



ASIIN Seal

Accreditation Report

Biology

Physics

Mathematics

Statistics and Operations Research

Provided by

University of Bahrain

Version: 20 March 2020

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A About the Accreditation Process

Name of the degree programme (in original language)	(Official) English translation of the name	Labels applied for ¹	Previous accreditation (issuing agency, validity)	Involved Technical Committees (TC) ²
البكالوريوس في علوم الحياة	Bachelor of Science in Biology	ASIIN	-	10
البكالوريوس في الفيزياء	Bachelor of Science in Physics	ASIIN	-	13
البكالوريوس في الرياضيات	Bachelor of Science in Mathematics	ASIIN	-	12
البكالوريوس في الإحصاء وبحوث العمليات	Bachelor of Science in Statistics and Operations Research	ASIIN	-	12
Peer panel: Prof. Dr. Martin Buhmann, University Giessen Prof. Dr. Mathias Getzlaff, University Duesseldorf Prof. Dr. Jürgen Klingauf, University Muenster Prof. Dr. Werner Manz, University Koblenz-Landau Prof. Dr. Karl Mosler, University Cologne Dr. Hartmut Presting, Daimler-Benz AG Ahlam Almutawa, German University of Technology in Oman "GUtech"				
Representative of the ASIIN headquarter:				

¹ ASIIN Seal for degree programmes;

² TC: Technical Committee for the following subject areas: TC 10 – Life Sciences; TC 13 – Physics; TC 12 – Mathematics

Rainer Arnold	
Responsible decision-making committee: Accreditation Commission for Degree Programmes	
Criteria used: European Standards and Guidelines as of 15.05.2015 ASIIN General Criteria as of 28.03.2014 Subject-Specific Criteria of Technical Committee 10 – Life Sciences as of 09.12.2011 Subject-Specific Criteria of Technical Committee 13 – Physics; as of 09.12.2011 Subject-Specific Criteria of Technical Committee 12 – Mathematics as of 09.12.2011	

B Characteristics of the Degree Programmes

a) Name	Final degree (original/English translation)	b) Areas of Specialization	c) Corresponding level of the EQF ³	d) Mode of Study	e) Double/Joint Degree	f) Duration	g) Credit points/unit	h) Intake rhythm & First time of offer
Ba Biology	Bachelor of Science in Biology	-	6	Full time	no	8 Semester	128 Credit Hours	Fall Semester 1981
Ba Physics	Bachelor of Science in Physics	-	6	Full time	no	8 Semester	128 Credit Hours	Fall Semester 1998
Ba Mathematics	Bachelor of Science in Mathematics		6	Full time	no	8 Semester	127 Credit Hours	September/ 1998
Ba Statistics and Operations Research	Bachelor of Science in Statistics and Operations Research		6	Full time	no	8 Semester	127 Credit Hours	September/ 1998

³ EQF = The European Qualifications Framework for lifelong learning

For the Bachelor's degree programmes Biology, Physics, Mathematics and Statistics and Operations Research, the College of Sciences at the University of Bahrain (UoB) has presented the following profile on its webpage:

“MISSION

The College of Science is dedicated to providing students with knowledge, intellectual and general skills; preparing them for future careers, graduate and professional studies; and guiding them to become active and responsible members of society. The College also aims to generate and disseminate knowledge in areas of national and international concerns that address society's problems and enhance economic development. The College is keen to: build partnerships with the public and private sectors; create a learning environment that provides excellent teaching, mentoring, and interactive student-based learning; innovative research; and reach out to local, regional, and global communities.”

Department of Biology:

“The main objective of the Department is to train students to enter the marketplace successfully and secure employment in the fields of life/ biological sciences, environment and health, and to join and compete successfully in graduate level studies or professional school programs (medical school), as well as to utilize ethically and positively their learned knowledge and skills to serve their community and contribute to its advancement in the relevant field.”

Department of Physics:

“The Department of Physics is committed to providing a high quality education in physics and applied physics; to providing physics graduates with scientific and technical skills; to establishing partnerships and collaborations with local institutions, industries, international universities, and scientific research centers; and to producing internationally recognized scientific research. The Department of Physics is also committed to serving the community by conducting scientific consultations and studies and by organizing public lectures and specialized workshops.”

Department of Mathematics:

“The main objective of the Department of Mathematics is to train students in the fundamental concepts of mathematics/ statistics and operations research, prepare them for a career in their field, and encourage research and consultations by faculty members.”

C Peer Report for the ASIIN Seal

1. The Degree Programme: Concept, content & implementation

Criterion 1.1 Objectives and learning outcomes of a degree programme (intended qualifications profile)

Evidence:

- Learning objectives of each degree programme according to the SAR (Self-Assessment Report) and the objective-module matrices
- Study plans of the degree programmes
- Module descriptions
- Discussion during the audit
- Webpage Department of Biology:
<http://www.uob.edu.bh/en/index.php/colleges/college-of-science/biology/89-b-sc-major-biology-minor>
- Webpage Department of Physics:
<http://www.uob.edu.bh/en/index.php/colleges/college-of-science/physics/200-b-sc-in-physics>
- Webpage Department of Mathematics:
<http://www.uob.edu.bh/en/index.php/colleges/college-of-science/mathematics>

Preliminary assessment and analysis of the peers:

The university informs about the vision, objectives and learning outcomes of the degree programmes at several institutional levels (university, college, department). The provided documentation is well suited to assess whether the defined objectives of the Bachelor's degree programmes Biology, Physics, Mathematics and Statistics and Operations Research adequately reflect the level of academic education aimed at and comply with the learning outcomes as described in the respective ASIIN Subject-Specific Criteria (SSC).

According to the general programme objectives, as stated in the Self-Assessment Reports, UoB wants to prepare academically qualified graduates that can conduct scientific research and are able to interact with the community.

The auditors base their assessment of the programme specific learning outcomes as mentioned on the programme specific websites and in the Self-Assessment Reports.

The auditors refer to the Subject-Specific Criteria (SSC) of the Technical Committees Biology, Mathematics and Physics as a basis for judging whether the intended learning outcomes of the four Bachelor's degree programmes under review as defined by UoB correspond with the competences as outlined by the respective SSC. They come to the following conclusions:

Graduates of the Bachelor's degree programme Biology should understand the basic biological process and be capable of applying the scientific and technological methods of the biological sciences. In addition, they should acquire relevant scientific knowledge in the different biological areas such as botany, zoology, microbiology, biochemistry, biostatistics, molecular biology, biotechnology, and the related natural sciences (chemistry, physics). They learn to work in a team and to carry out practical work in a laboratory and in the field. The purpose is to educate biologists that can work competently in biological laboratories or different private companies.

Graduates of the Bachelor's degree programme Physics should have a broad understanding of fundamental and applied physics, both from a theoretical and experimental perspective. They should acquire relevant scientific knowledge in classical physics (mechanics, electrodynamics, thermodynamics, vibrations, waves and optics) and be familiar with the fundamentals of quantum, atomic and molecular, nuclear, elementary particle, and solid-state physics. In addition, graduates should be trained to work in teams and to carry out experiments in a laboratory.

With respect to the Bachelor's degree programme Mathematics, the intended learning outcomes include gaining a profound overview of the contents of fundamental mathematical theories and applications and being able to identify their correlations. In addition, graduates should also be trained in using the appropriate mathematical techniques to analyse and interpret data. Finally, graduates should be capable of applying mathematical skills and knowledge to understand and solve real life problems.

The Bachelor's degree programme Statistics and Operations Research pursues the goal of preparing its graduates to work successfully in a career related to statistics and operations research (for example, employment in a population monitoring agency, environmental monitoring agency, banks, marketing organizations, medical research firms and governmental agencies). In addition, they should be able to use statistics effectively in making decisions that enhance society development. In order to achieve these goals, students should learn to understand, investigate, and treat real life problems and develop statistical models to solve them. In addition, students should develop basic communica-

tion and design skills in preparing course projects and be able to apply the knowledge and theory they acquired in lectures to solve and analyse real data and prepare reports on statistical results.

During the audit, the employer's representatives (mainly from public institutions) stress the high qualification of UoB's graduates. Students are well prepared for the labour market and there is a high demand for them. Nevertheless, employers point out that students need more hands on training with instruments, their theoretical background is very solid but they are sometimes lacking practical experience. This issue will be discussed in more detail under criterion 4.3.

In summary, it is plausibly demonstrated that the discipline-related skills and competences as defined for the Bachelor's level in the respective Subject-Specific Criteria (SSC) of the ASIIN Technical Committees are broadly covered by the learning outcomes of the degree programmes. The auditors are convinced that the intended qualification profiles of all degree programmes under review allow students to take up an occupation, which corresponds to their qualification. The degree programmes are designed in such a way that they meet the objectives set for them. The auditors judge the objectives and learning outcomes of the degree programmes to suitably reflect the intended level of academic qualification. The intended learning outcomes also sufficiently correspond with the ASIIN Subject-Specific-Criteria (SSC) of the Technical Committee 10 – Life Sciences (Ba Biology), Technical Committee 12 – Mathematics (Ba Mathematics, Ba Statistics and Operations Research) respectively of the Technical Committee 13 – Physics (Ba Physics).

In general, the Bachelor's degree programmes correspond with the qualifications according to the European Qualifications Framework level 6 (Bachelor).

Criterion 1.2 Name of the degree programme

Evidence:

- Self-Assessment Reports
- Webpage Department of Biology:
<http://www.uob.edu.bh/en/index.php/colleges/college-of-science/biology/89-b-sc-major-biology-minor>
- Webpage Department of Physics:
<http://www.uob.edu.bh/en/index.php/colleges/college-of-science/physics/200-b-sc-in-physics>

- Webpage Department of Mathematics:
<http://www.uob.edu.bh/en/index.php/colleges/college-of-science/mathematics>

Preliminary assessment and analysis of the peers:

The audit team considers all degree programme titles appropriate for reflecting the intended aims and learning outcomes. The main language used in teaching is English and if needed Arabic. They point out that the focus of the Bachelor's degree programme Statistics and Operations Research is on statistics and that there are only a few courses related to operations research in the curriculum. This issue is discussed in more detail under criterion 2.1.

