



AIC Report

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**Department of Food Science & Technology
UCA & Environmental Sciences, Islamia University, Bahawalpur**

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Executive Summary

Dr. Moazzam Jamil, Principal, University College of Agriculture and Environmental Sciences (UCA&ES) welcomed Prof. Dr. Faqir Muhammad Anjum and Dr. Saeed Akhtar; the members of accreditation inspection committee (AIC) HEC as external evaluators to technically assess and appraise the Discipline of Food Science and Technology at Islamia University -Bahawalpur (IUB).

Dr. Moazzam Jamil gave a presentation to the AIC team covering college history, faculty, degree programs, curriculum, research projects, students' perception, college budget and future plans. Dr Jamil highlighted the emergence of the discipline of Food Science and Technology stating that it started in September 2013 with the mission "To produce graduates who will be capable to work in a competitive field of Food Science and Technology to preserve national assets and to boost the country's economy"

Bahawalpur is known for production of dates and mangoes in addition to production several other kinds of fruits and vegetables. Moreover, many small food processing industries are also working in the region justifying that the establishment of the department of Food Science and Technology in this area would be a source of supplying skilled graduates and professionals for food industry and allied research and development organizations. Presently, the department is endeavoring to establish collaboration with different food processing industries and research institutions.

The department of Food Science and Technology has three full time teachers; one of them is on study leave for PhD. So, currently two full time teachers are available at the moment. Both of them are holding PhD and have experience of working in national and international food processing organizations. Presently only 26 students are studying in the discipline who are in 6th semester. Since only one class is enrolled therefore the teacher student ratio in the discipline comes out to be 1:13 for this year which will increase in the subsequent years.

MAJOR CRITERIA

1. Strength and Quality of Faculty

The existing faculty is well qualified and seems to be good enough for dissemination of good quality education in Food Science and Technology in this department. Presently two full time faculty members with the third one on study leave for her PhD are working in food science discipline. Both the teachers are PhDs. These faculty members had been able to publish research papers in well reputed national and international journals last year. They have also presented their research work in national and international conferences.. Three research projects have been designed; one of them is in progress while other two are under review. The faculty has shown promise to elevate educational, research and professional standards in the realm of Food Science and Technology however there exists a plenty of room for improvement and growth of this discipline in South Punjab and the existing faculty may escalate it further provided they are backed up by the superiors. .There is urgent need to appoint more faculty in the discipline of food science and technology

2. Curriculum Design and Development

The discipline of Food Science and Technology follows HEC recommended curriculum for B. Sc. (Hons.) degree program as per decision of the National Curriculum Revision Committee (NCRC) and duly approved by University's statutory bodies such as board of studies, board of faculty, academic council and syndicate. It is generally revised/updated after every four- five (4-5) years by HEC Islamabad. The scheme of studies of B. Sc. (Hons.) Agriculture-Food Science and Technology at UCA & ES comprise of 137 credit hours, as per direction of HEC with recommended major/minor/supporting courses. However, there is a lot of scope to modify the curriculum to some extent keeping in view the regional needs e.g. the local fruits and vegetables and other food crops may be focused for detailed studies.

Infrastructure and Learning Resources

Presently, all academic activities in Food Science and Technology are being carried out in the building of Faculty of Islamic Learning at IUB. However, the construction

of new building of the institute is in progress according to the approved PC-I and will be completed in near future. A Central Computer Lab is available at Central library comprising 200 computers. Student entry is free and they have access to world journals and books prescribed by HEC. One laboratory of 40 Computers has been planned in PC-I of the college for teaching various Computers / IT courses. Currently, computer labs in Faculty of Islamic Learning and Faculty of Science are available for students of Food Science and Technology. In addition to above, Desktop computers, Laptop computers and Multimedia are available for students in Labs. /rooms and all staff offices have internet/Wi-Fi connections. There is shortage of infrastructure comprising class rooms and laboratories. The books and journals relevant to the discipline in library are lacking and should be arranged on priority basis. The equipment and lab facilities for the discipline under inspection are not present in the institute which needs to be provided at the earliest.

MINOR CRITERIA

3. Students Support and Progression

The purpose of any educational institution is to train students to work for their own success and for the growth of the organization they work with. The discipline of Food Science and Technology is working hard to develop a sense of leadership among students so that they may work in the challenging environment of food processing industries and research organizations. The discipline of FST is trying to provide best opportunities to its students to enhance their professional capabilities, so that they may become valuable assets of nation. A good number of experiments regarding food analysis and food preservation are being carried out in the labs of department. The students enjoy free access of internet for having study material, to prepare reports and assignments. The University also owns a well established Central Library where many relevant books are available; students have free access to these books. There is also a book-bank within the library for students. To cater the medical needs of students, the university has a well established Medical Dispensary that works round the clock under the supervision of a team of qualified medical officers. The university also has play grounds where the students are encouraged to participate in extracurricular activities and sport competitions generally are held every year. The university also provides well organized transport facilities to students.

4. Research and Consultancy Activities

The discipline of Food Science and Technology at Islamia University of Bahawalpur has very short life as it started its journey from September, 2013 with 26 students who are in 6th semester; even then the discipline has been on the journey to success in terms of teaching and research. The discipline has three submitted projects (of Worth 0.5 M, 3.7 M and 1.0M) to HEC while one project (of worth 0.5 M) is in progress. The discipline of FST is also carrying out training activities on “Food Processing and Preservation” with the cooperation of PSDF (Punjab Skills Development Fund). However, the faculty needs to be involved in more research activities.

5. Governance and Leadership

University College of Agriculture & Environmental Sciences, Islamia University of Bahawalpur and discipline of Food Science & Technology has a well defined

hierarchical system. The Discipline of FST is working in the University College of Agriculture and Environmental Sciences under the “Principal of College”. The College is a part of Faculty of Sciences which is being headed by “Dean of Sciences”. The Dean, Sciences reports to Vice Chancellor. There is need to have an independent department of Food Science and technology headed by the chairman.

6. Recent Innovations and Best practices

The discipline is not able to give any innovation yet. However, a best practice is the working of QEC (Quality Enhancement Cell) at University and Discipline level that takes feed-back regarding teaching from the students and teachers; send the results to Principal UCA & ES for improvement.

SWOT ANALYSES:

Major strengths

- The faculty members of the discipline Food Science & Technology (FST), University College of Agriculture & Environmental Sciences (UCA&ES), The Islamia University of Bahawalpur (IUB) are PhD qualified, have acquired sufficient professional background and experience to teach the students, and qualify for HEC approved PhD supervisor status.
- The available faculty members of FST, UCA&ES, IUB are actively involved in teaching and research activities. They have been able to publish research in HEC recognized journals, and also have published in international conference proceedings coupled with winning several international and national awards.
- FST, UCA & ES, IUB has the ability to strengthen the production, post-harvest management, processing, value addition and export of local food products, such as date palm, mango and camel milk, and edible products of Cholistan (Rohi). Date palm conference conducted by UCA&ES, IUB was the most recent effort to achieve these objectives.
- The curriculum of FST, UCA&ES, IUB has capability to address the issues like food availability, food biosecurity, malnutrition of Rohi region, where food resources are very limited.
- The graduates of FST develop knowledge and skills for addressing the issues related to food safety, human nutrition, value addition, processing and preservation of local food products, to make them availability round the year throughout the region.
- The university students have free access to internet facility, and subscribed to the *Science Direct* scientific journals for retrieving latest research articles related to their subjects.

Major weaknesses

- The facility lacks space and equipment required for Practical and research, however, a separate section for laboratories for FST in a new building is under construction.
- No budget has been allocated for establishment of lab facilities and training of lab assistants/attendants in FST, UCA&ES, IUB.
- The faculty members need comprehensive teaching and post-doctoral trainings to acquire the latest teaching and research skills.
- The discipline of FST lacks a pilot plant for food processing which is necessary for the development of professional capabilities and skills in FST graduates.
- The central library at IUB has only 79 books related to the FST, and needs to be strengthened with latest recommended and prescribed books in the curriculum.

Major opportunities

- FST, UCA&ES, IUB can collaborate with national and international teaching and research organizations for exchange of students, faculty and expertise. Moreover, the department can collaborate with TEVTA and SMEDA for training of local community.
- Being the only institute of FST in Southern Punjab, the FST graduates can enjoy ample job opportunities in food processing industries situated here.
- Along with currently offered degree program, short courses in discipline of FST can be offered for promotion of public knowledge and skills for processing and storage of edible local products like dates, mango, camel milk etc.
- The department may be hub for research on mango dates and other food crops to meet regional needs in terms of food security and may also be a source to alleviate poverty in the region.

Major threats

- The department of FST is located in a poverty ridden region (South Punjab) where the literacy rate is relatively low and resources are scarce. The food industrialists do not prefer to establish industry in this region therefore this situation may consequent upon the reduced job opportunity for the students graduating for this department.
- The existing an established department of food science and technology in the nearest University BZU which is attracting the students thereby leading to the decreased number of students available to the FST.
- There have been little opportunities for the students to interact with food science professionals as the department is located in a less developed region.
- The shortage of faculty, support staff, research and development funds, recurring budgets and faculty development may hamper the growth of the department.

Final recommendation

Based on the documented proofs, enquiries with the teaching faculty, staff and students of FST, UCA&ES, IUB as well as physical inspection of classes and laboratory facilities, we hereby conclude that despite the acute shortage of staff, funds and facilities for this discipline, a genuine need exists for this program in this region. The quality of education offered at this department sufficiently meets the national requirements for the degree of B.Sc. Hons. Agriculture - FST. The faculty members are capable to handle the workload for undergraduate level. Moreover, the discipline of FST at UCA&ES, IUB is serving the local community with valuable training for the development of knowledge and skills.

