CURRICULUM

OF

FOOD SCIENCE AND TECHNOLOGY

BS/B.Sc (Hons)
MS/M.Sc (Hons)

(Revised 2010)

HIGHER EDUCATION COMMISSION
ISLAMABAD
CURRICULUM DIVISION, HEC

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
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<tr>
<td>Dr. Syed Sohail H. Naqvi</td>
<td>Executive Director</td>
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<tr>
<td>Prof. Dr. Altaf Ali G. Shaikh</td>
<td>Member (Acad)</td>
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<tr>
<td>Mr. Muhammad Javed Khan</td>
<td>Adviser (Academic)</td>
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<td>Ms. Ghayyur Fatima</td>
<td>Director (Curri)</td>
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<td>Dr. M. Tahir Ali Shah</td>
<td>Deputy Director (Curri)</td>
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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 and MS (Food Science and Technology). 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 meetings of NCRC in Food Science and Technology were held on 19-21 October, 2009 and 12-14 April, 2010 at HEC Regional Centre, Karachi. The meeting was attended by the following members:

<table>
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<tr>
<th>Sr.</th>
<th>Name</th>
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<tr>
<td>1.</td>
<td>Prof. Dr Faqir Muhammad Anjum, Convener</td>
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<td></td>
<td>Institute of Food Science and Technology,</td>
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<td>University of Agriculture, Faisalabad</td>
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<td>2.</td>
<td>Prof. Tariq Maqsood, Member</td>
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<td></td>
<td>Chairman</td>
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<td></td>
<td>Deptt of Food Science &amp; Tech</td>
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<td>Arid Agriculture University</td>
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<td>3.</td>
<td>Prof. Dr. Javeed Aziz Awan, Member</td>
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<td></td>
<td>National Institute of Food Science &amp; Technology</td>
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<td></td>
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<td>4.</td>
<td>Dr. Alam Zeb, Member</td>
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<tr>
<td></td>
<td>Professor</td>
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<td>KPK Agricultural University</td>
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<td>Peshawar</td>
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<td>5.</td>
<td>Dr. Saleem ur Rehman, Member</td>
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<td>Professor</td>
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<td>National Institute of Food Science &amp; Technology</td>
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<td></td>
<td>University of Agriculture, Faisalabad</td>
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<td>6.</td>
<td>Prof. Dr. Abid Hussain, Member</td>
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<td></td>
<td>Deptt of Food Science &amp; Tech</td>
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<td></td>
<td>University of Karachi</td>
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<td>7.</td>
<td>Dr. Ikram ul Haq, Member</td>
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<td></td>
<td>Director</td>
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<td></td>
<td>Institute of Industrial Biotechnology</td>
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<td></td>
<td>G.C. University</td>
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<td>Lahore.</td>
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<td>8.</td>
<td>Dr. Jehan Ara, Member</td>
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<td></td>
<td>Professor</td>
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<td></td>
<td>University of Karachi</td>
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7
9. Dr. Habib Ahmad Rathore  
   Chairman  
   Deptt of Food Tech  
   Faculty of Agriculture  
   University of Azad Jammu & Kashmir  
   Rawalkot, AJK  
   Member

10. Dr. Habib ur Rehman  
    Assistant Professor  
    Department of Food Science & Technology  
    Gomal University, D.I.Khan  
    Member

11. Dr. Sarfraz Hussain  
    Chairman  
    Department of Food Science & Technology  
    University of Sargodha  
    Member

12. Dr. M.A.K. Malghani  
    Professor  
    Department of Food Science & Technology  
    Balochistan University of Information Technology, Engineering Management Science, Quetta  
    Member

13. Dr. Zulfqar Ali  
    Assistant Professor, Food Technology  
    Karakoram International University  
    Gilgit  
    Member

14. Dr. Saeed Akhtar  
    Assistant Professor  
    Department of Food & Horticultural Science  
    University College of Agriculture  
    B.Z. University, Multan  
    Member

15. Dr. Samina Khalid  
    Food Quality & Nutrition Program  
    National Agriculture Research Centre (NARC) Park Road  
    Islamabad.  
    Member

16. Dr. Ihsanullah  
    Head  
    Food Science Division  
    Nuclear Institute for Food & Agriculture (NIFA) P.O. Box 446  
    Peshawar  
    Member
The proceedings started with the recitation of Holy Verses from the Holy Quran. Prof. Dr. Altaf Ali G. Shaikh, Member Curriculum Development Program and Academics, HEC Islamabad welcomed the participants and briefed about the objectives of the meeting and the obligations of the Higher Education Commission for review, revision and development of curricula. He informed the participants that curriculum of B.Sc (Hons), M.Sc (Hons) and Ph.D degrees in Food Technology were previously revised in 2001 and 2004.

