SUBJECT BENCHMARK STATEMENT

IN

FOOD SCIENCE AND TECHNOLOGY

Quality Assurance and Accreditation Council
University Grants Commission
Sri Lanka

December 2010

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FOREWORD

The work in connection with the development of Subject Benchmark Statements was begun in August 2003 as a part of the overall quality assurance framework that supports academic standards and the furtherance and dissemination of good practice in Universities in Sri Lanka.

Subject Benchmark Statements will support and promote quality and standards by:

- Providing universities with a common and explicit reference point for internal and external programme approval and review;

- Guiding and promoting curriculum development, especially in new departments and new universities, and in other institutions of higher education;

- Evolving over time to take account of changes and innovations that reflect subject development and new expectations;

- Providing an authoritative and widely recognized statement of expectations of what is expected of a graduate in a specific (or designated) subject area in a form readily accessible to students, employers and others with a stake in higher education;

- Providing a clear and transparent reference point for External Examiners;

- Assisting international comparison and competitiveness of higher education awards and student achievement.

SUBJECT BENCHMARK STATEMENT

FOOD SCIENCE & TECHNOLOGY

1. INTRODUCTION

1.1 Subject Benchmark Statement - Scope and Purpose

Subject Benchmarking is a policy device aimed at improving the capacity of subject communities to regulate their academic standards. The purpose of this Subject benchmark statement (statement) is to make explicit the nature and the standard of degree awards in the subject areas of Food Science and Technology. It is an essential component of quality assurance in the university system and provides points of reference for external review. This Subject Benchmark Statement in Food Science and Technology (SBSFST) is intended for undergraduate programmes leading to four year Bachelor of Science (B.Sc.), Bachelor of Applied Science (B. App. Sc.) degrees in Food Science and Technology (FST) and B.Sc Agric (Hons) degree majoring Food Science and Technology offered by universities in Sri Lanka. The statement will clarify the boundaries of each subject area and the specific threshold, typical and enhanced standards for the award of the B.Sc. or B. App.Sc. degree in Food Science and Technology .

It provides the following;

1. General guidelines on the nature, extent and scope of Food Science and Technology
2. Desired attributes and capabilities that the prospective of graduates who possess such qualifications should be able to demonstrate.
3. Expected specific standards for the award of a four year Bachelor degree in FST at threshold level (General Pass), and at typical (Second Class) or excellence (First Class) level.
4. Information on the purpose and content of the degree courses.

As such, it enables the comparison of the expected levels of attainment by graduates of the said degree programmes offered by respective Sri Lankan universities. This SBSFST provides general guidance for articulating the learning outcomes for general and specific areas in Food Science and Technology what is deemed appropriate by the subject community. It also provides a variety and flexibility in the design of programmes in achieving the skills and competencies required in Food Science and Technology and encourage innovation within an agreed overall framework.

However, this statement is not intended as a syllabus or a prescription for the amount of time devoted to each specific area in Food Science and Technology. Neither is it a syllabus nor a crude checklist of regulatory criteria for individual Bachelor degree programmes in FST. It has the provision to be reviewed, updated and revised if and when necessary, to reflect the developments in the subject and the experience of the institutions concerned. The statement is intended to be valuable to a wide variety of stakeholders, mainly prospective students, parents, employers as

well as policy makers and those who are involved in validation and design of FST related areas of the secondary and tertiary level education.

This SBSFST is the first attempt to provide general academic standards for four year Bachelor of Science (B.Sc.), Bachelor of Applied Science (B. App. Sc.) degrees in Food Science and Technology (FST) and B.Sc Agric (Hons) degrees majoring Food Science and Technology which are credit based and modular in structure comprising a minimum of 120 Carnegie credits, and conducted over eight academic semesters in Sri Lankan Universities. It has been prepared on the authority of the Quality Assurance and Accreditation Council (QAAC), University Grants Commission (UGC) by a team of nominated Senior Academics representing all departments of Food Science and Technology in the country, and acting on behalf of the subject community. The names of the members of the Benchmark Panel in Food Science and Technology are given in the Section 8 of this document.

This SBSFST, together with the others published concurrently, refers to the Bachelor degrees (B.Sc. and B. App. Sc. Degrees) with specialization in Food Science and Technology. This SBSFST also provides support to Universities in pursuit of internal quality assurance. It enables the learning outcomes specified for the programme to be reviewed and evaluated against agreed general expectations about standards. This subject benchmark panel recognizes that individual degree programmes offered by different Universities differ in their focus.

The subject benchmark statement may be one of a number of external reference points that is drawn upon for the purposes of external review. Reviewers can use the subject benchmark statement in conjunction with the specifications of the Food Science and Technology programme, internal evaluation documentations of the respective University in order to make a rounded judgment based on a broad range of evidence. SBSFST needs to be used with particular care in interdisciplinary or multidisciplinary contexts, where simple or general application may be inappropriate.

The benchmarking of academic standards for the subject area of Food Science and Technology has been undertaken by a group of subject specialists drawn from and acting on behalf of the subject community. The group's work was facilitated by the Quality Assurance and Accreditation Council of the University Grants Commission, Sri Lanka.

