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HELLENIC REPUBLIC

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Accreditation Report
for the Undergraduate Study Programme
(Integrated Master) of:

Mining and Metallurgical Engineering

Institution: National Technical University of Athens

Date: 10 April 2021

Ευρωπαϊκή Ένωση
Ευρωπαϊκό Κοινωνικό Ταμείο

Επιχειρησιακό Πρόγραμμα
Ανάπτυξη Ανθρώπινου Δυναμικού,
Εκπαίδευση και Διά Βίου Μάθηση
Με τη συγχρηματοδότηση της Ελλάδας και της Ευρωπαϊκής Ένωσης

ΕΣΠΑ 2014-2020

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Report of the Panel appointed by the HAHE to undertake the review of the Undergraduate Study Programme (Integrated Master) of **Mining and Metallurgical Engineering** of the **National Technical University of Athens** for the purposes of granting accreditation

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PART A: BACKGROUND AND CONTEXT OF THE REVIEW

I. The External Evaluation & Accreditation Panel

The Panel responsible for the Accreditation Review of the Undergraduate Study Programme (Integrated Master) of **Mining and Metallurgical Engineering** of the **National Technical University of Athens** comprised the following five (5) members, drawn from the HAHE Register, in accordance with Laws 4009/2011 & 4653/2020:

1. **Prof. Zach Agioutantis (Chair)**
   University of Kentucky, USA

2. **Mr. Sotirios Konstantakopoulos**
   Member of the Technical Chamber of Greece, Greece

3. **Prof. Theodoros Ntaflos**
   University of Vienna, Austria

4. **Prof. Vladimiros Papangelakis**
   University of Toronto, Canada

5. **Prof. Panagiotis Tsakiropoulos**
   University of Sheffield, United Kingdom

II. Review Procedure and Documentation

Due to the COVID-19 pandemic all meetings were held online via Zoom teleconferencing. The External Evaluation & Accreditation Panel (EEAP) held a preliminary meeting on Monday April 5th, 2021, and discussed the strategy and matters to be considered during the following online meetings with the SMME members.

On Tuesday, April 6th, the EEAP met with the University Vice-Rector, the Dean of SMME, the Quality Assurance Unit (QAU) of the Institution, the Internal Evaluation Group (IEG), the teaching staff members and the undergraduate students. The EEAP was briefed on the history and academic profile of the SMME, its current status, its strengths and areas of improvement. The above were supported by additional documents complementing the online presentations. The EEAP had an extensive meeting with IEG and discussed the compliance of the SMEE undergraduate program to the standards for quality evaluation and accreditation set by HAHE. Potential issues of the undergraduate study program and possible reforms were discussed in the teleconference with the undergraduate students. At the end of the teleconferences the EEAP met briefly to discuss and summarize the findings.

On Wednesday, April 7th, a virtual online tour of the School infrastructure was presented including classrooms, teaching and research laboratories, libraries and the Museum. The Panel had the opportunity to discuss with faculty and staff members the accessibility of the undergraduate students to the available facilities. Subsequently the EEAP met online the Program graduates to discuss their experience of studying at the SMME and provide information about their career path. The next session was an online meeting with the external stakeholders where their relations with the SMME were discussed including their experience as employers with the students in terms of their knowledge and skill sets during the one-month practical training (Πρακτική άσκηση) in their enterprise. A final review meeting was held among the EEAP, the Head of the SMEE, the IEG, and the QAU.

From Thursday April 8th to Saturday 10th, the EEAP held daily meetings and worked offline to complete the Accreditation Report.

III. Study Programme Profile

The SMME of the National Technical University of Athens was founded in 1946. The expected duration of studies in the SMME undergraduate program (Integrated Masters) is 5 years (10 semesters). Currently, the School consists of 19 Professors, 9 Associate Professors, 5 Assistant Professors, 23 lab and teaching staff (EEDIP), and 19 technical personnel (ETEP). The School also has 10 administrative staff.

The undergraduate program has five (5) specializations as follows:

(a) Environmental Engineering and Geo-Environment.
(b) Mining Engineering.
(c) Geo-Engineering.
(d) Metallurgical Processes.
(e) Materials Science and Engineering.

The annual intake of new students is approximately 100 (2016) as determined by the Ministry of Education and Religious Affairs of Greece. Based on the IEG data, the length of study of the graduating students for 2016 is distributed as follows: 37.5% graduated in 5 years, 19.6% in six years, 25% in seven years and 17.8% > 7 years. This implies that 82.1% graduate within 7 years. The average for graduation years 2016, 2017, and 2018 is 83%, which is higher than the NTUA average. The total number of students within the 5-year study program was 898 in 2018. The data provided by IEG for 2015-2018 indicate that 61% of the students graduate in n+2 years (7 years).

The completion of the undergraduate program requires 61 courses, of which 46 are mandatory (core), 12 are electives (optional). Practical Exercises 1 and 2 as well the Diploma thesis are also mandatory and should be completed by all students.

The current program of studies has been running under the same structure, with some minor modifications, since 2001 and with unaltered philosophy. Nevertheless, a new study program has been approved and will be starting from the Fall semester of 2021. The current review and evaluation concern the current program.