Keeping in view the prescribed criteria of NAEAC, the committee after deliberate evaluation and discussion, hereby unanimously recommends that the degree of B.Sc. Hons. Agriculture - FST offered by The Discipline of FST, UCA&ES, IUB be graded with the band --.

Evaluation Criteria Weightage for Agriculture Degree Programs

Sr. No.	Program Evaluation Criteria	Points Assigned	Points Awarded
			B.Sc (H)
Major Criteria			
1	Strength and Quality of Faculty	250	150
2	Curriculum Design and Development	150	100
3	Infrastructure and Learning Resources	200	100
4	Students Support and progression	100	72
Sub - Total (a)		700	422
Minor Criteria			
5	Research and Consultancy Activities	150	74
6	Governance and Leadership	100	72
7	Recent Innovations and Best practices	50	36
Sub - Total (b)		300	182
Grand Total (a+b)		1000	606

Name and Designation

Signature of Program Evaluator

Criteria I: Strength and Quality of Faculty 150/250

(Please consult standards (S1-S14) at page#18)

1.1 Full -Time and Part - Time Faculty 25/55

Regular and full-time faculty, teaching core subjects.

<u>Designation</u>	<u>Full Time</u>	<u>Part Time</u>	<u>Total</u>
Professor	0	0	0
Associate Professor	0	0	0
Assistant Professor	2	0	2
Lecturer	1	0	1
Total			03

1.1.1 Status of Faculty

Full time Faculty required	03	Full time Faculty in position	03
Visiting faculty required	-	Visiting Faculty in position	-

1.2 Faculty Qualifications and Teaching Experience 13/20

Status of Faculty qualification and experience.

<u>Qualification</u>	<u>Number</u>	<u>Average Teaching Experience (Years)</u>
Post Doctorate	0	0
Doctorate	02	4.5
M. Phil/M.Sc(Hons)	01	6

1.3 Teaching Work Load 13/20

Number of credit-hours teaching per week, based on actual number of different categories of teachers.

Designation	Existing Teaching Load
Professors	0
Associate Professors	0
Assistant Professors	12
Lecturers	12

1.4 Use of Students Assessment Instruments by Faculty 14/15

Assessment Instruments (Tick)	Adequately used	Inadequately used	Not used at all
• Quizzes	✓		
• Assignments	✓		
• Projects/seminars	✓		
• Sessional tests	✓		
• Mid-term	✓		
• Final exams	✓		

1.5 Faculty Course Review Reports 13/15

Preparation and submission of Course Review Reports (CRR) by each Faculty member at the time of course evaluation.

Course Review Reports (CRR) submitted:

Regularly ✓ Occasionally _____ CRR submitted Rarely _____
 (Evidence of course review reports may be ensured)

1.6 Degree Program Monitoring System 8/10

Adequate program monitoring system exists at the department level. ✓

Monitoring system exists but not implemented _____

Inadequate monitoring system _____, Monitoring system does not exist _____

1.7 Training of Newly Inducted Faculty Members 8/ 15

In order to become an effective teacher, all newly inducted faculty members are to receive 4-6 weeks training suitably designed to encompass the important aspects of teaching.

Systematic teachers training plan in place _____

Some orientation but no formal training plan

No system of teachers training in place _____

1.8 Faculty Development and Career Planning 7/15

Improvement plan of faculty qualification leading to PhD and Post-Doc etc.

Well planned and implemented _____ Poorly planned and rarely implemented Not planned at all _____

1.9 Salaries and Fringe Benefits of the Faculty 0 8/ 10

Attractive _____ Reasonable Low _____

Evidence of implementation of incentives (if any) _____

1.10 Environment at workplace of Teaching Faculty 03/ 05

Very Good _____ Good Satisfactory _____ Unsatisfactory _____

1.11 Faculty Stability Computed Index 03/05

Very Good _____ Good Satisfactory _____ Unsatisfactory _____

1.12 Awards/Recognitions received by the Faculty Members 5/10

Sufficient awards _____ Insufficient awards No awards _____

1.13 Participation of Faculty in Seminars/Conferences during Last 3 years 03/05

Adequate Participation Inadequate Participation _____ No Participation _____

1.14 Textbooks/Chapters of Books Written by the Faculty Members 05/10

Text books written _____ Chapters of books written

Conference proceedings

1.15 Graduate Research Supervision 00/ 10

Average No. of PhD Students supervised by each HEC approved Professor _____ NA

Average No. of M.Sc Students supervised by each Faculty Member _____ NA

1.16 Job Satisfaction 04/ 05

Very much Satisfied _____ Moderately Satisfied Least Satisfied _____

Reasons for Satisfaction/Dissatisfaction: Insufficient research facilities and less support to faculty for faculty development as Post Docs

1.17 Opportunities to Faculty for Academic Progress 02/05

Adequate Opportunities _____ Inadequate Opportunities ✓

1.18 Faculty Perception About on-going degree Programs 04/ 05

Performing well ✓ Not performing well _____

Degree Programs need up-gradation Yes ✓ No _____

Reasons for not performing well _____

1.19 Teaching-Learning Methods Adopted by the Faculty 12/ 15

	<u>Fully</u>	<u>Partially</u>	<u>None</u>
• Uses variety of appropriate instructional techniques.	<u>✓</u>	_____	_____
• Promote analytical and critical thinking.	_____	<u>✓</u>	_____
• Encourages questions from students.	<u>✓</u>	_____	_____
• Believes in dialogue and discussion.	<u>✓</u>	_____	_____
• Professional code of ethics is observed.	<u>✓</u>	_____	_____

Criteria II: Curriculum Design and Development 100/ 150

(Please consult standards (S15-S22) at page#18)

2.1 Curriculum Objectives of Degree Programs 14/ 20

Well defined ✓ Vaguely defined _____ Not defined _____

Curriculum objectives supportive to degree programs ✓ Fully Partially

Objectives examined and found relevant ✓ Objectives are achievable ✓

2.2 Curriculum Contents are: 10/ 15

	<u>Fully</u>	<u>Partially</u>	<u>None</u>
• Well-structured and rich in contents.	<u>✓</u>	_____	_____
• Compatible with emerging needs.	<u>✓</u>	_____	_____
• Information technology integrated into the curriculum.	<u>✓</u>	_____	_____
• Able to achieve students learning outcomes.	<u>✓</u>	_____	_____
• Flexible to offer sufficient choices for the students.	<u>✓</u>	_____	_____

2.3 Curriculum Revision 10/15

Curriculum revision in the light of National, HEC and International requirements and on the demand of the market.

Revised regularly (every 3-4 years), Revised occasionally _____ No revision _____

2.4 Students Perception about the Curricula 07/ 10

Students perception regarding the quality, innovation, new Knowledge and technology.

- | | | | |
|---------------------|------------|-----------------------------------|------------|
| • Innovative | _____ | • Good quality of course contents | ✓
_____ |
| • Current | ✓
_____ | • Fair quality of course contents | _____ |
| • Obsolete | _____ | • Poor quality of course contents | _____ |
| • Latest technology | _____ | | |

2.5 Textbooks, Reference Books and Journals etc 05/10

Prescribed textbooks/reference books may be examined in the light of International practices.

- | | | | |
|----------------------|------------|---|------------|
| • Highly recommended | _____ | • Available in the uni/deptt. Library | ✓
_____ |
| • Acceptable | ✓
_____ | • Old Edition/New Edition | _____ |
| • Sub-standard | _____ | • Available/Not available in the market | _____ |
| • Inadequate | _____ | | |

2.6 Course Contact Hours 06/10

Total contact hours committed to theory and practical work for effective teaching of different courses.

- | | | | |
|----------------------------|------------|---|----------------|
| • More than HEC guidelines | _____ | • Average Contact hours for theory course | <u>1</u> hrs |
| • Sufficient | ✓
_____ | • Average Contact hours for practicals | <u>2</u> hrs |
| • Insufficient | _____ | • Total Contact hours for a course | <u>3-4</u> hrs |

2.7 Completion of Courses 07/10

Completion of theory courses during the prescribed period as per official record (To be verified by the Program Evaluators/Experts).

Very good _____, Satisfactory ✓ _____, Unsatisfactory _____

2.8 Course Registration & Withdrawal Policy 07/10

Policy with adequate details Policy with inadequate details _____

Policy not available _____ policy is well spelled _____

Policy adequately disseminated to the students _____

2.9 Admission Policy 07/10

- Well documented and notified Documented but not notified _____
- Appropriately documented _____ Not documented. _____

2.10 Maintenance of Course Files (To be verified) 06/10

The practice of maintaining course file is adopted internationally to monitor as how effective the course has been taught. A course file may include all relevant data (such as given below) which could become the basis of evaluation.

- Lecture breakdown for entire semester.
- Schedule of monthly/mid-term tests and final examination and daily attendance record.
- Breakdown of laboratory experiments pertaining to the course and record of successful conduct.
- Listing of textbooks and other reference books pertaining to the course.
- Recommendations and suggestions related to the course for the next session.

Maintained and well organized , Not properly organized _____, Not maintained _____

(The Program Evaluators may examine a few course files for the Faculty Members the previous and on-going semesters.)