2. GENERAL DESCRIPTION OF THE SUBJECT AND SCOPE FOR EMPLOYMENT

2.1. Nature and Extent of the Subject – Food Science and Technology

Food Science is the systematic study of the nature and composition of food materials, and their behaviour under the various conditions to which they may be subjected. Food science is the discipline in which biology, physical sciences, and engineering are used to study the nature of foods, the causes of their deterioration, and the principles underlying food processing. Food technology is the application of food science to the selection, preservation, processing, packaging, distribution, and

use of safe, nutritious, and wholesome food. Food technology draws on, and integrates the application to food of, other technologies such as food engineering, instrumentation, electronics, agriculture and biotechnology. Thus, Food Science and Technology as a discipline applies the knowledge of the chemical composition of food materials, their physical, biological and biochemical behavior, and human nutritional requirements and the nutritional factors in food materials and the nature and behaviour of enzymes, the microbiology of foods, the interaction of food components with each other, with atmospheric oxygen, with additives and contaminants, and with packaging materials, pharmacology and toxicology of food materials, additives and contaminants, the effects of various manufacturing operations, product development and storage conditions and applications of appropriate marketing strategies and involves the use of statistics for designing experimental work and evaluating the results.

2.2. Scope for the Employment of FST graduates

Food Science and Technology as a discipline provides job opportunities in a wide range of areas. In Sri Lanka, for FST graduates, job prospects are comparatively satisfactory. Career opportunities FST graduates may have in the following area; Food manufacturing industries, Food ingredients manufacturing industries, Food plant, equipment and packaging material manufacturing industries, Retail food distribution and catering sectors, Government-administration, food legislation, food regulation, food safety assurance, enforcement-public analysts laboratories, enforcement-environmental health institutions, enforcement-trading standards institutions, Journalism/publishing/information services, Research/Educational institutions, Overseas locations (food sector), Consultancy (Local and international). In addition, FST garaduates also can enter to the following areas where knowledge in Food Science and Technology is not much essential but may be very useful; General management, Production supervision, Production management, Stock control, Work study, Purchasing, Marketing and Human Resource Management. in general, FST graduates can enter the employment market in various sectors. Main employment sectors include the following (Table 1):

Table 1. Major employment opportunities in various sectors

Sector	Specialisation
State and private sector	Tertiary education institutes
Universities and R & D Institutes	Research and analytical laboratories
State sector	Sri Lanka Administrative Service and Sri Lanka Foreign Service
State and private hospitals and diagnostic clinics	Pathology/microbiology laboratories
Government Ministries	S & T divisions, Departments of Agriculture, Fisheries and Aquaculture, Small and Medium scale enterprises, Animal quarantine, Import and Export divisions
State and private sector	Food manufacturing companies,
Private sector	Food import and export companies
State and private sector, NGOs and INGOs	Institutions supporting Ecotourism, organic farming and similar concept supporting
State and private sector, NGOs and INGOs	Food Based Entrepreneurships and rural development
UN based organisations and other INGOs	Food and Nutrition, Food Safety and community development projects;
Self- employment	Self- employment (Entrepreneurship) in Food Manufacture, Related services, Consultancies

3. ANTICIPATED GRADUATE PROFILE AND SPECIFIC OBJECTIVES OF THE FST DEGREE PROGRAMMES

3.1. Anticipated Graduate Profile

FST graduates are expected to play an important and leading role in promoting value addition to agricultural produce while keeping foods of high quality, safe and nutritionally sound and facilitating food industry development leading to a sustainable socio-economic development. The prospective FST graduates should possess the knowledge, skills and attitudes described in the profile given below. The FST graduates should have;

1. Wider knowledge and conceptual understanding of areas of Food Science and Technology
2. Agricultural practices associated with food production, harvesting, transports, storage and primary processing
3. Ability to perceive the behaviour of the food sector institutions dealing with the manufacture of different kind of foods and related services
4. Technical and intellectual skills to gather data/information and critically analyze the needs of local and international food sector
5. Learnt the way of searching new knowledge through research
6. A range of transferable skills, which are useful in decision making with regard to food resource matters such as handling data/information and interpretation, computer literacy, information management, teamwork, oral and written presentation/ communication etc.

7. Built self-confidence for independence, self-motivation for life-long-learning in the relevant field and for proceeding with postgraduate studies
8. Qualified to commence professional practice in food industry and related academic and research and development institutions

3.2. Specific Objectives of the FST Degree Programmes

To help the graduates to develop the profile, the FST programme offered by the Universities should facilitate the students to:

1. Acquire the knowledge, skills and attitudes based on a broad and multi-disciplinary approach in order to fulfil the current and emerging needs in local, regional and international food sector
2. Acquire the knowledge, skills and attitudes through theoretical, laboratory and out-door/field practical components in experiencing the real world practices in the field to establish and manage socially acceptable, economically viable and environmentally friendly food industries.
3. Identify problems and/or issues related to the food industry and develop proposals highlighting these problems and/or issues, objectives, hypotheses and methods/measures/approaches for solving the problems and/or issues to carry out research in order to find the most appropriate solutions, under the guidance provided by the respective departments.
4. Develop ICT skills
5. Develop interpersonal, teamwork and leadership skills
6. Develop self management and professional development skills
7. Maintain a acceptable moral conduct
8. Attend multiple tasks under stressful situations

