

INDUSTRY INPUT INTO PROFESSIONAL POST-GRADUATE STUDIES FOR THE NEEDS OF QATAR

Ibrahim S Al-Naimi*, and
Richard A Dawe**,

* Department of Chemistry, Qatar University, Doha, Qatar

**Chemical Engineering Department, University of West Indies, St Augustine,
Trinidad, West Indies

ABSTRACT

Qatar's Industry is needing Qatari graduate professionals to lead it. Support by industry for higher education for the next generation of professionals should be regarded as an investment in human resources. The College of Engineering of the University of Qatar is considering the development of an Advanced Engineering Degree programme for graduates who hold BSc degrees in engineering or related fields. Each degree will be a conversion course and give the graduates the technical essentials, including project management and project economics skills, for a position that requires management decision-making responsibilities by local industry. The degree itself is not the goal but the demonstration of enhanced skills. The programme will be a one-year full time course. The programme requires strong support from Qatar's industries, both in developing course content and identifying students, tutors and mentors. Importantly, a Joint Industry-Academic Consultative Committees (JIAAC) would decide the programmes and subject matter of each course.

This paper describes the general programme, the JIAAC input and an implementation plan. A typical programme is given, that for Petroleum Engineering, but any other course would follow the same plan.

Key Words: Advanced Degrees, Postgraduate Studies, Industry Support, Joint Industry Academic Advisory Committee.

INTRODUCTION

The development of new industrial projects in the State of Qatar will create a financial climate that should secure for the inhabitants of Qatar a high standard of the basic necessities of life. In particular the national petroleum policy adopted by

Al-Naimi And Dawe

the state of Qatar, under the leadership of His Highness the Emir, Sheikh Hamad Bin Khalifa Al-Thani, has led its energy and industry sector to some remarkable achievements, such as the development of the North Field and the initiation of the Ras Laffan Industrial complex. As a result it is establishing Qatar in the world gas trade as a major exporter of clean energy sources. The further expansion of, and investment in, the oil and gas-based industries to produce more value-added products will diversify the national income and further strengthen the economic base and create prosperity for all Qatar's citizens. However currently there are insufficient technically trained Qatari graduates available to take up the challenges offered by these expansions.

EMIRI DIRECTION

In a very timely speech to the graduates at the University Degree Ceremony in November 1998, His Highness the Emir, Sheikh Hamad Bin Khalifa Al-Thani said 'At this stage in the age of the University of Qatar, we strongly believe that it is high time to establish the necessary criteria for **the programmes of postgraduate studies** so that they take their place in the fabric of academic work aimed at promotion of the fields of research, specially in the **specialisations that serve the development plans and the labour market requirements**, taking into consideration the linkage of these studies with the efficiency and good standard of education at the University'. Thus government direction is now stated and State support should be forthcoming.

POSSIBLE ROUTES

Currently there are no post-graduate courses within the College of Engineering. The University could take the lead to educate to the highest standards by creating higher applied degree programmes. The BSc undergraduate programmes at the College of Engineering gives a student an essential general knowledge and some more specialised topics in their elective options are given in the final year, but these options still only give a flavour of the professional needs. Further training is needed before the graduate can take on responsibilities within their chosen career. Within the undergraduate framework further specialised topics needed by industry cannot be introduced because of the constraints of student numbers, staff costs and timetable flexibility. Even so some outsiders may feel that the BSc programme is sufficient and that a new recruit can learn 'on the job'. Unfortunately this route could prove costly to the State of Qatar if mistakes are made in the planning or operating the complex future projects. Others might say that it is better to send the recruit abroad for higher degree training. This clearly uses foreign currency and the educational teaching resource expertise is not kept in Qatar. Some of these topics

Industry Input Into Professional Post-Graduate Studies

could clearly be introduced by short courses. Short courses can be given in house, in Qatar or elsewhere in the world but costs escalate and the educational effectiveness of the stand-alone one or two weeks course can sometimes be questioned. It is often felt that the discipline of learning is not always cultivated. A local total immersion course in classroom style could be more effective.