PART B: COMPLIANCE WITH THE PRINCIPLES

Principle 1: Academic Unit Policy for Quality Assurance

INSTITUTIONS SHOULD APPLY A QUALITY ASSURANCE POLICY AS PART OF THEIR STRATEGIC MANAGEMENT. THIS POLICY SHOULD EXPAND AND BE AIMED (WITH THE COLLABORATION OF EXTERNAL STAKEHOLDERS) AT ALL INSTITUTION'S AREAS OF ACTIVITY, AND PARTICULARLY AT THE FULFILMENT OF QUALITY REQUIREMENTS OF UNDERGRADUATE PROGRAMMES. THIS POLICY SHOULD BE PUBLISHED AND IMPLEMENTED BY ALL STAKEHOLDERS.

The quality assurance policy of the academic unit is in line with the Institutional policy on quality, and is included in a published statement that is implemented by all stakeholders. It focuses on the achievement of special objectives related to the quality assurance of study programmes offered by the academic unit.

The quality policy statement of the academic unit includes its commitment to implement a quality policy that will promote the academic profile and orientation of the programme, its purpose and field of study; it will realise the programme's strategic goals and it will determine the means and ways for attaining them; it will implement the appropriate quality procedures, aiming at the programme's continuous improvement.
In particular, in order to carry out this policy, the academic unit commits itself to put into practice quality procedures that will demonstrate:

a) the suitability of the structure and organization of the curriculum;
b) the pursuit of learning outcomes and qualifications in accordance with the European and the National Qualifications Framework for Higher Education;
c) the promotion of the quality and effectiveness of teaching;
d) the appropriateness of the qualifications of the teaching staff;
e) the enhancement of the quality and quantity of the research output among faculty members of the academic unit;
f) ways for linking teaching and research;
g) the level of demand for qualifications acquired by graduates, in the labour market;
h) the quality of support services such as the administrative services, the Library, and the student welfare office;
i) the conduct of an annual review and an internal audit of the quality assurance system of the undergraduate programme(s) offered, as well as the collaboration of the Internal Evaluation Group (IEG) with the Institution's Quality Assurance Unit (QAU).

Study Programme Compliance

The NTUA has established an appropriate Quality Assurance policy clearly defining Key Performance Indicators (KPIs). The SMME is in line with the review processes of the NTUA. The continuous improvement is assured by the IEG a committee consisting of 5 members from the SMME. The IEG is in line with the QAU for the improvement of the undergraduate program. The QAU is monitoring and enforces the collection of data as per Quality Assurance policies.

Relevant information is shared to SMME academic staff members and student representatives at the School meetings. The internal evaluation reports on the QAU web site are not up to date. There is only one report from 2009-2010.

The study program and learning outcomes are in compliance with the European and National Qualifications Framework for Higher Education. There are no qualitative measurable criteria for the research output.

KPIs utilized in the Quality Assurance policy should emphasize the strategic objectives set by the SMME. The KPIs provided by the SMME for principle 1 should be expanded as they don't cover all strategic goals currently.

Panel Judgement

Principle 1: Institution Policy for Quality Assurance	
Fully compliant	
Substantially compliant	**X**
Partially compliant	
Non-compliant	

Panel Recommendations

It is recommended that additional KPIs are implemented to track progress on the strategic goals set by the department. Recommendations are given below per strategic goal

GOAL: Παρακολούθηση και Βελτίωση Παρεχόμενης Εκπαίδευσης του ΠΠΣ,

- KPIs for % active and non-active students, % students repeating courses etc.

GOAL: Βελτίωση υποδομών και των υπηρεσιών που παρέχονται από τη ΣΜΜΜ στους φοιτητές

- KPIs for age of laboratory equipment (i) for undergraduate (UG) labs (ii) for postgraduate (PG) labs and targets for replacement.
- KPIs for mapping the strategic plans of the School with respect to development in new areas (new materials, new technologies, etc.)

GOAL: Ενίσχυση εξωστρέφειας, διεθνούς θέσης και ερευνητικών αποτελεσμάτων ΣΜΜΜ

- KPIs for research activities of academic staff such as (a) graduated and/or active PhD students per academic staff, (b) MSc students per academic staff, (c) research expenditures per academic staff, (d) refereed journal publications per academic staff (e) referred conference publications with whole paper, etc.

GOAL: Παρακολούθηση και υποβοήθηση της επαγγελματικής σταδιοδρομία των αποφοίτων

- KPIs for relationships with external organisations such as (a) national research institutes (RIs), (b) international RIs (b1) EU, (b2) outside EU, (c) national private companies (d) international private companies (e) national public sector (f) overseas public sector

Principle 2: Design and Approval of Programmes

INSTITUTIONS SHOULD DEVELOP THEIR UNDERGRADUATE PROGRAMMES FOLLOWING A DEFINED WRITTEN PROCESS WHICH WILL INVOLVE THE PARTICIPANTS, INFORMATION SOURCES AND THE APPROVAL COMMITTEES FOR THE PROGRAMME. THE OBJECTIVES, THE EXPECTED LEARNING OUTCOMES, THE INTENDED PROFESSIONAL QUALIFICATIONS AND THE WAYS TO ACHIEVE THEM ARE SET OUT IN THE PROGRAMME DESIGN. THE ABOVE DETAILS AS WELL AS INFORMATION ON THE PROGRAMME'S STRUCTURE ARE PUBLISHED IN THE STUDENT GUIDE.