4. SUBJECT AREAS AND FEATURES OF THE FST DEGREE PROGRAMMES

4.1. Subject specific Knowledge and Subject Areas

The prospective FST graduates should be able to demonstrate comprehension with a wide range of subject-specific knowledge with related principles as well as an awareness of the scope and where-how of their applications. The FST students should be equipped with a comprehensive subject specific knowledge, skills and attitudes on the entire coverage of fundamental concepts, principles and practices associated with the characteristics of agricultural produce and composition of major food materials and their properties, impact of processing and related operations and economic challenges encountered in current food chains and aspects relate to food safety and regulations. In order to achieve these objectives, the curriculum should comprise the following subject areas;

4.1.1. Technical Subjects

4.1.1.1. Compulsory Subject Areas

Physiology of Food Animals and Food plants
Food Physics related subjects
Food Engineering
Biochemistry, Food chemistry and Food Analysis

Food Resources
Microbiology of Foods
Needs of Food Crops and Food Animals
Human Nutrition
Unit operations
Food Processing and Packaging (different food commodities)
Food preservation and postharvest technology
Food Marketing
Food Business Management and International Food Trade
Sensory evaluation of foods
Consumer behaviour and Food Choices
Food Quality Assurance
Food Safety and Food Regulations
Water quality and effluent management
Computer studies for Food Science and Technology and Nutrition
Mathematics for Food Sciences and Food Technologies
Statistics for Food Science and Technology and Nutrition

Note: Emphasise should be given to incorporate practical aspects of relevant subjects wherever appropriate

4.1.1.2. Ancillary Subjects

English
Career guidance

Under each subject area, emphasis should be given to;

1. The underlining principles, concepts, theories and methods
2. The current knowledge and developments
3. Current gaps in knowledge and current issues of wider concern
4. Potentials and constrains in the local, regional and global contexts
5. The linkages with other subjects, environment, socio-economic aspects and market situation
6. Issues of sustainability and environmental impact

4.2. Skills and Subject Areas

The prospective FST graduates should be able to demonstrate excellence in all subject related practical skills and apply both theoretical knowledge and related practical skills acquired appropriately in different situations. Therefore, in addition to equipping the students with subject-specific knowledge, the FST curricula should provide opportunities and include self-learning activities that promote subject specific skills and generic skills that have wider applications in continuing personal development and in the world of work.

4.2.1. Subject Specific Skills

The prospective FST graduates should develop their technical competencies in order to be fitting to any challenging situation in the Food Industry. Therefore, the FST degree programmes should be developed by incorporating appropriate learning activities tailored to skill development in a subject-specific context. These abilities

and skills that should be developed in FST degree programmes are subdivided into the following;

4.2.1.1. Intellectual skills;

- recognising and using appropriate theories, concepts and principles from a range of disciplines;
- collecting and integrating several lines of evidence and applying them in a balanced way in an argument;
- designing an experiment, investigation, survey or other means to test an hypothesis or proposition;
- critically analysing information, synthesising and summarising the outcomes;
- applying knowledge and understanding to address familiar and novel problems;
- demonstrating awareness of the provisional nature of the facts and principles associated with a field of study.

4.2.1.2. Practical Skills;

- Using appropriate instrument, equipment, technologies in the laboratory and field;
- planning, conducting, and reporting on investigations, including the use of secondary data;
- collecting and recording information or data in the library, laboratory, field or in the industry itself and summarising it using appropriate qualitative and/or quantitative techniques;
- devising, planning and undertaking field and laboratory investigations in a responsible and safe manner, paying due attention to risk assessment, rights of access, relevant health and safety regulations, legal requirements and sensitivity to the impact of investigations on the environment and stakeholders;

4.2.1.3. Research Skills;

- formulating a proposal, planning and executing research or development work with limited reliance on guidance, evaluating the outcomes and drawing valid conclusions;
- interpreting and presenting the findings to support the conclusions;

Note: The expected levels of subject specific skills for FST graduates are enumerated in Section 7.

In order to enhance the above subject specific skills, the curricula should include appropriate learning activities requiring application of subject knowledge in conducting laboratory practical; practical work in the field; problem identification in real world situation as case studies; Industrial Placement (In-plant training); planning and conducting independent research, collecting, analysing and interpreting data, scientific writing and communication.

4.3 Generic Skills

The key generic skills taken into consideration are the following;

Numeracy Skills

- appreciating issues of sample selection, accuracy, precision and uncertainty during collection recording and analysis of data in the field and laboratory;
- appreciating the difficulties of having incomplete information on which to base decisions;
- understanding the nature of risk;
- preparing, processing, interpreting and presenting data, using appropriate qualitative and quantitative techniques and packages;
- solving numerical problems using computer-based and non-computer based techniques.