Dr. Shaikh informed the members that Government is striving hard to enhance the quality of education in public sector Universities/Institutions by developing curriculum and making it more compatible with international standards, job oriented and in line with the needs of the society. He distributed the template of the 4 years B.Sc Hons. in Agriculture disciplines among the members as a guideline for developing Food Science & Technology curriculum. He suggested that Internship of full semester be reduced to a four to six credit hours course and contact hours of practical be increased from 2 to 3 hours. The four years degree program comprises 130 to 140 credit hours.

He further informed the house that after developing the first draft of the curriculum, it will be sent abroad for review to meet the international standards. The comments on curriculum received from foreign experts...
will be communicated and discussed in final meeting to be convened at appropriate time.

Prof. Dr. Faqir. Muhammad Anjum who was elected as convener of the committee welcomed all the members and Dr. Altaf Ali G. Shaikh and thanked the participants for attending the meeting. Dr Faqir M Anjum informed the members about various curricula being taught at different Universities. After through discussions and deliberations, it was decided to provide copies of syllabi being taught at various institutions for review. The syllabi of Undergraduate program B.Sc. Hons (4-years) of the following universities were given to each member for review.

1. University of Agriculture, Faisalabad.
2. Sindh Agriculture University, Tandojam.
4. The University of Sargodha, Sargodha.
5. Karakaram International University, Gilgat.

On the next day, every member participated in discussions and briefed the house about the deficiencies in the syllabi of various Universities and finally developed a template for B.Sc. Hons (4-Years) in Food Science and Technology containing compulsory courses, foundation courses, supporting courses and major courses.

The Curricula of postgraduate program was also discussed in length. Courses were distributed among the participants and finally a list of courses to be proposed was developed and revisions were suggested in the course contents.

In the end, Dr. M. Tahir Ali Shah, Deputy Director, Curriculum, HEC thanked all the members for attending the meeting and their contributions. The meeting ended with a vote of thanks.

Dr. Saghir A. Sheikh
Member/Secretary

Prof. Dr. Faqir Muhammad Anjum
Convener
## Scheme of Studies

### Four years B.Sc. (Hons.) / B.S. Food Science & Technology/ Food Technology

<table>
<thead>
<tr>
<th>S#</th>
<th>Course Code</th>
<th>Title</th>
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<tr>
<td><strong>1st Year: 1st Semester</strong></td>
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<tr>
<td>1.</td>
<td>Math Bio</td>
<td>Mathematics-I or Biology-I</td>
<td>3(3-0) 3(2-1)</td>
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<tr>
<td>2.</td>
<td>Stat</td>
<td>Statistics-I</td>
<td>3(3-0)</td>
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<tr>
<td>3.</td>
<td>CS</td>
<td>Introduction to Information Technology/ Computer</td>
<td>2(1-1)</td>
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<tr>
<td>4.</td>
<td>SSH</td>
<td>Pakistan Studies</td>
<td>2(2-0)</td>
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<tr>
<td>5.</td>
<td>Eng</td>
<td>English-I</td>
<td>3(3-0)</td>
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<td>6.</td>
<td>Biochem</td>
<td>Biochemistry</td>
<td>3(3-0)</td>
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<td>7.</td>
<td>FST</td>
<td>Introduction to Food Science and Technology</td>
<td>3(2-1)</td>
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<td><strong>Total</strong></td>
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<td><strong>1st Year: 2nd Semester</strong></td>
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<tr>
<td>1.</td>
<td>Math Bio</td>
<td>Mathematics-II or Biology-II</td>
<td>3(3-0) 3(2-1)</td>
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<td>Stat</td>
<td>Statistics-II</td>
<td>3(2-1)</td>
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<td>3.</td>
<td>IS SSH</td>
<td>Islamic Studies or Ethics (For Non-Muslim Students)</td>
<td>3 (3-0)</td>
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<td>Agron</td>
<td>Basic Agriculture</td>
<td>3(2-1)</td>
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<td>5.</td>
<td>Hort</td>
<td>Horticulture</td>
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<td>6.</td>
<td>FST</td>
<td>General Microbiology</td>
<td>3(2-1)</td>
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<td>7.</td>
<td>FST</td>
<td>Principles of Human Nutrition</td>
<td>3 (3-0)</td>
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<td>1.</td>
<td>Ento</td>
<td>Entomology</td>
<td>3(2-1)</td>
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<td>2.</td>
<td>PP</td>
<td>Plant Pathology</td>
<td>2(1-1)</td>
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<tr>
<td>3.</td>
<td>ENG</td>
<td>English-II</td>
<td>2(1-1)</td>
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<td>PHY</td>
<td>Physics</td>
<td>3 (2-1)</td>
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<td>FST</td>
<td>Food Processing &amp; Preservation</td>
<td>3(2-1)</td>
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<td>Food Chemistry</td>
<td>3(3-0)</td>
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<td><strong>2nd Year: 4th Semester</strong></td>
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<td>MAB</td>
<td>Marketing and Agri. Business</td>
<td>3 (3-0)</td>
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<td>2.</td>
<td>FST</td>
<td>Unit Operation in Food Processing</td>
<td>3(3-0)</td>
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<td>3.</td>
<td>FST</td>
<td>Fluid Mechanics</td>
<td>3(2-1)</td>
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<td>4.</td>
<td>FST</td>
<td>Food Plant Layout</td>
<td>2 (2-0)</td>
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<td>5.</td>
<td>FST</td>
<td>Food Analysis</td>
<td>3(1-2)</td>
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<tr>
<td>6.</td>
<td>FST</td>
<td>Food Process Engineering-I</td>
<td>3 (2-1)</td>
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**3rd Year: 5th Semester**

