prerequisites:

Research Methods in Horticulture.

Specific Objectives:

To develop ability in the students to identify and plan research projects in different areas of Horticulture and write their reports.

Theory:

Concept of research, Scientific method and experiment, Steps in experimentation, Writing of research proposal, Layout of field experiments, Observation of field trials, Measurement of crop growth and yield, Collection, tabulation and analysis of data, Measures of experimental variability, Interpretation of data, Writing and summarizing of scientific paper.

Practical:

Preparation of research proposal, Layout of field experiments, Collection and tabulation of data, Analysis of data, Presentation of data in tables, curves, histograms etc, Writing of scientific paper.

Books Recommended:

1. Anderson, J., B.H. Durston and M. Poole. 1992. Thesis and Assignment Writing. Wiley Eastern Ltd. New Delhi, India.
2. Awan, J.A. 2003. Scientific Presentation. Uni-tech Communication, Faisalabad, Pakistan.
3. Hashmi, N. 1989. Style Manual of Technical Writing, 2nd Edition. Pakistan Economic Analysis Network Project, Govt. of Pakistan, Ministry of Food and Agriculture, Islamabad, Pakistan.
4. Mathews, J.R., J.M. Brown and R.W. Mathews. 2000. Successful Scientific Writing: A Step-by-Step Guide for Bio-Medical Scientists, 2nd Edition. Cambridge University Press, Cambridge, U.K.
5. Redmond, W.A. 1992. Getting Started with Microsoft Windows. Version 3.1, One Microsoft Way 98052-6399 (1991-92), Microsoft Corporation, Washington.
6. Petersen, R.G. 1994. Agricultural Field Experiments—Design and Analysis. Marcel Dekker, Inc., New York.

SCHEME OF STUDIES FOR MS/M.Sc(HONS) IN HORTICULTURE

Course No.	Title of the course	Credit hours
Hort. 701	Advanced Fruit Science	3(2-1)
Hort. 702	Advanced Vegetable Science	3(2-1)
Hort. 703	Vegetable Breeding	3(2-1)
Hort. 704	Fruit Breeding	3(2-1)
Hort. 705	Mineral Nutrition of Horticultural Crops	3(2-1)
Hort. 706	Plant Growth Regulators	3(2-1)
Hort. 707	Post-Harvest Physiology	3(2-1)
Hort. 708	Landscape Designs	3(2-1)
Hort. 709	Plant Tissue Culture	3(1-2)
Hort. 710	Environmental Horticulture	3(2-1)
Hort. 711	Prospective Horticultural Crops	3(2-1)
Hort. 712	Special problem	1(1-0)
Hort. 713	Seminar	1(1-0)
Hort. 714	Research and Thesis	6(0-6)

Books Recommended:

1. Swiader, J.M., G.W. Ware and J.P. McCollum. 1992. Producing Vegetable Crops (4th Ed.). Interstate Publisher Inc., Daniville, Illinois.
2. Wein, H.C. 1997. The Physiology of Vegetable Crops. CAB. International Publications, New York.

Hort. 703

VEGETABLE BREEDING

3(2-1)

Theory:

Objectives of vegetable breeding, Planning breeding programmes, Development of inbred lines, Combining ability, Exploitation of male sterility, Hybrid seed production, Breeding for diseases and stress resistance, Breeding cucurbits, solanaceous fruits, cole crops, root crops, peas, onion, lettuce, okra and spinach, Improvement of asexually propagated vegetables.

Practical:

Study of floral characters of self and cross-pollinated vegetables, Crossing techniques for important self-pollinated and cross pollinated vegetables, selection procedure for root crops.

Books Recommended:

1. Bassett, M.J. 1986. Breeding Vegetable Crops. Avi. Pub. Co. Inc., Westport, Connecticut.
2. Simmond, N.W. 1976. Evolution of Crop Plants. Longman Inc., New York.
3. Singh, A.P. 2003. Vegetable Breeding and Seed Production. Kalyani Publishers, New Delhi.
4. Ram, H.H. 2005. Vegetable Breeding, Principles and Practices. Kalyani Publisher, New Delhi.

Hort. 704

FRUIT BREEDING

3(2-1)

Theory:

Objectives of fruit breeding, Importance of germplasm and its maintenance, Breeding techniques, Pollen and seed management, Hybridization and handling seedling population, Breeding of regionally important fruits, Breeding for disease and stress resistance, Mutation breeding.

Practical:

Study of floral characters of various fruits, Crossing techniques of important fruits, Selectable markers for fruit breeding, Study of different types of chimeras.

Books Recommended:

1. Janick, J. and J.N. Moore. 1975. Advances in Fruit Breeding. Purdue Univ. Press, West Lafayette, Indiana

2. Moore, G.N. and J. Janick. 1983. Methods in Fruit Breeding. Purdue Univ. Press West Lafayette, Indiana.
3. Shukla, A.K., A.K. Shukla and B.B. Vashishtha. 2004. Fruit Breeding: Approaches and Achievements. International Book Distributing Company (Publishing Division), Lucknow, India.