Communication Skills (with special emphasis on scientific communication);

- receiving, evaluating and responding to a variety of information sources (e.g. electronic, textual, numerical, verbal, graphical);
- communicating accurately, clearly, concisely, confidently and appropriately to a variety of audiences in written, verbal and graphical forms;
- contributing constructively to group discussions;
- listening to, appreciating and evaluating the views of others.

Information and Communication Technology (ICT) Skills;

- using the internet critically as a means of communication and a source of information;
- demonstrating competence in the use of computer-based information handling and data processing tools;
- using computer packages to create effective ways to communicate information.

Interpersonal/Teamwork Skills;

- working as a team player;
- setting realistic targets;
- identifying individual and collective goals and responsibilities;
- planning, allocating and evaluating the work of self, individuals and teams;
- performing in a manner appropriate to these roles and responsibilities;
- recognising and respecting the views and opinions of other team members;
- having positive intent;
- reflecting on and evaluating own performance as an individual and as a team member.

Self Management and Professional Development Skills.

- appreciating the need for professional codes of conduct where applicable;
- recognising the moral and ethical issues related to the subject;
- assuming responsibility for one's actions;
- identifying and working towards targets for personal, academic and career development;
- developing an adaptable and flexible approach to study and work;
- developing the skills necessary for self-managed and lifelong learning (e.g. working independently, time management and organisation skills);
- displaying the potential for competence, behaviour and attitudes required in a professional working life including initiative, leadership and team skills.

Note: The expected levels of subject specific skills for FST graduates are enumerated in Section 7.

To enhance the above generic skills, inclusion of ancillary subjects areas and some components in to compulsory subjects is suggested.

4.4 Attitudes

A balanced view of ethical aspects relating to (professional) honesty and integrity, appreciation of environmental and social issues related to Food Science and Technology should be an essential integral component of FST degree programmes. It is noted that there are practical difficulties in assessing such attitudes in students. Nevertheless, it is desirable to device the enhancement of the following attitudinal attributes through curricular activities.

1. Ethical and rational conduct
2. Adaptability to diverse social, cultural, and work situations
3. Honesty, loyalty and dependability
4. Teamwork and cooperativeness
5. Respecting others' views and options
6. Punctuality and commitment to work
7. Positive intent

It is desirable to design specific courses such as Career Guidance or to incorporate relevant activities into technical and/or auxiliary courses.

4.5 Other features of the FST Degree Programmes

It may be advantageous to design curricula for the FST degree programmes consisting of both core and elective modules. The core module should cover the entire range of subject areas referred in the section 4.1.1.1 and be made compulsory for all FST undergraduates to ensure imparting the expected essential aspects knowledge, skills and attitudes stipulated in the SBSFST. In addition, the FST degree programmes should include advance course unit subjects to impart in-depth knowledge and skills in specified subject areas. However, depending on the nature and specific objectives of the individual degree programmes and specific considerations taken into account by the curriculum developers, individual curricula can vary in terms of specific contents provided that general framework is observed.

In addition to the common structure and minimum number of credits suggested in the Section 1, all FST degree programmes should be adopted the common grading system and levels of GPA approved by the UGC for the award of classes.

5. TEACHING AND LEARNING STRATEGIES

The FST graduates have wide employment prospects and need to be adaptable as well as having subject-specific knowledge and abilities and transferable skills. There are many different formats for teaching and learning in order to develop these attributes. The degree programmes incorporate a research project leading to a thesis and other self-motivated individual studies.

The teaching and learning strategies used should be appropriately designed with a view to develop highly competent FST graduates. The choice of strategies should be inspirational and challenging in nature and foster deep learning and critical thinking in a progressive manner transforming the students from dependent (teacher-centred learning practices) to independent (student-centred learning practices) learners and enabling the FST graduates to fit into the profile descried in the Section 3.1. A wide range of teaching and learning methods appropriate to the development of highly competent graduates can be used (this is not intended to be prescriptive or exhaustive);

- Lecturing and tutorials
- Group and individual assignments
- Workshops and presentations
- Field/factory visits
- Guest lectures
- Demonstrations, exhibition (e.g. ProFood ProPack) etc
- Report writing and presentation
- Peer learning/teaching
- Independent learning
- Practical work in the field
- Work with community/industry in problem solving
- Industrial Placement (In-plant training) as a method of external institutional training
- Independent Research under supervision
- Use of Interactive CD ROMs
- Database, web site and computer-assisted learning
- Case Studies and directed reading

6. ASSESSMENT STRATEGIES

Assessments can be formative as well as summative and one or several forms mentioned below can be selected as summative ones in order to incorporate in to the final evaluation. It is managed to promote deep rather than surface learning. Assessments based on real world problems during in-plant training or research placement with employer involvement and with effective feedback are of importance and will be included provided they are compatible with the assurance of academic standards. The style of assessment will vary between disciplines and Universities. However, assessments are linked to clearly defined goals and intended learning outcomes and they should be aligned with the teaching and learning strategies employed in each course. They should be designed to test subject knowledge and understanding as well as the skills and competencies that are expected in a FST graduate. A combination of assessments methods may be used, depending on the attributes to be tested. Wherever possible, students should be given feedback on their performance and attainment. The following methods practiced by different University may be applied as appropriate;

1. Written Examinations Closed and/or Open Book
2. Continuous Assessments
3. Viva Voce Examinations
4. Assignments
5. Practical Tests/Examinations
6. Field Reports
7. Project Reports

8. Thesis
9. Spot tests
10. Critical Analysis of Case Studies
11. Presentations Oral, Poster, Audio-Visual
12. Peer Assessments
13. Work Experience/Industrial Training Reports
14. Web Based/Computer Based Assignments/Examinations (e.g. Moodle based packages)

Note : This list is neither prescriptive nor exhaustive.