Academic units develop their programmes following a well-defined procedure. The academic profile and orientation of the programme, the objectives, the subject areas, the structure and organisation, the expected learning outcomes and the intended professional qualifications according to the National Qualifications Framework for Higher Education are described at this stage. The approval or revision process for programmes includes a check of compliance with the basic requirements described in the Standards, on behalf of the Institution's Quality Assurance Unit (QAU).

Furthermore, the programme design should take into consideration the following:

- *the Institutional strategy*
- *the active participation of students*
- *the experience of external stakeholders from the labour market*
- *the smooth progression of students throughout the stages of the programme*
- *the anticipated student workload according to the European Credit Transfer and Accumulation System*
- *the option to provide work experience to the students*
- *the linking of teaching and research*
- *the relevant regulatory framework and the official procedure for the approval of the programme by the Institution*

Study Programme Compliance

The present EEAP evaluation is based on data concerning the current study program. However, it should be noted that the SMME plans to implement a new approved undergraduate program starting from academic year 2021-2022.

The school is implementing the current undergraduate program since it was designed in 2001. This implementation follows:

(i) A well-defined procedure in accordance with the National Qualifications Framework for Higher Education, and the Institution's Quality Assurance Unit policies,

(a) with student participation

(b) with limited input from external stakeholders (i.e., industry, alumni)

(ii) The relevant regulatory framework and

(iii) The official procedure for the approval and periodic revision of the programme by the Institution.

The Panel considers the number of students to be high, even when it is taken into account that the 40% of the total number of enrolled students has been in the program for more than n+2

years and are partly, or wholly, inactive. The existing laboratory infrastructure does not offer optimal conditions for hands-on training to all undergraduate students independent of the direction they choose for their integrated master.

The ECTS system is a cornerstone of the Bologna process for higher education in Europe. However, in practice the implementation of the ECTS system by SMME is not in force. For example, although the ECTS is applied across the curriculum, there appears to be inconsistencies when assigning ECTS to the various courses taught as well as service courses offered by other Schools at the NTUA. The anticipated student workload is not consistent with respect to the ECTS system as courses with similar contact hours appear to have different ECTS values. As a result, SMME seems to underestimate the significance and value of the ECTS system regarding its international recognition and the employability of its graduates.

SMME provides practical training to each student (Practical Training II). The consensus opinion of the stakeholders was that it would be extremely beneficial to the students if practical training were extended to more than the one-month minimum. Further, it appears that the ratio of depth versus breadth education is low, due to the very wide breadth of the curriculum.

There appears to be courses with overlapping content. Some courses are not taught in the proper logical sequence partly due to the lack of prerequisite courses.

Panel Judgement

Principle 2: Design and Approval of Programmes	
Fully compliant	
Substantially compliant	**X**
Partially compliant	
Non-compliant	

The External Evaluation & Accreditation Panel agrees that this Programme leads to a Level 7 Qualification according to the National & European Qualifications Network (Integrated Master)	**YES**	**NO***
	X	

Panel Recommendations

- Form an external Advisory Board consisting of external stakeholders (i.e., industry, alumni, Greek research institutes such as Demokritos) to formalize structured external input and feedback to the School. Stakeholders should be given the opportunity to provide suggestions on needed skills that will help with updating the content of the program.
- Ensures that ECTS is rigorously applied in a consistent and transparent manner across the curriculum, so that student mobility to and from SMME with its European counterparts is easier and improves in the coming years. SMEE should fully engage with the ECTS system in order to improve its international recognition and employability of its graduates.
- Establish prerequisite courses to benefit knowledge retention and course completion of courses in higher semesters.
- Check courses for any overlaps and for logical sequencing.
- Fully implement the recommendations made by the 2013 evaluation. The present Panel is in full agreement with those.

Principle 3: Student- centred Learning, Teaching and Assessment

INSTITUTIONS SHOULD ENSURE THAT THE UNDERGRADUATE PROGRAMMES ARE DELIVERED IN A WAY THAT ENCOURAGES STUDENTS TO TAKE AN ACTIVE ROLE IN CREATING THE LEARNING PROCESS. THE ASSESSMENT METHODS SHOULD REFLECT THIS APPROACH.

Student-centred learning and teaching plays an important role in stimulating students' motivation, self-reflection and engagement in the learning process. The above entail continuous consideration of the programme's delivery and the assessment of the related outcomes.

The student-centred learning and teaching process

- *respects and attends to the diversity of students and their needs, enabling flexible learning paths;*
- *considers and uses different modes of delivery, where appropriate;*
- *flexibly uses a variety of pedagogical methods;*
- *regularly evaluates and adjusts the modes of delivery and pedagogical methods aiming at improvement;*
- *regularly evaluates the quality and effectiveness of teaching, as documented especially through student surveys;*
- *reinforces the student's sense of autonomy, while ensuring adequate guidance and support from the teaching staff;*
- *promotes mutual respect in the student - teacher relationship;*
- *applies appropriate procedures for dealing with students' complaints.*

In addition :

- *the academic staff are familiar with the existing examination system and methods and are supported in developing their own skills in this field;*
- *the assessment criteria and methods are published in advance;*
- *the assessment allows students to demonstrate the extent to which the intended learning outcomes have been achieved. Students are given feedback, which, if necessary is linked to advice on the learning process;*
- *student assessment is conducted by more than one examiner, where possible;*
- *the regulations for assessment take into account mitigating circumstances;*
- *assessment is consistent, fairly applied to all students and carried out in accordance with the stated procedures;*
- *a formal procedure for student appeals is in place.*

Study Programme Compliance

The SMME follows a student-centered learning process. This has been identified in a number of sessions by both faculty members and students.

