

**National Authority for Quality Assurance and Accreditation of
Education**

**National Academic Reference Standards (NARS)
For
Agriculture**

May 2008

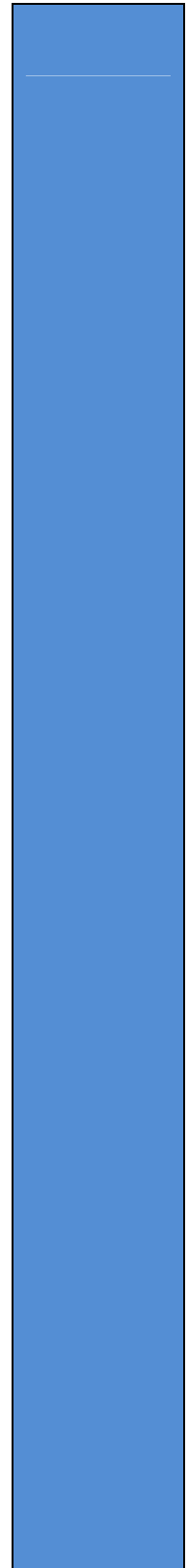


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I: INTRODUCTION TO AGRICULTURE PROGRAMS

Agriculture is an economic activity that provides the community with safe food and fiber. The agricultural programs are aiming at graduating professionals to fulfill the community needs in the sector of agri-business. This is in addition to strengthen the concepts of natural resources preservation as well as make emphases on good agricultural practices and maintain the natural bio-diversity.

The agricultural programs are planned to allow students to complete their study within four years. Structure of the programs is designed as a combination of biology, mathematics, economics, sociology and other sciences related to agriculture. This academic reference structure is targeted to build-up the capacity of the graduates to integrate the principles of basic sciences to adopt and utilize the new concepts and technologies for sustainable agricultural development.

The B. Sc. in agriculture includes eight programs, each program may comprises one or more majors:

1. Plant production that serves the majors of agronomy and horticulture,
2. Animal production that serves the majors of livestock, poultry and fish production,
3. Food sciences include the sectors of dairy and food processing,
4. Plant protection
5. Biotechnology
6. Agricultural engineering
7. Agricultural socio- economic that services the majors of agriculture economics and agriculture extension
8. The soil and Water integrated management or Agriculture natural resources management and Environment

The NARS of these programs are based on the national requirements and international standards. The NARS allow flexibility for the academic programs to adopt new techniques and technologies in the light of the international progress and profession development. The NARS also give a special attention to the skills of self-management and evaluation, self-learning, communication, language and leadership skills.

Graduates of these programs have job opportunity in a wide range of agricultural firms: Agro-industries, commercial trading, mass media, rural development, human nutrition, analytical laboratories, pharmaceutical firms, technical sales, quality control and research stations, educational institutions and agricultural ecommerce organization.

II: GENERAL ATTRIBUTES OF AGRICULTURE GRADUATES

Graduate of agriculture must:

1. Recognize the role of agriculturalists in the society
2. Manage and utilize agricultural resources appropriately
3. Participate in managing agricultural business
4. Display appropriate professional commitment and attitudes
5. Conserve natural resources and maintain bio- diversity
6. Demonstrate awareness of relevant legal, ethical, and socio-economic issues,
7. Be prepared for self-management and continuous learning
8. Be prepared to engage in research studies

III. GENERAL NATIONAL ACADEMIC REFERENCE STANDARDS

III. A. Knowledge and Understanding

Graduate of agriculture must acquire the following knowledge and understanding:

1. The basic and applied sciences related to agriculture
2. The terminologies in agriculture used in farming communities areas
3. Quality management concepts
4. Risk factors in agriculture and how to deal with it
5. Methods of handling and recycling agricultural wastes
6. Basics of planning for agricultural business
7. Basics of micro- economics, macroeconomics, and international economics.
8. Socio- economic aspects related to sustainable agriculture
9. Bio-safety regulations and practices in agriculture
10. Concepts of bio-diversity and maintaining natural resources
11. Agricultural legislations and ethics related to environment and human-being health
12. Basics of information economy and experimental economics

III. B. Intellectual Skills

Graduates must be able to:

1. Observe, collect, and analyze data to solve agricultural problem
2. Design and conduct experiments and draw conclusions
3. Integrate some lines of evidence to elucidate phenomenon and assess risks
4. Choose the best among alternatives to maximize benefits