INDUSTRY PARTICIPATION AND CONTACT

Any applied advanced degree programme can only succeed in giving Qatar its qualified local young professional thinking engineers if industry and Government contributes significantly. The type of courses envisaged here requires strong support from Qatar's industries and Government. A high powered committee of government, industry and academia, a **Joint Industry/Academic Advisory Committee (JIAAC)**, would create a 10-year plan of the needed engineer specialisms in the light of needs of the developing Qatar industry. Any higher degree programme must be planned with industry so as to reflect accurately these needs. There must be an interchange of advice and ideas in order for up-to-date knowledge transfer. The content of the courses, identified by JIAAC, would be a conversion programme into the specialities of the chosen topic from other engineering and science based degrees. Visiting professors and lecturers from the Industry and Government establishments would make an important contribution to the more specialised teaching of the programme. As discussed later, industry would make its contribution in the design projects by senior personnel helping as mentors. Industry should also provide financial support for certain academic posts and advanced course bursaries.

Clearly these advanced degree programmes would be the major source of Qatari recruits for employment for the responsible professional posts in Industry. The strong links with industry of the College of Engineering would continue to develop particularly with the interchange of advice and ideas for projects, research course content and design project mentoring. Industry and Government must provide the support for certain academic posts as well as scholarships for promising students. Such industry supported conversion type degrees would therefore be an investment not only to the University and to the State of Qatar but also Industry itself i.e. this spending of time and money by the industry is really an investment into the education of the next generation of Qatari engineers. The real cost for this human resource is in fact really small compared with the return and the alternative cost of sending possible recruits abroad or hiring expatriates. As a result the companies should regard the programme as the first and good source of recruits.

Joint Industry/Academic Advisory Committee (JIAAC)

The JIAAC would help steer the programme. Its terms of reference should be:

- To advise on the development and maintenance of adequate contact and collaboration between the University, particularly the College of Engineering, and Industry in the general field of engineering education and research.
- To advise on the education and training of engineers, including management and economic factors.
- To advise on the development of arrangements with Industry to ensure a flow of sponsored students as well as support of faculty and development of research.
- To advise and assist the University and particularly the College of Engineering generally in fulfilling its role as a national centre for the advancement of engineering.

The JIAAC would:

- Act as a sounding board to obtain industry advice and reactions to proposals for change and improvement in the Engineering education. In particular ensuring project management and planning and project economics skills are emphasised.
- Be particularly helpful in providing pressure to get industry scholarships, work placements and project ideas and perhaps fund raising.
- Provide an opportunity to discuss recruitment patterns, manpower strategic planning within the industry, and to discuss trends in 'company needs', which can be included in the programmes.
- Should ensure that the directions that the University is taking and its support are in order. The academic responsibility is clearly with the University, but the dialogic is important.

The support needed by the University and directed by JIAAC, or appointed sub-committees, can be envisaged under a number of headings: -

University course development -contact with industry

- Guidance with syllabus
- Help in identifying and supporting good faculty and students

Course development - contributions with industry

- Lectures -from engineers at the 'sharp end'
-from managers to share their troubles
- In-house lectures at company offices
- Short course and seminar exchange
- In-house technical literature

Industry Input Into Professional Post-Graduate Studies

- Support for library, AV aids, posters (even models of fields), educational technical material
- Site visits e.g. Facilities and offices.

Faculty development - requires long term financial commitment

- Seconding staff -to the University
 -to the Industry
- Start-up funds to help academic staff
- Encouraging faculty to attend and participate in conference meetings in-house and outside Qatar.

Student development and support- requires long term financial commitment

- Identification of good students
- Individual projects suggestion and partial supervision
- Scholarships
- Vacation training
- Employment
- Open days

Research contact with industry- requires long term financial commitment

- Research possibilities-discussion of exploitation and production problems which might be turned to research proposals
- Capitalise on the laboratory facilities in the university.