It was noted that the close collaboration between students and faculty has assisted students to succeed in achieving one of the lowest duration of studies in the NTUA.

Student assessment criteria vary between courses, nevertheless it seems that students are informed of student assessment criteria in advance through the MyCourses web facility and/or their instructors.

Student appeals are handled internally in a satisfactory manner, although there does not seem to be in place a formal process for appeals.

Panel Judgement

Principle 3: Student- centred Learning, Teaching and Assessment	
Fully compliant	**X**
Substantially compliant	
Partially compliant	
Non-compliant	

Panel Recommendations

- Provide detailed feedback to the students in each course, on problems, assignments and lab reports before the final grade is assessed. This includes final exam performance feedback.
- Publish student assessment criteria in the SMME study guide
- Establish a formal process and committee for student appeals due to performance evaluation, illness, absence, and other conflicts.

Principle 4: Student Admission, Progression, Recognition and Certification

INSTITUTIONS SHOULD DEVELOP AND APPLY PUBLISHED REGULATIONS COVERING ALL ASPECTS AND PHASES OF STUDIES (ADMISSION, PROGRESSION, RECOGNITION AND CERTIFICATION).

Institutions and academic units need to put in place both processes and tools to collect, manage and act on information regarding student progression.

Procedures concerning the award and recognition of higher education degrees, the duration of studies, rules ensuring students progression, terms and conditions for student mobility should be based on the institutional study regulations. Appropriate recognition procedures rely on institutional practice for recognition of credits among various European academic departments and Institutions, in line with the principles of the Lisbon Recognition Convention.

Graduation represents the culmination of the students' study period. Students need to receive documentation explaining the qualification gained, including achieved learning outcomes and the context, level, content and status of the studies that were pursued and successfully completed (Diploma Supplement).

Study Programme Compliance

Incoming students are strongly supported by the School in terms of orientation and introduction to the field of Mining and Metallurgical Engineering. The Mineral Museum is helping a lot in this direction.

It is not clear how systematically the student progression is monitored using metrics other than just course grades.

The student mobility is not actively encouraged, as it is left to individual student initiative to seek for opportunities with the help of faculty members.

A Diploma supplement is issued in Greek without request for all graduates, and in English after request by the student.

Quality control for the Diploma Thesis is achieved by the final examination committee, and therefore it might be variable across the unit.

Practical training is in place and the School has developed a network to support this component. However, it depends on individual faculty networking ecosystem and therefore it is variable.

Practical training is in place but was found insufficient to offer a uniformly meaningful training due to its short 1-month duration.

Panel Judgement

Principle 4: Student Admission, Progression, Recognition and Certification	
Fully compliant	**X**
Substantially compliant	
Partially compliant	
Non-compliant	

Panel Recommendations

- Student progression monitoring will benefit by strengthening the "Advising Faculty" concept, as well as from the establishment of a new office responsible for undergraduate student monitoring using a variety of metrics (e.g., number of courses needed to graduate, course loads, practical training reports from industry supervisors, etc.).
- Student mobility needs to be actively encouraged, even if the ERASMUS+ program is providing limited funding
- A transparent algorithm needs to be instituted that evaluates the ECTS value of each course/lab in a consistent manner.
- The Diploma Thesis should be allowed to start formally in the 9th semester, followed by a public seminar and/or poster presentation on the Thesis topic at the beginning of the Fall semester in order to kick-start the work and normalize the diploma thesis load and quality across the School.
- Practical training needs to be extended to more than minimum one summer month in order to increase the educational and training impact on students as well as develop links with the industry that offers the placements. Presently, one-month placements are not and cannot be meaningful. Industry stakeholders seem to be willing to financially support the students fully. The curriculum should be redesigned to offer the flexibility to accommodate optional extended or additional placements for students that would like to do so.
- Providing one week free from course requirements before the start of the final exam period, will help students manage their stress levels better and minimize mental health issues.

Principle 5: Teaching Staff

INSTITUTIONS SHOULD ASSURE THEMSELVES OF THE QUALIFICATIONS AND COMPETENCE OF THE TEACHING STAFF. THEY SHOULD APPLY FAIR AND TRANSPARENT PROCESSES FOR THE RECRUITMENT AND DEVELOPMENT OF THE TEACHING STAFF.

The Institutions and their academic units have a major responsibility as to the standard of their teaching staff providing them with a supportive environment that promotes the advancement of their scientific work. In particular, the academic unit should:

- *set up and follow clear, transparent and fair processes for the recruitment of properly qualified staff and offer them conditions of employment that recognize the importance of teaching and research;*
- *offer opportunities and promote the professional development of the teaching staff;*
- *encourage scholarly activity to strengthen the link between education and research;*
- *encourage innovation in teaching methods and the use of new technologies;*
- *promote the increase of the volume and quality of the research output within the academic unit;*
- *follow quality assurance processes for all staff members (with respect to attendance requirements, performance, self-assessment, training etc.);*
- *develop policies to attract highly qualified academic staff.*

Study Programme Compliance

The teaching staff demonstrated high moral and pride for being members of such a historic academic unit with ample contributions to the economic development of the country.