2.11 Meetings of Board of Studies/Faculty (Evidence of the meetings held) 15/20

Held regularly Held occasionally _____ Never held _____

Regular and frequent meetings of Board of Studies

Changes/Updating the curriculum during the last 2-3 years

Stakeholders feedback is solicited and incorporated in the curricula

Mechanism of stakeholders feedback exists

2.12 Students View-point about Teacher's performance 06/10

Very much satisfied _____ Satisfied Not satisfied _____

Criteria III: Infrastructure and Learning Resources 100/ 200

(Please consult standards (S23-S53) at page#18)

3.1 Labs and their Capacity 14/30

No. of Research Labs 02 No. of Teaching Labs 1

Working capacity of Research Labs. 20 Working capacity of Teaching Labs. 30

3.2 Adequacy and Quality of Lab Equipment 7/20

- Adequate • Fully operational • Good quality
- Inadequate ✓ • Partially operational ✓ • Average quality ✓
- Not available • Not operational • Poor quality

3.3 Lab Equipment Utilization 05/10

- Properly utilized ✓ Reasons for inadequate utilization
- Inadequately utilized Reasons for poor utilization
- Poorly utilized Apparatus/Equipment out of order

3.4 Availability and Qualification of Lab. Staff 05/ 10

- Available ✓ Partly Available Not Available
- ¹Trained for the job Partly Trained ✓ Not Trained
- Highly Experienced Moderately Experienced Least Experienced ✓
- Lab Staff with professional qualification Matric/DAE

3.5 Lab Safety Measures 6/10

- Availability & use of Lab manual & Protocols Available ✓ Not Available
- Lab safety equipment & manual Available ✓ Not Available

3.6 Annual Budget Allocation for Maintenance and Operation of Labs 05/10

More than Adequate Adequate
Inadequate ✓ Amount Allocated

¹ Qualified & Trained as Lab Technician, Lab assistant and Lab attendant
National Agriculture Education Accreditation Council (NAEAC)

3.7 Library Annual Budget 05/10

Main Lib. Annual budget Rs. 50000 Department Lib. Annual budget Nil

More than Adequate _____ Adequate _____ Inadequate ✓

3.8 Students Views about Lab Practicals 02/ 05

<u>Conduct of Practicals</u>		<u>Coverage of Course practicals</u>	
• Regular	<u>✓</u>	All practicals arranged	_____
• Irregular	_____	Some of practicals arranged	<u>✓</u>
		<u>Yes</u>	<u>No</u>
Practical Note-books complete and maintained (Evidence to ensure Please)		<u>✓</u>	_____

3.9 Subject Books: Total and Purchased (during Past two years) 05/10

	<u>Main Library</u>		
	<u>Text Books</u>	<u>Ref. Books</u>	<u>Total</u>
Total No. of books	<u>50</u>	<u>30</u>	<u>80</u>
Books purchased Last two years	<u>30</u>	<u>15</u>	<u>45</u>
No books purchased	_____	_____	_____

	<u>Department Library</u>		
	<u>Text Books</u>	<u>Ref. Books</u>	<u>Total</u>
Total No. of books	<u>NA</u>	_____	_____
Books purchased Last two years	_____	_____	_____
No Books purchased	_____	_____	_____

3.9 Subscription to Foreign Journals during last two years 05/10

Adequate number of magazines and journals for each program may be subscribed through hard copies.

Number of Foreign Journals Subscribed Science direct Journals

3.10 Local and Foreign Journals 3/05

Local Journals 05 Foreign Journals Nil

Sufficient and variety available _____ Sufficient but variety not available _____

Insufficient _____ Non – existing _____ +

3.11 Book Bank 03/ 05

Availability of discipline textbooks and reference books in the central library for borrowing by the students for the whole session.

Sufficient _____ Total No. of books in book bank _____

Exist but insufficient _____ Books purchased for the last two years _____

Does not exist _____

3.12 Library Equipment 06/ 10

Equipment in the central library such as computers, photocopiers, typewriters, scanners, video and audio equipment, CD Writer, computerized search etc (please give number).

Computers ✓ _____ Photocopiers ✓ _____ Typewriters _____ Scanners ✓ _____

Video & Audio Equipment _____ CD Writer ✓ _____

3.13 Library Space/environment 03/05

No. of Chairs/Seats 120 Peace of mind ✓ _____ Lack of least noise _____

3.14 Students Access to various Facilities 07/10

Computer seating capacity Sufficient ✓ _____ Insufficient _____

Online surfing capacity _____ ✓ _____

Students Access to Library Facilities Yes ✓ _____ No _____

3.15 Students opinion about the quality of services provided by the library 08/10

Comments: The library staff cooperates and the environment of library is comfortable to learn.

3.16 Faculty/Students Computer Ratio 03/ 05

Computers for Faculty 03 Computers for Students 02
Computers for M.Sc (Hons) NA

3.17 Website of the Institution/Department 04/05

Maintained and updated regularly Maintained but not updated _____
No Website _____

3.18 Buildings and Total Covered Area 04/ 05

Departmental building infrastructure as per academic and administrative requirements. Total Covered area (Sq.ft) 5000

3.19 Class Rooms and Faculty Offices 04/ 05

No. of Class rooms 02 Covered area (sq. ft) 1600
Class rooms with multimedia Nil No. of Faculty offices 02
Faculty offices Covered area (sq.ft) 300 Faculty offices with internet 02
Computer lab Nil Common room

3.20 Experimental Area and Farm Machinery 00/10

Total Farm area (acres) _____ Distance from the Department _____
Buildings at the Farm _____
Adequate Research facilities for post-graduate students _____
Details of Farm Machinery & Equipment (List) _____
(Please ensure complete list of farm equipment)

Criteria IV: Students Support and Progression 72/ 100

(Please consult standards (S54-S64) at page#19)

4.1 Nature of Admission Response to Degree Programs of the Discipline 5/05

Overwhelming Moderate _____ Low _____

4.1.1 Annual Intake of Students 04/05

More than requirement _____ Average intake in B.Sc (Hons) 1st Semester 180 (26 in Major)
According to requirement Average intake in M.Sc(Hons) 1st semester NA

4.2 Yield Index 05/05

Yearly percentage of the graduating students with respect to total admission in a year.

Academic Year	Students Enrolled		Students Graduated	
	B.Sc (Hons)	M.Sc(Hons)	B.Sc (Hons)	M.Sc(Hons)
2009-10	120 in Agri.(Major FT: NA)	NA	Major FT: NA	NA
2010-11	180 in Agri (Major FT: NA)	Major FT NA	Major FT: NA	NA
2011-12	179 in Agri (Major FT: NA)	Major FT NA	Major FT: NA	(Major FT: NA)
2013	188 in Agri (26 in Major FT)	Major FT: NA	Major FT: NA	(in 6 th Semester)

4.2.1 Dropouts in a academic year 05/05

Average No. of dropouts in B.Sc (Hons) Nil (Major FT), No. of dropouts in M.Sc (Hons) NA FT)

4.2.2 CGPA of Students of Degree Programs for the last three years 05/05

	Highest CGPA	Average CGPA
B.Sc (Hons)	4.00/4.00	3.5/4.00 (Major FT)
M.Sc (Hons)	4.00/4.00	NA (Major FT)

4.3 Financial Support to Students 03/ 05

Various scholarships and interest-free loans, the students received from various sources last year.

	Scholarships awarded by the University	
	Merit Based	Need-Based
B.Sc (Hons)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
M.Sc (Hons)	MSc (Hons) Food Tech NA	MSc (Hons) Food Tech NA

4.4 Availability of Interest- free Loans 03/ 05

Adequate _____ Inadequate _____ Not Available _____

4.5 Students Scholarships opportunities other than university 3/ 05

- Adequate _____ Scholarships Sources 1 Punjab Educational Endowment Fund (PEEF) _____
2 _____
- Inadequate _____ 3 _____

4.6 Availability of Hostel(s) Accommodation 03/05

Adequate _____ Inadequate _____ Poor _____
No. of Hostels 8 Capacity For Housing students 3000

4.7 Convocation Hall/Auditorium 02/ 05

Adequate Inadequate _____ Not Available _____

4.8 Sports Facilities (swimming pool, gym, play grounds, Indoor games etc) 03/05

Adequate Inadequate _____ Does not Exist _____

4.9 Transport facilities for Students 03/05

Adequate Inadequate _____ No. of university buses 36
Total Seating capacity 2000
Not available _____

4.10 Medical Facilities for Faculty and Students 04/05

Adequate Inadequate _____ Not Available _____

4.11 Academic Counseling 03/05

Guidance available to the students from discipline teachers beyond teaching hours.

Well organized Unarranged & occasional _____ No counseling at all _____

4.12 Internship/Project Training 07/10

Eighth semester Undergraduates internship/project training carrying (5) credit hours or Engagement of students in practical training.

Compulsory Reasonable provision _____ No provision _____
Evidence/verification of internship (reports with emphasis quality) from department _____

4.13 Students Interaction with Teachers 02/ 03

Very Encouraging Encouraging _____ Discouraging _____

4.14 Students General Attitude Towards Studies 02/02

Very Encouraging _____ Encouraging Discouraging _____

4.15 Students Attendance Record 2/05

Properly maintained Improperly maintain _____ Not maintained at all _____
Attendance % Required 75%

4.16 Students Perception about Degree Programs 05/ 05

Best Aspects of the degree programs

The subject of Food Science and Technology is helpful for obtaining jobs in Pakistan and abroad; the study of this subject is also beneficial for community health.

Aspects of the degree programs that could be improved.

More focus and emphasis is needed for the laboratory work.