The University of Qatar's Advanced Degree Professional Development programme.

Objectives

The College of Engineering would develop the Advanced Engineering Degree programme. The programme would have the primary goal of preparing Qatari engineers with enhanced scientific and technical competence to enable them to participate in the various development aspects of the country. The degree would seek to develop advanced degree studies which improves the Qatari engineering professional's technical expertise and research and problem solving skills, and gives them specialised technical training in their chosen discipline. The courses would be aimed at providing the necessary background for employment in the industries of Qatar, as well as serving as a refresher for those already working in industry. Topics would be introduced by request and support from Industry e.g. the Chemical, Civil, Electrical, Mechanical, Petroleum and Natural Gas engineering

Al-Naimi And Dawe

etc. needs (perhaps very focussed courses in specialised areas such as chemical processing, petroleum engineering, electromechanical machines, gas processing, power generation, water resources, safety and accident assessment, fire engineering, environmental engineering, computing, instrumentation, marine engineering, telecommunication engineering, as well as information technology...or even MBA..). Some of the specialised teaching would be on a 'short course' type module basis, so that these modules could be taken by other local engineers to supplement their work experience. The programme should also create applied research opportunities, so providing engineering and technical consulting to industries internally in Qatar. This could be possible through the individual projects, which would be suggested by industry. This will enhance the University's ability to play a major role as a contributor to the technical infrastructure of the country. This research would further the work of the Scientific and Applied Research Centre (SARC) of the University.

Developing the Advanced Degree Programme:

Modus operandi

The programme would consist of, Figure 1:-

- General core courses
- Specialist courses
- Design project with industry mentor and to include some project and personnel management, project economics and time management skills.
- Personal project with industry support (guidance of topic).

Time scale

The degree would take 10 months over a 12-month period (40 weeks and of 36 contact hours – a contact hour being about 15 hours e.g. 15 one hour periods for 15 weeks or 3 five-hour periods etc). plus examinations. The rest of the time would be holidays, Ramadam, Eides etc.

A typical programme, that for petroleum engineering, is given in Appendix 1.

Degree & Diplomas

The University would award:-

- Advanced Degree (Qatar University) for any participant, who completed satisfactorily the whole course, perhaps entitled MEng or whatever was thought appropriate.
- Diploma of Qatar University for each course attended and examination passed.

Industry Input Into Professional Post-Graduate Studies

The structure would be

- Taught courses - 21 contact hours over the first 6 months
 - 9 hours core courses, over 2 months and 12 hours specialist courses,
 over 4 months.
- Group project - 9 contact hours over the next 3 months.
- Personal project - 6 contact hours over 2 months.

Part 1	General Core Courses (2 months)
Part 2	Specialist courses (4 months)
Part 3	Design project (3 months) With industry mentor Some management skills
Part 4	Personal project with industry support (2 months) (for guidance of topic)

Figure 1 Advanced Degree programme

Co-operation with Industry for the implementation of the programme

Much consultation and industry involvement can be envisaged, Figure 2. The major contributions would include:-

- JIAAC, (Qatar Industry, Government Ministries and University) decide on Topic Areas to be developed. This would need to be a 5-10 year running plan, with perhaps 2 to 5 topics per year depending on the needs of Qatar as seen at the time.
- A course leader for each of the Topic Areas to be identified and selected.
- Course leaders and industry committee decides on syllabus for each programme topic (the 6-month coursework). Then the leader finds suitable lecturers to cover the syllabus with, if necessary, short courses.
- Course leaders finds industry mentors for design and individual projects involvement and lecturers and instructors for each specialist course.
- Project topics should be proposed and partly supervised by industry. Lectures on some courses must be given by personnel from industry and some specialised short course brought in.