Criterion 1.3 Curriculum

Evidence:

- Self-Assessment Reports
- Study plans of all degree programmes
- Module descriptions
- Discussion during the audit
- Webpage Department of Biology:
<http://www.uob.edu.bh/en/index.php/colleges/college-of-science/biology/89-b-sc-major-biology-minor>
- Webpage Department of Physics:
<http://www.uob.edu.bh/en/index.php/colleges/college-of-science/physics/200-b-sc-in-physics>
- Webpage Department of Mathematics:
<http://www.uob.edu.bh/en/index.php/colleges/college-of-science/mathematics>

Preliminary assessment and analysis of the peers:

The Bachelor's degree programme Biology encompasses 128 UoB credit hours. These hours are distributed on 42 courses: 24 courses (70 credit hours) in the major fields of biology, 4 courses (11 credit hours) as university requirements, 11 courses (41 credit hours) as college requirement, and 2 courses (6 credit hours) of university free-electives. Almost all core courses include laboratory sessions that represent 60% of the course contact hours in each course.

A similar distribution can be found in the Physics curriculum: 84 credit hours in the major fields of physics, 10 courses (24 credit hours) as college requirements, 4 courses (11 credit hours) as university requirements, and 3 courses (9 credit hours) for general electives.

Both undergraduate degree programmes at the Department of Mathematics encompass 127 UoB credit hours. The curriculum of the Mathematics programme consists of 11 credit hours of university requirements, 24 credit hours as college requirements, 89 credit hours in the major fields of mathematics, and 3 credit hours for general electives. The distribution in the Bachelor's degree programme Statistics and Operations research is very similar: 11 credit hours of university requirements, 24 credit hours as college requirements, 86 credit hours in the major fields of mathematics, and 6 credit hours for general electives.

The university requirements are the same four courses for all undergraduate degree programmes at UoB and include ARAB 110 (Arabic Language Skills I), HIST 121 (Modern Bahrain History and Culture), ISLM 101 (Islamic Culture), and HRLC 107 (Principles of Human Rights). The core courses are divided into Major Support Requirements (MSR), Major Requirements (MR), and Major Electives (ME). The internship as well as the senior graduation project are compulsory courses in the Biology, Physics, and Statistics programmes. In the Mathematics programme, the internship is also mandatory, but the senior graduation project is an elective. This issue is discussed also under criterion 2.1.

In the view of the auditors, the curricula are designed appropriately and contain all basic courses necessary for a Bachelor's degree programme in the relevant area. They conclude that the imparted discipline-specific curricular content of all four programmes – minor exceptions given – reflects the state of the art and is adequate for the level and objectives of the programmes. The courses are suited for achieving the intended learning outcomes in a comprehensive manner, as specified in the syllabus (module descriptions). The students interviewed by the peers during the audit underline that curricular content and learning outcomes match their expectations with regard to their professional career. However, the auditors gain the impression from discussing with the employers and the students that practical skills should be even stronger emphasized especially in the Biology and Physics programmes.

Criterion 1.4 Admission requirements

Evidence:

- Self-Assessment Reports
- UoB Study and Exams Regulations

- Discussion during the audit
- Webpage Department of Biology:
<http://www.uob.edu.bh/en/index.php/colleges/college-of-science/biology/89-b-sc-major-biology-minor>
- Webpage Department of Physics:
<http://www.uob.edu.bh/en/index.php/colleges/college-of-science/physics/200-b-sc-in-physics>
- Webpage Department of Mathematics:
<http://www.uob.edu.bh/en/index.php/colleges/college-of-science/mathematics>

Preliminary assessment and analysis of the peers:

Admission requirements for all degree programmes under review are based on three elements: the final grade of the high school degree, result of UoB's general aptitude test, and passing an interview with a teacher from UoB.

As specified on the university's homepage the admission requirements at UoB are:

1. Must have a high school diploma/secondary school certificate with an average of at least 70%.
2. Should apply for admission within two semesters after receiving high school certificate or its equivalent.
3. Take the General Aptitude Test conducted by the University:
4. Successfully pass a personal interview.
5. Should be medically fit.
6. Should have good conduct and behaviour.

During the audit, the auditors learn that in 2017 UoB has implemented a "Foundation Programme" for all new students. This new programme was introduced to better prepare high school graduates for studying at UoB. It spans over two semesters and focuses on English Language courses (three courses per semester with 13 credit hours). This seems very useful, since the undergraduate programmes at UoB are taught in English and the English proficiency of high school graduates is lacking. In addition, introductory courses in mathematics and in computing are part of the Foundation Programme. All new students need to pass the Foundation Programme before being admitted to the undergraduate programmes. There are only exceptions for high school students with a GPA above 90 % or a very high score in the General Aptitude Test. According to UoB's webpage, "the Foundation Program at the University of Bahrain is a mandatory program for students of

all undergraduate programs. Applicants are exempted from the Foundation Program if they meet one of the following requirements:

1. Secondary School Score equal to or higher than 90%
2. Overall score in English Language courses undertaken in Secondary School Studies equal to or higher than 90%
3. Evidence of IELTS of 5.5 or TOFEL of 500 and above results taken in the last two years
4. Pass the English language proficiency section of the General Aptitude Test”

The auditors consider the implementation of the Foundation Programme very suitable for better preparing new students for studying at UoB by improving their English language skills and thus reducing the failure rate in the first year classes. Although, students from the first batch are now only entering the degree programmes and a detailed evaluation is not possible yet, there are already some positive effects (e.g. in Physics 101 the failure rate was 70 % and is now about 40 %).

During the audit, the peers discuss with students and teachers about the content and goal of the admission interviews. They learn that the interviews are not subject related, teachers have too many candidates to work with and, therefore, ask only rarely important questions related to the student's future studies. Consequently, a student who wants to join the College of Science does not necessarily have an interview with a teacher from the same college. As a result, the interview concerns more general questions on motivation and overall interests. The teachers confirm that conducting the interviews takes a lot of time and has little additional benefit. For this reason, the auditors recommend abolishing the admission interviews and relying solely on the high school grades and the result of the General Aptitude Test for deciding on the admission of new students.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 1:

The peers agree that laboratory and field work are essential parts of the curriculum, especially in the Biology and Physics programmes. For this reason, they support the plans to improve the students' practical skills by reducing the number of students in the lab sessions and allowing for more direct hands-on experience with the relevant instruments.

The peers understand that the admission interviews are a compulsory part of the admission process and that all staff members are required to conduct these interviews. Nevertheless, the peers are convinced that unstructured interviews with students that apply for other faculties are not useful. Consequently, they recommend to cancel these interviews all together, or to make them subject-specific and to design a guideline on how to con-

duct the interviews, what topics to discuss, and how to evaluate them. If UoB wants to keep the interviews, staff members from the intended field of studies should conduct them.

The peers consider the criterion to be mostly fulfilled.

2. The degree programme: structures, methods and implementation

Criterion 2.1 Structure and modules

Evidence:

- Self-Assessment Reports
- Study plans of the degree programmes
- Module descriptions
- Discussion during the audit

Preliminary assessment and analysis of the peers:

The structure of the Bachelor's degree programmes Biology, Physics, Mathematics and Statistics and Operations Research as well as the individual courses are, from the auditors' point of view, coherent and consistent. This assessment is confirmed by the students who are satisfied with the organisation and structure of the degree programmes. The auditors acknowledge positively that there is an Academic Committee in each department, which meets regularly to discuss about the courses, possible overlaps, and the general structure of the respective degree programmes.

Each degree programme is composed of modules (here named "courses"), which the auditors perceive as comprehensive and self-contained teaching and learning units. Consequently, the auditors consider the intended learning outcomes and the content of the courses to be reasonable and adequate.

In general, the degree programmes under review are designed to be completed within 4 academic years and are taught entirely in English. Nevertheless, the auditors learn during the audit that, especially in the first two semesters, part of the courses are taught in Arabic. The exception is the Biology programme where apparently all courses are completely taught in English. The auditors understand that some high school graduates have problems following classes in English and, therefore, some classes in the Physics and Mathe-

matics programmes are partly taught in Arabic if students feel more comfortable with it. With the introduction of the Foundation Programme, this language barrier should not exist anymore, because new students must pass the English language classes before being admitted to the Department of Science. For this reason, the auditors recommend teaching all courses completely in English. This will improve their English proficiency and their opportunities after graduation.

The auditors see that each of the four Bachelor's degree programmes includes a compulsory internship that is usually done in the summer months between the third and fourth year of studies. The internship course is designed to impart practical experience in the working world. Students spend two months to complete the internship; this includes submitting a written report and an oral evaluation by the respective academic supervisor. As the internship is a compulsory course, the peers point out that it is necessary to award credit hours for it. As UoB's credit hour system is based on contact hours, the auditors understand that currently no credit hours are awarded for the internship. Nevertheless, students spend 8 weeks on the course and credits must be awarded according to the actual workload of the students. This issue is also discussed under criterion 2.2.

The auditors consider the internship as an important part of the curriculum that helps students to acquire necessary practical skills, provides useful contacts with private companies and public institutions, and prepares them for the labor market. During the audit, students point out that it is somewhat difficult to find a suitable place for carrying out the internship, because many companies either are not interested in interns or offer only low profile placements. As a result, several students have problems finding a viable internship and end up with non-subject related placements. In addition, this may prolong the studies, because students postpone the internship until the end of the fourth year.

For this reason, the auditors recommend improving contacts with public institutions, industry and private companies with the goal to offer more high profile internships. Secondly, it would help students to have more flexibility with respect to the time during which the internship is done (not only July and August) and, finally, UoB should allow and support students in finding suitable placements outside Bahrain.

The peers discuss with the programme coordinators about the organisation of the physics courses in the first two semesters. The physics students have stressed that these classes are also attended by students from the College of Engineering, which causes bottlenecks with respect to laboratory space and instruments. In order to cope with the large number of engineering students, the Department of Physics has enlarged the group size in the practical courses to four to five students. The auditors judge this not useful; there should be enough instruments and working places in the laboratories so that students can con-

duct experiments in groups not larger than generally two or exceptionally three. Otherwise, they will not be able to acquire the necessary hands-on experience that is needed in the advanced practical courses. In addition, students point out that physics students require a more intensive theoretical education in the basic sciences than engineering students do and that their starting level of knowledge is different. Physics classes in the first semester are taught together with other majors; this slows the learning progress of the physics students. Moreover, not all topics can be covered as expected. In addition, the programme coordinators should foresee and organize a strict separation between physics and engineering students in the experimental courses carried out in the labs. This is due to different status of knowledge, interest and last not least motivation to conduct physical experiments. Therefore, physics students have deficits and lack some of the knowledge needed in more advanced classes. The peers support this reasoning and recommend offering separate courses in physics for engineering students, hiring additional staff members to give these lectures, and purchasing more instruments.