Hort. 705 MINERAL NUTRITION OF HORTICULTURAL CROPS **3(2-1)**

Theory:

Nutrient elements in plants, Criteria of essentiality and role of mineral nutrients in plants, Requirements and plant composition, Mechanism and factors affecting absorption and translocation of nutrients, Ion interactions, Nutrient concepts, Methods for evaluation of nutrients and their application, Deficiencies and toxicities, Growth yield and quality as affected by nutrient status.

Practical:

Relevant field and laboratory studies, surveys and assignments.

Books Recommended:

1. Devlin, R.M. and F.H. Witham. 1983. Plant Physiology (4th Ed.). Willard Grant Press, Boston.
2. Marschner, H. 1995. Mineral Nutrition of Higher Plants. Academic Press, London.
3. Mengel, K., and E.A. Kirkby. 1987. Principles of Plant Nutrition. International Potash, Institute, Bern, Switzerland.
4. Nijjar, G.S. 1996. Nutrition of Fruit Trees. Kalyani Publisher, New Delhi.
5. Kumar, D.D. 2000. Micronutrients-Their Behaviour in Soil and Plants. Kalyani Publisher, New Delhi.
6. Salisbury, F.B. and C.W. Ross. 1985. Plant Physiology (2nd Ed.), Wadsworth Publishing Company. Inc.

Hort. 706 PLANT GROWTH REGULATORS **3(2-1)**

Specific Objectives:

Theory:

History, classification of growth regulators (PGRs); auxins, gibberellins, cytokinins and others, Biosynthetic pathways, Source sink relationship in relation to PGR, Occurrence and role of growth regulators in plants, Chemical nature of plant regulators and its relation with physiological activities, Theories of action and interactions of growth regulators, Interrelationships between growth regulators and other organic and inorganic plant substances, Applications in horticulture; growth, propagation, parthenocarpy, flower and fruit thinning, control of pre-harvest drop, fruit maturity, dormancy and storage, seed treatment and weed control, Uses in vegetable and flower nursery, Advances in PGR's.

Practical:

Relevant field and Laboratory studies, surveys and assignments.

Books Recommended:

1. Arteca, R.N. 1997. Plant Growth Substances: Principles and Applications. CBS Publishers and Distributors, New Delhi, India.
2. Devlin, R.M. and F.M. Witman. 1983. Plant Physiology. Willard Grant Press, Boston.
3. Salisbury, F.B. and C.W. Ross. 1985. Plant Physiology (2nd Ed.), Wadsworth Publishing Company. Inc.
4. Nickell, L.G. 1982. Plant Growth Regulators (Agricultural Uses). Springer-Verlag, Berlin, Heidelberg, New York.
5. Wareing, P.F. and I.D.J. Phillips. 1981. Growth and Differentiation in Plants. Pergamon Press, New York.
6. Wearer, R.V. 1992, Plant Growth Substances in Agriculture. W.H. Freeman Co., San Francisco.

Hort. 707**POST-HARVEST PHYSIOLOGY****3(2-1)****Theory:**

Introduction, Pre and post-harvest factors affecting the shelf life, Perishable and non-perishable commodities, Compositional changes, Physical, chemical and biochemical processes in storage of fruits, vegetables and flowers in relations to maturation, ripening and senescence, Role of ethylene in ripening, Ethylene scrubbers, Role and regulation of environmental factors in storage, temperature, humidity, Oxygen, carbon dioxide and ethylene, Physiological and pathological disorders in storage.

Practical:

Relevant field and Laboratory studies, surveys and assignments.

Books Recommended:

1. Kader, A.A. 1992. Postharvest Technology of Horticultural Crops. University of California Press, Berkley.
2. Kays, S.J. 1998. Postharvest Physiology of Perishable Plant Products. CBS Publishers & Distributors, New Delhi, India.
3. Mitra, S.K. 1997. Post-Harvest Physiology and Storage of Tropical and Sub-tropical Fruits. CAB International Publishing, Wallingford, U.K.
4. Salunkhe, D.K., N.R. Bhatt and B.B. Desai. 1989. Post-Harvest Biotechnology of Flowers and Ornamental Plants. Bidhan Chandra Krishi Viswavidyalaya, Kalyani, India.
5. Shewfelt, R.L. and S.E. Prussia (Eds.). 1993. Postharvest Handling: A Systems Approach. Academic Press, California, USA.
6. Wills, R.B.H., T.H. Lee, D. Graham, W.B. McGlasson and E.G. Hall. 1984. Post-Harvest. The AVI Publishing Co. Inc., West Port, Connecticut.

Theory:

Importance of landscape gardening and design, Principles and elements of landscape design, Landscape design materials, Types of designs; formal and informal garden designs, Chinese and Japanese gardening, Rockeries, terrace, roof and water gardens, Plants suitable for various designs, Landscape designs for public and private buildings, parks and playgrounds etc, Highway and roadside plantations, Developmental cost estimates for landscape.