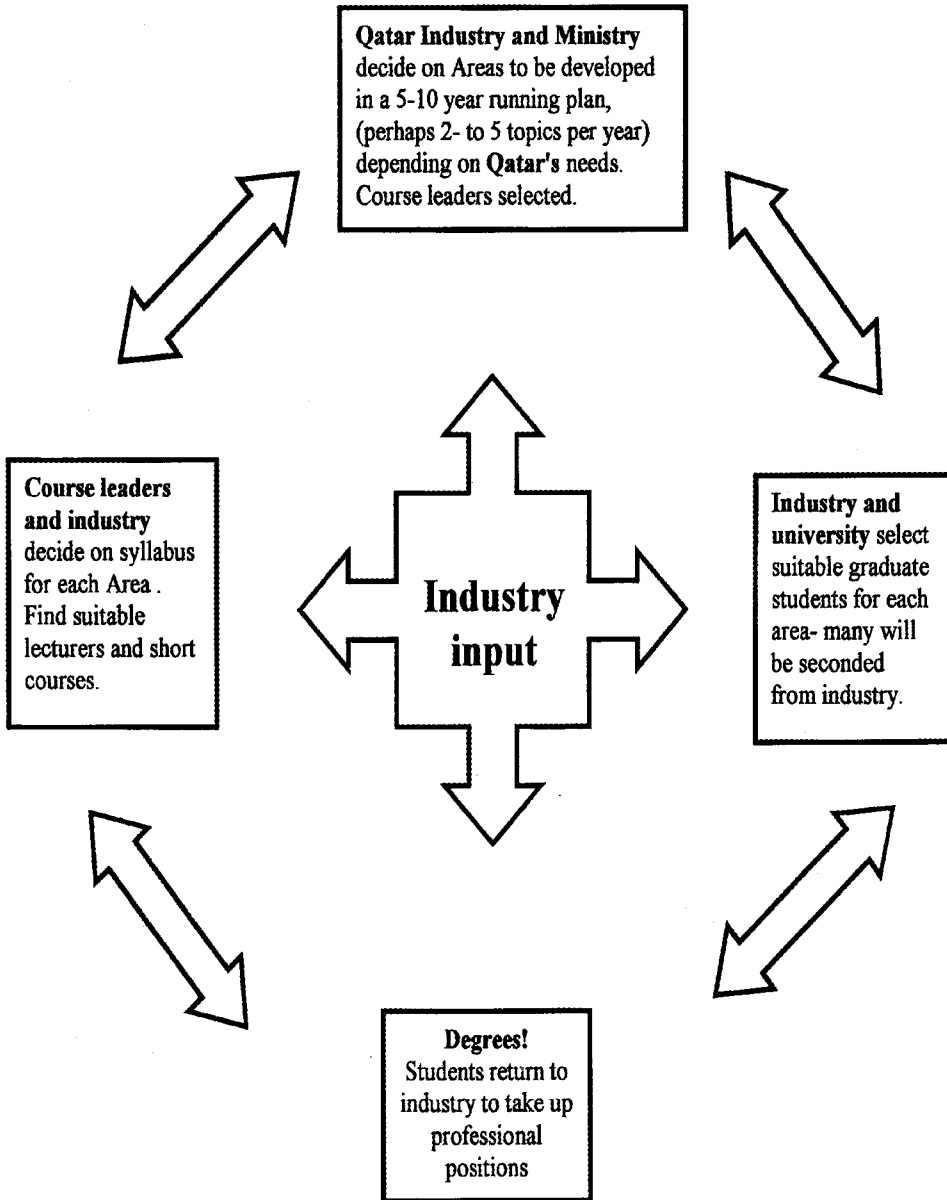


Figure. 2 Procedure for developing and implementing programme

Industry Input Into Professional Post-Graduate Studies

- Industry and University select suitable graduate students for each topic area (perhaps 10-12 students per area); many will be seconded from industry. Industry support through secondment and scholarships would be expected.
- Regular seminars to be given by engineers and managers from industrial companies or government officers.
- Management skills will be introduced during the design project through industry involvement.
- Industry should provide environmental and safety awareness. Environmental damage has triggered an alarm within the minds of many policy makers. This has created environmental protection policies within industrial development plans with the hope of striking a balance. Aspects would be included in all the courses to ensure the graduates would incorporate the knowledge in real life.
- Industry welcomes students on visits.
- Student project presentations should be given to an audience from industry.