While analysing the provided sample senior graduation projects, the peers see that error calculation is not taken into account. This is not acceptable, especially in the experimental projects of the biology and physics students. Although, the programme coordinators ensure that error calculation is taught in the laboratory courses of the first year, in more advanced classes this important aspect of practical scientific work is neglected. For this reason, the auditors insist that error calculation must be used in all practical courses, especially in the senior graduation project.

The auditors discuss with the students about the curricula and learn that the physics students would like the course in computational physics to be offered earlier than in the last year, because the content is needed in other courses e.g. the senior graduation project. The peers support this point of view and suggest offering the course in computational physics already in the third year of the Bachelor's degree programme Physics. Moreover, the auditors point out that the courses in solid state physics and laser physics should be adjusted to make sure that students are familiar with the theoretical background before conducting the related experiments.

With respect to the Bachelor's degree programme Statistics and Operations Research, the auditors notice that the curriculum only includes a few classes in the area of operations research. Some important topics, such as mathematical optimization and decision analysis are not addressed in sufficient detail. For this reason, the auditors suggest strengthening these topics in the curriculum. In particular a course is missing that introduces students to the basics of operations research: modelling economic and technical problems, decision theory, and linear and nonlinear programming. In addition, the auditors point out that all statistics students should become familiar with standard statistical software

e.g. SPSS, MATLAB or R, including the writing of simple scripts. It would also be possible to use more open source software (e.g. GNU Octave instead of MATLAB) so that students can use these programmes on their private computers and the university does not have to pay for expensive licenses. Finally, the peers expect that it be made transparent in the syllabus what software will be used in the course and it would be useful if all teachers would use the same software packages.

The auditors discuss with students and graduates about job opportunities. Most of the graduates of the Physics and Mathematics programmes become high school teachers or work for governmental institutions. Since there is a shortage in teachers for mathematics and physics in Bahrain, the graduates have very good job perspectives. Biologist can find jobs in the agricultural area, environmental companies, the fishery industry, or hospitals and public institutions. Graduates of the Statistics programmes have several job perspectives especially in the banking and insurance sector. Even if there are employment opportunities in the private sector, graduates prefer governmental jobs, because they are more secure and usually better paid.

International Mobility

The peers discuss with the programme coordinators whether there are windows of mobility for the students and point out that the international visibility and reputation of a university is increased by its research activities and the academic mobility of staff members and students. The academic mobility of the faculty members is already quite high and almost all teachers have international experience and contacts.

With respect to academic mobility of students, the auditors find that studying abroad for a limited period during a Bachelor's programmes is not an option so far. The programme coordinators concede that the College of Science has several international contacts but mainly for postgraduate studies. The only positive exception is a summer programme for physics students with the European Organization for Nuclear Research (CERN) in Switzerland. Two students are sent to CERN from the Physics Department every summer. The programme is financed by CERN. In addition, some exchange programmes with international universities exist for Bachelor's students; these programmes are established centrally by UoB and students are accepted according to their GPA, it is connected with a scholarship.

Since the auditors learn from students that some of them plan to apply for international Master's programmes and want to spend some time abroad during the Bachelor's programme, the College of Science should initiate exchange programmes with international universities and actively support the students in gaining international experience. A good starting point to initiate international cooperations are the manifold personal interna-

tional contacts of the faculty members. The auditors emphasize that it is very useful for students to spend some time abroad already during their Bachelor's studies to improve their chances to be accepted in an international Master's programme.

There are rules for recognizing achievements acquired at other universities outside UoB, but this possibility is only a theoretical option and currently depends on the individual effort of the student. No support mechanisms for actively promoting academic mobility of students are currently offered by the College of Science.

Criterion 2.2 Workload and credits

Evidence:

- Self-Assessment Reports
- Study plans of the degree programmes
- Module descriptions
- Discussion during the audit

Preliminary assessment and analysis of the peers:

The workload of the degree programmes under review is defined in the study plans. It differs between the Physics and Biology programme (128 credit hours), and the Statistics and the Mathematics programme (127 credit hours).

The credit point system in use at UoB is mainly based on contact hours, including lectures, seminars and labs. One credit hour is awarded for one hour of theoretical lecture or for two to three hours of laboratory work or seminars. The number of contact hours is stipulated in the course syllabus (module descriptions). The auditors perceive that the underlying credit hour system used for assigning credit points primarily reflects attendance times of students, without including working hours required for self-studies. Workload indicates the time students typically need to complete all learning activities (such as lectures, seminars, projects, practical work, self-study and examinations). The number of credits ascribed to each component should be based on its weight in terms of the workload students need in order to achieve the learning outcomes.

During the discussion with the programme coordinators, the peers learn that UoB has determined the self-study time for all courses in the biology programme and provides this information. Unfortunately, it is not transparent how the self-study time was determined and how it is verified.

The estimation of students' workload must not be based on contact hours only (i.e. hours spent by students on activities guided by teaching staff). It embraces all the learning activities, including the time spent on independent work, compulsory work placements, preparation for assessment and the time necessary for the assessment. In other words, a seminar and a lecture may require the same number of contact hours, but one may require significantly greater workload than the other because of differing amounts of independent preparation by students. This is especially necessary for the senior research project, as the auditors gain the impression that students spend a lot of time on preparing and finalising the project. The auditors refer to the ECTS user's guide for further information about the estimation of student's workload and the conversion in ECTS credit points.

In summary, the College of Science should include information about student's workload (contact hours and self-study time) in all module descriptions and should make transparent, how the total workload and the respective credit hours are determined. Moreover, the auditors suggest systematically analysing the workload for all courses and adjusting the crediting system in case discrepancies regarding allocated credits become obvious.

In past years, not only the College of Science but also all Colleges at UoB faced the serious problem of a rising number of students failing classes and dropping out of the degree programmes. Furthermore, less students were able to finish their studies in the expected frame of time. Analysis of this critical issue led to the implementation of the Foundation Programme in 2017. The main reason for students failing classes and dropping out was their lacking English proficiency and deficits in mathematics and computer science. The Foundation Programme is mandatory for all undergraduate students at UoB (possible exception are mentioned under criterion 1.4) and was designed to provide students with the essential skills (mainly English) prior to their undergraduate studies. Improving the English language skills before starting the degree programme is essential from the auditors' point of view. Otherwise, students will not be able to follow the lectures properly and consequently will fail the class. The auditors expect that the introduction of the Foundation Programme will help students to complete their studies successfully and thus significantly reduce the number of dropouts.

During the discussion with the auditors, the students confirm that the overall workload in all degree programmes under review is appropriate and that it is possible to complete the degree without exceeding the expected duration of 8 semesters.

Criterion 2.3 Teaching methodology

Evidence:

- Self-Assessment Reports
- Study plans of the degree programmes
- Discussion during the audit
- Module descriptions

Preliminary assessment and analysis of the peers:

The Bachelor's degree programmes Biology, Physics, Mathematics, and Statistics and Operations Research at UoB are full-time programmes with classroom and self-study activities. Class attendance is mandatory for all courses.

The auditors confirm that a number of different teaching methods such as traditional lectures, classroom and laboratory exercises, assignments, project work and seminars are used. The panel positively acknowledges that homework and laboratory work are essential parts of many courses in the Biology and Physics programmes. The auditors also see that discussions between teachers and students are carried out in social media groups and via an electronic learning platform, allowing direct and real-time communication, also beyond regular lecture and university hours. In addition, some teachers use e-learning elements like online quizzes.

In general, the auditors see that the employed teaching methods are appropriate to support the achievement of the intended learning objectives.

Criterion 2.4 Support and assistance

Evidence:

- Self-Assessment Reports
- Discussion during the audit

Preliminary assessment and analysis of the peers:

Students receive extensive support in study- as well as in personal-related situations at UoB. The auditors are impressed by the commitment of the teachers in counselling students and helping to solve as many problems as possible. Resources and infrastructure for an effective support and assistance system are clearly visible and are appreciated by the students.

For guidance and assistance in planning their programme, students are assigned an academic advisor at the beginning of their studies. Involved in support and assistance are also programme coordinators and all members of the teaching staff.

On university level, the Deanship of Student Affairs is responsible for assisting students during their studies. This includes financial, social, and psychological support. The Center for English Language Learning (CELL) provides help and support for students who need to improve their language skills and the E-Learning center organises workshop on using the digital platforms at UoB. Finally, UoB has established the Career Counselling Office to prepare students for entering the labour market; it organizes the annual Careers Day, which allow students to meet possible employers.

Both staff and students seem highly involved in the academic activities. Good relationships evidently exist between students and staff members. Reportedly, the teaching staff is highly responsive towards the students' needs and complaints as well. In addition, students have the opportunity to participate in student clubs and social activities.

The auditors are impressed by the dedication of the teaching staff for supporting and assisting students. This strong engagement is directly reflected by contentment and respect of the students towards their teachers. The support and assistance system at the College of Science is one of the strong points of the degree programmes.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 2:

The peers are convinced that the introduction of the foundation programme will significantly increase the English proficiency of the students. As a result, Arabic language should be used in the courses as few as possible and the goal should be to teach all classes completely in English.

The peers appreciate that UoB will introduce more topics related to operations research into the curriculum of the Statistics programme. They also support the plan to review the programme in light with market needs and the latest developments.

The peers confirm that UoB will award credits for all compulsory courses (including the internship) and has already provided sufficient verification for the implementation. Offering a compulsory internship course in the Mathematics programme seems to be a good idea.

UoB's plan to expand the cooperation with institutions, companies, and industry to increase and enhance the opportunities for internships is supported by the peers. In addition, they appreciate to give students more flexibility and allowing them to conduct the internship course outside Bahrain.

The peers understand that theoretically the content and the intended learning outcomes for the introductory physics courses are the same for physics and engineering students.

Nevertheless, it is obvious, that in reality the knowledge of the physics and engineering students is different and physics students are not satisfied with the learning advance's in the classes and the level of education. Consequently, the peers are still convinced that it would be very useful to offer different classes for the physics students and to make sure that the number of students in the labs is reduced.

The peers see that in the Statistics programme statistical software packages (e.g. SAS, SPSS) are used. They appreciate that in November 2018 MATLAB and OCTAVE were installed in Mathematics Department computer lab and hope that all students will become familiar with this software.