III. C. Practical Skills

Graduates must be able to:

1. Apply good practices in agriculture that increase and improve agro-products
2. Produce safe food and fiber considering environmental issues
3. Use of agricultural recourses for sustainable agriculture
4. Prepare **preliminary** accounting records for agricultural projects
5. Plan according to changes in national and international economics
6. Prioritize developmental issues related to rural community and urban areas
7. Perform agricultural extension plans and programs
8. Plan and conduct an independent investigation with limited guidance,

III. D. General Skills

Graduates must be able to:

1. Present information and interpret phenomena verbally by report writing
2. Show satisfactory English language
3. Use appropriate audiovisual aids in a presentation
4. Work in a team and understand group behavior
5. Demonstrate basic management capabilities
6. Use software packages in variety of agricultural activities
7. Use information technology for trade and communication
8. Demonstrate self and long life learning
9. Exhibit satisfactory leadership ability

IV: PLANT PRODUCTION PROGRAM

A. Introduction to plant production program

The NARS of this program cover the major fields of, vegetable, pomology and ornamental agriculture crops. In addition to basic and related sciences; plant breeding, soil and water, economics, plant pathology, plant protection, sociology and agricultural engineering sciences are required to fulfill the graduate attributes of this program.

Career opportunities for the graduates in this program include agri-business firms, seed and seedling productions, biotechnology laboratories, and stations of grading, evaluating and packing, research stations and agriculture extension centers

B. Attributes of plant production graduates

Graduates must be able to:

1. Suggest plans of cultivation based on soil and water types and quality.
2. Use water and soil resources efficiently
3. Practice agriculture under different production and ecological systems.
4. Minimize post harvest loss.

C. National academic reference standards

C. 1: Knowledge and Understanding

Graduates of plant production program must acquire the following knowledge and understanding:

1. Morphology, anatomy and histology of kingdom planta
2. Requirements for optimal growth and production of major crops
3. Crop production systems in relation to ecological matrix
4. Soil management and practice of soil conservation and maintenance
5. Principles of using fertilizers and fertilizer requirements of major crops
6. Water requirement of major crops and irrigation / drainage systems
7. Principles of agriculture machinery and applications in agricultural practices
8. Basics of weed and pest control and plant pathogens
9. Pre and post-harvest good practices for different crops.
10. Crops import and export regulations and legislations

C. 2: Intellectual Skills

Graduates must be able to:

1. Suggest plans for commercial plant production
2. Analyze and evaluate farm activities and plan accordingly

C. 3: Practical Skills

Graduates must be able to:

1. Grow and propagate major crops
2. Calculate and apply appropriate fertilizers

3. Calculate water requirements for certain crop and apply appropriate irrigation system
4. Calculate and apply appropriate pesticides and herbicides
5. Harvest major crops appropriately
6. Manage post harvest processes of major crops
7. Identify key fungal, viral and bacterial problems, to assess risks and suggest the appropriate control methods
8. Select and breed high quality crops
9. Use tissue culture for vegetative propagation
10. Design an appropriate crop rotation for field/ green houses
11. Calculate cost of production for specific crop
12. Practice integrated pest management
13. Select appropriate crops relative to ecological matrix, water and soil quality
14. Use appropriate agro machines
15. Apply the general field/green houses agricultural practices

C. 3. a: Additional practical skills related to Ornamental agriculture option

1. Design landscape for rural and urban areas
2. Maintain effective ingredients during harvesting and post-harvest of medicine plants
3. Apply effective extraction methods for medicine plants

C. 3. b: Additional practical skills related to Pomology option

1. Establish new orchard
2. Apply methods for grow fruit-tree breeding for maximum production
3. Select certain pollinators for high fruit production
4. Apply methods to induce fruit maturation

C. 3. c: Additional practical skills related to vegetable crops option

1. Grow vegetables using different agricultural systems
2. Increase vegetable shelf life

V: ANIMAL PRODUCTION

A. Introduction to animal production program

The NARS cover the requirements of knowledge and skills needed in animal and/or poultry production business. Sciences of genetics, bio-chemistry, animal health and diseases, economics, processing and handling of animal products, agronomy and agricultural mechanization as well as specialized sciences in breeding, physiology, nutrition, and production systems are required to build up the capacity of the graduates of this program.