| 1.   | FST       | Food Toxicology and Safety | 3(3-0)  |
| 2.   | FST       | Fruit and Vegetable Processing | 3(2-1) |
| 3.   | FST       | Cereal Technology          | 3(2-1)  |
| 4.   | FST       | Sugar Technology           | 3(2-1)  |
| 5.   | FST       | Technology of Fats and Oils | 3(2-1) |
| 6.   | FST       | Instrumental Techniques in Food Analysis | 3(1-2) |
| 7.   | FST       | Food Process Engineering-II | 3 (2-1) |
| Total|           |                            | 21      |

**3rd Year: 6th Semester**

| 1.   | FST       | Community Nutrition and Dietetics | 3(2-1) |
| 2.   | FST       | Beverage Technology               | 3(2-1) |
| 3.   | FST       | Confectionery and Snack Foods     | 3(2-1) |
| 4.   | FST       | Bakery Products Technology        | 3(2-1) |
| 5.   | FST       | Postharvest Technology            | 3(2-1) |
| 6.   | FST       | Food Microbiology                 | 3(2-1) |
| 7.   | FST       | Food Product Development          | 3(1-2) |
| Total|           |                            | 24      |

**4th Year: 7th Semester**

| 1.   | FST       | Meat Technology                  | 3(2-1) |
| 2.   | FST       | Dairy Technology                 | 3(2-1) |
| 3.   | FST       | Food Laws and Regulations        | 3(3-0) |
| 4.   | FST       | Food Biotechnology               | 3(2-1) |
| 5.   | FST       | Food Packaging                   | 3(2-1) |
| 6.   | FST       | Poultry and Egg Processing       | 3(2-1) |
| 7.   | FST       | Research Projects and Scientific Writing | 2(1-1) |
| Total|           |                            | 20      |

**4th Year: 8th Semester**

| 1.   | FST       | Sensory Evaluation of Foods      | 3(2-1) |
| 2.   | FST       | Sea Food Processing Technology   | 3(2-1) |
| 3.   | FST       | Extrusion Technology             | 3(2-1) |
| 4.   | FST       | Milk and Meat Hygiene and Public Health | 3(2-1) |
| 5.   | FST       | Food Quality Management          | 2(2-0) |
| 6.   | FST       | Internship and Report Writing    | 4(0-4) |
| Total|           |                            | 18      |

*Note:* Courses, codes, placement and number of courses may be adopted by the Universities as per their nomenclature and requirements.
Details of Courses for Bs/Bsc (Hons) in Food Science and Technology

FST- Introduction to Food Science and Technology 3(2-1)

Theory

Practical
Use of laboratory equipments. Estimation of moisture, fat, protein, carbohydrates, fiber and ash in food samples. Determination of soluble solids, total solids, pH, acidity, total sugars, specific gravity, refractive index and peroxide value.