The peers consider criterion 2 to be mostly fulfilled.

3. Exams: System, concept and organisation

Criterion 3 Exams: System, concept and organisation
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Evidence:

- Self-Assessment Reports
- Module descriptions
- Discussion during the audit

Preliminary assessment and analysis of the peers:

The auditors see that a variety of examination forms is used for assessing the intended learning outcomes. In each course, the students can achieve a maximum of 100 points. The teacher may allocate 60 % to periodic assessments consisting of assignments, mid-term exams, lab reports, quizzes, and projects while the remaining 40% is allocated to the final written examination. The elements used for the grading are described in detail in the syllabus (module descriptions). At the beginning of each semester, students are given the syllabus for their courses. This includes information on the assessment methods used and their contribution to the final grade.

From studying the Self-Assessment Reports and from discussions during the visit, the auditors gain the impression that the methods used by the teaching staff at the College of Science for assessing learning outcomes are generally appropriate. One weak point they identify is the senior graduation project. In the course of this project, students are expected to work under the supervision of a faculty member on a project. This includes literature research, submitting a research proposal, conducting experiments, writing a final

project report, and defending/presenting the result in front of a panel of staff members from the relevant department. The final project can also be done outside UoB or in cooperation with private companies or public institutions (e.g. fishery industry, hospitals in Biology programme).

Not all theses shown to the auditors correspond to high scientific standards. The range of submitted projects is quite broad and especially the projects with a theoretical focus are rather strong, whereas the more experimental oriented projects reveal some weaknesses (e.g. missing error calculation). For this reason, the peers suggest strengthening the students' practical competences and fostering their hands-on experience.

In addition, the auditors point out that there is no compulsory final project in the current curriculum of the Bachelor's degree programme Mathematics. For this reason, they expect UoB to introduce a compulsory final project into the curriculum.

Finally, the peers see that many final exams, especially in the first two years, are multiple-choice test. They understand that this makes it easier for teachers to evaluate and grade exams. Nevertheless, the auditors point out that for appropriately assessing the achievement of the intended learning outcomes multiple choice test are only of limited use. Therefore, it would be useful to conduct less multiple-choice tests as final exams.

As stated in the Self-Assessment Reports, there is a period in every semester for midterm exams and a period for final exams. Organization and scheduling of exams runs smoothly as exam dates are planned and published at the beginning of each semester and no issues of overlaps were reported by either students or teachers. Failed exams cannot be repeated, the whole course must be attended again. A failed course can be repeated four times. Students confirm that all rules and regulations regarding exams, calculation of grades, and pass rates as well as scheduling and re-sits are clear to them and are transparently described.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 3:

The peers expect that a compulsory final thesis will be introduced into the curriculum of the Mathematics programme and that error calculation is taken into account in all courses.

The peers consider the criterion to be mostly fulfilled.

4. Resources

Criterion 4.1 Staff

Evidence:

- Self-Assessment Reports
- Staff Handbook
- Discussion during the audit

Preliminary assessment and analysis of the peers:

At UoB, staff members have different academic positions. There are full professors, associate professors, assistant professors, lecturers and demonstrators. The academic position of every staff member is based on research activities, publications, academic education, supervision of students, and community activities. The auditors learn that the average teaching load is 12 to 15 hours per week for all academic staff members at the College of Science.

According to the Self-Assessment Reports, the Biology Department currently employs 13 full time academic faculty members (2 associate professors, 9 assistant professors, and 2 lecturers). Additionally, there are 4 part time faculty members. The full time faculty members hold PhD degrees (11) and M.Sc. degrees (2) in different specializations. All of the part time teachers are PhD holders. The number of academic faculty members is very similar in the Physics Department: 3 associate professors, 9 assistant professors, and 2 lecturers. In the Mathematics Department, there are a total of 30 full time academic staff members: 4 professors, 3 associate professors, 20 assistant professors, and 3 lecturers.

Within the last few years, the number of faculty members in the College of Science has decreased due to retirement while on the other hand the number of students has increasing significantly, especially in the Biology Department. For this reason, the average teaching load has risen and the teacher to student ratio has dropped. In addition, teachers at the College of Science have to spend more and more time on teaching students from other colleges (e.g. engineering). As a result, academic staff members have less and less time for their students and research activities. For this reason, the peers expect that the vacant positions in all three departments be reoccupied as soon as possible. Since the auditors see that UoB is aware of this problem and tries to solve it, they accept the current situation but encourage UoB to increase the efforts to hire more academic staff members.

The majority of the staff members are Bahraini and hold permanent positions; employment contracts for the non-Bahraini teachers are limited to two years and, thus, need to be renewed regularly. For achieving the aim to reach international standards, the audi-

tors consider the fact that several staff members have acquired their PhD abroad, e.g. in UK a valuable starting point. This approach could, according to the auditors' opinion, be turned into a more general effective qualification scheme if the College of Science could send more students abroad for postgraduate education and would be able to provide more scholarships for them.

In order to use highly trained academic staff as good as possible for educating students, the auditors suggest supporting professors by trained and permanently available professional technicians. Teachers as well as students report in discussions during the audit that the teaching staff performs regular maintenance of laboratory equipment, if ability and available spare parts allow doing so. Maintaining the expensive indispensable equipment seems to be a general problem in the Departments of Biology and Physics at UoB. According to the teachers, repairs of laboratory instruments in case of a break down consumes significant time and is sometimes hampered by lacking technical expertise in maintenance and availability of spare parts. In order to solve issues like these, institutes in other countries commonly employ an adequate number of trained technicians. According to information provided by the professors, UoB employs few to none professional technicians for running instruments used for educational purposes and the Physics Departments lacks an electronic and mechanical workshop. For this reason, the auditors strongly recommend developing an appropriate concept for assuring that an adequate number of professional technicians is available for maintaining and running technical instruments. In addition, the auditors suggest employing advanced Bachelor's students or postgraduate student as paid teaching assistant. They could supervise tutorials and help with teaching classes and labs in general, which would significantly lower the teaching load of the academic staff members and allow them to pursue more research activities.

Regarding teaching in general, the auditors are impressed by the excellent and open-minded atmosphere among the students and the staff members in all divisions visited during the audit. This interaction creates an atmosphere of understanding and support and is one of the strong points of the Bachelor's degree programmes in Biology, Physics, Mathematics and Statistics and Operations Research.

Criterion 4.2 Staff development
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Evidence:

- Self-Assessment Reports
- Staff Handbook
- Discussion during the audit

Preliminary assessment and analysis of the peers:

According to the Self-Assessment Reports, UoB provides several opportunities for faculty members to further developing their professional teaching skills. New faculty members are encouraged to take a one-year in-campus Postgraduate Certificate in Academic Practice (PCAP). Senior faculty members are encouraged to attend workshops prepared by the Continuous Professional Development (CPD) programme at UoB. In addition, specialized workshops based on the needs of teachers are offered. For instance, the Quality Assurance and Accreditation Centre organizes workshops for staff members concerned with quality assurance. Finally, faculty members can attend national and international conferences, seminars and workshops.

The auditors discuss with the members of the teaching staff opportunities for developing personal skills and learn that the teachers are satisfied with the internal qualification programme at UoB. Nevertheless, the teachers criticise that the former possibility for a sabbatical (at least for associated professors and professors once per life) was possible; this regulation is put on hold due to financial restriction. Consequently, teachers only have the opportunity to take an unpaid leave or use the summer months for visiting international universities or joining international research programmes. In addition, the auditors learn that promotion of faculty members is based on community services (workshops, consultation), university services (teaching, tutoring, administration) and research activities (publications). The auditors point out that the teaching load is currently very high compared to international standards and leaves not enough room for conducting research activities which hinders promotions. In addition, the teachers stress during the audit that community service is not feasible for certain areas (e.g. Mathematics) and, therefore, not a good criteria for promotion with respect to academic qualification. The auditors understand this point of view and emphasise that promotion criteria should be transparent, feasible, and accepted by all faculty members. The auditors also learn that recently politics at UoB have been changed with respect to promotion and are now applied according to the relevant regulations. Hence, they agree with the current policies.

In summary, the auditors regard options and support mechanisms provided by UoB for members of the teaching staff for further developing professional and teaching skills as adequate and sufficient.

Criterion 4.3 Funds and equipment
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Evidence:

- Self-Assessment Reports

- On-site visit of the laboratories and lecture rooms
- Discussion during the audit

Preliminary assessment and analysis of the peers:

As described in the Self-Assessment Reports, in the Department of Biology there are twelve teaching laboratories, and ten research laboratories. The Department of Physics contains fifteen teaching labs, and six research labs. The Mathematics Department has two computer labs with up to date computers and software packages. The teaching laboratories are designed for 15 to 20 students, whereas the research labs can accommodate 3 to 5 students.

In addition, there are 21 classrooms at the College of Science. Each classroom has a minimum of 35 seats and is equipped with a PC connected to a multimedia projector. Wi-Fi connection is available throughout the College of Science.

Students can use computers provided by the university in a public section of the library or use their own laptops. Centralized services, such as learning environments are accessible for registered personal from outside the campus. The university library provides relevant databases for conducting scientific research and for educational purposes. Students have access to printed and electronic versions of books as well as contemporary scientific journals. The library is built and equipped for on-site and online retrieval of information and users have access to international literature, scientific journals, and publications. The students express in discussions their satisfaction with the library and the available literature. Nevertheless, students would like more opportunities to learn either individually or in groups. This may become an even bigger problem with rising number of students. In addition, it would be useful to prolong the library's opening hours in the evening (e.g. until 8 pm).

The auditors discuss with representatives of UoB's management funding issues and available financial resources for the College of Sciences. The auditors learn that the government provides funding for teaching and equipment.

During the audit, the peer group visits the laboratories and the classrooms in order to assess the quality of infrastructure and technical equipment. They notice that there are no severe bottlenecks due to missing equipment or a lacking infrastructure. The basic technical equipment is available although some of it is not state of the art; there are not enough funds for purchasing modern instruments and there is an evident lack of professional technicians. The students confirm during the discussion with the auditors that in general they are satisfied with the available equipment for teaching only some consumables for the laboratory work are missing and most of the technical equipment is outdated.