7. MAINTAINING STANDARDS

7.1 Grade Point Average (GPA)

An aggregate index called Grade Point Average (GPA) will be used to rank thew students and award of classes. The GPA is calculated as the weighted average of the grade points obtained from different courses and the number of corresponding course units, using the following formula;

$$\mathbf{GPA = \Sigma (G_i . C_i)/\Sigma (Ci)}$$

Where G_i = Grade point of the i^{th} course

C_i = Number of Credit Units assigned to the i^{th} course

7.2 Benchmark standards

Every student who has successfully completed the FST bachelor degree programme is expected to demonstrate the minimum level of knowledge, skills and attitudes that are specified in this statement. There will be differences in levels of attainment among students. This statement specifies the "Threshold performance or the minimum required level of performance to qualify for the award of a Bachelor Degree as specified by the respective faculty. FST graduates with Second Class (Upper and Lower divisions) and First Class should demonstrate progressively deeper and broader level of knowledge and greater proficiency in skills than those with threshold level do. In this section (Table 1 and 2), standards of achievement are expressed as statements of learning outcomes. These describe what a student should be able to achieve on completion of the degree with a First Class or Second Class or a General Pass.

The outcomes will be demonstrable through appropriate assessment strategies. However, it is obvious that not all learning outcomes can be objectively assessed. It is important that standards of achievement reflect the shared values of the academic community as moderated internally and externally by academic quality procedures, including the external examiner system. Four levels of performances can be considered;

1. **Threshold performance** is the minimum required to obtain the degree (Table 2). A student, who achieves this level by obtaining a Grade Point Average of not less than 2.0 will be able to demonstrate an acceptable level of ability and skills and he/she will qualify for a General Pass;

2. **Typical performance** is that expected of students at the lower/upper second class boundary (Table 2). A student who achieves these levels either by obtaining a Grade Point Average of not less than 2.75 for a Second Class Lower division or by obtaining not less than 3.30 for a Second Class Upper division will be able to demonstrate definite competence and skills;
3. **Excellent performance** is demonstrated by students gaining a First Class (Table 2). A student, who achieves this level by obtaining a Grade Point Average of not less than 3.75 will be able to demonstrate an acceptable level of ability and skills and he/she will qualify for a First Class. These students will have a range of competencies and skills at an enhanced level.

Table 2. Levels of performances and achievements

Performance	**Achievement**	**Minimum GPA required**
Threshold performance	**For qualifying for BSc Degree**	**> 2.0**
Typical performance	**Second Class Lower Division**	**> 2.75**
	Second Class Upper Division	**> 3.33**
Excellent performance	**First Class**	**> 3.75**

Performance levels are defined for the seven main categories of abilities and skills outlined in section 7 in table 3 and for subject-specific skills in table 4. These categories do not constitute a checklist, nor does the list imply any particular weighting. Whereas the full range of abilities and skills should feature in undergraduate programmes, their point of introduction and the level of engagement will be decided by curriculum designers. To reach a given level of performance at the completion of a FST degree covered by this statement, students should demonstrate achievement across the main categories of abilities and skills stipulated in tables 3 and 4.

Table 3 a : Definition of performance levels for FST degrees

	Threshold performance (General Pass)	**Typical performance (Second class)**	**Excellent performance (First class)**
Intellectual skills	With regard to the performance levels defined into seven main categories of abilities and skills the FST graduate should be able to;		
	demonstrate some understanding of subject specific theories, paradigms, concepts and principles	demonstrate understanding of subject-specific theories, paradigms, concepts and principles, as well as some understanding of more specialised areas	demonstrate thorough understanding of subject-specific theories, paradigms, concepts and principles as well as in depth understanding of more specialised areas
	demonstrate ability to define and solve routine problems	demonstrate ability to define problems, and devise and evaluate solutions to both routine and unfamiliar problems	demonstrate ability to define problems, devise and evaluate possible solutions, and to solve both routine and unfamiliar problems confidently
	collate and summarise information	analyse, synthesise, summarise and evaluate information	seek out, analyse, synthesise, summarise and critically evaluate information
	integrate lines of evidence from a limited range of sources to support findings and hypotheses	integrate lines of evidence from a range of sources to formulate and test hypotheses	show a well developed ability to integrate lines of evidence from a wide range of sources to formulate and test hypotheses
	demonstrate some ability to consider issues from a range of multi-disciplinary and interdisciplinary perspectives	demonstrate the ability to consider issues from a range of multidisciplinary and interdisciplinary perspectives and to draw on appropriate concepts and values in arriving at a critical assessment	demonstrate the ability to consider issues from a wide range of multidisciplinary and inter-disciplinary perspectives and to draw on appropriate concepts and values in arriving at a critical assessment
	source academic literature and extract relevant points.	critically appraise academic literature and other sources of information	demonstrate a highly developed ability for critical appraisal of academic literature and other sources of information.