There is a clear process for the election of a new academic member, which complies with the Greek Law, but there is no strategy for the recruitment of new professorial staff in targeted strategic areas. Several faculty members are graduates of the School, which is not helping the enrichment of the School with new ideas, experiences and approaches.

The professional development opportunities for the teaching staff are left to the initiative of the academic staff. It appears that the high course requirement for graduation (61 courses) induces high teaching loads, that is 4 courses per year on average. This high load is limiting time availability for professional development.

There is strong evidence of linking teaching with research in view of the strong research output of the School. However, not all faculty members are equally active in research (only 60%). The School has not defined any particular research areas for long-term strategic growth. However, it has defined strategic areas for teaching emerging subjects in the new curriculum.

The undergraduate program has been consciously designed to offer a joint mining and metallurgical engineering degree encompassing a very wide spectrum of sub-disciplines. This offers breadth (and access to more job opportunities for its graduates) but it is at the expense of depth.

Teaching staff is regularly evaluated by students through surveys. However, student participation is very low allegedly due to the online impersonal nature of the evaluations. This results in teaching quality indices that are not representative.

Panel Judgement

Principle 5: Teaching Staff	
Fully compliant	
Substantially compliant	**X**
Partially compliant	
Non-compliant	

Panel Recommendations

- The School should develop a recruitment strategy for new academic appointments that is attractive to candidates from the best Schools in Universities around the world in the strategic research areas of interest to the School. This would enrich the School with exposure to new ideas, philosophies and approaches to teaching, research and organization.
- A number of elective courses with overlapping content need to be amalgamated. This will create room to afford professional development opportunities to faculty in terms of Sabbatical/Research Leaves and/or training in modern engineering pedagogy approaches better suited for the current young generation. The latter will be particularly useful to instructors with low teaching quality evaluations.
- Aim at hiring more female faculty to achieve a gender balance reflecting student ratios of male to female (ranging from 2 to 4 in the last 3-4 years).
- Teaching evaluations communicated to individual instructors should have additional metrics to compare the individual instructor performance to the average evaluations of the School and the NTUA for all key performance questions. A clear follow-up process between the academic unit and the faculty member should be established that offers mentoring and training when evaluations systematically reveal weak teaching performance.
- Ensure that new faculty hires are evaluated for their teaching ability separately from their research ability at the time of the interview.
- Provide opportunities to promote teaching quality by introducing new pedagogical approaches in engineering.

Principle 6: Learning Resources and Student Support

INSTITUTIONS SHOULD HAVE ADEQUATE FUNDING TO COVER TEACHING AND LEARNING NEEDS. THEY SHOULD –ON THE ONE HAND- PROVIDE SATISFACTORY INFRASTRUCTURE AND SERVICES FOR LEARNING AND STUDENT SUPPORT AND–ON THE OTHER HAND- FACILITATE DIRECT ACCESS TO THEM BY ESTABLISHING INTERNAL RULES TO THIS END (E.G. LECTURE ROOMS, LABORATORIES, LIBRARIES, NETWORKS, BOARDING, CAREER AND SOCIAL POLICY SERVICES ETC.).

Institutions and their academic units must have sufficient funding and means to support learning and academic activity in general, so that they can offer to students the best possible level of studies. The above means could include facilities such as libraries, study rooms, educational and scientific equipment, information and communications services, support or counselling services.

When allocating the available resources, the needs of all students must be taken into consideration (e.g. whether they are full-time or part-time students, employed or international students, students with disabilities) and the shift towards student-centred learning and the adoption of flexible modes of learning and teaching. Support activities and facilities may be organised in various ways, depending on the institutional context. However, the internal quality assurance ensures that all resources are appropriate, adequate, and accessible, and that students are informed about the services available to them.

In delivering support services the role of support and administrative staff is crucial and therefore they need to be qualified and have opportunities to develop their competences.

Study Programme Compliance

The School aims to offer its students the best possible level of studies supported by facilities that include libraries, educational and scientific equipment, information and communications services. The School encourages student-centered learning and uses flexible models for learning and teaching.

A list of equipment used for undergraduate laboratories was not provided. Also, a list of the teaching assignments related to lab equipment was not provided. Although the School tries to upgrade lab equipment as much as possible, the EEAP noticed aged teaching and research equipment. More specifically, the existing single ocular microscopes used for teaching purposes constitute a health and safety hazard according to current EU safety norms (https://osha.europa.eu/en/publications/e-fact-16-hazards-and-risks-leading-work-related-neck-and-upper-limb-disorders-wrulds/view). The single ocular microscopes should be replaced with bi-ocular microscopes. In addition, facilities for one the new streams in the School that focus on new materials, and mechanical and process metallurgy should be upgraded. This would also help with diploma theses in these new fields.

It is noted that limited funding is available to students to improve their mobility and participation in exchange programs such as ERASMUS+.

Faculty resources and ability to participate in conferences or other events does not seem adequate uniformly and seem to be hampered by bureaucracy.

Panel Judgement

Principle 6: Learning Resources and Student Support	
Fully compliant	
Substantially compliant	**X**
Partially compliant	
Non-compliant	

Panel Recommendations

- The use of single ocular microscopes raises severe health and safety issues and are not in compliance with current EU safety norms. The single ocular microscopes should be replaced by bi-ocular microscopes. A concrete timeframe should be defined and appropriate budgeting should be prioritized.
- Funding for exchange programs such as ERASMUS+ should be increased. For example, such additional funding can be secured by donations from industry and alumni through the creation of an "Education and Training Fund."