The peer group understands that modern equipment for sophisticated laboratory work, sufficient in terms of quality and quantity, is not available and that the funds are restricted. Although, all students have the opportunity to carry out laboratory experiments, compared to international standards the amount of hands-on experimental and problem solving oriented laboratory work should be increased. In addition, the peers learn that in some courses (e.g. Physics 101) experiments are conducted in groups of 4 to 5 students. In order to gain sufficient hands on experience in the labs, students groups at one experiment should be limited to 2 to 3 students. For this reason, the auditors expect UoB to provide a concept, a reliable financial plan, and a timetable for stepwise increasing and upgrading the technical equipment used for teaching, education and research in the laboratories. In the Biology programme, in particular light and fluorescence microscopes for education and teaching including digital image acquisition and analysis software, and updated equipment for preparation, amplification, analysis and manipulation of nucleic acid are needed. In the Physics programme the peers recommend purchasing modern lasers and optical parts and to use them in the laboratory courses.

Besides the already mentioned restrictions, the auditors judge the available funds, the technical equipment, and the infrastructure (laboratories, library, seminar rooms etc.) to comply with the requirements for sustaining the degree programmes.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 4:

The peers appreciate UoB's effort to increase the number of staff members and technicians and to improve the technical equipment. The peers are still convinced that it would be very useful to acquire additional basic equipment for nucleic acid analysis for teaching purpose. They understand that this is a long term project but expect first practical steps including an annual budget for cost intensive consumables to be taken as soon as possible.

The peers consider the criterion to be partly fulfilled.

5. Transparency and documentation

Criterion 5.1 Module descriptions
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Evidence:

- Self-Assessment Reports

- Module descriptions
- Discussion during the audit

Preliminary assessment and analysis of the peers:

After studying the module descriptions, the auditors confirm that the module descriptions (course syllabus) include all necessary information about responsible teachers, teaching methods, intended learning outcomes, content, admission and examination requirements, forms of assessment, and details explaining how the module mark is calculated.

The only weak point they identify is the fact that, as discussed under criterion 2.2, all module descriptions must include detailed information about the workload and the awarded credits.

Criterion 5.2 Diploma and Diploma Supplement

Evidence:

- Self-Assessment Reports
- Sample Transcript of Records for each degree programme
- Sample Diploma Certificate for each degree programme
- Sample Diploma Supplements for the Biology and Statistics programme

Preliminary assessment and analysis of the peers:

The auditors understand that the students of the degree programmes under review receive a Diploma Certificate and a Transcript of Records. Unfortunately, no sample Diploma Supplement was provided for the Bachelor's degree programmes Physics and Mathematics. The auditors could examine the sample Diploma Supplements of the Bachelor's degree programmes Biology and Statistics and Operations Research. The samples include all necessary information about the structure and content of the respective degree programme as well as about the individual performance of the student.

The auditors expect that all graduates be provided with a standardised Diploma Supplement. This makes academic qualifications comparable and raises the chances for succeeding on the job market or for applying for further studies abroad.

Therefore, the auditors ask UoB to submit a sample Diploma Supplement for the Physics and Mathematics programmes.

Criterion 5.3 Relevant rules

Evidence:

- Self-Assessment Reports
- Webpage Department of Biology:
<http://www.uob.edu.bh/en/index.php/colleges/college-of-science/biology/89-b-sc-major-biology-minor>
- Webpage Department of Physics:
<http://www.uob.edu.bh/en/index.php/colleges/college-of-science/physics/200-b-sc-in-physics>
- Webpage Department of Mathematics:
<http://www.uob.edu.bh/en/index.php/colleges/college-of-science/mathematics>

Preliminary assessment and analysis of the peers:

The auditors receive confirmation that the rights and duties of both UoB and the students are clearly defined and binding. All rules and regulations are published on the university's website and hence available to all relevant stakeholders.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 5:

The peers expect UoB to rewrite the module descriptions to include information about the actual workload and awarded credits. The submitted Diploma Supplements for the physics and mathematics programmes are sufficient and include all necessary information about the respective programme.

The peers consider criterion 5 to be mostly fulfilled.

6. Quality management: quality assessment and development

Evidence:

- Self-Assessment Reports
- Course Evaluation Report, UoB 2017 – 2018
- Program Quality Assurance and Enhancement Policy
- Discussion during the audit

Preliminary assessment and analysis of the peers:

The auditors are impressed by UoB's comprehensive quality assurance system; it is built on several layers of responsibility and activity, on university, college and department level. UQU has established the Quality Assurance Accreditation Center to coordinate and organize all quality related activities, including national and international accreditation of degree programmes.

The quality assurance system at UoB consists of the Quality Assurance Accreditation Center (QAAC) at university level, the Quality Assurance Office Directors (QAD) at each college, the Quality Assurance Committees (QAC) of each programme, the Program Advisory Committee (PAC), the Student Advisory Committee (SAC), and the Quality Assurance Executive Committee (QAE). This committee is headed by the QAAC director and comprises the President's Advisor for Quality and all college's Quality Assurance Offices Directors. The quality management system is based on standards and criteria of the National Education and Training Quality Authority (BQA).

Stakeholders of the degree programmes under review are consulted and their feedback is taken into consideration (e.g. offering a minor in astronomy or shifting courses from first to second semester). Each Department has a Student Advisory Committee and a Program Advisory committee. The PAC members are from governmental institutions and private organizations or companies. The SAC members are elected every year by all the students of the department. The head of the Department has at least one meeting with each committee every year to discuss program related issues, for instance the current curriculum and programme outcomes.

The auditors see that quality management at UQU is understood as a continuous process for improving the quality of the degree programmes, achieved through internal and external evaluation. Internal evaluation of the quality of the degree programmes is performed by online surveys via the Student Information System. A students' survey is centrally organised by the university for every course at the end of the semester. In case of negative feedback, the Dean of the College of Science talks to the respective teacher, analyses the problems, and offers solutions. The auditors are convinced that, in addition to the systematic quality assurance activities, direct communication between students and teachers also contributes to enhancing the degree programmes' quality. A direct feedback to the students who were evaluating the course would hence be beneficial. If deficits are identified, changes are implemented. The students confirm during the discussion with the auditors that their concerns are taken into account and resolved where possible. To this extent, the panel considers the feedback loops to be closed.

Furthermore, the College of Science conducts a graduate survey with respect to the quality of the degree programmes. This type of feedback is designed to consider changes in the curriculum by the College of Science for matching needs of graduates in terms of job perspectives and plans.

Finally, employers are asked to give their feedback on the qualification profile and employability of graduates from the College of Sciences. For this purpose, employers are members of the PAC who regularly meet with the programme coordinators in order to discuss about further developing the degree programmes to meet the requirements of the job market.

UoB stays in contact with its graduates, regularly conducts alumni surveys and annually organise a job fair with representatives from the private and public sector. The peers learn that the teachers also keep personally in touch with their graduates and that the UoB alumni centre is not very effective. It should increase its efforts to keep in contact with alumni e.g. by offering a new e-mail-address after graduation that can be kept life long. In addition, the students criticise the organisation of the job fair, it is a university wide event but mainly relevant for engineering and business students. The needs of the science students are neglected and most employers present at the job fair are not specifically looking for science students. For this reason, the auditors suggest organising an annual job fair only for the College of Science, this will open up more job opportunities for the graduates and make the degree programmes better known.

The auditors, in summary, consider the quality management system at the College of Science operative and suitable for identifying weaknesses and inappropriate trends and for implementing modifications to improve and strengthen the degree programmes. All stakeholders are involved in the process.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 6:

The peers support the plan to organise the job fair by the colleges. Therefore, each college at the university will organize a specific job fair on its own that is more relevant to its students.

The peers consider criterion 6 to be fulfilled.

D Additional Documents

Before preparing their final assessment, the panel asks that the following missing or unclear information needs to be provided together with the comment of the Higher Education Institution on the previous chapters of this report:

- Sample Diploma Supplements for the Physics and Mathematics programmes

E Comment of the Higher Education Institution (15.02.2019)

The institution provided a detailed statement as well as the following additional documents:

- Diploma Supplement for Physics
- Diploma Supplement for Mathematics
- Five Syllabi indicating the embedded topics of operational research in the Statistics Programme
- Class list for 399 2nd semester 2019 indicating flexibility of registration
- Evidences of mobility (Jordan, Saudi Arabia, Pakistan)
- Evidences related to the statistics software
- NQF Handbook showing definition and calculation of workload
- NQF course verification indicating the calculation of workload
- Course syllabus including the workload
- List of published papers from research projects
- Evidence for technician training to maintain instruments
- Contract with specialized companies to maintain the instruments (Renewal of the contract)
- Promotion regulations
- Evidences indicating that purchasing equipment is an ongoing process. Instruments list received by Biology Department in 2018 and the ordered instruments
- Evidences indicating that purchasing equipment is an ongoing process. Instruments list received by Physics Department 2016-2018 and the ordered instruments
- University approval for awarding credits for the internship course

F Summary: Peer recommendations (05.03.2019)

Taking into account the additional information and the comments given by UoB, the peers summarize their analysis and **final assessment** for the award of the seals as follows:

Degree Programme	ASIIN-seal	Subject-specific label	Maximum duration of accreditation
Ba Biology	With requirements for one year	-	30.09.2024
Ba Physics	With requirements for one year	-	30.09.2024
Ba Mathematics	With requirements for one year	-	30.09.2024
Ba Statistics and Operations Research	With requirements for one year	-	30.09.2024

Requirements

For all degree programmes

- A 1. (ASIIN 5.1) Rewrite the module descriptions to include information about the actual workload and awarded credits.
- A 2. (ASIIN 2.2) Make sure that the actual workload of the students and the awarded credits correspond with each other, especially with respect to the graduation project.

For the Bachelor's degree programme Mathematics

- A 3. (ASIIN 2.1) Make the graduation project a compulsory course.

For the Bachelor's degree programmes Biology and Physics

- A 4. (ASIIN 4.3) Technical equipment and instruments in the teaching labs need to be upgraded and increased in numbers. Sufficient consumables must be available for lab work.
- A 5. (ASIIN 4.3) Make sure that students' groups at one experiment are limited to 2 to 3 students.

For the Bachelor's degree programmes Statistics and Operations Research

A 6. (ASIIN 2.1) Offer a compulsory introductory course in Operations Research and Optimization.

For the Bachelor's degree programme Physics

A 7. (ASIIN 2.1) Make sure that that error calculation is used in all practical courses, especially in the senior graduation project.