Table 3 b : Definition of performance levels for FST degrees (continuation of the table 3 a)

	Threshold performance (General Pass)	**Typical performance (Second class)**	**Excellent performance (First class)**
Intellectual skills	With regard to the performance levels defined into seven main categories of abilities and skills the FST graduate should be able to;		
	recall knowledge based on the directly taught programme	recall knowledge based on the directly taught programme with some evidence of wider enquiry	recall knowledge based well beyond the directly taught programme
	demonstrate some understanding of subject specific theories, paradigms, concepts and principles	demonstrate understanding of subject-specific theories, paradigms, concepts and principles, as well as some understanding of more specialised areas	demonstrate thorough understanding of subject-specific theories, paradigms, concepts and principles as well as in depth understanding of more specialised areas
	demonstrate ability to define and solve routine problems	demonstrate ability to define problems, and devise and evaluate solutions to both routine and unfamiliar problems	demonstrate ability to define problems, devise and evaluate possible solutions, and to solve both routine and unfamiliar problems confidently
	collate and summarise information	analyse, synthesise, summarise and evaluate information	seek out, analyse, synthesise, summarise and critically evaluate information
	integrate lines of evidence from a limited range of sources to support findings and hypotheses	integrate lines of evidence from a range of sources to formulate and test hypotheses	show a well developed ability to integrate lines of evidence from a wide range of sources to formulate and test hypotheses
	demonstrate some ability to consider issues from a range of multi-disciplinary and interdisciplinary perspectives	demonstrate the ability to consider issues from a range of multidisciplinary and interdisciplinary perspectives and to draw on appropriate concepts and values in arriving at a critical assessment	demonstrate the ability to consider issues from a wide range of multidisciplinary and inter-disciplinary perspectives and to draw on appropriate concepts and values in arriving at a critical assessment
	locate source academic literature and extract relevant points.	critically appraise academic literature and other sources of information	demonstrate a highly developed ability for critical appraisal of academic literature and other sources of information.

Table 3 c : Definition of performance levels for FST degrees (continuation of the tables 3 a and b)

	Threshold performance (General Pass)	**Typical performance (Second class)**	**Excellent performance (First class)**
Practical skills	With regard to the performance levels defined into seven main categories of abilities and skills the FST graduate should be able to;		
	plan, conduct and present an independent investigation with reliance on guidance	plan, conduct and present an independent investigation with some reliance on guidance	suggest, plan, conduct and present an independent investigation with limited reliance on guidance
	relate investigations to some prior work and reference it appropriately·	relate investigations to prior work and reference it appropriately; recognise when information is incomplete	relate investigations to prior work, be aware of recent research developments and reference it appropriately
	use appropriate laboratory and field equipment safely	use appropriate laboratory and field equipment competently and safely	use appropriate laboratory and field equipment highly competently and safely
	apply a range of methods to solve problems	select and apply a range of appropriate methods to solve problems	select, justify and apply a range of appropriate methods to solve challenging problems
	use technologies to address problems	use appropriate technology to address problems efficiently	select and use appropriate technology to address problems effectively
	describe and record in the field and laboratory	describe clearly and record accurately in the field and laboratory	describe adequately and record accurately in the field and laboratory
	interpret practical results with guidance	interpret practical results in a logical manner	interpret practical results with flair
	present results of investigations in a number of formats.	present research findings effectively and appropriately in a number of formats.	present research findings effectively and with flair in a number of formats.

Table 3 d : Definition of performance levels for FST degrees (continuation of the tables 3 a, b and c)

	Threshold performance (General Pass)	**Typical performance (Second class)**	**Excellent performance (First class)**
Numeracy skills	With regard to the performance levels defined into seven main categories of abilities and skills the FST graduate should be able to;		
	select an appropriate sampling procedure	define a suitable and effective sampling procedure	define a suitable and efficient sampling procedure
	recognise when information is incomplete	recognise incomplete sets of information and propose appropriate solutions	recognise incomplete sets of information and suggest solutions
	appreciate risk	understand risk	understand and quantify risk
	process and interpret data	process and interpret data effectively	choose appropriate techniques to process data and interpret them effectively
	solve basic numerical problems using appropriate techniques.	solve a range of numerical problems using appropriate techniques.	solve challenging numerical problems using appropriate techniques.
Communication skills	With regard to the performance levels defined into seven main categories of abilities and skills the FST graduate should be able to;		
	communicate to a variety of audiences in written, graphical and verbal forms	communicate effectively to audiences in written, graphical and verbal forms	communicate effectively and engagingly to a variety of audiences in written, graphical and verbal forms
	make contributions to group discussions	contribute coherently to group discussions	contribute constructively to group discussions
	listen and respond to others.	listen attentively and respond to others.	listen to, evaluate and respond effectively to the views of others.