Books Recommended

FST- General Microbiology 3(2-1)

Theory

Practical
Safety in microbiological laboratory. Basic functions and handling of laboratory equipments. Use of microscope. Sterilization and disinfection

**Books Recommended**


**FST- Principles of Human Nutrition 3(3-0)**

**Theory**


**Books Recommended**


FST- Food Processing & Preservation 3(2-1)

Theory

Practical

Books Recommended

FST- Food Chemistry 3(3-0)

Theory

Books Recommended

FST- Unit Operations in Food Processing 3(3-0)

Theory

Books Recommended


FST- Fluid Mechanics 3(2-1)

Theory

Practical

Books Recommended

FST- Food Plant Layout 2(2-0)

Theory
Food processing industry: introduction, investment. Plant location and layout: significance, location analysis, selection criteria - freedom from

Books Recommended

FST- Food Analysis 3(1-2)

Theory

Practical
Books Recommended


FST- Food Process Engineering-I 3 (2-1)

Theory

Practical

Books Recommended

FST- Food Toxicology and Safety 3(3-0)

Theory

Books Recommended

FST- Fruits and Vegetable Processing 3(2-1)

Theory

Practical
Preparation of fruits and vegetables products: dried, frozen and canned. Quality evaluation of the products during storage. Manufacturing of pickle, juice concentrate, ready to serve juices, squashes, syrups and
fruit candies. Use of edible coating for fruits and vegetables. Visit to fruit and vegetable processing units.

Books Recommended

FST- Cereal Technology 3(2-1)

Theory

Practical
Grading of grains. Milling of cereal grain through different mills. Tests for flour quality assessment. Visit to wheat, maize and rice processing industries.

Books Recommended
FST- Sugar Technology 3(2-1)

Theory

Practical

Books Recommended

FST- Technology of Oils and Fats 3(2-1)

Theory
Practical
Extraction of oils and fats. Determination of physical and chemical constants: color, cold test, melting point, smoke point, specific gravity, solid fat index, refractive index, acid value, peroxide value, iodine value, saponification value. Visit to oil and fat industries.

Books Recommended

FST- Instrumental Techniques in Food Analysis 3(2-1)

Theory

Practical

Books Recommended
FST- Food Process Engineering-II 3(2-1)

Theory

Practical

Books Recommended

FST- Community Nutrition and Dietetics 3(2-1)

Theory

**Practical**

**Books Recommended**

**FST- Beverage Technology 3(2-1)**

**Theory**

Practical
Water treatment and analysis. Preparation and preservation of fruit pulps and juice concentrates. Formulation and preparation of carbonated beverages. Analysis of beverages: chemical, microbiological, sensory. Manufacture of fermented beverages and synthetic drinks. Visit to beverage industries

Books Recommended

FST- Confectionery and Snack Foods 3(2-1)

Theory

Practical
Preparation of candy, toffee, chocolates, and other sugar based confectionery. Manufacture of potato chips, fried legumes, nuts, nuggets, extruded snacks. Visit to confectionery and snack food industries.

Books Recommended

**FST- Bakery Products Technology 3(2-1)**

**Theory**
Science of bakery product: emulsions, oils & fats, proteins, starch, water. Raw materials: grains, milling; grades of flours; types of flours – Chorleywood bread flour, patent, soft, wholemeal, brown and low moisture flours; leavening agents; flour treatments; food starch excluding flour; fats; emulsifiers; colors; flavors; antioxidants; sugars; dairy ingredients; gums and gelling agents. Bread making: chemistry of dough development, making of bread, types of breads, variants of bread. Products other than bread: pastry, biscuits, wafers, cakes and other chemically leavened products. Dietetics bakery products. Quality control in bakery.

**Practical**
Preparation of breads, pastry, biscuits, wafers, cakes and chemically leavened products. Effect of different ingredients on bakery products. Visit to different baking plants.

**Books Recommended**

**FST- Postharvest Technology 3(2-1)**

**Theory**
technology of cereals: harvesting, threshing, drying, storage and handling. New developments in postharvest technology.

Practical
Determining harvest maturity of different fruits and vegetables. Grading and sorting. Applications of different postharvest techniques. Changes in physical and chemical quality parameters of fruits during storage - weight loss, acidity, TSS, vitamin C degradation, firmness, color changes. Effect of packaging materials on stored fruits and vegetables. Effect of different chemicals - anti-sprouting, anti-ripening.