Practical:

Visits to different parks and gardens, Landscape designs for private and community houses, schools, colleges, universities, municipal and national parks, industrial areas and roadsides; establishing various types of gardens.

Books Recommended:

1. Arora, J.S. 1992. Introductory Ornamental Horticulture. Kalyani Publishers, New Delhi.
2. Biondo, R.J., and C.B. Schroeder. 2006. Introduction to Landscaping Design, Construction and Maintenance (3rd Ed.). International Book Distributing Company (Publishing Division), Lucknow, India.
3. Bhattacharjee, S.K. 2004. Landscape Gardening and Design with Plants. Aavishkar Publishers, Distributors, Jaipur, India.
4. Raj, D. 2002. Floriculture and Landscaping. Kalyani Publishers, New Delhi, India.
5. Ingels, J.E. 1992. Landscaping: Principles and Practices. Delmar Publishing Inc. New York.
6. Booth, N.K. and W.H. Elsevier. 1983. Basic elements in Landscape Architecture Design. Science Publishing Co., New York.
7. Khan, M.A. and T.A. Bader. 1992. Landscape Designs, Student Manual. University Printing Press, University of Agriculture, Faisalabad.

Hort. 709 PLANT TISSUE CULTURE**3(1-2)****Theory:**

Introduction, history and importance, Tissue culture media, Asepsis, Types of culture (organ culture, callus culture, cell suspension culture, protoplast culture), Types of regeneration (callogenesis, organogenesis and embryogenesis), Micropropagation, micrografting, Germplasm conservation, Somatic hybridization, Cytoplasmic hybridization, Genetic transformation, Somaclonal variation, Secondary plant products.

Practical:

Laboratory equipment and supplies, Stock solutions and media preparation, Maintenance of asepsis, Shoot-tip culture, Nodal culture, Leaf disk culture,

Embryo culture, Ovule culture, Anther culture, Callus culture, Cell suspension culture, Protoplast culture, Protoplast fusion, Plantlet regeneration, *In-vitro* grafting, Production and testing of virus free plants, Transfer of plantlets from tissue culture to green house and field, Leaf disk culture for genetic transformation, Visits to tissue culture laboratories.

Books Recommended

1. Pierik, R. 1987. *In Vitro Culture of Higher Plants*. Martinus Nijhoff Publishers, Amsterdam.
2. Evans, D.E., J.O.D. Coleman and A. Kearns. 2003. *Plant Cell Culture (The Basics)*. BIOS Scientific Publishers, London, New York.
3. Kumar, U. 2005. *Methods in Plant Tissue Culture*. Agrobios, Jodhpur, India.
4. Lindsey, K. (Ed.). 2007. *Plant Tissue Culture Manual*. Springer – Kluwer Academic Publishers, New Delhi, India.
5. Narayanaswamy, S. 1994. *Plant Cell and Tissue Culture*. Tata-McGraw Hill Publishing Company Limited, New Delhi, India.
6. Razdan, M.K. 2004. *Introduction to Plant Tissue Culture (2nd Ed.)*. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi. Stafford, A. and G. Warren. 1991. *Plant Cell and Tissue Culture*. Open University Press, Milton Keynes. U.K.
7. Chawla, H.S. 2003. *Plant Biotechnology. Laboratory Manual for Plant Biotechnology*. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Hort. 710 ENVIRONMENTAL HORTICULTURE

3(2-1)

Theory:

Introduction and importance, Pollutants and their types, Role of plants to minimize pollution, Selection of plants for various environments, Aesthetic horticulture, Plants to improve the environment; atmospheric purification, climate, surface erosion, dust, wind and noise control, Horticultural science in sociosphere, Environmental impact studies.

Practical:

Identification and selection of plants for environmental control, Poster preparation for awareness, Monitoring plant health in polluted areas (industries and motor-ways etc.) and their comparison with field grown plants, Laboratory experiments, Planting for outdoor beautification, Vegetation impact on microclimate of buildings. Visits of industrial areas causing pollution.

Books Recommended:

1. Hussain, M. 1998. *Environmental Degradation: Realities and Remedies*. Feroz Sons Pvt. Ltd., Lahore.
2. McKinney, M.L. and R.M. Schoch. 1998. *Environmental Science: Systems and Solutions*. Jones and Bartlett Pub. Inc., Sudbury.

3. Robinette, G.O. 1977. Plants, People and Environmental Quality. US Department of Interior, National Park Service, Washington, DC.
4. Smith, K. 1992. Environmental Hazards: Assessing Risk and Reducing Disaster. Rutledge, London.