4.17 Opportunities/resources for students to participate in seminars/conferences/field tours 03/05

Satisfactory

4.18 Involvement of students in the community welfare activities by organizing university students club. 04/ 05

Satisfactory

Criteria V: Research and Consultancy Activities 74/ 150

5.1 Total Annual Research funds received from HEC and other sources 14/30

Total Research fund during Past three years Rs. 0.5M

Regular/Irregular _____ Occasional ✓

5.1.1 Utilization of Annual Research Grant 08/15

Faculty Research Rs. _____ Graduate Research Rs. _____ Both Activities _____

5.2 Faculty Publications (Other than Student Thesis) during last 3 years 14/20

Each faculty member is expected to publish at least 1-2 good papers in a reputed referred journal.

Impact Factor Journals ✓ HEC approved Journals ✓
Other Journals ✓ All Types of Proceedings etc ✓

5.3 Continuity of Faculty Research 05/ 10

Adequate _____ Inadequate ✓ Does not exist _____

5.4 Academic Collaboration (Meetings, Seminars, Journals, Research Projects) 06/10

The collaboration can be quite effective if the objectives of the collaborative programs are clearly defined.

Collaborating agencies

1. Private Sector 2. HEC
3. _____ 4. _____

5.6 Budgetary Allocations for Seminars and Conferences, etc (last 3 years) 0/20

Amount Allocated Rs. _____

5.7 Funded Research Projects underway and completed during last 3 years 10/20

Projects Completed 0 Projects Underway 01 Projects in pipeline 02

5.8 Advisory Services rendered to other Organizations 04/05Organization receiving services

1. _____ PSDF _____ 2. _____ Food Industry _____
 3. _____ Local community _____ 4. _____ _____

5.9 Dissemination and Use of Research Results 03/ 05

Evidence of Publication and dissemination of completed research (e.g. booklets, brochures, leaflets, flyers, etc for the end users) _____ Journals

5.10 Organized the following during Last 3 Years 10/ 15

<u>Activity</u>	<u>Yes</u>	<u>No</u>	<u>Number</u>
• Farmers Field Days	_____	<input checked="" type="checkbox"/>	_____
• Zari Mella Stall (Agri.business exhibition)	<input checked="" type="checkbox"/>	_____	<u>01</u>
• Farmers Moot (Mango festival)	<input checked="" type="checkbox"/>	_____	<u>01</u>
• Farmers Colloquia (Date palm conference)	<input checked="" type="checkbox"/>	_____	<u>01</u>

Criteria VI: Governance and Leadership of the Institution 72/100

(Please consult standards (S69-S71) at page#19)

6.1 Administrative Authority/Governance 10/10

Clearly defined vaguely defined _____ Status not defined _____

6.2 Organizational Setup 15/15

Organizational Setup of financial and academic infrastructure.

Well laid out Overlapping _____ Weak _____

6.3 Rules and Procedures Documented 15/ 15

Well documented Not appropriately documented _____ Not documented _____

6.4 Administrative Control 08/10

Academic and administrative powers delegated to essential organs.

Powers clearly delineate Not clearly delineated _____ not delineated _____

Highly Centralized _____ Moderately Centralized Decentralized _____

6.5 Financial Resources 04/ 10

Financial resources available to the Department from various sources. Stability of Financial Resources:

Highly stable _____ Stable _____ Existing but unstable

6.6 Operational Budget 04/10

Allocated current budget compared with the required budget of the Department.

Total operational budget requirement Rs. 1.5 M

Available Operational Budget Rs. No independent budget; Budget is shared with the Principal office's (0.97 M).

6.7 Development/ Research Budget 01/05

Budget available to department for Research, development & administrative functions for last 3 years. 1.5 Lac.

6.8 Placement Bureau 03/05

Each teaching department should have placement bureau and maintain record of students' employment, assist the students in placement and interact with relevant employers.

Exists and operative _____ Exists but not operative Does not exist _____

6.9 Alumni's Profile (Students Forum) 07/10

The Department is encouraged to develop a database of outgoing graduates to receive their feedback through establishment of a placement bureau and form an alumni's association.

Satisfied Unsatisfied _____ Not available _____

6.10 Calendar of Activities of Degree Programs 05/ 05

Annual Calendar prepared regularly in consultation with Faculty and Support Staff

Annual calendar is available Not available _____ Not prepared _____

6.11 News Bulletin/Magazine 0/05

Department regularly issues the followings:

Newsletter _____ News Bulletin _____ Magazine _____

Criteria VII: Adoption of Good Practices 36/50

7.1 Please describe at least two good practices adopted related to Curriculum Review and Development and Faculty Development. 14/20

- 1- The discipline of Food Science and Technology, UCA & ES follows HEC prescribed curriculum for BSc(Hons)- Food Science and Technology; however, the faculty tends to modify the contents of the courses for making them more understandable to the students; this helps them to use various methodologies.
- 2- For the purpose of improving faculty potential and exposure, the faculty members are encouraged to participate in seminars, symposia and conferences at local and international level. This will help in sharing the scientific expertise and open the ways of collaboration.

7.2 Please indicate at least two good practices adopted pertaining to quality instructions and teaching methods by the faculty. 8/10

- 1- The teachers of the discipline maintain course files that help them to teach in a planned way; it is also helpful in completing the courses in due period of time.
- 2- During contact with class of Food Science & Technology, the students were found very confident about their subject, they had clear concepts which imply that teachers taught them in a good way and utilized the time effectively.

7.3 Good Practices adopted for Students – Teachers Assessment 7/10

- 1- In the discipline, the students are motivated for presentations and they give presentations. This practice develops confidence in students. During the questioning/answering with other students they make their concepts clear; this activity ultimately prepares them for interviews.
- 2- In the institute, the system of examination is well managed. At college level, the examination system is centralized. During examination and while finalizing the results, the marks for Mid and Final Exam, quizzes, attendance are well documented to ensure transparency of examination system.
- 3- At university level there is QEC (Quality Enhancement Cell) which is responsible for carrying out the assessment of teachers by students. At the end of each semester QEC takes feed-back from students on prescribed forms, conducts analysis of feed-back and send it back to concerned teachers via higher authorities. The teachers in response look into their shortcomings and improve themselves.

7.4 Good Practices adopted for Knowledge Acquisition and Skill Development in Graduate Students 07/10

1. Near the completion of each course, a study tour is arranged to an industry relevant to the course where the students learn processing at industrial level.
2. Using available sources, the under graduate students are taught various laboratory techniques regarding food analysis and food processing & preservation.
3. During the last semester of degree the students are sent to different Food Processing Organizations and Research Institutions for internship where they participate in different activities regarding to the subject and improve their knowledge and skills.

1. GENERAL RECOMMENDATIONS

1. The institute need to appoint new faculty with expertise in different areas of food science and technology like cereal and baking technology, fruits and vegetable processing, food engineering etc.
2. There is need to establish a specialized “Food Processing Hall”, equipped with baking line, canning line, fruits and vegetable processing line and dairy processing line. It will give students practical exposure of different food processing techniques, as well as the pilot scale plants will be a source of regular income for the Institute.
3. AIC team has noticed that there is an incomplete building besides IAGS main building. Funds may be provided to complete the construction and furnishing of this building to establish specified labs in this building at shortest possible time.
4. Nomenclature of the degrees should be changed as “B.Sc (Hons.) Food Science and Tehcnology” and “M.Sc (Hons.) Food Science and Technology”.
5. Most of the teachers are serving as TTS, contractual or visiting faculty with no job security. Therefore, it is recommended that TTS/contractual faculty be gradually appointed on regular basis for their job security. This will improve faculty strength in the Institute.
6. There is no senior faculty member specialized in the field of food science and technology. Hiring of experienced faculty members at the level of Associate Professor / Professors is highly recommended.
7. Teaching labs should be entitled as Under-graduate Labs and Post-graduate Labs rather than Agronomy lab, Entomology lab, Horticulture lab, M.Sc Lab and PhD lab etc.
8. Laboratory staff should be adequately trained. The capacity of existing supporting staff could be improved through short-term trainings.

9. Adequate financial assistance should be provided to support the internship program at undergraduate level and to carryout graduate and postgraduate research activities.
10. Sufficient financial resources should be provided to the Institute for operational expenses and financial grant should be provided for the improvement of efficiency of the faculty and the supporting staff. It is recommended to separately allocate a specified budgetary support for the discipline of Food Science and Technology as per actual requirement.
11. The department library should be enriched with induction of books, local and international journals, literature and computers on continuous basis.
12. To broaden the view of the students and teachers, more linkages should be developed with institutions of higher learning both at national and international levels.
13. Independent identity should be given to the department for better their better progress
14. With respect to higher student ratio, new faculty appointment is recommended.

2. FINAL RECOMMENDATIONS

Although, the Institute has been offering various degree programs like Plant Pathology and Horticulture, It can play a significant role in producing the graduates in the discipline of Food Science and Technology to cater the need of the food industries around Lahore. Based on NAEAC prescribed criteria , the committee after deliberation and brain storming, unanimously ***recommended the degree programs of the Institute to be graded at the upper band of “ X “ category*** with 78% (i.e. The classification of degree programs with minor shortfalls expected to meet the criteria as set by the Council of Accreditation).