Books Recommended

FST- Food Microbiology 3(2-1)

Theory

Practical
Isolation, identification and characterization of micro organisms: morphology, biochemical. Enumeration of microorganisms in food and water samples (total count, viable count, MPN). Examination of foods for pathogenic organisms (Escherichia coli, Coliform, Salmonella and Listeria monocytogenes).

Recommended Books

FST- Food Product Development 3(2-1)

Theory

Practical
Food product development projects - strategy, design, development, commercialization, launch and evaluation. Practical aspects and sensory evaluation techniques. Chemical and instrumental quality analysis.

Recommended Books

FST- Meat Technology 3(2-1)

Theory

**Practical**

**Books Recommended**

**FST- Dairy Technology 3(2-1)**

**Theory**

**Practical**
**Books Recommended**


**FST- Food Laws and Regulations 3(3-0)**

**Theory**

**Books Recommended**


**FST- Food Biotechnology 3(2-1)**

**Theory**
Biotechnology: introduction, history. Microbial metabolism. Developments in metabolic and biochemical engineering: metabolites, range of fermentation processes, components of fermentation

**Practical**
Isolation, purification and maintenance of yeast and bacterial cultures. Aerobic and anaerobic fermentation and production of various fermented food products.

**Books Recommended**

**FST - Food Packaging 3(2-1)**

**Theory**

**Practical**

**Books Recommended**
2. EIRI (Engineers India Research Institute). 2007. Handbook of packaging technology. Engineers India Research Institute, New Delhi, India.

FST- Poultry and Egg Processing 3(2-1)

Theory


Practical

Books Recommended

FST- Research Projects and Scientific Writing 2(1-1)

Theory
Types of scientific presentations. Collection of literature: printed and electronic sources. Managing literature. Initiating write up. Writing
scientific documents: synopsis, research proposal, articles, references, internship report. Oral presentations.

Practical
Exercises in collecting literature from different sources on assigned topics. Organizing and analysis of collected material. Writing synopsis/proposal, short communication, Delivering oral presentation.

Books Recommended

FST - Sensory Evaluation of Foods 3(2-1)

Theory

Practical
Taste, odor identification, trigeminal sensations, taste modifiers. Use of sequential testing in selecting judges. Training of panelists by difference tests such as triangle test, paired comparison test, duo-trio test. Color, threshold determination, just noticeable difference. R-Index rating and ranking. Category scaling, determining an ideal level of an ingredient. Magnitude estimation. Descriptive analysis of different foods. Consumer test and analysis.

Books Recommended


FST- Sea Food Processing Technology 3(2-1)

Theory

Practical

Recommended Books

FST- Extrusion Technology 3(2-1)

Theory
vegetable protein, breakfast cereals, direct expanded and third generation snacks.

**Practical**
Quality assessment of raw materials. Preparatory operations of raw material. Preparation of textured vegetable proteins, breakfast cereals, flavor coated snacks, third generation snacks. Effect of variation of ingredients, screw speed, temperature, etc. on the quality of end product.

**Books Recommended**

**FST- Milk and Meat Hygiene and Public Health 3(2-1)**

**Theory**


**Practical**

Books Recommended


FST- Food Quality Management 2(2-0)

Theory

Books Recommended


FST- Internship and Report Writing 4(0-4)
Every student will undertake practical training in an approved food industry or research organization. The student will maintain a daily diary duly signed by the industrial/research supervisor. At the end of the internship, the student will submit a written report. He/she will be
evaluated by a committee on the basis of his/her performance in the industry/research organization, final written report and oral presentation.
### Scheme of Studies
MS/M.Sc. (Hons.)/ Ph.D Food Science & Technology

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<tr>
<th>Course No.</th>
<th>Title of Course</th>
<th>Credit Hours</th>
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<td>Food Biotechnology</td>
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<td>FST-</td>
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<td>FST-</td>
<td>Dairy Processing-I</td>
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<td>FST-</td>
<td>Advanced Food Microbiology</td>
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<td>Ind. Processing Technol. of Edible Oils &amp; Fats Products</td>
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<td>Meat Science</td>
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<td>Technology of Processed Meat</td>
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<td>Food Industrial Waste Management</td>
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<td>FST-</td>
<td>Post Harvest Management</td>
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<td>Food Packaging</td>
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<td>Physical Properties of Food</td>
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<td>FST-</td>
<td>Recent Advances in Food Science and Technology</td>
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<td>FST-</td>
<td>Milling of Cereals</td>
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<td>FST-</td>
<td>Food Quality Assurance Management</td>
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<tr>
<td>FST-</td>
<td>Special Problem</td>
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</table>
Detail of courses for MS/M.Sc. (Hons.)/Ph.D in Food Science & Technology