Hort. 711 PROSPECTIVE HORTICULTURAL CROPS 3(2-1)

Theory:

Introduction, importance, present status and future scope, Soil and climatic requirements, propagation, cultural operations, harvesting, processing and marketing of following crops: olive, oil palm, amla, avocado, pecans, hazel nut, hickory, kiwi fruit, jack fruit, custard apple, cherimoya, currants and berries, tea, saffron, leek, celery, asparagus, broccoli and Brussel's sprout etc.

Practical:

Identification of plants, their propagation, raising of nursery, management practices, harvesting and processing.

Books Recommended:

1. Bose, T.K. and S.K. Mitra. 1990. Fruits: Tropical and Subtropical. Naya Prokash, Calcutta-Six.
2. Hartmann, H.T., W.S. Flocker and A.M. Kofranek. 1981. Plant Science: Growth, Development and Utilization of Cultivated Plants. Prentice-Hall Inc., New Jersey.
3. Singh, A.P. 2002. Vegetable Growing in India. Kalyani Publisher, New Delhi.
4. Das, P.C. 2003. Vegetable Crops of India. Kalyani Publisher, New Delhi.
5. Das, B.C. and S.N. Das. 2000. Cultivation of Minor Fruits. Kalyani Publisher, New Delhi.

Hort. 712 SPECIAL PROBLEM 1(1-0)

Hort. 713 SEMINAR 1(1-0)

Hort. 714 RESEARCH AND THESIS 6(0-6)

RECOMMENDATIONS

After a comprehensive discussion the participants of the curriculum revision committee of horticulture made the following recommendations:

1. Faculty development at various universities for proper and uniform implementation of curriculum should be taken on priority.
2. Competent professionals should be inducted to overcome the shortage at various campuses, according to the need of the respective institutions.
3. Faculty recruitment should be based on well defined and transparent recruitment policy to induct only the competent and professionals with teaching aptitude.
4. In service training of the faculty members should be encouraged by the HEC in the field of horticulture inland and abroad on priority basis.
5. Minimum credit hours for BS/B.Sc. (Hons.) degree in Agriculture (Horticulture) should be uniform in all universities. A list of optional courses is also being recommended by the committee, which may be adopted by the institutions as needed.
6. In-view of the rising importance of horticultural crops, the departments of horticulture may be upgraded to the faculty of horticulture.
7. National experts in horticulture should be involved in national projects as consultant and in curriculum development as subject specialist to extend their potential.
8. HEC should arrange and supply at least two copies of each book from the list of recommended books to each university / college to strengthen the education.
9. HEC should provide adequate funds for the development of laboratories and provision of Research Journals in horticulture.
10. Faculty development programme should be established for those who hold master degrees and crossed the age limit to upgrade their qualification up to Ph.D.
11. Post Doctoral research in foreign universities / research organizations be encouraged with a special quota for scholars / teachers holding Ph.D. in horticulture from local universities.

12. HEC should arrange and finance visit of teachers to various universities / colleges in different ecological zones so that they are well informed about other universities and their research programmes.
13. In NCRCs, participation from the R&D / S&T organizations should be ensured.
14. It has been noted that experts / faculty members invited to participate in NCRC meeting hesitate to turn up because of no proper incentives / honorarium. It is therefore suggested that in addition to TA/DA HEC should also offer honorarium to the members.

DETAILS OF COMPULSORY COURSES

COMPULSORY COURSES IN ENGLISH FOR Undergraduate Level

English I (Functional English)

Credit Hrs. 3

Objectives: Enhance language skills and develop critical thinking.

Course Contents

Basics of Grammar
Parts of speech and use of articles
Sentence structure, active and passive voice
Practice in unified sentence
Analysis of phrase, clause and sentence structure
Transitive and intransitive verbs
Punctuation and spelling

Comprehension

Answers to questions on a given text

Discussion

General topics and every-day conversation (topics for discussion to be at the discretion of the teacher keeping in view the level of students)

Listening

To be improved by showing documentaries/films carefully selected by subject teachers

Translation skills

Urdu to English

Paragraph writing

Topics to be chosen at the discretion of the teacher

Presentation skills

Introduction

Note: Extensive reading is required for vocabulary building

Recommended books:

1. Functional English

a) Grammar

1. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 1. Third edition. Oxford University Press. 1997. ISBN 0194313492
2. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press. 1997. ISBN 0194313506

b) Writing

1. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 0 19 435405 7 Pages 20-27 and 35-41.

- c) Reading/Comprehension
 1. Reading. Upper Intermediate. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 453402 2.
- d) Speaking

English II (Communication Skills)

Credit Hrs. 3

Objectives: Enable the students to meet their real life communication needs.