Principle 7: Information Management

INSTITUTIONS BEAR FULL RESPONSIBILITY FOR COLLECTING, ANALYSING AND USING INFORMATION, AIMED AT THE EFFICIENT MANAGEMENT OF UNDERGRADUATE PROGRAMMES OF STUDY AND RELATED ACTIVITIES, IN AN INTEGRATED, EFFECTIVE AND EASILY ACCESSIBLE WAY.

Institutions are expected to establish and operate an information system for the management and monitoring of data concerning students, teaching staff, course structure and organisation, teaching and provision of services to students as well as to the academic community.

Reliable data is essential for accurate information and for decision making, as well as for identifying areas of smooth operation and areas for improvement. Effective procedures for collecting and analysing information on study programmes and other activities feed data into the internal system of quality assurance.

The information gathered depends, to some extent, on the type and mission of the Institution. The following are of interest:

- *key performance indicators*
- *student population profile*
- *student progression, success and drop-out rates*
- *student satisfaction with their programme(s)*
- *availability of learning resources and student support*
- *career paths of graduates*

A number of methods may be used for collecting information. It is important that students and staff are involved in providing and analysing information and planning follow-up activities.

Study Programme Compliance

The IEG and QAU work together well, however several deficiencies are noted below:

The KPIs, the system for measuring performance, which are important parameters for setting the strategic goals of the School have been partially implemented. This does not help the efficient management of the undergraduate program. For example, the student population profile (progression, success, drop-out rates) is not reflected in the KPIs.

The EEAP found that the student participation in the course evaluation is too low and therefore not representative. This is also a challenge for the entire NTUA.

The SMME keeps very good data for current students (average duration of studies, grade distribution, enrolment distribution, etc.). However, it seems that SMME does not keep detailed records on alumni career paths (Indices M4.111 – M4.126 are not provided)

Panel Judgement

Principle 7: Information Management	
Fully compliant	**X**
Substantially compliant	
Partially compliant	
Non-compliant	

Panel Recommendations

The following steps are recommended to increase student participation in the course evaluations:

a. Students should be notified and reminded by email that their course is due for evaluation.
b. During class hours, the instructor should also emphasize the importance of participation in the evaluation process.
c. Other possible innovative ways (e.g., mobile app) should be adopted.
d. Finding ways to communicate to students that their evaluations are taken into account and actions for improvement are taken.
e. The SMME/NTUA should also consult other universities for best practices.

The SMME should keep track of the graduate path careers via collaboration with the Technical Chamber of Greece and its alumni so that statistical outcomes become available.

Principle 8: Public Information

INSTITUTIONS SHOULD PUBLISH INFORMATION ABOUT THEIR TEACHING AND ACADEMIC ACTIVITIES WHICH IS CLEAR, ACCURATE, OBJECTIVE, UP-TO-DATE AND READILY ACCESSIBLE.

Information on Institution's activities is useful for prospective and current students, graduates, other stakeholders and the public.

Therefore, institutions and their academic units provide information about their activities, including the programmes they offer, the intended learning outcomes, the qualifications awarded, the teaching, learning and assessment procedures used, the pass rates and the learning opportunities available to their students, as well as graduate employment information.

Study Programme Compliance

The School has put a lot of effort on its website. It has a modern look, and it is easy to navigate. It includes a wealth of information on the School structure, important decisions made by the general Assembly, scholarship opportunities, activities of personnel, programs, students and many other relevant information. The site has a modern and well-designed look.

The course outlines, offerings, bibliography and timetable per semester in each year of study are listed online.

It should be noted that the course information provided is not uniform for all courses. The English version is mirrored on the Greek version, albeit less detailed compared to the Greek version. A link to switch to the Greek version is missing from the English version.

Information (short bio, recent publications) about faculty and support academic staff is not uniformly available for all members of the SMME.

The School does not have a website or webpage dedicated to alumni activities which could be very useful.

The School policy on quality assurance is not published online.

The term "Τομέας" should not be translated in English using the term "Department". The term "Division" or similar should be used. The term Department typically refers to standalone academic units.

Panel Judgement

Principle 8: Public Information	
Fully compliant	
Substantially compliant	**X**
Partially compliant	
Non-compliant	

Panel Recommendations

- Provide additional information to course descriptions so that complete information is available for all courses offered.
- Provide a link to switch to the Greek version from the English version.
- Develop a site for alumni and publish information that targets this group specifically. Relevant information can be on School strategic initiatives, faculty research distinctions and awards, upcoming seminars. Publish opportunities for visits and engagement with the undergraduate program.
- Consider developing pages that convey information to the stakeholders, i.e., the general public and industry. Such activity may require the creation of a separate public/external relations office.
- Consider improving the website search engine.
- School policy and its philosophy on quality assurance should be published online and separately from the QAU.
- The website should include job opportunities in the School including faculty and other support staff recruitment efforts.
- The School should consider a more active communication approach with all its constituencies and stakeholders, by issuing and emailing periodic Newsletters describing School news, initiatives, student and faculty awards, recognitions, impacts in the industry, etc.
- Services provided by the large number of specialized instruments existing in the academic unit should be broadly published. This may be a source of additional School income to support student initiatives, equipment renewal, student mobility and industry placements, etc.
- Consider changing the term “Τομέας” to “Division” or similar.