Advanced Food Biotechnology 3(2-1)

Theory

Practical
Isolation, purification and maintenance of yeast and bacterial cultures, aerobic and anaerobic fermentation and production of various fermented food products. Production of metabolites and enzymes, their purification.

Books Recommended

Food Additives 3(2-1)

Theory
Food additives: purpose of application in food, regulatory status, generally recognized as safe (GRAS), mode of action, stability & interaction with food components, metabolism & carcinogenic effect, recommended doses, application techniques in food, benefits & risks, precautionary instructions for safe use of food additives in food, hypersensitivity of food, consumers attitude towards food additives.
Types of food additives: antimicrobial agents, nutritional additives – vitamins and minerals, antibiotics, colors, flavoring & flavor enhancers, sugar and fat substitutes, sweeteners, acids, bases, humectants, thickening agents, gel builders, stabilizers, anticaking agents, emulsifiers, bleaching, glazing agents, sequestrant. Recommended analysis techniques of various food additives in food.

Practical
Estimation of food additives in different foods: antioxidants, enzymes, vitamins, minerals, anti-nutritional factors, colors, flavors, sweeteners, amino acids, sorbates, benzoates, emulsifiers.

Books Recommended

Food Enzymology 3(2-1)

Theory

Practical
Books Recommended

Food Toxicology 3(3-0)

Theory

Books Recommended

Baking Science & Technology

Theory

Practical

Books Recommended

Starch Chemistry and Technology 2(2-0)

Theory
development. Starch and health; physical performance, nutritional fractions and resistant starches.

Books Recommended

Dairy Processing I 3(2-1)

Theory

Practical

Books Recommended
Dairy Processing-II 3(2-1)

Theory

Practical

Books Recommended
Advanced Food Microbiology 3(2-1)

Theory

Practical
Microbial techniques, detection of microorganism in food samples, detection of automated rapid and conventional methods for microbial toxins, metabolites, inhibitory substances, pathogens and bacteriophages through HPLC, GC and other techniques. Electrophoretic protein profiles of bacteria.

Books Recommended

Advanced Food Chemistry 3(2-1)

Theory
Carbohydrates: Nomenclature, classification, structure. Sugars: properties, functions in food, structural and functional changes during processing. Polysaccharides: Starch - structure, properties, gelatinization, retrogradation. Cellulose/Pectins/Gums - structure,

**Practical**
Isolation and extraction of different food components. Titrametric determination of sugars, vitamin C, iodine etc. Separation of natural food colors. Extraction of pectin from fruit waste. Estimation of starch, cholesterol, total dietary fiber, glucose, pigments etc.

**Books Recommended**

**Chemistry of Edible Oils and Fats 3(2-1)**

**Theory**
Introduction, history of triglyceride analysis, triglycerides types, nomenclature and possible applications. Extraction, isolation and fatty acid analysis (Methyl ester preparation, column, identification of peaks, quantization etc.). Preparation of chemical derivation reactions at double bond (hydrogenation, permanganate oxidation, ozonization, bromination, mercuration etc) reactions at ester linkages, hydroxy, epoxy and keto groups, silver ion adsorption chromatography, TLC, Column chromatography and application, GLC, Fractional crystallization. Distribution theories of fatty acid in natural triglyceride mixtures.

**Practical**
Extraction of lipids, isolation of triglycerides by column chromatography, Florisil/ salicylic acids, TLC. Fatty acid analysis by GLC, Methyl ester
preparation. Catalytic hydrogenation, permagnate oxidation, ozonization, epoxidation, bromination etc. Silver ion adsorption chromatography.

Books Recommended

Industrial Processing Technology of Edible Oils & Fats Products 3(2-1)

Theory

Practical
Oil extraction, refining, bleaching, hydrogenation and deodorization. Preparation of different fat products: butter, margarine, dressings, toppings etc. Visits to various oil processing plants and quality control laboratories.

Books Recommended
Meat Science 3(2-1)

Theory

Practical
Determination of chemical composition of red meat. Protein profile of various meats. Determination of minerals, vitamins, fatty acids and toxins.