Course Contents

Paragraph writing

Practice in writing a good, unified and coherent paragraph

Essay writing

Introduction

CV and job application

Translation skills

Urdu to English

Study skills

Skimming and scanning, intensive and extensive, and speed reading, summary and précis writing and comprehension

Academic skills

Letter/memo writing, minutes of meetings, use of library and internet

Presentation skills

Personality development (emphasis on content, style and pronunciation)

Note: documentaries to be shown for discussion and review

Recommended books:

Communication Skills

- a) Grammar
 1. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press 1986. ISBN 0 19 431350 6.
- b) Writing
 1. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Françoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 019 435405 7 Pages 45-53 (note taking).
 2. Writing. Upper-Intermediate by Rob Nolasco. Oxford Supplementary Skills. Fourth Impression 1992. ISBN 0 19 435406 5 (particularly good for writing memos, introduction to presentations, descriptive and argumentative writing).
- c) Reading
 1. Reading. Advanced. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1991. ISBN 0 19 453403 0.
 2. Reading and Study Skills by John Langan
 3. Study Skills by Riachard Yorke.

English III (Technical Writing and Presentation Skills) Crh. 3

Objectives: Enhance language skills and develop critical thinking

Course Contents

Presentation skills

Essay writing

Descriptive, narrative, discursive, argumentative

Academic writing

How to write a proposal for research paper/term paper

How to write a research paper/term paper (emphasis on style, content, language, form, clarity, consistency)

Technical Report writing

Progress report writing

Note: Extensive reading is required for vocabulary building

Recommended books:

Technical Writing and Presentation Skills

- a) Essay Writing and Academic Writing
 1. Writing. Advanced by Ron White. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 435407 3 (particularly suitable for discursive, descriptive, argumentative and report writing).
 2. College Writing Skills by John Langan. Mc=Graw-Hill Higher Education. 2004.
 3. Patterns of College Writing (4th edition) by Laurie G. Kirszner and Stephen R. Mandell. St. Martin's Press.
- b) Presentation Skills
- c) Reading
The Mercury Reader. A Custom Publication. Compiled by norther Illinois University. General Editors: Janice Neulib; Kathleen Shine Cain; Stephen Ruffus and Maurice Scharon. (A reader which will give students exposure to the best of twentieth century literature, without taxing the taste of engineering students).

ISLAMIC STUDIES (Compulsory)

Objectives:

This course is aimed at:

- 1 To provide Basic information about Islamic Studies
- 2 To enhance understanding of the students regarding Islamic Civilization
- 3 To improve Students skill to perform prayers and other worships
- 4 To enhance the skill of the students for understanding of issues related to faith and religious life.

Detail of Courses

Introduction to Quranic Studies

- 1) Basic Concepts of Quran
- 2) History of Quran
- 3) Uloom-ul -Quran

Study of Selected Text of Holly Quran

- 1) Verses of Surah Al-Baqra Related to Faith(Verse No-284-286)
- 2) Verses of Surah Al-Hujrat Related to Adab Al-Nabi (Verse No-1-18)
- 3) Verses of Surah Al-Mumanoon Related to Characteristics of faithful (Verse No-1-11)
- 4) Verses of Surah al-Furqan Related to Social Ethics (Verse No.63-77)
- 5) Verses of Surah Al-Inam Related to Ihkam(Verse No-152-154)

Study of Selected Text of Holly Quran

- 1) Verses of Surah Al-Ihzab Related to Adab al-Nabi (Verse No.6,21,40,56,57,58.)
- 2) Verses of Surah Al-Hashar (18,19,20) Related to thinking, Day of Judgment
- 3) Verses of Surah Al-Saf Related to Tafakar,Tadabar (Verse No-1,14)

Seerat of Holy Prophet (S.A.W) I

- 1) Life of Muhammad Bin Abdullah (Before Prophet Hood)
- 2) Life of Holy Prophet (S.A.W) in Makkah
- 3) Important Lessons Derived from the life of Holy Prophet in Makkah

Seerat of Holy Prophet (S.A.W) II

- 1) Life of Holy Prophet (S.A.W) in Madina
- 2) Important Events of Life Holy Prophet in Madina
- 3) Important Lessons Derived from the life of Holy Prophet in Madina

Introduction To Sunnah

- 1) Basic Concepts of Hadith
- 2) History of Hadith
- 3) Kinds of Hadith
- 4) Uloom –ul-Hadith
- 5) Sunnah & Hadith
- 6) Legal Position of Sunnah

Selected Study from Text of Hadith

Introduction To Islamic Law & Jurisprudence

- 1) Basic Concepts of Islamic Law & Jurisprudence
- 2) History & Importance of Islamic Law & Jurisprudence
- 3) Sources of Islamic Law & Jurisprudence
- 4) Nature of Differences in Islamic Law
- 5) Islam and Sectarianism

Islamic Culture & Civilization

- 1) Basic Concepts of Islamic Culture & Civilization
- 2) Historical Development of Islamic Culture & Civilization
- 3) Characteristics of Islamic Culture & Civilization
- 4) Islamic Culture & Civilization and Contemporary Issues

Islam & Science

- 1) Basic Concepts of Islam & Science
- 2) Contributions of Muslims in the Development of Science
- 3) Quranic & Science

Islamic Economic System

- 1) Basic Concepts of Islamic Economic System
- 2) Means of Distribution of wealth in Islamic Economics
- 3) Islamic Concept of Riba
- 4) Islamic Ways of Trade & Commerce