A 8. (ASIIN 2.1) Make sure that student are familiar with the theoretical background before the related experiments are conducted.

Recommendations

For all degree programmes

E 1. (ASIIN 1.4) It is recommended to abolish the admission interviews.

E 2. (ASIIN 2.1) It is recommended to teach all courses completely in English.

E 3. (ASIIN 2.1) It is recommended to better help the students to find suitable internships and be more flexible in recognizing internships done abroad.

E 4. (ASIIN 2.1) It is recommended to send more Bahraini students abroad and to establish cooperations with international universities on a college level.

E 5. (ASIIN 3) It is recommended to conduct less multiple choice tests as final exams.

E 6. (ASIIN 4.1) It is strongly recommended to hire new staff members and reoccupy vacant positions as soon as possible.

E 7. (ASIIN 4.1) It is recommended to better involve graduate students and advanced undergraduate students in running the labs and tutoring students as paid teaching assistants.

E 8. ASIIN 4.1) It is recommended to train/employ professional technicians for maintaining the technical equipment.

E 9. (ASIIN 6) It is recommended to organise a job fair especially for the College of Science.

For the Bachelor's degree programme Statistics and Operations Research

E 10. (ASIIN 2.1) It is recommended to make transparent what statistical software is used and all statistics students should learn to write scripts and become familiar with standard statistical software.

For the Bachelor's degree programme Physics

E 11. (ASIN 2.1) It is recommended to offer separate physics courses for physics students and divide them from engineering students.

G Comment of the Technical Committees

Technical Committee 10 – Life Sciences (08.03.2019)

Assessment and analysis for the award of the ASIIN seal:

The Technical Committee sees that the technical equipment in biology in particular needs to be improved and is surprised that a country as rich in oil as Bahrain has problems in adequately funding its most renowned university. The problem of the lack of a workload survey is also common at other international universities. Overall, the TC endorses the proposals made by the auditors.

The Technical Committee 10 – Life Sciences recommends the award of the seals as follows:

Degree Programme	ASIIN seal	Subject-specific labels	Maximum duration of accreditation
Ba Biology	With requirements for one year	-	30.09.2024
Ba Physics	With requirements for one year	-	30.09.2024
Ba Mathematics	With requirements for one year	-	30.09.2024
Ba Statistics and Operations Research	With requirements for one year	-	30.09.2024

Technical Committee 12 - Mathematics (11.03.2019)

Assessment and analysis for the award of the ASIIN seal:

The Technical Committee mostly agrees with the assessment of the auditors and makes only some editorial changes.

In addition, the TC points out that the presentation of the requirements and recommendations should be editorially revised so that they are presented in a more orderly manner.

The Technical Committee 12 – Mathematics recommends the award of the seals as follows:

Degree Programme	ASIIN seal	Subject-specific labels	Maximum duration of accreditation
Ba Biology	With requirements for one year	-	30.09.2024
Ba Physics	With requirements for one year	-	30.09.2024
Ba Mathematics	With requirements for one year	-	30.09.2024
Ba Statistics and Operations Research	With requirements for one year	-	30.09.2024

Recommendations

For all degree programmes

E 4. (ASIIN 2.1) It is recommended to send more Bahraini students abroad and to establish cooperations with international universities.

Technical Committee 13 - Physics (08.03.2019)

Assessment and analysis for the award of the ASIIN seal:

The Technical Committee discusses the procedure as well as the conditions and recommendations and proposes some editorial changes. Otherwise, the TC agrees with the suggested requirements and recommendations.

The Technical Committee 13 – Physics recommends the award of the seals as follows:

Degree Programme	ASIIN seal	Subject-specific labels	Maximum duration of accreditation
Ba Biology	With requirements for one year	-	30.09.2024
Ba Physics	With requirements for one year	-	30.09.2024
Ba Mathematics	With requirements for one year	-	30.09.2024
Ba Statistics and Operations Research	With requirements for one year	-	30.09.2024

Requirements

For the Bachelor's degree programme Physics

- A 8. (ASIIN 2.1) Make sure that students are familiar with the theoretical background before the related experiments are conducted.

Recommendations

For all degree programmes

- E 6. (ASIIN 4.1) It is strongly recommended to improve the staffing resources.
- E 8. (ASIIN 4.1) It is recommended to train and/or employ professional technicians for maintaining the technical equipment.
- E 9. (ASIIN 6) It is recommended to organise a job fair especially for the College of Science.

For the Bachelor's degree programme Physics

- E 11. (ASIIN 2.1) It is recommended to offer separate physics courses for physics students and for engineering students.

H Decision of the Accreditation Commission (29.03.2019)

Assessment and analysis for the award of the ASIIN seal:

The Accreditation Commission agrees in general with the proposed requirements and recommendations and endorses the changes that have been suggested by the involved Technical Committees. Only with respect to recommendation E 4 they do not follow the suggestion of TC 12 and retain the add on “on a college level”, because the University has already international cooperations and the peers want to emphasize the usefulness of establishing exchange programmes exclusively for the College of Science.

The Accreditation Commission for Degree Programmes decides to award the following seals:

Degree Programme	ASIIN seal	Subject-specific labels	Maximum duration of accreditation
Ba Biology	With requirements for one year	-	30.09.2024
Ba Physics	With requirements for one year	-	30.09.2024
Ba Mathematics	With requirements for one year	-	30.09.2024
Ba Statistics and Operations Research	With requirements for one year	-	30.09.2024

Requirements

For all degree programmes

- A 1. (ASIIN 5.1) Rewrite the module descriptions to include information about the actual workload and awarded credits.
- A 2. (ASIIN 2.2) Make sure that the actual workload of the students and the awarded credits correspond with each other, especially with respect to the graduation project.

For the Bachelor’s degree programme Mathematics

- A 3. (ASIIN 2.1) Make the graduation according to international scientific standards project a compulsory course.

For the Bachelor’s degree programmes Biology and Physics

- A 4. (ASIIN 4.3) Technical equipment and instruments in the teaching labs need to be upgraded and increased in numbers. Sufficient consumables must be available for lab work.
- A 5. (ASIIN 4.3) Make sure that students' groups at one experiment are limited to 2 to 3 students.

For the Bachelor's degree programmes Statistics and Operations Research

- A 6. (ASIIN 2.1) Offer a compulsory introductory course in Operations Research and Optimization.

For the Bachelor's degree programme Physics

- A 7. (ASIIN 2.1) Make sure that that error calculation is used in all practical courses, especially in the senior graduation project.
- A 8. (ASIIN 2.1) Make sure that students are familiar with the theoretical background before the related experiments are conducted.

Recommendations

For all degree programmes

- E 1. (ASIIN 1.4) It is recommended to abolish the admission interviews.
- E 2. (ASIIN 2.1) It is recommended to teach all courses completely in English.
- E 3. (ASIIN 2.1) It is recommended to better help the students to find suitable internships and be more flexible in recognizing internships done abroad.
- E 4. (ASIIN 2.1) It is recommended to send more Bahraini students abroad and to establish cooperations with international universities on a college level.
- E 5. (ASIIN 3) It is recommended to conduct less multiple choice tests as final exams.
- E 6. (ASIIN 4.1) It is strongly recommended to improve the staffing resources.
- E 7. (ASIIN 4.1) It is recommended to better involve graduate students and advanced undergraduate students in running the labs and tutoring students as paid teaching assistants.
- E 8. ASIIN 4.1) It is recommended to train and/or employ professional technicians for maintaining the technical equipment.
- E 9. (ASIIN 6) It is recommended to organise a job fair especially for the College of Science.

For the Bachelor's degree programme Statistics and Operations Research

E 10. (ASIIN 2.1) It is recommended to make transparent what statistical software is used and all statistics students should learn to write scripts and become familiar with standard statistical software.

For the Bachelor's degree programme Physics

E 11. (ASIIN 2.1) It is recommended to offer separate physics courses for physics students and for engineering students.

I Fulfilment of Requirements (March 2020)

Comments of the peers and the Technical Committees (09.03.2020)

Requirements

For all degree programmes

- A 1. (ASIIN 5.1) Rewrite the module descriptions to include information about the actual workload and awarded credits.

Initial Treatment	
Peers	fulfilled Justification: The module description have been updated and now inform about the students' total workload and accordingly awarded credits.
TC 10	fulfilled Justification: The TC follows the assessment of the peers.
TC 12	fulfilled Justification: The TC agrees with the assessments of the peers.
TC 13	fulfilled Justification: The TC follows the assessment of the peers.

- A 2. (ASIIN 2.2) Make sure that the actual workload of the students and the awarded credits correspond with each other, especially with respect to the graduation project.

Initial Treatment	
Peers	fulfilled Justification: The university has asked the students about their actual workload and has adjusted the awarded credits.
TC 10	fulfilled Justification: The TC follows the assessment of the peers.
TC 12	fulfilled Justification: The TC agrees with the assessments of the peers.
TC 13	fulfilled Justification: The TC follows the assessment of the peers.

For the Bachelor's degree programme Mathematics

- A 3. (ASIIN 2.1) Make the graduation according to international scientific standards pro-

ject a compulsory course.

Initial Treatment	
Peers	fulfilled Justification: The graduation project is now a compulsory course in the Mathematics programme.
TC 10	fulfilled Justification: The TC follows the assessment of the peers.
TC 12	fulfilled Justification: The TC agrees with the assessments of the peers.
TC 13	fulfilled Justification: The TC follows the assessment of the peers.

For the Bachelor’s degree programmes Biology and Physics

A 4. (ASIIN 4.3) Technical equipment and instruments in the teaching labs need to be upgraded and increased in numbers. Sufficient consumables must be available for lab work.

Initial Treatment	
Peers	fulfilled Justification: The peers appreciate the efforts of UoB in fulfilling the requirement regarding the renewal and acquisition of new instruments and consumables to improve the teaching quality in Physics and Biology.
TC 10	fulfilled Justification: The TC follows the assessment of the peers.
TC 12	fulfilled Justification: The TC agrees with the assessments of the peers.
TC 13	fulfilled Justification: The TC follows the assessment of the peers.

A 5. (ASIIN 4.3) Make sure that students’ groups at one experiment are limited to 2 to 3 students.

Initial Treatment	
Peers	fulfilled Justification: New instruments have been purchased and the experiments are now conducted by groups of 2 to 3 students.
TC 10	fulfilled Justification: The TC follows the assessment of the peers.
TC 12	fulfilled Justification: The TC agrees with the assessments of the peers.
TC 13	fulfilled Justification: The TC follows the assessment of the peers.