Books Recommended

Technology of Processed Meat 3(2-1)

Theory
Practical
Local meat products and cookery: Beef stews, chili, sausages, meat balls with gravy, sliced dried beef, potted meat, smoked meat & other meat products, restructured meat products.

Books Recommended

Food Industrial Waste Management 3(3-0)

Theory
Food industrial wastes: types; sources and characteristics of food processing wastes. Waste disposal and physical, chemical and biological treatments. BOD, COD, Bio processing in food waste treatment. Management of waste by products: sugar, fruits and vegetable, meat, fish, oil and fat, dairy and cereals. Recovery of materials from effluents by different systems. Utilization of food industry wastes.

Books Recommended

Post Harvest Management 3(3-0)

Theory
Fruits and vegetables: Structure, composition, physiology and biochemistry methods of harvesting, losses during harvesting, handling, transportation, packaging and storage. Water losses, respiration activity,

Books Recommended

Food Packaging 3(2-1)

Theory

Practical
Selection of packaging material for specific foods, study of shelf life of different foods in various packaging materials, comparison of different packaging. Materials for quality, migration of hazardous chemicals from packaging material to foods. Package integrity checks. Testing of packaging materials and packages.

Books Recommended

Physical Properties of Food 3(2-1)

**Theory**

**Practical**

**Books Recommended**

Recent Advances in Food Science and Technology 3(2-2)

**Theory**
technology. Modern quality standards like ISO-22000. New tools in food analysis: HPLC, electrophoresis, FTIR, Mass spectrometry and coupling techniques like GC-MS, LC-MS. Recent news in food science and technology.

Books Recommended

Milling of Cereals 3(2-1)

Theory

Practical

Books Recommended

Advanced Beverage Technology 3(2-1)

Theory

Filling systems: Premix, post mix, three stage processes. Composition and formulation of carbonated and non-carbonated beverages: Carbon dioxide and carbonation. Trouble shooting in beverage industry: spoilage detection and control, physical, chemical and microbiological spoilage. Shelf life of beverages: factors affecting shelf life.

Practical
Production and sensory evaluation of different instant and powdered mixes/drinks, fermented, still, carbonated and non-carbonated beverages. Storage study of such prepared products under different conditions through taking laboratory tests (physical, chemical, sensory and microbiological examination) during whole storage life.

Books Recommended

Food Quality Assurance Management 3(3-0)

Theory
Codex Alimentarius: Format of commodity standards. Quality assurance: theoretical and practical considerations, description of different systems: GMP, TQM, HACCP, ISO – 9000, 9001 and 22000 series. Verification, certification and validation. WHIMS. Biosecurity programs. Philosophical approaches to quality assurance: Deming's,
Juran’s Corsby’s etc. Statistical quality control techniques. Sanitation and hygiene in quality assurance. Quality Assurance tools, instrument calibration, production line check record, laboratory analysis record. Incoming material inspections, certificate of analysis, training manuals and programmes, Internal and external audits.

Books Recommended

Special Problem 1 (1-0)
Seminar 1 (1-0)
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

   b) Writing

   c) Reading/Comprehension

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**

b) **Writing**

c) **Reading**
   2. Reading and Study Skills by John Langan
   3. Study Skills by Riachard Yorky.

**English III (Technical Writing and Presentation Skills)**

Credit Hrh. 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

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 Scharton. (A reader which will give students exposure to the best of twentieth century literature, without taxing the taste of engineering students).
Annexure – B

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 Holy 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 Selec ted 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) Ulum –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,”
6) Ahmad Hasan, “Principles of Islamic Jurisprudence” Islamic Research Institute, International Islamic University, Islamabad (1993)
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
   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
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.


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

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


Recommended Books:
Dolciani MP, Wooton W, Beckenback EF, Sharron S, Algebra 2 and Trigonometry, 1978, Houghton & Mifflin,
Kaufmann JE, College Algebra and Trigonometry, 1987, PWS-Kent Company, Boston

Boston (suggested text)
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:
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:**


**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 digram, 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 digram
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 kinesis

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
4. Basic Statistics an Inferential Approach 2nd Ed. (1986) Fran II. Dietrich-II and Thomas J. Kears
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

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)
Computers, Communications & Information: A User’s Introduction by Sarah E. Hutchinson, Stacey C. Swayer
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
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

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