Animal / poultry production business, artificial insemination firms, feed processing plants, biotechnology and feed analytical laboratories, feed trades and inspection, agricultural quarantine and research stations are the main career opportunities for graduates of this program.

B. Attributes of animal production graduates

1. Manage livestock / flocks under extensive and intensive systems
2. Integrate reproductive techniques in breeding plans and genetic resources conservation
3. Plan for genetic improvement considering the farm level
4. Produce high quality animal products
5. Integrate the concepts of animal nutrition in feeding practices.
6. Practice to prevent spreading of epidemic and endemic diseases.

C. National Academic Reference Standards

A. Knowledge and understanding

Graduates of animal production must acquire the following knowledge and understanding:

1. The interdisciplinary sciences relevant to animal production.
2. The physiological basis of endocrinology, reproduction, digestion, growth, lactation, and adaptation
3. Major concepts of livestock production systems

4. Nutrients, nutritional requirements, feeding practices and major steps of feed processing
5. Theories of inheritance and methods for animal / poultry breeding.
6. Housing and managerial practices needed to overcome the adverse impact of micro- and macro- climates
7. Necessary procedures to prevent and control the epidemic, endemic and zoonotic diseases
8. Principles of animal/poultry transportation and product handling
9. The interaction between animals/ poultry and ecosystems
10. Feeding, reproduction, production and acclimatization behavior

B. Intellectual skills

The graduates must be able to:

1. Interpret records to extract evidence
2. Draw preliminary breeding plan for genetic improvement
3. Discuss issues related to animal production based on scientific facts

C. Practical skill

The graduates must be able to:

1. Select quality livestock / poultry
2. Design and maintain livestock records to extract evidences and make decisions to improve productivity and health
3. Calculate livestock nutritional requirements according to age, productive and reproductive status
4. Formulate economic balanced ration
5. Identify infectious diseases and take the necessary actions to control disease spreading
6. Handle animals and their products properly
7. Apply the international standards for animal / poultry welfare
8. Calculate costs of production for livestock/ poultry farms

E1: Additional skills related to poultry production option

1. Manage poultry farms
2. Grade / evaluate table and hatching eggs
3. Grade / evaluate poultry carcass
4. Manage hatcheries

E2: Additional skills related to animal production option

1. Manage dairy, beef, and sheep farms
2. Operate and maintain machine milking appropriately
3. Practice calf rearing appropriately
4. Diagnose pregnancy
5. Grade / evaluate meat, carcass and wool
6. Choose the appropriate treatment to overcome low fertility of farm animals

E3: Additional skills related to fish production option

1. Manage Fish farms
2. Operate, maintain equipments and machinery used in fish farms
3. Judge fish quality
4. Establish and manage fish hatcheries

VI: PLANT PROTECTION PROGRAM

A. Introduction to plant protection program:

The program of plant protection is a multidiscipline program based on the integration among economic entomology, plant pathology, zoology and pesticides sciences. This program integrates knowledge about biological and ecological aspects of pests with a wide variety of cultural, physical, biological and chemical approaches to find the most environmentally sensitive and economically feasible method of pest control. The NARS of this program make emphases on the methods of prevent spreading, diagnose infection and treat the case of pest infection.

In addition to the field work of plant protection and pest control business, the career of this program is also extended to include agro-chemical industries, mass production of bio- control agents, honey bee production, trading pesticides, laboratories of pesticide residue analysis, and researches stations.

B. Attributes of graduates

The graduates of plant protection program must be able to:

1. Design plans for pest prevention.
2. Use efficiently the appropriate control method(s) considering the ecological aspects.
3. Plan and implement integrated pest management program.

4. Maintain pest damage below the economic injury level.
5. Assess hazards of pesticides on non-target organisms
6. Distinguish among the symptoms of different plant diseases

C. Academic Reference Standards

A. Knowledge and understanding

Graduates of plant protection must acquire the following knowledge and understanding:

1. Basics of classification of pests and pathogens
2. Taxonomy, morphology, anatomy, and physiology of pests and their natural enemies and factors influencing their spreading.
3. Ecological factors that convert plant diseases to epidemic diseases
4. Classes of pesticides and their formulations, mode of action and hazard categories.
5. Principles of integrated pest management (IPM)
6. Basics of pest control biologically and chemically.
7. Good practices for handling, transferring, storing and application of pesticides,
8. Products of honey bees and silk worms
9. Effects of pests on plant and animal health
10. National and international safety standards related to pesticide residues in agricultural products.
11. International standards, legislations, registration and regulation related to trading, handling and usage of pesticides.