I. Teaching Faculty profile

Sr No	Name	Qualification	Designation	Experience
1	Dr. Muazzam Jamil	PhD Soil Science	Associate Professor/Principal	20 years
2	Dr. Zulfiqar Ahmad	PhD Food Sci and Tech	Assistant Professor	07 years
3	Dr. Ammar Khan	PhD Food Sci and Tech	Lecturer	05 years
4	Miss Zahida Qadeer	MSc (Hons) Food Sci and Tech	Lecturer	07 years
5	Miss Sara Zafar Awan	MSc (Hons) Food Sci and Tech	Lecturer	01 year
6	Dr Muhammad Iqbal	PhD PBG	Associate	22 years
7	Dr Muhammad Naeem	PhD PBG	Assistant Professor	03 years
8	Mr.Mueen Alam Khan	MSc (Hons)	Assistant Professor	06 years
9	Dr Tanveer Hussain	PhD Forestry	Associate	15 years
10	Dr Irfan Ashraf	PhD Forestry	Assistant Professor	07 years
11	Dr Muhammad Rafay	PhD Forestry	Assistant Professor	01 year
12	Dr Muhammd Abdullah	PhD Forestry	Assistant Professor	01 year
13	Mr. Muhmmad Safeer	MSc (Hons) Forestry	Lecturer	02 year
14	Dr Naeem Ch	PhD Agronomy	Assistant Professor	25 years
15	Dr Own Samar Raza	PhD Agronomy	Assistant Professor	03 year

16	Dr Ijaz Ahmad	PhD Agronomy	Assistant Professor	02 year
17	Dr Muhammad Saqib	PhD Agronomy	Assistant Professor	02 years
18	Dr Hafiz Haider Ali	PhD Agronomy	Assistant Professor	01 years
19	Mr Muhammad Latif	MSc (Hons) Agronomy	Lecturer	08 years
20	Dr Javed Iqbal	PhD Entomology	Assistant Professor	08 years
21	Dr Waqar Ul Hassan	PhD Entomology	Assistant Professor	04 years
22	Miss Bushra Siddique	MSc (Hons) Entomology	Lecturer	07 years
23	Miss Riffat Yasmin	MSc (Hons) Entomology	Lecturer	05 years
24	Dr Maqshoof Ahmad	PhD Soil Science	Assistant Professor	03 years
25	Dr Ghulam Hassan Abbassi	PhD Soil Science	Assistant Professor	03 years
26	Mr Fakhar uz Zaman	MSc.(Hons) Soil Science	Assistant Professor	10 years
27	Sarwar Yaqoob	MSc (Hons) Horticulture	Assistant Professor	12 years
28	Dr Liaqat Ali	PhD Horticulture	Assistant Professor	02 years
29	Mr Muhammad Nafees	MSc (Hons) Horticulture	Lecturer	06 years
30	Mr Muhammad Ishtiaq	MSc (Hons) Horticulture	Lecturer	02 years
31	Dr Fareeha Rehman	PhD Extension	Assistant Professor	02 years

32	Miss Ambreen	MSc (Hons) Plant Pathology	Lecturer	04 years
33	Mr Hamid Nawz	MSc (Hons) Extension	Lecturer	10 years
34	Mr Rana M Bilal	MSc (Hons) Animal Nutrition	Lecturer	05 years

II. Support staff

The detailed list of employees presently working in the Discipline Food Science and Technology and University College of Agriculture and Environmental Sciences is given below:

Lab and supporting staff for faculty and scholars

Sr. No.	Name of Employee	Designation	BPS	Nature of Job	Qualification
1	Shehzad Akhter	Instrument Mechanic	11	05 years	BA
2	Sajid Ali	Junior Clerk	7	07 years	FA
3	Muhammad Yousaf	Junior Clerk	7	07 years	M.Com
4	Shehbaz Hussain	Lab Assistant	7	06 years	M.A English
5	Shamshad Khan	Senior Clerik	9	15 years	Matric
6	Muhammad Asif	Lab Assistant	7	06 years	M.A English
7	Muhammad Arif	Lab Assistant	7	10 years	Matric
8	Muhammad Hamid Ali	Lab Assistant	7	08 years	Matric
9	Ahmed Sher	Electritian	5	08 years	Matric
10	Liaquat Ali	Lab Attendant	3	25 years	Matric
11	Muhammad Rizwan	Lab Attendent	3	03 years	Matric

12	Javed Sarwar	Lab Assistant	7	25 years	Matric
13	Muhammad Athar Baloch	Lab Attendant	3	25 years	Middle
14	Muhammad Maqbool Chishti	Lab Attendant	2	04 years	FA
15	Muhammad Shahbaz	Lab Attendant	2	08 years	FA
16	Muhammad Kamran	Baildar	2	05 years	Matric
17	Aamir Maseeh	Sweeper	2	05 years	Primary
18	Mukesh Kumar	Sweeper	2	12 years	Primary
19	Tanvir Hussain	Baildar	2	06 years	Middle

II. List of Books in University Libraries

	Book Name	Author	Publisher/Year	Location in library
1	Activated Carbon Applications In The Food and Pharmaceutical Industry	<u>Roy, Glenn M.</u>	<u>Technomic Publishing.</u> (AMER) 1995.	Sir Sadiq Muhammad Khan Library. Call No. 660.6 R888A.
2	Advanced Dairy Science and Technology	<u>Britz, Trevor J.</u>	<u>Blackwell Publishing.</u> (OXFOD) 2008.	Sir Sadiq Muhammad Khan Library. Call No.637 B862A.
3	Bakery Science and Cereal Technology	<u>Khetarpaul, Neelam.</u>	<u>Daya Publishing.</u> (N.D.) 2005	Sir Sadiq Muhammad Khan Library. Call No.664 K456B.
4	Beverages: Technology, Chemistry and Microbiology	<u>Varnam, Alan H.</u>	<u>An Aspen Publication.</u> (N.Y.) 1999.	Sir Sadiq Muhammad Khan Library. Call No.641.2 V317B.
5	Biotech's Dictionary of Dairy Science	<u>Arora, Dinesh. Ed.</u>	<u>Biotech Books.</u> (N.D.) 2006.	Sir Sadiq Muhammad Khan Library. Call No.637.03 A769B
6	Citrus Fruit: Biology, Technology	<u>Ladaniya, Milind S.</u>	<u>Elsevier Press.</u> (BOST) 2008	Sir Sadiq Muhammad Khan Library. Call No.634.35 L153C .
7	Commercial Food Patents, U.S.,1976	<u>North, Hallie B.</u>	<u>Olivers S. North.</u> (VIRG) 1976.	Sir Sadiq Muhammad Khan Library. Call No.641.973 N864C.
8	Nutrition: Concepts and Controversies	<u>Sizer, Frances Sienkiewicz.</u>	<u>Thomson Learning.</u> (ME XI) 2003.	Sir Sadiq Muhammad Khan Library. Call No.613.2 S625N.
9	Dairy Science and Technology and Food and Dairy Engineering	<u>Sharma, Harish.</u>	<u>CBS Publishers.</u> (N.D.)2005	Sir Sadiq Muhammad Khan Library. Call No.637.076 S531O.
10	Dairy Microbiology	<u>Parihar, Pradeep.</u>	<u>Agrobios.</u> (JODH) 2006.	Sir Sadiq Muhammad Khan Library. Call No.637 P431D.

11	Dairy Science and Technology and Food and Dairy Engineering	Sharma, Harish.	CBS Publishers, (N.D.) 2005.	Sir Sadiq Muhammad Khan Library. Call No.637.076 S531O.
12	Dictionary of Food and Nutrition	Pathak. ed.	Mohit publications, (N.D.) 2005.	Sir Sadiq Muhammad Khan Library. Call No.641.3003 P298D.
13	Dictionary Food and Nutrition	Bender, David A.	Oxford University Press, (OXFO) 2005.	Sir Sadiq Muhammad Khan Library. Call No.641.303 B458F.
14	Elements of Food Science	Ramaswamy, Arindam.	Oxford Book Company, (JAIP) 2010.	Sir Sadiq Muhammad Khan Library. Call No.641.3 R165E.
15	Encyclopaedic Dictionary of Food and Nutrition	Sabarwal, Bhavana.	Commonwealth, (N.D.) 2005.	Sir Sadiq Muhammad Khan Library. Call No.641.3003 S113F.
16	Essentials of human nutrition	Mann, Jim.	Oxford University Press, (N.Y.). 2005	Sir Sadiq Muhammad Khan Library. Call No.612.3 M281E
17	Food Biotechnology	Shetty, Kalidas.	Taylor & Francis Group, (AMER) 2006.	Sir Sadiq Muhammad Khan Library. Call No.664 S539F.
18	Food Chemistry	Belitz, H. D.	Springer, (N.Y.) 1999.	Sir Sadiq Muhammad Khan Library. Call No.664.07 B431F.
19	Food Industry and The Environment In The European Union	Dalzell, Janet M.	Aspen Publication, (C) 2000.	Sir Sadiq Muhammad Khan Library. Call No.338.194 D153F.
20	Food and Nutrition Education: Programmed Course	Chopra, Punam.	A P H Publishing, (N.D.) 2005.	Sir Sadiq Muhammad Khan Library. Call No.641.1 C549F.
21	Food Processing	Singh, M.K.	Discovery Publishing House, (N.D.) 2007.	Sir Sadiq Muhammad Khan Library. Call No.664 S617F.
22	Food Presetvation and Irradiation	Mahindru, S.N.	APH Pb, (N.D.) 2005.	Sir Sadiq Muhammad Khan Library. Call No.664.028 M214F.