For the Bachelor's degree programmes Statistics and Operations Research

A 6. (ASIIN 2.1) Offer a compulsory introductory course in Operations Research and Optimization.

Initial Treatment	
Peers	fulfilled Justification: UoB has designed a meaningful course for the introduction to Operations Research and Optimization and included it as a compulsory course in the curriculum.
TC 10	fulfilled Justification: The TC follows the assessment of the peers.
TC 12	fulfilled Justification: The TC agrees with the assessments of the peers.
TC 13	fulfilled Justification: The TC follows the assessment of the peers.

For the Bachelor's degree programme Physics

A 7. (ASIIN 2.1) Make sure that that error calculation is used in all practical courses, especially in the senior graduation project.

Initial Treatment	
Peers	fulfilled Justification: Error calculation is now done in all relevant experiments as well as in the Graduation Project.
TC 10	fulfilled Justification: The TC follows the assessment of the peers.
TC 12	fulfilled Justification: The TC agrees with the assessments of the peers.
TC 13	fulfilled Justification: The TC follows the assessment of the peers.

A 8. (ASIIN 2.1) Make sure that students are familiar with the theoretical background before the related experiments are conducted.

Initial Treatment	
Peers	fulfilled Justification: The theoretical and practical parts of the courses have been adjusted in order to make sure that students are familiar with the theoretical background before conducting the experiments.
TC 10	fulfilled Justification: The TC follows the assessment of the peers.
TC 12	fulfilled Justification: The TC agrees with the assessments of the peers.
TC 13	fulfilled Justification: The TC follows the assessment of the peers.

Decision of the Accreditation Commission (March 2020)

Degree Programme	ASIIN seal	Subject-specific labels	Maximum duration of accreditation
Ba Biology	All requirements fulfilled	-	30.09.2024
Ba Physics	All requirements fulfilled	-	30.09.2024
Ba Mathematics	All requirements fulfilled	-	30.09.2024
Ba Statistics and Operations Research	All requirements fulfilled	-	30.09.2024

Appendix: Programme Learning Outcomes and Curricula

According to the Self-Assessment Report, the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Bachelor's degree programme Biology:

- a) Comprehend a broad spectrum of knowledge in the major fields of science.
- b) Recognize the relationship of between structure and function at the molecular, cellular and organismal level.
- c) Apply biological knowledge and techniques in the fields of biology.
- d) Communicate concepts in biology through the proper use of the vocabulary of the discipline.
- e) Analyze and/or Evaluate issues pertaining to biological sciences.
- f) Integrate IT skills, humanities, and social studies throughout biology program.
- g) Work independently and as a member of a team
- h) Integrate ethics and self-development skills throughout the educational and professional life.
- i) Plan and execute a project based on a scientific method.

The following **curriculum** is presented:

BSc PROGRAM IN BIOLOGY					
SEMESTER 1					
Course Code	Title	Credits			Prerequisite
		T	L	cr	
ARAB 110	Studies in Arabic Text	3	0	3	
BIOLS 102	General Biology I	3	3	4	
CHEMY 101	General Chemistry I	3	3	4	
MATHS 121	Calculus & Anal. Geometry I	3	0	3	
ENGL 125	English for Science	4	0	3	
Total		16	6	17	
SEMESTER 2					
Course Code	Title	Credits			Prerequisite
		T	L	cr	
BIOLS 103	General Biology II	3	3	4	BIOLS 102
ITCS 103	Introduction to CSC& Programming	4	0	3	
HIST 122	Modern Bahrain History & Citizenship	3	0	3	
PHYCS 101	General Physics I	3	3	4	
ISLAM 101	Islamic Culture	3	0	3	
Total		16	6	17	
SEMESTER 3					
Course Code	Title	Credits			Prerequisite
		T	L	cr	
BIOLS 232	Invertebrate Zoology I	2	3	3	BIOLS 103
BIOLS 250	Microbiology	2	3	3	BIOLS 103
CHEMY 102	General Chemistry II	3	3	4	CHEMY 101

0 Appendix: Programme Learning Outcomes and Curricula

ENGL 126	English for Science	3	0	3	ENGL 125
MATHS 122	Calculus & Anal. Geometry II	4	0	4	MATHS 121
OR					
PHYCS 102	General Physics II	3	3	4	PHYCS 101
Total		13/14	9	17	
SEMESTER 4					
Code	Title	Credits			Prerequisite
		T	L	cr	
BIOLS 222	Plant Morphology	2	3	3	BIOLS 103
BIOLS 234	Chordate Zoology	2	3	3	BIOLS 103
CHEMY 223	Organic Chemistry for Biological Sciences	2	3	3	CHEMY 102
STAT 272	Introduction to Biostatistics	3	0	3	MATHS 121
HU/SS xxx	Humanities/ Social Science	x	x	3	
Total		12	9	15	
SEMESTER 5					
Course Code	Title	Credits			Prerequisite
		T	L	cr	
BIOLS 300	Cell Biology	2	3	3	BIOLS 102
BIOLS 360	Principles of Genetics	2	3	3	BIOLS 102
BIOLS 380	Marine Biology	2	3	3	BIOLS 222and BIOLS 232
HRLC 107	Introduction to Human Rights	2	0	2	
BIOLS 3xx	Dept. Elective	x	x	3	
BIOLS 3xx	Dept. Elective	x	x	3	
Total		12	15	17	

SEMESTER 6					
Course Code	Title	Credits			Prerequisite
		T	L	cr	
BIOLS 315	Biochemistry	2	3	3	BIOLS 102 & CHEMY 223
BIOLS 320	Plant Physiology	2	3	3	BIOLS 300
BIOLS 340	General Ecology	2	3	3	BIOLS 103
BIOLS 372	Human Physiology	2	3	3	BIOLS 300
BIOLS 3/4xx	Dept Elective	x	x	3	
BIOLS 399	Internship	0	0	0	
Total		10	12	15	
SEMESTER 7					
Code	Title	Credits			Prerequisite
		T	L	cr	
BIOLS 404	Biotechnology	2	3	3	BIOLS 250 & BIOLS 360
BIOLS 465	Gene Technology	2	3	3	BIOLS 250 & BIOLS 360
BIOLS 3/4xx	Job Placement 1	x	x	3	
Free Elective	University I	x	x	3	
BIOLS 499	Senior Research Project	2	3	3	Dept. Approval
Total		11	12	15	
SEMESTER 8					
Code	Title	Credits			Prerequisite
		T	L	cr	
BIOLS 451	Immunology	2	3	3	BIOLS 250

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BIOLS 4xx	Dept. Elective	2	3	3	
Free Elective	University II	X	x	3	
BIOLS 4xx	Job Placement 2	2	3	3	
BIOLS 4xx	Dept. Elective	2	3	3	
Total		8	12	15	
Total Credit = 128					

According to the Self-Assessment Report, the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Bachelor's degree programme Physics:

The program of B.Sc. in Physics enables students by the time of graduation to:

- PILO a) Apply knowledge of Science and Mathematics to related disciplines.
- PILO b) Identify, formulate and solve problems in physics.
- PILO c) Design and implement computational models for physical systems.
- PILO d) Conduct experiments working independently or in collaboration with others.
- PILO e) Interpret and analyze data to reach sound conclusions.
- PILO f) Use information technology to search and locate scientific information.
- PILO g) Conduct basic scientific research.
- PILO h) Communicate scientific information and conclusions effectively to a broad audience.
- PILO i) Recognize recent developments in physics.
- PILO j) Understand professional, ethical and social issues and responsibilities.
- PILO k) Acquire self-learning skills to ensure lifelong learning.

The following **curriculum** is presented:

Year 1 - Semester 1

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
ARAB 110	Arabic Language Skills	3	0	3	UR	-----	No
CHEMY 101	General Chemistry I	3	3	4	CR	-----	No
ENGL 125	English for Science I (SCI)	3	0	3	CR	-----	No
MATHS 121	Calculus and Analytic Geometry I	3	0	3	CR	-----	No
PHYCS 101	General Physics I	3	3	4	CR	-----	Yes

Year 1 - Semester 2

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
ITCS 113	Computer Programming I	3	2	3	CR	-----	No
HIST 122	Modern History of Bahrain and Citizenship	3	0	3	UR	-----	No
MATHS 122	Calculus and Analytic Geometry II	4	0	4	MSR	MATHS 121	No
PHYCS 102	General Physics II	3	3	4	MR	PHYCS 101	Yes
ENGL 126	English for Science II (SCI)	3	0	3	CR	ENGL 125	No

Year 2 - Semester 3

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
BIOLS 102	General Biology I	3	3	4	CR	-----	No
ISLM 101	Islamic Culture	3	0	3	UR	-----	No
MATHS 211	Linear Algebra	3	0	3	MSR	MATHS 121	No
PHYCS 209	Bulk Properties of Matter	3	2	3	MR	PHYCS 101	Yes
PHYCS 222	Modern Physics	3	2	3	MR	PHYCS 102	Yes

Year 2 - Semester 4

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CHEMY 102	General Chemistry II	3	3	4	MSR	CHEMY 101	No
MATHS 205	Differential Equations	3	0	3	MSR	MATHS 122	No
PHYCS 221	Methods of Mathematical Physics I	3	0	3	MR	PHYCS 102 & MATHS 122	Yes
PHYCS 241	Introductory Electronics	3	2	3	MR	PHYCS 102	Yes
GSE XXX	Humanities / Social Science	X	X	3	GSE	-----	No

Year 3 - Semester 5

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
HRLC 107	Human Rights	2	0	2	UR	-----	No
PHYCS 314	Classical Mechanics	3	2	3	MR	PHYCS 221 or MATHS 205	Yes
PHYCS 326	Quantum Mechanics I	3	2	3	MR	PHYCS 222	Yes
PHYCS 331	Physical Optics	3	2	3	MR	PHYCS 102	Yes
PHYCS 348	Electromagnetic Theory	3	2	3	MR	PHYCS 221 or MATHS 205	Yes
PHYCS 365	Thermal Physics	3	2	3	MR	PHYCS 209	Yes