Table 3 e : Definition of performance levels for FST degrees (continuation of the tables 3 a, b, c and d)

	Threshold performance (General Pass)	**Typical performance (Second class)**	**Excellent performance (First class)**
ICT skills	With regard to the performance levels defined into seven main categories of abilities and skills the FST graduate should be able to;		
	use the Internet for communication and information retrieval	use the Internet critically for communication and information retrieval	use the Internet critically and imaginatively for communication and information retrieval
	handle computer based information with guidance, using appropriate techniques and software.	handle computer based information using appropriate techniques and software.	handle computer based information confidently and competently using appropriate techniques and software.
Interpersonal and teamwork skills	With regard to the performance levels defined into seven main categories of abilities and skills the FST graduate should be able to;		
	make some contribution to teamwork and goals	organise a team effectively	organise and motivate a team effectively
		contribute effectively to teamwork	contribute effectively and enthusiastically to teamwork
		identify individual and collective goals	identify individual and collective goals and responsibilities
	recognise and respect the views of others	recognise and respect the views of others	recognise and respect the views of others
	reflect on team performance.	evaluate performance as an individual and team member.	evaluate performance as an individual and team member, and learn for the future.

Table 3 f : Definition of performance levels for FST degrees (continuation of the tables 3 a, b, c, d and e)

	Threshold performance (General Pass)	**Typical performance (Second class)**	**Excellent performance (First class)**
Self-management and professional development skills	With regard to the performance levels defined into seven main categories of abilities and skills the FST graduate should be able to;		
	recognise the existence of moral and ethical issues associated with the subject	recognise and be able to comment on the moral and ethical issues associated with the subject	Recognise, explain and evaluate the moral and ethical issues associated with the subject
	appreciate the need for professional codes of conduct	understand and be able to apply professional codes of conduct	understand and be able to apply professional codes of conduct
	accept some responsibility for their own learning	accept responsibility for their own learning	assume responsibility for their own learning
	identify targets for personal, career and academic development	identify and work towards targets for personal, career and academic development	identify and work towards ambitious targets for personal, career and academic development
	be adaptable and have a flexible approach to study and work	take a responsible, adaptable and flexible approach to study and work	manage a responsible, adaptable and flexible approach to study and work
	develop some skills necessary for self-managed and lifelong learning (that is, independent study, time management, organisational skills)	develop the skills necessary for self-managed and lifelong learning (that is, independent study, time management, organisational skills)	develop the skills necessary for self-managed and lifelong learning (that is, independent study, time management, organisational skills) to an enhanced level
	recognise personal strengths and weaknesses.	analyse personal strengths and weaknesses.	analyse personal strengths and weaknesses and take account of them.

	Threshold performance (General Pass)	Typical performance (Second class)	Excellent performance (First class)
Research Skills	With regard to the performance levels defined into three main categories of abilities and skills the FST graduate should be able to;		
	Formulating a proposal with clear objectives with planning	Formulating a proposal with clear objectives with planning	Formulating a proposal with clear objectives with planning
	Executing research or product development work with limited reliance on guidance, evaluating the outcomes and drawing valid conclusions;	Executing research or product development work with limited reliance on guidance, evaluating the outcomes and drawing valid conclusions;	Executing research or product development work with limited reliance on guidance, evaluating the outcomes and drawing valid conclusions;
	Interpreting and presenting the findings to support the conclusions	Interpreting and presenting the findings to support the conclusions leading to new findings and/products	Interpreting and presenting the findings to support the conclusions leading to new findings and/products and to a full research papers and scientific communication

Table 4 a: Subject specific knowledge and understanding in FST degrees

	Threshold performance (General Pass)	**Typical performance (Second class)**	**Excellent performance (First class)**
Subject specific knowledge and understanding in FST	This subject benchmark panel recognizes that the FST graduates should have some familiarity with food crop and livestock production as food resources which will be used in food processing. This will help the graduates to understand the important aspects of crop production and animal husbandry. However, the depth of these components can vary from University to University depending on the specific objectives of respective Universities.		
	Thus, the FST graduates will have some familiarity with the biology and management of sustainable production systems of food crops and food animals which will be studied as Food Resources. Therefore, 1. graduates will be able to demonstrate some understanding of the biological factors affecting production of food crops and food animals. 2. graduates will have a well-grounded understanding of use and exploitation of biological entities. 3. graduates will have a well-grounded understanding of agricultural production systems. 4. graduates will have a well-grounded understanding of livestock production systems. 5. graduates will have a well-grounded understanding of physiological and nutritional principles of crop and livestock 6. graduates will have a well-grounded understanding of global issues in the production, distribution and use of agricultural and livestock products.		