23	Food, Nutrition and Sports Performance II	Maughan, R. J. Ed.	Routledge, (LON) 2006.	Sir Sadiq Muhammad Khan Library. Call No.613.7 M449F.
24	Fundamentals of Enzymology	Meena, Meenakshi.	Aavishkar Publishers, (JAIP) 2009.	Sir Sadiq Muhammad Khan Library. Call No.574.1925 M494F
25	Fruit and Vegetable Preservation: Principles and Practices	Srivastava, R. P.	Internatioal Book Distrubuting Co., (LUCK) 2002.	Sir Sadiq Muhammad Khan Library. Call No.634 S77F.
26	Handbook of Food Analysis	Nollet, Leo M.	Marcel Dekker, (N.Y.) 2004	Sir Sadiq Muhammad Khan Library. Call No.664.07 N795H
27	Handbook of Fruit Science and Technology	Salunkhe, D. K.	marce Dekker, Inc., (N.Y.) 1995.	Sir Sadiq Muhammad Khan Library. Call No.634.0202 S181H.
28	Handbook of Edible Fruits	De, L. C.	Aavishkar Publishers, Distributors, (Jaipur, India :) 2008	Sir Sadiq Muhammad Khan Library. Call No.635.6 D278H.
29	Handbook of Meat Poultry & Seafood Quality	Nollet, Leo M.L.	Blackwell publishers, (OXFO). 2007	Sir Sadiq Muhammad Khan Library. Call No.363.1929 N795H.
30	Hand Book of Cereal Technology: Practical Approach	Nagi, H.P.S.	Kalyani Publishers, (N.D.) 2007.	Sir Sadiq Muhammad Khan Library. Call No.664.7 N148H.
31	Introduction To Food Science	Parker, Rick.	Delmar Thomson Learning, (AUST) 2003.	Sir Sadiq Muhammad Khan Library. Call No.664 P238I.
32	Milk and Dairy Product Technology	Spreer, Edgar.	Marcel Dekker, (N.Y.) 1998.	Sir Sadiq Muhammad Khan Library. Call No.637.1 S768M.
33	Principles of	Bilal	Butterworth-Heinemann,	Sir Sadiq Muhammad Khan Library.

	Enzymology for Technological Applications		(N.D.) 1993.	Call No. 660.634 B988P.
34	Pesticides in Food: Issues and Perspectives.	Chakraborty, Amrita Ed.	The Lcfai University Press, (HYDE) 2010.	Sir Sadiq Muhammad Khan Library. Call No.641.4 C435P.
35	Sport Nutrition	Jeukendrup, Asker E.,	Human Kinetics, (Champaign, IL).2010.	Sir Sadiq Muhammad Khan Library. Call No. 613.2024796 J58S .
36	Testing Milk and Its Products	Farrington, E. H.	Axis Books (India) (Sardarpura) 2010.	Sir Sadiq Muhammad Khan Library. Call No.637.1277 F246T.
37	Milk the Most Perfect Food.	Godbole, N.N.	Biotech Books, (N.D.) 2007	Sir Sadiq Muhammad Khan Library. Call No.641.371 G577M
38	Laboratory Techniques in Food Analysis	Pearson, D.	Butterworth & Co. (Publishers) Ltd. (LON) 1975.	Sir Sadiq Muhammad Khan Library. Call No.543.1 P361L
39	Laboratory Manual For Analysis of Milk and Milk Products	Masud, Tariq	Higher education commission (Islamabad). 2012.	Sir Sadiq Muhammad Khan Library. Call No.637.127 T187L
40	Meat Hygiene	Marwaha, Kavita. Ed.	Gene-Teach Book, (N.D.) 2007.	Sir Sadiq Muhammad Khan Library. Call No. 664.9028 M391M.
41	Meat Science 2nd Edition	Warriss, Paul.		Sir Sadiq Muhammad Khan Library. Call No.664.9 W295M.
42	Methods in Meat Science	Kowale, B. N.	Jaypee Brothers Medical Pub, (S.I.) 2008.	Sir Sadiq Muhammad Khan Library. Call No.641.36 K88M

43	Microbiological Analysis of Red Meat Poultry and Eggs	Mead, G.C.	Woodhead Publishing , (N.Y.) 2007.	Sir Sadiq Muhammad Khan Library. Call No.636.51 M479M.
44	Milk Processing and Quality Management	Tamime, A.Y.		Sir Sadiq Muhammad Khan Library. Call No. 637.1 T158M.
45	Nutrition Eating for Good Health	United States department of Agriculture.	United States department of Agriculture , (SL)	Sir Sadiq Muhammad Khan Library. Call No.362.176 U58N.
46	Poultry Meat Science	Richardson, R.I.	CABI Publishing , (ENGL) 2003.	Sir Sadiq Muhammad Khan Library. Call No.636.513 R521P.
47	Poultry Meat Processing	Owens, Casey M.	CRC Press , (N.Y.) 2010.	Sir Sadiq Muhammad Khan Library. Call No.164.93 B97P.
48	Postharvest: Introduction To The Physiology and Handling of Fruit	Wills, R.B.H.	UNSW Press , (SYDN) 2007.	Sir Sadiq Muhammad Khan Library. Call No.635.046 W689P
49	Principles of Nutrition	Wilson, Eva D.	John Wiley & Sons , (N.Y.) 1979.	Sir Sadiq Muhammad Khan Library. Call No.641.1 W747
50	Standard Methods For The Examination of Dairy Products	Wehr, Michael.	American Public Health Association , (S.I.) 2004.	Sir Sadiq Muhammad Khan Library. Call No. 637.028 W414S.
51	Textbook of Food Science and Technology	Sharma, Avantina.	International book distributing co. , (N.D.) 2006.	Sir Sadiq Muhammad Khan Library. Call No.641.3 S531T
52	The Chemistry & Manufacture of Indian Dairy Products	Rangappa, K.S	The Banlogalore Printings &	Sir Sadiq Muhammad Khan Library. Call No.637.0954 R196C.

			Publishing Co, Ltd (Bangalogue). 1948.	
53	What Price Food?	Streeten, Paul.	Macmillan , (LO N) 1987.	Sir Sadiq Muhammad Khan Library. Call No.338.131 S915W
54	Food Laws Manual	Hanif, Ch. Muhammad.	Lahore Law Times Publications , (Lahore :) 1978	Abbasia Campus Law Library. Call No.348.02 H237F.
55	ABC of Nutrition	Truswell, A. Stewart.	BMJ , (London) 2003.	Khawaja Farid Campus Library. Call No.613.2 T873N
56	An introduction to Nutrition and Metabolism	Bender, David A.	UCL Press (London). 1993.	Khawaja Farid Campus Library. Call No.612.3 B458I
57	Rapid Microbiological Methods For Foods, Beverages, and Pharmaceuticals	Stannard et al.	Blackwell Scientific Publications , (Oxford ,ngland) 1989.	Khawaja Farid Campus Library. Call No.664/.07 S784R.
58	Hobbs' Food Poisoning and Food Hygiene	McLauchlin, Jim. Little, Christine.	Hodder Arnold , (London) 2007	Khawaja Farid Campus Library. Call No.615.945 L366H
59	Krause's Food, Nutrition, & Diet Therapy	Mahan, L. Kathleen. E scott-Stump, Sylvia	W.B. Saunders , (Philadelphia) 2004.	Khawaja Farid Campus Library. Call No.612.3 M214K
60	Food Science	Potter, Norman N.	Chapman & Hall , (New York) 1995.	Khawaja Farid Campus Library. Call No.664 P868F
61	Food Microbiology	Frazier, W. C.	McGraw-Hill , (New York) 1978.	Khawaja Farid Campus Library. Call No.576/.163 F848F

62	Food and Nutrition	Fieldhouse, Paul.	Chapman & Hall (London) 1995.	Khawaja Farid Campus Library. Call No.641.3 F453F.
63	Rheology Essentials of Cosmetic and Food Emulsions	Brummer, RÅ diger	Springer, (Berlin ; New York) 2006.	Khawaja Farid Campus Library. Call No.615.45 B893R
64	Food Microbiology and Laboratory Practice	Bell, C.,	Blackwell Science, (Oxford) 2005.	Khawaja Farid Campus Library. Call No.576.163 B433F.
65	Food Microbiology	Bohra, A.	Agrobios (India) (Jodhpur) 2006.	Khawaja Farid Campus Library. Call No.576.163 B677F.
66	Handbook of pediatric nutrition	Samour, Patricia Queen. Helm , Kathy King. Lang, Carol E.	Jones and Bartlett Publishers, (Sudbury, Mass.) 2004.	Khawaja Farid Campus Library. Call No.618.92 S191H.
67	Life cycle nutrition	Edelstein, Sari. Sharlin, Judith.	Jones and Bartlett Publishers, (Sudbury, Mass.) 2009.	Khawaja Farid Campus Library. Call No.612.3/99 E219L
68	Nutrition in Health and Disease	Anderson, Linnea	J. B. Lippincott Company (Philadelphia). 1982.	Khawaja Farid Campus Library. Call No.612.3 A547N
69	The Food Tract	Blackwood, A. L.	B. Jain Publiishers (New Delhi). 1993.	Khawaja Farid Campus Library. Call No.618.38 B632F.
70	Nutritional and Medicinal Values Of Plant Foods	Basak, S. L.	Naya Udyog (Kolkata) 2003.	Khawaja Farid Campus Library. Call No.615.321 B297N.