Year 3 - Semester 6

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
PHYCS 324	Atomic and Molecular Physics	3	2	3	MR	PHYCS 222	Yes
PHYCS 351	Solid State Physics I	3	2	3	MR	PHYCS 222	Yes
PHYCS 3/4XX	Major Elective 1	X	X	3	ME	As per ME list	Yes
PHYCS 3/4XX	Major Elective 2	X	X	3	ME	As per ME list	Yes
PHYCS 3/4XX	Major Elective 3	X	X	3	ME	As per ME list	Yes

Training

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
PHYCS 399	Internship	0	0	0	MR-Training	Completion of 75 credits	No

Year 4 - Semester 7

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
GSE XXX	Free Elective Course 1	X	X	3	GSE	-----	No
GSE XXX	Free Elective Course 2	X	X	3	GSE	-----	No
PHYCS 3/4XX	Major Elective 4	X	X	3	ME	As per ME list	Yes
PHYCS 3/4XX	Major Elective 5	X	X	3	ME	As per ME list	Yes
PHYCS 499	Senior Research Project	0	9	3	MR	Department Approval	Yes

Year 4 - Semester 8

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
PHYCS 425	Computational Physics	3	2	3	MR	PHYCS 221 or MATHS 205	Yes
PHYCS 432	Laser Physics	3	2	3	MR	PHYCS 324 & PHYCS 331	Yes
PHYCS 471	Nuclear Physics	3	2	3	MR	PHYCS 326	Yes
PHYCS 4XX	Major Elective 6	X	X	3	ME	As per ME list	Yes
PHYCS 4XX	Major Elective 7	X	X	3	ME	As per ME list	Yes

According to the Self-Assessment Report, the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Bachelor's degree programme Mathematics:

a) Demonstrate knowledge of core areas of mathematics; statistics and basic sciences
b) Use logical reasoning, formal proof, generalization and abstraction
c) Apply mathematics to real life problems by formulating and solving them and interpreting their solutions
d) Employ different mathematical concepts in solving a wide range of problems within mathematics
e) Identify the relationship between mathematics and other disciplines
f) Communicate effectively within practice
g) Integrate technology in solving and understanding mathematical and scientific problems
h) Understand ethics, responsibility, legal and social issues within professional practice
i) Perform basic scientific research
j) Pursue mathematical lifelong learning through continuous professional development

The following curriculum is presented:

Year 1 - Semester 1

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
ARAB 110	Arabic Language Skills	3	0	3	UR	-----	No
ITCS 113	Computer Programming I	3	2	3	CR	-----	No
ENGL 125	English for Science I (SCI)	3	0	3	CR	-----	No
MATHS 121	Calculus and Analytic Geometry I	3	0	3	CR	-----	Yes
PHYCS 101	General Physics I	3	3	4	CR	-----	No

Year 1 - Semester 2

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
HRLC 107	Human Rights	2	0	2	UR	-----	No
MATHS 122	Calculus and Analytic Geometry II	4	0	4	MR	MATHS 121	Yes
PHYCS 102	General Physics II	3	3	4	MSR	PHYCS 101	No
ITCS 114	Computer Programming II	3	2	3	MSR	ITCS 113	No
ENGL 126	English for Science II (SCI)	3	0	3	CR	ENGL 125	No

Year 2 - Semester 3

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
MATHS 204	Calculus and Analytic Geometry III	3	0	3	MR	MATHS 122	Yes
MATHS 205	Differential Equations	3	0	3	MR	MATHS 122	Yes
CHEMY 101	General Chemistry I	3	3	4	CR	-----	No
ISLM 101	Islamic Culture	3	0	3	UR	-----	No
STAT 271	Introduction to Probability	3	0	3	MR	MATHS 121	Yes

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Year 2 - Semester 4

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
MATHS 211	Linear Algebra	3	0	3	MR	MATHS 121	Yes
MATHS 253	Set Theory	3	0	3	MR	MATHS 121	Yes
BIOLS 102	General Biology I	3	3	4	CR	-----	No
HIST 122	Modern History of Bahrain and Citizenship	3	0	3	UR	-----	No
ITCS 214	Data Structures	3	2	3	MSR	ITCS 114	No

Year 3 - Semester 5

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
MATHS 303	Analysis I	3	0	3	MR	MATHS 204	Yes
MATHS 331	Numerical Analysis I	3	0	3	MR	MATHS 122 & ITCS 114	Yes
STAT 371	Probability and Statistics I	3	0	3	MR	MATHS 122 & STAT 271	Yes
Minor	Course 1	X	X	3/4	Minor	As per Minor	No
Minor	Course 2	X	X	3	Minor	As per Minor	No
GSE XXX	Humanities / Social Science	X	X	3	GSE	-----	No

Year 3 - Semester 6

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
MATHS 304	Analysis II	3	0	3	MR	MATHS 303	Yes
MATHS 311	Abstract Algebra I	3	0	3	MR	MATHS 211	Yes
MATHS 381	Methods of Applied Mathematics	3	0	3	MR	MATHS 204 & MATHS 205	Yes
MATHS 341	Complex Analysis I	3	0	3	MR	MATHS 204	Yes
Minor	Course 3	X	X	3	Minor	As per Minor	No

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Year 4 - Semester 7

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
MATHS 312	Abstract Algebra II	3	0	3	MR	MATHS 311	Yes
MATHS 395	Problem Solving in Mathematics	3	0	3	MR	MATHS 381	Yes
MATHS 401	Applied Mathematics I	3	0	3	MR	MATHS 381	Yes
Minor	Course 4	X	X	3	Minor	As per Minor	No
Minor	Course 5	X	X	3	Minor	As per Minor	No

Year 4 - Semester 8

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
MATHS 3/4XX	Major Elective 1 from list 4	3	0	3	ME	As per ME list	Yes
MATHS 4XX	Major Elective 2 from list 4	3	0	3	ME	As per ME list	Yes
MATHS 4XX	Major Elective 3 from list 4	3	0	3	ME	As per ME list	Yes
Minor	Course 6	X	X	3	Minor	As per Minor	No
Minor	Course 7	X	X	3	Minor	As per Minor	No

According to the Self-Assessment Report, the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Bachelor's degree programme Statistics and Operations Research:

(a) Demonstrate knowledge of various fields of statistics, operations research, mathematics, and basic sciences.
(b) Formulate a real life problem in statistical terms and design an appropriate statistical model to its solution.
(c) Apply statistical techniques to solve a wide range of practical problems.
(d) Analyze real life data using statistical tools and interpret the corresponding results.
(e) Design and conduct qualitative and quantitative sample surveys.
(f) Use statistical software to handle and manage data analysis.
(g) Communicate effectively in practice.
(h) Understand ethics, responsibility, legal and social issues within professional practice.
(i) Apply statistical skills in performing basic scientific research.
(j) Pursue statistical lifelong learning through continuous professional development.

The following curriculum is presented:

Year 1 - Semester 1

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
ARAB 110	Arabic Language Skills	3	0	3	UR	-----	No
ITCS 113	Computer Programming I	3	2	3	CR	-----	No
ENGL 125	English for Science I (SCI)	3	0	3	CR	-----	No
MATHS 121	Calculus and Analytic Geometry I	3	0	3	CR	-----	Yes
PHYCS 101	General Physics I	3	3	4	CR	-----	No

Year 1 - Semester 2

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
PHYCS 102	General Physics II	3	3	4	MSR	PHYCS 101	No
MATHS 122	Calculus and Analytic Geometry II	4	0	4	MR	MATHS 121	Yes
STAT 271	Introduction to Probability	3	0	3	MR	MATHS 121	Yes
STAT 275	Introduction to Statistics using Software	3	0	3	MR	MATHS 121	Yes
ENGL 126	English for Science II (SCI)	3	0	3	CR	ENGL 125	No

Year 2 - Semester 3

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
MATHS 204	Calculus and Analytic Geometry III	3	0	3	MR	MATHS 122	Yes
ITCS 114	Computer Programming II	3	2	3	MSR	ITCS 113	No
STAT 371	Probability and Statistics I	3	0	3	MR	MATHS 122 & STAT 271	Yes
MATHS 211	Linear Algebra	3	0	3	MR	MATHS 121	Yes
ECON 140	Microeconomics	3	0	3	MSR	-----	No

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Year 2 - Semester 4

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
ISLM 101	Islamic Culture	3	0	3	UR	-----	No
BIOLS 102	General Biology I	3	3	4	CR	-----	No
CHEMY 101	General Chemistry I	3	3	4	CR	-----	No
STAT 372	Probability and Statistics II	3	0	3	MR	STAT 371	Yes
STAT 391	Nonparametric Statistics	3	0	3	MR	STAT 271	Yes

Year 3 - Semester 5

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
HIST 122	Modern History of Bahrain and Citizenship	3	0	3	UR	-----	No
ITCS 214	Data Structures	3	2	3	MSR	ITCS 114	No
MATHS 205	Differential Equations	3	0	3	MR	MATHS 122	Yes
STAT 374	Regression Analysis	3	0	3	MR	MATHS 211 & STAT 372	Yes
Minor	Course 1	X	X	3	Minor	As per Minor	No

Year 3 - Semester 6

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
HRLC 107	Human Rights	2	0	2	UR	-----	No
Minor	Course 2	X	X	3	Minor	As per Minor	No
Minor	Course 3	X	X	3	Minor	As per Minor	No
STAT 378	Surveys and Sampling	3	0	3	MR	STAT 371	Yes
STAT 381	Time Series Analysis	3	0	3	MR	STAT 372	Yes
STAT 394	Linear programming	3	0	3	MR	MATHS 122 & STAT 271	Yes

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Training Requirement

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
STAT 399	Internship	0	0	0	MR-Training	Completion of 75 credits	No

Year 4 - Semester 7

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
Minor	Course 4	X	X	3	Minor	As per Minor	No
Minor	Course 5	X	X	3	Minor	As per Minor	No
STAT 373	Statistical Packages and Simulation	3	0	3	MR	STAT 271	Yes
STAT 392	Operational Research I	3	0	3	MR	MATHS 211	Yes
STAT 499	Senior Research Project	0	9	3	MR	Department Approval	Yes

Year 4 - Semester 8

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
Minor	Course 6	X	X	3	Minor	As per Minor	No
Minor	Course 7	X	X	3	Minor	As per Minor	No
STAT 393	Operational Research II	3	0	3	MR	STAT 392	Yes
STAT 3/4XX	Major Elective 1 from lists 1 or 2	3	0	3	ME	As per ME list	Yes
STAT 4XX	Major Elective 2 from lists 1 or 2	3	0	3	ME	As per ME list	Yes