Political System of Islam

- 1) Basic Concepts of Islamic Political System
- 2) Islamic Concept of Sovereignty
- 3) Basic Institutions of Govt. in Islam

Islamic History

- 1) Period of Khlaft-E-Rashida
- 2) Period of Ummayyads
- 3) Period of Abbasids

Social System of Islam

- 1) Basic Concepts of Social System of Islam
- 2) Elements of Family
- 3) Ethical Values of Islam

Reference Books:

- 1) Hameed ullah Muhammad, "Emergence of Islam", IRI, Islamabad
- 2) Hameed ullah Muhammad, "Muslim Conduct of State"
- 3) Hameed ullah Muhammad, "Introduction to Islam"
- 4) Mulana Muhammad Yousaf Islahi,"
- 5) Hussain Hamid Hassan, "An Introduction to the Study of Islamic Law" leaf Publication Islamabad, Pakistan.
- 6) Ahmad Hasan, "Principles of Islamic Jurisprudence" Islamic Research Institute, International Islamic University, Islamabad (1993)
- 7) Mir Waliullah, "Muslim Jrisprudence and the Quranic Law of Crimes" Islamic Book Service (1982)
- 8) H.S. Bhatia, "Studies in Islamic Law, Religion and Society" Deep & Deep Publications New Delhi (1989)
- 9) Dr. Muhammad Zia-ul-Haq, "Introduction to Al Sharia Al Islamia" Allama Iqbal Open University, Islamabad (2001)

Pakistan Studies (Compulsory)

Introduction/Objectives

- Develop vision of historical perspective, government, politics, contemporary Pakistan, ideological background of Pakistan.
- Study the process of governance, national development, issues arising in the modern age and posing challenges to Pakistan.

Course Outline

1. Historical Perspective

- a. Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-i-Azam Muhammad Ali Jinnah.
- b. Factors leading to Muslim separatism
- c. People and Land
 - i. Indus Civilization
 - ii. Muslim advent
 - iii. Location and geo-physical features.

2. Government and Politics in Pakistan

Political and constitutional phases:

- a. 1947-58
- b. 1958-71
- c. 1971-77
- d. 1977-88
- e. 1988-99
- f. 1999 onward

3. Contemporary Pakistan

- a. Economic institutions and issues
- b. Society and social structure
- c. Ethnicity
- d. Foreign policy of Pakistan and challenges
- e. Futuristic outlook of Pakistan

Books Recommended

1. Burki, Shahid Javed. *State & Society in Pakistan*, The Macmillan Press Ltd 1980.
2. Akbar, S. Zaidi. *Issue in Pakistan's Economy*. Karachi: Oxford University Press, 2000.
3. S.M. Burke and Lawrence Ziring. *Pakistan's Foreign policy: An Historical analysis*. Karachi: Oxford University Press, 1993.
4. Mehmood, Safdar. *Pakistan Political Roots & Development*. Lahore, 1994.
5. Wilcox, Wayne. *The Emergence of Banglades.*, Washington: American Enterprise, Institute of Public Policy Research, 1972.
6. Mehmood, Safdar. *Pakistan Kayyun Toota*, Lahore: Idara-e-Saqafat-e-Islamia, Club Road, nd.

7. Amin, Tahir. *Ethno - National Movement in Pakistan*, Islamabad: Institute of Policy Studies, Islamabad.
8. Ziring, Lawrence. *Enigma of Political Development*. Kent England: WmDawson & sons Ltd, 1980.
9. Zahid, Ansar. *History & Culture of Sindh*. Karachi: Royal Book Company, 1980.
10. Afzal, M. Rafique. *Political Parties in Pakistan*, Vol. I, II & III. Islamabad: National Institute of Historical and cultural Research, 1998.
11. Sayeed, Khalid Bin. *The Political System of Pakistan*. Boston: Houghton Mifflin, 1967.
12. Aziz, K.K. *Party, Politics in Pakistan*, Islamabad: National Commission on Historical and Cultural Research, 1976.
13. Muhammad Waseem, *Pakistan Under Martial Law*, Lahore: Vanguard, 1987.
14. Haq, Noor ul. *Making of Pakistan: The Military Perspective*. Islamabad: National Commission on Historical and Cultural Research, 1993.

**COMPULSORY MATHEMATICS
COURSES FOR B.Sc (Hons) AGRICULTURE**

1. MATHEMATICS I (ALGEBRA)

Prerequisite(s): Mathematics at secondary level

Credit Hours: 3 + 0

Specific Objectives of the Course:

To prepare the students, not majoring in mathematics, with the essential tools of algebra to apply the concepts and the techniques in their respective disciplines.

Course Outline:

Preliminaries: Real-number system, complex numbers, introduction to sets, set operations, functions, types of functions.

Matrices: Introduction to matrices, types, matrix inverse, determinants, system of linear equations, Cramer's rule.