71	Nutrition Made Incredibly Easy	Lippincott Williams & Wilkins.	Lippincott Williams & Wilkins. (Philadelphia) 2007.	Khawaja Farid Campus Library. Call No.616.39 M468N
72	Handbook of Medicinal Plants	Yaniv, Zohara. Bachrach, Uriel.	Food Products Press : Haworth Medical Press. (New York) 2005.	Khawaja Farid Campus Library. Call No.615/.321 Y23H .
73	Milk and Its Products	Kapoor, Ajay.	Vishvabharti Publications (New Delhi). 2005.	Khawaja Farid Campus Library. Call No.637.1 K17M.
74	Minerals in Animal and Human Nutrition	McDowell, L. R.,	Elsevier, (Amsterdam). 2003.	University College of Veterinary & Animal Sciences. Call No.613.285 McD478M
75	Williams' basic nutrition & diet therapy	Nix, Staci.	Elsevier Mosby, (New Delhi) 2005.	Khawaja Farid Campus Library. Call No.613.28 N736W
76	Milk and Milk Products	Mahindru, S N.	APH Publishing Corporation, (S.I.).2009.	University College of Veterinary & Animal Sciences. Call No.637.127 M214M.
77	Meat and Meat Products	Varnam, Alan H.	Springer, (New Delhi) 1995.	University College of Veterinary & Animal Sciences. Call No.664.9 V317M.
78	Handbook on Analysis of Milk	Srivastava, M. K.	IBDC Publishers, (Lucknow). 2010.	University College of Veterinary & Animal Sciences. Call No.637.14 S774H.

List of Books in Staff Offices

Sr No.	Name of book	Author	Publisher	Year
1	Food Science	N.Potter and J Hotchkiss	CBS Publisher and Distributors, New Dehli	2000
2	Bender,s Dictionay of Nutrition and Food Technology	DA Bender and AE Bender	Woodhead Publishing Limited Cambridge,England	2005
3	Food Processing Hand Book	JG Brennan	Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim,Germany	2006
4	ISO 9001:2008 Quality Management System ---- Requirments	ISO	ISO Switzerland	2008
5	ISO 14001:2004 Environmental Management Systems- Requirments with guidance for use	ISO	ISO Switzerland	2004
6	ISO 22000:2005 Food Safety Management Systems — Requirements For Any Organization in The Food Chain	ISO	ISO Switzerland	2005
7	BS OHSAS 18001:2007 Occupational Health and Safety Assessment	British Standards Institute	British Standards Institute, UK	2007

	Series-Requirements			
8	Microbiology Manual	JA Awan &SU Rehman	Unitech Communication, Faisalabad, Pakistan	2005
9	Food Preservation Manual	JA Awan &SU Rehman	Unitech Communication, Faisalabad, Pakistan	2011
10	Food Analysis Manual	JA Awan &SU Rehman	Unitech Communication, Faisalabad, Pakistan	2005
11	Food Toxicology	JA Awan & FM Anjum	Unitech Communication, Faisalabad, Pakistan	2010
12	Elements of Food & Nutrition	Javaid Aziz Awan	Unitech Communication, Faisalabad, Pakistan	2011
13	Food Processing & Preservation	Javaid Aziz Awan	Unitech Communication, Faisalabad, Pakistan	2011
14	Food Science & Technology	Javaid Aziz Awan	Unitech Communication, Faisalabad, Pakistan	2011
15	Oils and Fats in the Food Industry	Frank D. Gunstone	Wiley-Blackwell, UK	2008
16	The Science of Sugar Confectionary	WP Edawards	The Royal Society of Chemistry, Cambridge, UK	2000
17	Food and Dairy Microbiology	MK Rao	Manglam Publishers & Distriubutors, Dehli, India	2007
18	Toxicology	PD Sharma	Rastogi Publications, India	1997
19	Food Chemistry	MM Burghagen	Springer-Verlag Berlin Heidelberg, Germany	2004
20	Sugar Confectionary Manufacture	EB Jackson	Blackie Academic & Professional, Glasgow	1995
21	Unit Operations in	A Ibarz &	CRC Press, USA	2003

	Food Engineering	CV Barbosa-Canovas		
22	Food Processing Hand book	JG Brennan	WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany	2006
23	Chemistry and Technology of Soft Drinks and Fruit Juices	R. Ashurst	Blackwell Publishing , UK	2005
24	The Soft Drinks Companion	M Shachman	CRC PR ESS, United States of America	2005
25	Fruit Manufacturing	J E. Lozano	Springer ScienceρBusiness Media, LLC	2006
26	Fruit and Vegetable Processing	Wim Jongen	Woodhead Publishing Limited, Abington Hall, Abington Cambridge CB1 6AH, England	2002
27	Cereals Processing Technology	Gavin Owens	Wood head Publishing Limited Cambridge, England	2001

Laboratory Facilities

The list of Laboratories of the Discipline of Food Science and Technology and the College of Agriculture are given below along with instruments:

A.

Laboratory Title	Food Analysis Laboratory
Location	At Islamic Learning Faculty
Objectives	To perform analysis of various foods and food products
Adequacy for Instruction	Teaching staff delivers necessary instructions in the beginning of each laboratory course. Also instruction sheets for all the experiments are available with the laboratory staff for consultation.
Courses taught	FST-501, FST-503, FST-505, FST-507, 502, 504, 506, 508
Major apparatus	Soxhlet apparatus, Hot plate heater, Hot plate heater with magnetic stirrer, Titration assembly,
Major equipment	Hand refractometer, pH meter, TDS meter, Water distillation unit, Water deionizer, Automatic dispenser, EC meter, Analytical balance, Tripple beam ballance
Safety regulations	Safety measures are observed
Working condition	Ok

B.

Laboratory Title	Food Processing Section
Location	At Islamic Learning Faculty

Objectives	To perform practical for the preservation of foods and to develop new food items
Adequacy for Instruction	The teaching staff guides the students to develop new food items
Courses taught	FST-501, FST-505, FST-507
Major apparatus	Blender, Shaker, Grinder, Gas burner, Peelers, Cutters,
Major equipment	Pulper, Weighing balances,
Safety regulations	Safety measures are observed
Working condition	Ok

C.

Laboratory Title	Animal Study Room (Food Safety Evaluation Lab)
Location	At Islamic Learning Faculty
Objectives	To carry out the safety evaluation of different additives being used in food processing
Adequacy for Instruction	The teaching staff guides how to work
Courses taught	Trials are under process
Major apparatus	Cages to keep experimental animals
Major equipment	Weighing balances,
Safety regulations	Safety measures are observed
Working condition	Ok

D.

Laboratory Title	Germ Plasm Preservation Lab for Plant Breeding & Genetics
Location	Central Library Basement
Objectives	To equip students with the basic techniques of Genetics and Biotechnology
Adequacy for Instruction	Teaching staff delivers necessary instructions in the beginning of each laboratory course. Also instruction sheets for all the experiments are available with the laboratory staff for consultation.
Courses taught	PBG-401, PBG-402, PBG-510
Major apparatus	Student Binocular Microscope, Electronic Balance
Major equipment	Horizontal Gel Electrophoresis (Final stages of purchase)
Safety regulations	Safety measures are observed
Working condition	Ok

E.

Laboratory Title	Sample Preparation and Ginning Room
Location and area	Central Library Basement
Objectives	To equip the students with practical regarding soil and plant samples for lab analysis and the basic ginning techniques in cotton

Adequacy for Instruction	Teaching staff delivers necessary instructions in the beginning of each laboratory course. Also instruction sheets for all experiments are available with the laboratory staff for consultation.
Courses taught	PBG-401, PBG-503, PBG-505
Major apparatus	Cotton Ginning Machines, Electronic Balance
Safety regulations	Safety measures are observed
Working condition	Ok

F.

Laboratory title	Plant Breeding & Genetics /Soil & Environmental Sciences
Location	At Islamic Learning Faculty
Objectives	The students are equipped with the knowledge of the emerging & re-emerging diseases of the plants. Various pathological morphological lesions are explained. Various techniques of soil and water testing are explained
Adequacy for Instruction	Teaching staff deliver necessary instructions in the beginning of each laboratory course. Also instruction sheets for all the experiments are available with the laboratory staff for consultation.
Courses taught	SS-301, 302, PBG-401, 402, SS-501, 502.

Major apparatus	Refrigerator, Wash Bottles and Glassware of all types
Major equipment	Kjeldhal Apparatus, , Conductivity Meter, pH meter, Centrifuge Machine, Laminar Flow Cabinet, Spectrophotometer, Grain Moisture Meter, Autoclave, Digital Analytical Balance, Zoom Microscope, Flame photometer
Safety regulations	General Safety Regulations are observed.
Safety regulations	Safety measures are observed
Working condition	Ok

G.

Laboratory Title	Entomology Laboratory
Location	At Islamic Learning Faculty
Objectives	The students are equipped with the knowledge of insect diversity, insect behavior and their resistance to different chemicals of plant origin.
Adequacy for Instruction	Teaching staff deliver necessary instructions in the beginning of each laboratory course. Also instruction sheets for all the experiments are available with the laboratory staff for consultation.
Courses taught	ENT-703, ENT-713, ENT-711, ENT-603, ENT-609
Major apparatus	Microscopes, Insect breeding chambers, Dissection boxes
Major equipment	Food preference glass chamber,

Safety regulations	General Safety regulations are observed.
Working condition	Ok

H.

Laboratory Title	Laboratory of Stored Products Pests
Location	At Islamic Learning Faculty
Objectives	The students are equipped with the knowledge of insect diversity, insect behavior and toxicological studies.
Adequacy for Instruction	Teaching staff delivers necessary instructions in the beginning of each laboratory course. Also instruction sheets for all the experiments are available with the laboratory staff for consultation.
Courses taught	ENT-703, ENT-713, ENT-711, ENT-603, ENT-609
Major apparatus	Digital micrometer,
Major equipment	Fumigation chamber
Safety regulations	General Safety regulations are observed.
Working condition	Ok

I.