Table 4 b: Subject specific knowledge and understanding in FST degrees (continuation of the table 4 a)

	Threshold performance (General Pass)	**Typical performance (Second class)**	**Excellent performance (First class)**
Subject specific knowledge and understanding in FST	Graduates will have some familiarity with the key scientific disciplines relevant to food. They will be able to:	Graduates will have a well grounded understanding of the key scientific disciplines relevant to food. They will be able to:	Graduates will have a comprehensive understanding of the key scientific disciplines relevant to food. They will demonstrate an excellent knowledge of current scientific developments relevant to food. This will distinguish the manner in which they will be able to:
	demonstrate some understanding of the chemistry underpinning molecular interactions occurring in foods and food production	demonstrate understanding of the chemistry underpinning molecular interactions and the behaviour of components in food materials during processing and storage	demonstrate understanding of the chemistry underpinning molecular interactions and the behaviour of components in food materials during processing and storage
	describe key biochemical, chemical, physical and biological factors underlying the synthesis and metabolism of food materials	explain biochemical, chemical, physical and biological factors underlying the synthesis and metabolism of food materials	explain biochemical, chemical, physical and biological factors underlying the synthesis and metabolism of food materials
	describe a limited range of physical properties of food and experimentally determine their values	· describe physical properties of food and experimentally determine their values	explain physical properties of food and experimentally determine their values
	explain the role of key nutrients in health.	explain the role of nutrients in health.	explain the role of nutrients in health.

Table 4 c: Subject specific knowledge and understanding in FST degrees (continuation of the tables 4 a and b)

	Threshold performance (General Pass)	**Typical performance (Second class)**	**Excellent performance (First class)**
Subject specific knowledge and understanding in FST	Graduates will be able to assist in the extension of knowledge and understanding of food through a scientific approach. They will be able to:	Graduates will have a well grounded ability to extend knowledge and understanding of food through a scientific approach. They will be able to:	Graduates will have a comprehensive ability to extend knowledge and understanding of food through a scientific approach. They will demonstrate an excellent appreciation of areas where scientific knowledge is limited and will be capable of proposing methods for overcoming these deficiencies. This will distinguish the manner in which they will be able to:
	use appropriate methods of analysis safely for most types of large and small molecules of relevance to food	use appropriate methods of analysis safely for all types of large and small molecules of relevance to food	use appropriate methods of analysis safely for all types of large and small molecules of relevance to food
	explain and undertake standard methods for the detection and enumeration of microorganisms important to the food industry.	explain and undertake standard methods for the detection and enumeration of microorganisms important to the food industry and undertake appropriate examination of the microbiology of foods.	explain and undertake methods for the detection and enumeration of microorganisms important to the food industry and undertake appropriate examination of the microbiology of foods.

Table 4 d: subject specific knowledge and understanding in FST degrees (continuation of the tables 2 a, b and c)

	Threshold performance (General Pass)	**Typical performance (Second class)**	**Excellent performance (First class)**
Subject specific knowledge and understanding in FST	Graduates will be able to assist in the application and communication of knowledge of food to meet the needs of society, industry and the consumer for sustainable food quality, safety and security of supply. They will be able to:	Graduates will have a well grounded ability to apply and communicate knowledge of food to meet the needs of society, industry and the consumer for sustainable food quality, safety and security of supply. They will be able to:	Graduates will have a comprehensive ability to apply and communicate knowledge of food to meet the needs of society, industry and the consumer for sustainable food quality, safety and security of supply. They will demonstrate excellent knowledge of the literature, creative application of the material and a capacity for synthesis. This will distinguish the manner in which they will be able to:
	describe the principles and practice of major food processing operations and food preservation systems	explain the principles and practice of food processing operations and food preservation systems	explain the principles and evaluate the practice of food processing operations and food preservation systems
	evaluate key aspects of engineering design of food equipment	evaluate engineering design of food equipment and communicate professionally with specialist food engineers	evaluate engineering design of food equipment and communicate professionally with specialist food engineers
	explain the role of packaging materials for food products	explain characteristics and properties of packaging materials for food products and identify appropriate packaging systems	explain characteristics and properties of packaging materials for food products and identify appropriate packaging systems
	apply simple sensory evaluation methods to assess food quality and/or preference	design, apply and interpret statistically valid sensory evaluation methods to assess food quality and/or preference	design, apply and interpret statistically valid sensory evaluation methods to assess food quality and/or preference
	describe the food law framework within which food businesses	assess the performance of a process and the conformance of food to specifications and legislation	assess the performance of a process and the conformance of food to specifications and legislation

Subject specific knowledge and understanding in FST	**Threshold performance (General Pass)**	**Typical performance (Second class)**	**Excellent performance (First class)**
	Assist in the operation of quality assurance programmes	contribute directly to quality assurance programmes	contribute directly to quality assurance programmes
	Describe the risk to health of key chemical contaminants of foods	describe the risks to health of chemical contaminants of food and outline appropriate methods for risk reduction	evaluate the risks to health of chemical contaminants of food and advise on appropriate methods for risk reduction
	Describe the main aspects of business operate	describe the main aspects of the business environment in which food businesses operate and recognise the impact of management principles on the decision making process	describe the main aspects of the business environment in which food businesses operate and recognise the impact of management principles on the decision making process
	Explain the importance of hygiene and waste management systems for the food industry	participate in hygiene and waste management systems for the food industry.	participate in hygiene and waste management systems for the food industry.

8. ANNEX1. MEMBERS OF THE BENCHMARK GROUP

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