B. Intellectual skills

The graduates must be able to:

1. Design programs for solving pest problems,
2. Plan preventive actions for plant protection
3. Design programs for control insects involved in plant diseases transmission

C. Practical Skills

The graduates must be able to:

1. Estimate pest population size and the populations of their natural enemies.
2. Apply appropriate methods for biological control.

3. Identify pathogens and define management actions.
4. Determine pesticide residue in agricultural products and environment.
5. Analyze and manage the problem of pest resistance to pesticides and other control agents.
6. Manage apiaries
7. Produce honey and control honey bees pest
8. Rear silk-worms and produce silk
9. Identify symptoms of pesticide poisoning and apply first aid measures
10. Test and evaluate quality of pesticide formulation

V. FOOD SCIENCES

A. Introduction to food sciences program

Food science program includes two majors; food processing and dairy technology. In addition to basic sciences related to agriculture program, microbiology, chemistry, human nutrition and engineering sciences are the cornerstones of this program.

Graduates' of this program have the opportunities to work in food processing firms, quality control organizations, technical sales, research and development, food microbiologist, food standards officer, food technologist and research centers.

B. Attribute of graduates

Graduates of this program must be able to:

1. Process different food and related products.
2. Apply quality control and food safety standards.
3. Use the up dated methods to evaluate food and related products.
4. Recognize the appropriate storage conditions for various food products.
5. Control food deterioration and spoilage.

C. Knowledge and understanding

Graduates of food sciences must acquire the following knowledge and understanding:

1. Physical properties and reactions of food components and how to control these reactions.

2. Traditional and non-traditional methods for food processing and preservation
3. Important pathogens and spoilage microorganisms in foods and how to control their growth
4. Concepts of total quality management in industrial firms.
5. Principles of handling and transportation of food –stuff
6. Principles of processing flow, techniques and food preservation
7. Basics of thermo-dynamics and mechanical operations during food processing
8. Properties and uses of different food packaging materials.
9. Basic principles and practices of cleaning and sanitation in food processing operations.
10. Organoleptic qualities of food.
11. The national and international legislation and agencies relevant to the food quality.
12. The recycling of food by-products and treatment food industry wastes.

D. Intellectual skills

1. Apply mathematical and statistical principles to food industry
2. Identify and solve basic processing problems.

E. Practical skills

1. Analyze food physically, chemically and microbiologically
2. Identify storage problems and affiliated causes in processing technology
3. Select appropriate package for processed food
4. Operate basic food processing equipment
5. Apply the good manufacture practices (GMP)
6. Monitor sanitary food delivery and transportation system
7. Implement the principles of food processing and preservation methods
8. Control deterioration and spoilage of raw materials and processed food.
9. Detect food adulteration.
10. Apply quality control standards and assure food safety

E1. Additional skills for dairy technology option

1. Process native dairy products
2. Perform concentration and ice cream mixtures calculations.
3. Evaluate dairy products

E2. Additional skills for food processing option

1. Process traditional foods
2. Grade/evaluate meat and fish products.
3. Process cereal grains.
4. Formulate daily dietetic requirements
5. Process edible oils, vegetables, fruits, sweeteners, brewing products and oil products.
6. Process vegetables and fruits
7. Process sweeteners and brewing products
8. Process functional food
9. Process sugar and its products.

VIII: AGRICULTURE SOCIO-ECONOMIC PROGRAM

A. Introduction to socio-economic program

Agricultural socio-economic program includes two majors; agricultural economics, and rural sociology and agricultural extension. Economics of the firm, consumer behavior, value chain of agricultural products, characteristics and dynamics of rural societies, and agricultural extension techniques and plans are the main areas of concern of this program.

Graduates of this program have several career opportunities including: Banking/ farm lending institutions, international trade, agribusiness firms, product distributors/ marketing, consultancy services, extension agencies and media, and cooperatives and national and international governmental and non-governmental organizations, educational and research institutions and development projects

B. Attributes of the Agricultural Socio economic graduate

Graduates must be able to:

1. Make decisions based on economic and social principles
2. Predict the impacts of economic and social changes
3. Disseminate the results of applied agricultural research and technology transfer to different end users.