Principle 9: On-going Monitoring and Periodic Internal Review of Programmes

INSTITUTIONS SHOULD HAVE IN PLACE AN INTERNAL QUALITY ASSURANCE SYSTEM FOR THE AUDIT AND ANNUAL INTERNAL REVIEW OF THEIR PROGRAMMES, SO AS TO ACHIEVE THE OBJECTIVES SET FOR THEM, THROUGH MONITORING AND AMENDMENTS, WITH A VIEW TO CONTINUOUS IMPROVEMENT. ANY ACTIONS TAKEN IN THE ABOVE CONTEXT SHOULD BE COMMUNICATED TO ALL PARTIES CONCERNED.

Regular monitoring, review and revision of study programmes aim to maintain the level of educational provision and to create a supportive and effective learning environment for students.

The above comprise the evaluation of:

- *the content of the programme in the light of the latest research in the given discipline, thus ensuring that the programme is up to date;*
- *the changing needs of society;*
- *the students' workload, progression and completion;*
- *the effectiveness of the procedures for the assessment of students;*
- *the students' expectations, needs and satisfaction in relation to the programme;*
- *the learning environment, support services and their fitness for purpose for the programme*

Programmes are reviewed and revised regularly involving students and other stakeholders. The information collected is analysed and the programme is adapted to ensure that it is up-to-date. Revised programme specifications are published.

Study Programme Compliance

There is a clear process and methodology to evaluate internally the curriculum, share the results with the academic unit and make decisions for improvements/changes. Changes, however, are progressing very slowly. The current program is in effect since 2001 and does not reflect current trends in the field. As mentioned previously, the School is already working in this direction by revamping and modernizing the undergraduate curriculum. The timeline between the annual review after data collection to decisions made and to implementation is not structured.

The School has established an annual assessment procedure that enables the reviewing and modernization of the courses.

Panel Judgement

Principle 9: On-going Monitoring and Periodic Internal Review of Programmes	
Fully compliant	**X**
Substantially compliant	
Partially compliant	
Non-compliant	

Panel Recommendations

- Communicate widely to the public that a continuous improvement process is in place.
- Communicate on the School website any measures taken that led to actionable items and implementations to improve the study plans and curriculum.

Principle 10: Regular External Evaluation of Undergraduate Programmes

PROGRAMMES SHOULD REGULARLY UNDERGO EVALUATION BY COMMITTEES OF EXTERNAL EXPERTS SET BY HAHE, AIMING AT ACCREDITATION. THE TERM OF VALIDITY OF THE ACCREDITATION IS DETERMINED BY HAHE.

HAHE is responsible for administrating the programme accreditation process which is realised as an external evaluation procedure, and implemented by a committee of independent experts. HAHE grants accreditation of programmes, with a specific term of validity, following to which revision is required. The accreditation of the quality of the programmes acts as a means of verification of the compliance of the programme with the template's requirements, and as a catalyst for improvement, while opening new perspectives towards the international standing of the awarded degrees.

Both academic units and institutions participate in the regular external quality assurance process, while respecting the requirements of the legislative framework in which they operate.

The quality assurance, in this case the accreditation, is an on-going process that does not end with the external feedback, or report or its follow-up process within the Institution. Therefore, Institutions and their academic units ensure that the progress made since the last external quality assurance activity is taken into consideration when preparing for the next one.

Study Programme Compliance

The study program of the School was externally evaluated following a process that was administered by HAHE in 2013. The School of Mining and Metallurgical Engineering has partly implemented the suggestions given by the previous external evaluation. SMME has undertaken actions to resolve some of the issues addressed by the 2013 evaluation, such as:

- Enhancing external outlook (events, dialogue fields with external bodies, Museum, European student cooperation programs)
- Enhancing internal communication of laboratory units (joint research collaborations
- Full functionality of online course information through MyCourses
- Reduction of courses and teaching hours (this will be implemented in the new undergraduate program)

However, although efforts have been undertaken, the Panel found that the School did not uniformly implement some of the major recommendations made during the External Evaluation of 2013, which the Panel considers to be essential for the success of the undergraduate studies programme.
These are:

- establishment of prerequisites
- more training on technical presentations
- introduction to engineering economics
- identification of target areas for expansion and new positions
- development of an alumni association

Panel Judgement

Principle 10: Regular External Evaluation of Undergraduate Programmes	
Fully compliant	
Substantially compliant	**X**
Partially compliant	
Non-compliant	

Panel Recommendations

It is strongly recommended that the SMME should implement the recommendations provided by the 2013 external evaluation. Furthermore:

- The Panel strongly recommends the policy of required prerequisite courses exploiting and implementing flexible and reasonable criteria that are adapted according to the needs of the curriculum.
- The SMME should consider improving the skill sets of the students in the areas of health and safety, people and project managements, engineering law, team working.
- Through consultation with industry and alumni the undergraduate curriculum should embrace new technologies and standards such as digitalization and Industry 4.0 (the current trend of automation and data exchange in manufacturing technologies). It appears that the new curriculum that will be implemented in the Fall of 2021 aims to cover some of these deficiencies.