Quadratic Equations: Solution of quadratic equations, qualitative analysis of roots of a quadratic equations, equations reducible to quadratic equations, cube roots of unity, relation between roots and coefficients of quadratic equations.

Sequences and Series: Arithmetic progression, geometric progression, harmonic progression.

Binomial Theorem: Introduction to mathematical induction, binomial theorem with rational and irrational indices.

Trigonometry: Fundamentals of trigonometry, trigonometric identities.

Recommended Books:

Dolciani MP, Wooton W, Beckenback EF, Sharron S, *Algebra 2 and Trigonometry*, 1978, Houghton & Mifflin,

Boston (suggested text)

Kaufmann JE, *College Algebra and Trigonometry*, 1987, PWS-Kent Company, Boston

Swokowski EW, *Fundamentals of Algebra and Trigonometry* (6th edition), 1986, PWS-Kent Company, Boston

2. MATHEMATICS II (CALCULUS)

Prerequisite(s): Mathematics I (Algebra)

Credit Hours: 3 + 0

Specific Objectives of the Course:

To prepare the students, not majoring in mathematics, with the essential tools of calculus to apply the concepts and the techniques in their respective disciplines.

Course Outline:

Preliminaries: Real-number line, functions and their graphs, solution of equations involving absolute values, inequalities.

Limits and Continuity: Limit of a function, left-hand and right-hand limits, continuity, continuous functions.

Derivatives and their Applications: Differentiable functions, differentiation of polynomial, rational and transcendental functions, derivatives.

Integration and Definite Integrals: Techniques of evaluating indefinite integrals, integration by substitution, integration by parts, change of variables in indefinite integrals.

Recommended Books:

Anton H, Bevens I, Davis S, *Calculus: A New Horizon* (8th edition), 2005, John Wiley, New York

Stewart J, *Calculus* (3rd edition), 1995, Brooks/Cole (suggested text)

Swokowski EW, *Calculus and Analytic Geometry*, 1983, PWS-Kent Company, Boston

Thomas GB, Finney AR, *Calculus* (11th edition), 2005, Addison-Wesley, Reading, Ma, USA

3. MATHEMATICS III (GEOMETRY)

Prerequisite(s): Mathematics II (Calculus)

Credit Hours: 3 + 0

Specific Objectives of the Course:

To prepare the students, not majoring in mathematics, with the essential tools of geometry to apply the concepts and the techniques in their respective disciplines.

Course Outline:

Geometry in Two Dimensions: Cartesian-coördinate mesh, slope of a line, equation of a line, parallel and perpendicular lines, various forms of equation

of a line, intersection of two lines, angle between two lines, distance between two points, distance between a point and a line.

Circle: Equation of a circle, circles determined by various conditions, intersection of lines and circles, locus of a point in various conditions.

Conic Sections: Parabola, ellipse, hyperbola, the general-second-degree equation

Recommended Books:

Abraham S, *Analytic Geometry*, Scott, Freshman and Company, 1969

Kaufmann JE, *College Algebra and Trigonometry*, 1987, PWS-Kent Company, Boston

Swokowski EW, *Fundamentals of Algebra and Trigonometry* (6th edition), 1986, PWS-Kent Company, Boston

Note:

- 1. Two courses will be selected from the following three courses of Mathematics.**
- 2. Universities may make necessary changes in the courses according to the requirement as decided by the Board of Studies.**

Statistics-I

Credit 3 (2-1)

Definition and importance of Statistics in Agriculture, Data Different types of data and variables

Classification and Tabulation of data, Frequency distribution, stem-and-Leaf diagram, Graphical representation of data Histogram, frequency polygon, frequency curve.

Measure of Central tendency, Definition and calculation of Arithmetic mean, Geometric mean, Harmonic mean, Median quantiles and Mode in grouped and ungrouped data.

Measure of Dispersion, Definition and Calculation of Range, quartile deviation, Mean deviation, Standard deviation and variance, coefficient of variation.

Practicals

- a. Frequency Distribution
- b. Stem-and-Leaf diagram
- c. Various types of Graphs
- d. Mean, Geometric mean Harmonic Mean,
- e. Median, Quartiles Deviation, mean Deviation.
- f. Standard Deviation, Variance, Coefficient of variation,
- g. Skewness and kurtosis

Book Recommended

1. Introduction to Statistical Theory Part- I by Sher Muhammad and Dr. Shahid Kamal (Latest Edition)
2. Statistical Methods and Data Analysis by Dr. Faquir Muhammad
3. A. Concise Course in A. Level Statistics with world examples by J. Crawshaw and J. Chambers (1994)
4. Basic Statistics an Inferential Approach 2nd Ed. (1986) Fran II. Dietrich-II and Thomas J. Keans

Statistics-II

Credit 3 (2-1)

Sampling Probability and non-Probability Sampling, Simple random sampling stratified random sampling Systematic sampling error, Sampling distribution of mean and difference between two means. Interference Theory: Estimation and testing of hypothesis, Type—I and type-II error, Testing of hypothesis about mean and difference between two means using Z-test and t-test, Paired t-test, Test of association of attributes using X² (chi-square) Testing hypothesis about variance.