Knowledge and understanding

Graduates of agriculture socio-economic program must acquire the following knowledge and understanding:

1. Principals of producer and consumer behavior under different market structures
2. Principles of production economics and farm management analysis
3. Producer response to changes in prices of inputs and/ or outputs
4. Investment analysis techniques and credit worthiness' analysis
5. Features and dynamics of spot and future markets for agricultural commodities
6. Different stages of value chain analysis and its relation to marketing and business planning
7. Farm records, and book-keeping and prepare different financial statements for farm or agribusiness entities
8. Socio economic research methods
9. Fundamentals of quantitative and qualitative analysis methods
10. Principles of designing, implementing and evaluating extension programs
11. Human resource development approaches
12. Rural community structure, dynamics, and methods of cultural change
13. Principle of community needs assessment and situation analysis
14. Principles information technology economics, ecommerce and emarketing
15. Principles of experimental economics

C. Intellectual skills:

Graduates must be able to:

1. Identify and utilize sources of information needed for problem identification and manipulation.
2. Extract results from available information.

D. Practical skills

Graduates must be able to:

1. Apply different techniques of socio- economic analysis.
2. Propose, design, and implement social and economic agricultural surveys and sampling.
3. Use different statistical packages.

E1. Additional skills for economics option

1. Design a farm business plan
2. Conduct cost / benefit analysis of an agricultural project
3. Calculate credit option for investment and calculate rates of return
4. Develop marketing plan for agricultural enterprise and agribusiness.
5. Create book-keeping system for an agricultural enterprise and manage and maintain financial records

E2. Additional skills for agricultural extension option

1. Plan for rural community development
2. Conduct situation analysis and assess rural needs
3. Design an agricultural extension program.
4. Conduct a training needs assessment
5. Design a training plan based on the **needs** assessment.
6. Simplify the agricultural research findings
7. Rephrase farming problems in a scientific form.

IX: BIOTECHNOLOGY PROGRAM

A: Introduction to biotechnology program

The NARS of this program include the knowledge, understanding and skills required to build the graduate capacity. Sciences of genetics, biochemistry, microbiology, botany, zoology, ecology, propagation, entomology, horticulture, agronomy, plant and animal breeding and propagation comprises the main sciences of this program.

Career opportunities for the graduates in this program are agri-business and pharmaceutical firms, gene banks, seed technology firms, food and feed industry, biotechnology laboratories and research institutes.

B: Attributes of Biotechnology Graduates

Graduates of biotechnology program must be able to:

1. Apply biotechnological tools for improving productivity of plants and animals
2. Adopt different molecular techniques in agricultural development programs
3. Integrate knowledge and procedures to produce genetically modified organisms
4. Use biotechnological applications in agro-industries and ecology maintenance
5. Follow the bio-safety regulations in production of genetically modified organisms.

C. Academic standards of biotechnology program

A. Knowledge and understanding

Graduates of biotechnology program must acquire the following knowledge and understanding:

1. The interdisciplinary sciences relevant to biotechnology
2. Applications of biotechnology in agriculture development and environment maintenance.
3. Techniques of tissue culture and its application
4. Role of recombinant DNA in manipulating organisms
5. Genome, genomics, proteomics and bioinformatics
6. Process and procedures involved in animals and plants biotechnology
7. Use biotechnology in control and diagnosis of plant diseases
8. Production of biological by-products via bioreactors

9. Importance of biotechnology on food industry and safety.
10. Basics of pathogenicity and the production of pathogen and contaminant-free plants.
11. Biotechnological aspects of bio-fertilizers and bio-pesticides
12. Biotechnological bases for conservation of genetic resources
13. International social and ethical standards of biotechnology application.
14. Economics of biotechnology application.

B. Intellectual skills

Graduates must be able to:

1. Evaluate the role of genetic diversity in evolutionary processes
2. Use bioinformatics methods in the analysis of biotechnology data.

C. Practical skills

Graduates must be able to:

1. Provide technical support on agricultural biotechnology problems
2. Use biotechnology in executing plant and animal improvement plans
3. Apply the biotechnological techniques in treatment of environmental pollution.
4. Perform research and diagnostic tests and outlined protocol to achieve goals
5. Use of biotechnological tools to develop valuable by-products
6. Apply molecular markers in plants and animals selection programs
7. Use tissue culture techniques in commercial plant production
8. Apply molecular genetics for manipulation of genetic materials of microorganisms in food/feed technology, bio-fertilizer and bio-pesticide.
9. Apply appropriate laboratory procedures to handle, archive or dispose samples safely
10. Produce secondary products via bioreactors
11. Identify genetically manipulated organisms.