PART C: CONCLUSIONS

I. Features of Good Practice

- The NTUA has established an appropriate Quality Assurance policy clearly defining Key Performance Indicators (KPIs). The SMME is in line with the review processes of the NTUA. The continuous improvement is assured by the IEG, a committee consisting of 5 members from the SMME. The IEG is in line with the QAU for the improvement of the undergraduate program. The QAU is monitoring and enforces the collection of data as per Quality Assurance policies.
- The study program and learning outcomes are in compliance with the European and National Qualifications Framework for Higher Education.
- The SMME follows a student-centered learning process. This has been identified in a number of sessions by both faculty members and students.
- There is strong evidence of efforts to link teaching with research in view of the research output of the School.
- Courses and teaching staff are regularly evaluated by students through surveys.
- The School aims to offer its students the best possible level of studies supported by facilities that include libraries, educational and scientific equipment, information and communications services. The School encourages student-centered learning and uses flexible models for learning and teaching.
- There is a clear process and methodology to internally evaluate the curriculum, share the results with the academic unit and make decisions for improvements/changes.

II. Areas of Weakness

- The ECTS system is a cornerstone of the Bologna process for higher education in Europe. However, in practice the implementation of the ECTS system by SMME is not in force. For example, although the ECTS is applied across the curriculum, there appears to be inconsistencies when assigning ECTS to the various courses taught as well as service courses offered by other Schools at NTUA. The anticipated student workload is not consistent with respect to the ECTS system as courses with similar contact hours appear to have different ECTS values. It seems that SMME underestimates the significance and value of the ECTS system regarding its international recognition and the employability of its graduates.
- Practical training is in place but was found insufficient to offer a uniformly meaningful training due to its short 1-month duration
- SMME has not defined any particular research areas for long-term strategic growth.
- Student participation in teaching evaluations is very low allegedly due to the online impersonal nature of the evaluations. This results in teaching quality indices that are not representative.
- Course information provided on the school website is not uniform for all courses. The School has partly implemented the suggestions given by the previous external evaluation in 2013 and has undertaken actions to resolve some of the issues addressed by that evaluation. Although efforts have been undertaken, the Panel found that the School has not uniformly implemented some of the major recommendations made during the External Evaluation of 2013. It did not implement some of the recommendations in relation to the study program under accreditation which include:

- course prerequisites
- more training on technical presentations
- introduction to engineering economics
- identification of target areas for expansion and new positions
- development of an alumni association

III. Recommendations for Follow-up Actions

- Formulate additional KPIs to better reflect progress on strategic growth objective. Indicative KPIs are discussed under principle 1.
- Ensure that all stakeholders (industry and alumni) are consulted periodically for the planning and reviewing of the study program. Stakeholders should be given the opportunity to provide suggestions on needed skills that will help with updating the content of the program.
- Fully implement the ECTS system according to the Bologna process. It is strongly recommended that SMME ensures that ECTS is applied in a consistent and transparent manner across the curriculum, so that student mobility to and from SMME with its European counterparts is easier and improves in the coming years. Furthermore, the School should fully engage with the ECTS system in order to improve its international recognition and employability of its graduates.
- It is strongly suggested that the SMME should implement the recommendations provided by the 2013 external evaluation. The Panel strongly recommends the policy of required prerequisite courses, exploiting and implementing flexible and reasonable criteria that are adapted according to the needs of the curriculum.
- Establish a formal process and committee for student appeals due to performance evaluation, illness, absence, and other conflicts.
- Actively encourage student mobility, even if the ERASMUS+ program is providing limited funding
- Consider extending practical training to more than minimum one summer month in order to increase the educational and training impact on students as well as develop links with the industry that offers the placements.
- Develop a recruitment strategy for new academic appointments that is attractive to candidates from the best Schools in Universities around the world in the strategic research areas of interest to the School.
- Define research areas for strategic growth with the aim to develop world class research output in both emerging and traditional areas of research
- Promote active participation in teaching evaluations among the student body.
- Update course information provided on the school website to include information on all courses.
- Form an external Advisory Board consisting of external stakeholders (i.e., industry, alumni, Greek research institutes) to formalize structured external input and feedback to the School
- Implement annual evaluations of all academic staff members
- Develop processes to recognise faculty, staff and students by means of awards on excellence, innovation, and entrepreneurship in the School

IV. Summary & Overall Assessment

The Principles where full compliance has been achieved are: **3, 4, 7, and 9.**

The Principles where substantial compliance has been achieved are: **1, 2, 5, 6, 8, and 10.**

The Principles where partial compliance has been achieved are: **None**

The Principles where failure of compliance was identified are: **None.**

Overall Judgement	
Fully compliant	
Substantially compliant	**X**
Partially compliant	
Non-compliant	

The External Evaluation & Accreditation Panel agrees that this Programme leads to a Level 7 Qualification according to the National & European Qualifications Network (Integrated Master)	**YES**	**NO**
	X	

The members of the External Evaluation & Accreditation Panel

Name and Surname **Signature**

1. **Prof. Zach Agioutantis (Chair)**
   University of Kentucky, USA

2. **Mr. Sotirios Konstantakopoulos**
   Member of the Technical Chamber of Greece, Greece

3. **Prof. Theodoros Ntaflos**
   University of Vienna, Austria

4. **Prof. Vladimiros Papangelakis**
   University of Toronto, Canada

5. **Prof. Panagiotis Tsakiropoulos**
   University of Sheffield, United Kingdom