Laboratory Title	Agronomy and Forestry Laboratory
Location	At Islamic Learning Faculty
Objectives	To equip students with practical of Agronomy and Forestry

Adequacy for Instruction	Teaching staff delivers necessary instructions in the beginning of each laboratory course. Also instruction sheets for all the experiments are available with the laboratory staff for consultation.
Courses taught	AGR-301, AGR-401, FRW-301
Major apparatus	Orient dispenser, Beverage cooler, Vertical freezer
Major equipment	Analytical balance, Plant water potential apparatus (to be purchased)
Safety regulations	General safety regulations are observed.
Working condition	Ok

Faculty participation in seminars/conferences

Seminar/Workshops/Conferences

- a) Coordinated and attended a workshop on ‘Advanced Teaching Rhetorics and Research Methodologies’ from June 20, 2012 to July 19, 2012 at IUB in collaboration with Senior Experten Service (SES) Germany.
- b) Coordinated International Conference on “Prospects & Challenges to Sustainable Agriculture, July 14-16, 2011”. Faculty of Agriculture Rawalakot, University of Azad Jammu and Kashmir, Muzaffarabad.
- c) “National Conference on Saline Agriculture: Fighting Hunger & Poverty in Southern Punjab” at Islamia University Abbassia Campus, Bahawalpur. April 9-10, 2012.
- d) ‘Improving bread quality through *Aspergillus niger* xylanase’ at conference on “Agriculture and Food Security Issues in Global Environmental Perspectives, July 11-13, 2012” at The University of Poonch, Rawalakot, Azad Kashmir.
- e) “Nutritional enhancement of wheat flour cookies with buckwheat flour” at conference on “Agriculture and Food Security Issues in Global Environmental Perspectives, July 11-13, 2012” at The University of Poonch, Rawalakot, Azad Kashmir.
- f) “Hyper production of glucoamylase by gamma-rays mutagenization of *Aspergillus niger*” at conference on “Agriculture and Food Security Issues in Global Environmental Perspectives, July 11-13, 2012” at The University of Poonch, Rawalakot, Azad Kashmir.
- g) Date and Date Palm: Historical, Religious and Nutritional significance.”International Conference on Date Palm: Present Status and future Prospectus, September 02-03, 2013”.The Islamia University of Bahawalpur, Bahawalpur.
- h) Quality assessment of duck breast meat after salting, heating and high pressure treatments. [M] 1st Asia Pacific Food Innovation Conference (APFIC), Innovative Solutions for the Future of Foods, Technology Park, Perth, Western Australia. June 11-12 2013. URL: www.apfic.net.
- i) Quality assessment of breast meat of Cherry Valley duck after salting, heating and high pressure. [M] 11th World Conference on Animal Production (WCAP 2013), Beijing, China. October 16-20 2013. WCAP-4.4-02-M1.

Research Publications:

- 1). Zulfiqar Ahmad, Masood Sadiq Butt, Faqir Muhammad Anjum, Muhammad Siddique Awan Habib Ahmed Rathore, Muhammad Tahir Nadeem, Anwar Ahmad and Abdul Khaliq. Effect of corn cobs concentration on xylanase biosynthesis by *Aspergillus niger*. African Journal of Biotechnology. 11(7): 1674-1682, 2012.
- 2). Zulfiqar Ahmad, Masood Sadiq Butt, Anwaar Ahmed, Muhammad Riaz, Syed Mubashar Sabir, Umar Farooq and Fazal Ur Rehman. Effect of *Aspergillus niger* xylanase on dough characteristics and bread quality attributes. Journal of Food Science and Technology. DOI 10.1007/s13197-012-0734-8.2012.
- 3). Anwaar Ahmed, Mahwish Anjum, Asif Ahmad, Nauman Khalid, Atif Randhawa, Zulfiqar Ahmad and Wajiha Farid. Effect of hydrocolloids on partial baking and frozen storage of wheat flour chapatti. Food Science and Technology Research. Vol. 19 (2013) No. 1 p. 97-103
- 4). Zulfiqar Ahmad, Masood Sadiq Butt, Riaz Hussain, Anwaar Ahmed and Muhammad Riaz. Effect of Oral Application of Xylanase on Some Hematological and Serum Biochemical Parameters in Broilers. Pak Vet J, 33(3): 388-390. 2013.
- 5). Fazal-ur Rehman, Shahid Adeel, Muhammad Shahid, Ijaz Ahmad Bhatti, Faiza Nasir, Nasim Akhtar, Zulfiqar Ahmad. Dyeing of γ -irradiated cotton with natural flavonoid dye extracted from irradiated onion shells (*Allium cepa*) powder. Radiation Physics and Chemistry 92: 71–75.2013.
- 6) SR Abbas, SM Sabir, SD Ahmad, A. Zulfiqar, A. WAjid, A. Hamid, A. Batool MR Abbas. Antioxidant activity and biochemical variation among juices of different genotypes of sugarcane. Italian journal of Food Science, vol. 25 – 2013.
- 7). Zulfiqar Ahmad, Masood Sadiq Butt, Muhammad Tahir Nadeem, Muhammad Yasin. Optimization of Cultural Conditions for Xylanase Biosynthesis by *Aspergillus niger* Using Sugarcane bagasse. Pakistan Journal of Food Sciences. 2013: Volume 23, Issue 2, Page(s): 94-99.
- 8). Zulfiqar Ahmad, Masood Sadiq Butt and Muhammad Riaz. Partial Purification and Characterization of Xylanase Produced from *Aspergillus niger* USING WHEAT BRAN. Pak. J. Agri. Sci., Vol. 50(3), 433-437; 2013.
- 9). A. Rao, S. D. Ahmad, S. M. Sabir, S. I. Awan, A. Hameed, S. R. Abbas, M. Shehzad, M. F. Khan, S. Shafique and Z. Ahmad. Detection of Saline Tolerant Wheat Cultivars (*Triticum aestivum* L.) Using Lipid Peroxidation, Antioxidant Defense System,

Glycine-Betaine And Proline Contents. *Journal of Animal and Plant Sciences*. 23(6):1742-1748. 2013.

- 10). Zulfiqar Ahmad, Masood Sadiq Butt, Anwaar Ahmed, Nauman Khalid. Xylanolytic Modification in Wheat flour and its Effect on Dough Rheological Characteristics and Bread Quality Attributes. *The Korean Society for Applied Biological Chemistry*. 56:723–729.2013.
- 11). Khan MA, Ali S, Abid M, Ahmad H, Zhang L, Tume RK & Zhou GH. Improved duck meat quality by application of high pressure and heat: A study of water mobility and compartmentalization, protein denaturation and textural properties. [J] *Food Research International*, 2014, xx: xxx-xxx. (DOI: 10.1016/j.foodres.2014.04.006).
- 12). Khan MA, Ali S, Abid M, Ahmad H, Zhang L, Tume RK & Zhou GH. Enhanced texture, yield and safety of a ready-to-eat salted duck meat product using a high pressure-heat process. [J] *Innovative Food Science and Emerging Technologies*, 2013, xx: xxx-xxx. (DOI: 10.1016/j.ifset.2013.10.008).
- 13). Khan MA, Ali S & Zhou GH. Quality assessment of duck breast meat after salting, heating and high pressure treatments. [M] 1st Asia Pacific Food Innovation Conference (APFIC), Innovative Solutions for the Future of Foods, Technology Park, Perth, Western Australia. June 11-12 2013. URL: www.apfic.net.
- 14). Khan MA, Ali S & Zhou GH. Quality assessment of breast meat of Cherry Valley duck after salting, heating and high pressure. [M] 11th World Conference on Animal Production (WCAP 2013), Beijing, China. October 16-20 2013. WCAP-4.4-02-M1.
- 15). Cao JX, Ou CR, Zou YF, Ye KP, Khan MA, Pan DD & Zhou GH. Activation of caspase-3 and its correlation with shear force in bovine skeletal muscles during postmortem conditioning. [J] *Journal of Animal Science*. 2013, 91: 4547-4552. (DOI: 10.2527/jas.2013-6469).
- 16). Abid M, Jabbar S, Hu B, Hashim MM, Wu T, Shicheng Lei, Khan MA, & Zeng X. Thermosonication as a potential quality enhancement technique of apple juice. [J] *Ultrasonics Sonochemistry*, 2013, xx: xxx-xxx. (DOI: 10.1016/j.ultsonch.2013.12.003).
- 17). Ahmad H, Jinke T, Wang JJ, Khan MA, Wang YX, Zhang LL & Tian W. Effect of dietary sodium selenite and selenium yeast on antioxidant enzymes activities and oxidative stability of chicken breast meat. [J] *Journal of Agricultural and Food Chemistry*. 2012, 60: 7111-7120. (DOI: 10.1021/jf3017207).
- 18). Zhang L, Zhou J, Liu H, Khan MA, Huang K & Gu Z. Compositions of anthocyanins in blackberry juice and their thermal degradation in relation to antioxidant activity. [J]

European Food Research and Technology. 2012, 235:637-645. (DOI: 10.1007/s00217-012-1796-6).

- 19).** Abid M, Jabbar S, Hua B, Hashima MM, Wu T, Wu ZW, Khan MA, Zeng XX. Synergistic impact of sonication and high hydrostatic pressure on microbial and enzymatic inactivation of apple juice. [J] LWT - Food Science and Technology. 2014, xxx:xx-xx. (DOI: 10.1016/j.lwt.2014.04.039).