Practicals

- a. Sampling random sampling
- b. Stratified random sampling.
- c. Sampling distribution of mean
- d. Testing of hypotheses regarding population mean
- e. Testing of hypotheses about the difference between population means
- f. Chi-square test
- g. Testing of Correlation Coefficient
- h. Fitting of simple linear regression
- i. One-way ANOVA
- j. Two-way ANOVA

Book Recommended

1. Introduction to Statistical Theory Part-II by Sher Muhammad and Dr. Shahid Kamal (Latest Edition)
2. Statistical Methods and Data Analysis by Dr. Faquir Muhammad
3. Principles and Procedures of Statistics A Bio-metrial approach, 2nd Edition, 1980 by R.G.D Steal and James H. Tarric
4. Statistical Procedures for Agricultural Research 2nd Edition (1980) by K.A. Gomez and A.A. Gomez

Note: *Universities may make necessary changes in the courses according to the requirement as decided by the Board of Studies.*

Course Name: Introduction to Information and Communication Technologies

Course Structure: Lectures: 2 Labs: 1

Credit Hours: 3

Pre-requisite: None

Semester: 1

Course Description:

This is an introductory course on Information and Communication Technologies. Topics include ICT terminologies, hardware and software components, the internet and world wide web, and ICT based applications.

After completing this course, a student will be able to:

- Understand different terms associated with ICT
- Identify various components of a computer system
- Identify the various categories of software and their usage
- Define the basic terms associated with communications and networking
- Understand different terms associated with the Internet and World Wide Web.
- Use various web tools including Web Browsers, E-mail clients and search utilities.
- Use text processing, spreadsheets and presentation tools
- Understand the enabling/pervasive features of ICT

Course Contents:

- : Basic Definitions & Concepts
- : Hardware: Computer Systems & Components
- : Storage Devices , Number Systems
- : Software: Operating Systems, Programming and Application Software
- : Introduction to Programming, Databases and Information Systems
- : Networks
- : Data Communication
- : The Internet, Browsers and Search Engines
- : The Internet: Email, Collaborative Computing and Social Networking
- : The Internet: E-Commerce
- : IT Security and other issues
- : Project Week
- : Review Week

Text Books/Reference Books:

Introduction to Computers by Peter Norton, 6th International Edition (McGraw HILL)

Using Information Technology: A Practical Introduction to Computer & Communications by Williams Sawyer, 6th Edition (McGraw HILL)

Computers, Communications & information: A user's introduction by Sarah E. Hutchinson, Stacey C. Swayer

Fundamentals of Information Technology by Alexis Leon, Mathewsleon Leon Press.

Functional Biology-I

Credit Hours 3+0

Biological Methods

Principles of Cellular Life
Chemical Basis
Structure and Function
Principles of Metabolism
Energy Acquisition

Principles of Inheritance

Mitosis and Meiosis
Chromosomes
Observable Inheritance Patterns
DNA Structure and Function
RNA and Proteins
Genes
Genetic Engineering and Biotechnology

Biodiversity

Fundamental Concept of Biodiversity
One or two examples of each of the following from commonly found organism
Prions
Viruses
Bacteria
Protistans
Algae
Fungi
Plants
Crops
Animals
Invertebrates
Vertebrates

Reading

1. Roberts, M.M., Reiss and G.Monger. 2000. Advanced Biology, Nelson.
2. Starr, C, and R, Taggart, 2001. Biology: The Unity and Diversity of Life Brooks and Cole.
3. Campbell, N.A., J.B, Reece, L.G. Mitchell, M.R, Taylor. 2001. Biology: Concepts and Connections. Prentice-Hall.

Functional Biology-II

Credit Hours 3+0

Myths and Realities of Evolution

Microevolution

Speciation

Macroevolution

Level of Organization

Plants

Tissues

Nutrition and Transport

Reproduction

Growth and Development

Animals

Tissue, Organ System and Homeostasis

Information Flow and Neuron

Nervous System

Circulation and Immunity

Nutrition and Respiration

Reproduction and Development

Ecology and Behavior

Ecosystems

Biosphere

Social Interactions

Community Interactions

Human Impact on Biosphere

Environment Conservation

Reading

1. Roberts, M.M., Reiss and G.Monger. 2000. Advanced Biology, Nelson.
2. Starr, C, and R, Taggart, 2001. Biology: The Unity and Diversity of Life Brooks and Cole.
3. Campbell, N.A., J.B, Reece, L.G. Mitchell, M.R, Taylor. 2001. Biology: Concepts and Connections. Prentice-Hall.

Note: *Universities may make necessary changes in the courses according to the requirement as decided by the Board of Studies.*