X: AGRICULTURAL ENGINEERING PROGRAM

A. Introduction

Agricultural engineering program concerns with proper use of machineries at the different stages of agricultural production and processing systems. In addition to engineering and agricultural basic and applied sciences, the program provides specialized sciences that cover the disciplines of farm power and machinery, food and post harvest engineering, farm irrigation and drainage engineering and farm building and bioenvironmental engineering .

Graduates in this program will have the opportunity to work in farms, agricultural machinery stations, soil reclamation companies, irrigation and drainage projects, harvesting and grading crops stations, agricultural construction firms, agricultural machinery agencies food, research centers and feed industry.

B. Attributes of Agricultural Engineering graduates

Graduates of Agricultural Engineering program must be able to:

1. Participate in management of agricultural mechanization stations.
2. Operate and maintain irrigation and drainage systems.
3. Plan an agro-industrial complex.
4. Implement the appropriate irrigation system to manage water resources efficiently .
5. Work with machines, equipment and tools in a safe manner.
6. Participate in processes related to farm building construction.

C. Knowledge And Understanding

Graduates of agricultural engineering must acquire the following knowledge and understanding:

1. Principals of plant and animal biology and agricultural production systems
2. Bases of engineering applications in irrigation systems and drainage.
3. Concepts of conventional and non-conventional renewable energy and sources .
4. Basics and components of hydraulic systems.
5. Structural parts of buildings and types of materials.
6. Land surveys
7. Fundamentals of establishment and managing water wells.

D. Intellectual skills

Graduates must be able to:

1. Evaluate the design and performance of agricultural equipment and machinery.
2. Solve engineering problems applying mathematics and engineering sciences.
3. Trouble shoot and diagnose malfunction pertaining to agricultural machineries.
4. Estimate loss in harvesting processes.
5. Calculate the required power needed to field works.
6. Analyze systems of agriculture matrix

E. Practical skills

Graduates must be able to:

1. Determine appropriate agriculture equipment to meet the intended needs.
2. Select and safely operate agriculture equipment and shop tools.
3. Implement and manage irrigation systems.
4. Design agricultural buildings and control the micro-environment
5. Test the performance of agricultural production and processing machinery and systems.
6. Disassemble and assemble machine parts .
7. Draw maps and execute topography surveys
8. Select the appropriate pumps for well establishment
9. Participate in teams of well establishment.

XI. CURRICULUM STRUCTURE

The percentages mentioned in the following table for each area of study is just a guide for faculties of agriculture and not obligatory to follow.

| # | Area of study | Range (%) | Science Characterization |
|---|--------------------------------|-----------|---|
| 1 | Basic Sciences | 30 – 35 | Chemistry, Physics, Botany, Zoology, Physiology, Genetics, Statistics, Mathematics. |
| 2 | Humanities and Social Sciences | 5 – 12 | Economics, Sociology, English, Administration, Communications |
| 3 | Core Sciences | 40 – 45 | Varied among programs |
| 4 | Field Training & projects | 5 -7 | Field training and capstone courses |
| 5 | Information Technology | 3-5 | Basics of IT, application of IT in the profession |
| 6 | Discretionary subjects * | 7-8 | |

- Allowed to each faculty to used based on its mission

GLOSSARY

Academic standards:

Specific standards decided by the institution and informed by external references and including minimum knowledge and skills to be gained by the graduate from the program and fulfilling the stated mission of the institution.^[1]

Attributes:

The set of characteristics expected of a graduate, which draw upon the acquired knowledge, understanding and skills for employment and/or further education and academic research at an appropriate level field.^[1]

Benchmark statements:

Benchmark statements set out expectations about standards of degrees in a range of subject areas. They describe what gives a discipline its coherence and identity, and define what can be expected of a graduate in terms of the abilities and skills needed to develop understanding or competence in the subject. Benchmark statements do not represent a national curriculum in a subject area rather they allow for flexibility and innovation in programme design, within an overall conceptual framework established by an academic subject community.^[2]

Intended Learning outcomes (ILOs):

The ILOs are the knowledge, understanding and skills which the institution intends for its program that are mission-related the use of external reference standards at appropriate level.^[1]

Skills:

The set of abilities to do tasks which will require the application of applied knowledge.^[1]