Group project:

A group project is a vital component in the course. Not only does it link all the taught parts of the course, it also develops the team approach and the working environment now practised in industry. The project consists of a competitive evaluation/development exercise carried out by groups of students (possibly five/six, depending on class enrolment). A mentor from industry will be appointed: he will guide the students with his experience of the current and best practices in industry. It is anticipated that industry would be very willing to make such people available, since it would be good for their image and company exposure as well as perhaps identify possible future employees. The projects would be of direct application to the needs of Qatar. For instance in petroleum engineering, the production of a development plan for a reservoir; in gas engineering, the design of a LNG plant; in civil engineering, the design of an industrial structure; in mechanical engineering the design of a compressor for a specific heavy duty and so on. Active participation by all the group members is essential for the exercise to be fully effective, and participation will be monitored. In particular practice in the managerial skills (including project management, project scheduling and project economics) experienced in the project would sharpen the student's abilities for industrial practice. The group projects would be assessed by presentation to academic staff, industry visitors and external examiners. Highly professional presentations would be expected.

Individual personal project topics

The topics will be mostly from a selection suggested by the industry, the mentors sponsors and general supporters. The student would propose/ accept a project in conjunction with his sponsor. The student may well work in the company offices where the facilities can be more appropriate to the study and data made

Al-Naimi And Dawe

readily available but in a confidential climate. Also the company can see whether the person can perform to their needs before finalising recruitment. Confidentiality conflicts can be a burden if not anticipated but academic needs must prevail and the results be able to be presented, albeit in an anonymous form.

Short course participation

Most of the specialised topics are envisaged as being taught as 3-4 week modules but some may have the middle week taught as an intensive advanced high level, up-to-date short course. The disadvantages of short courses given outside Qatar have been discussed earlier. A local total immersion course in classroom style could be very effective. Possibly well-known specialists would be hired for that week. Introductory material would be revisited in an earlier period. Classroom, homework and examinations would also be added for the following week. The whole module would count towards the Advanced degree. Delegates from industry would be welcome and it would be anticipated that their course fees would cover much of the cost/expenses of the week. Delegates could take an examination and gain a diploma for that topic.

Professional societies and institutes

Strong interaction with the professional institutes/societies would be expected. For example, the Society of Petroleum Engineers, an international learned society, aims to disseminate frontier knowledge from fundamental to field experience. Equivalent Institutes and Societies exist for all engineering groups. Clearly it would be anticipated that accreditation of the degree would be sought from suitable Institutes.

Sponsorship

Sponsorship via JIAAC input for faculty, studentships and teaching materials would be anticipated from major companies interested in employing the graduates. Industry should regard this conversion advanced degree programme as an investment into the future human resources of Qatar. The cost could be much smaller and yield greater dividends than any other investment envisaged by a company. Sponsorship costs could be much lower than the current costs of world-wide advertisements carried out by many of the companies.

Expected enrolment

Each advanced degree programme will have been specially designed because the State of Qatar needs graduates in that speciality. An average enrolment in any programme of say ten to twelve full-time students per topic would be anticipated so that eight to ten degrees per topic will be awarded. It would be expected that sufficient properly qualified students would come forward if there were sufficient advertising, particularly as it could be an alternative (cheaper) for a student going abroad. Also in the light of QGPC's desire for advanced technical education, this

Industry Input Into Professional Post-Graduate Studies

may be a route whereby suitable personnel from QGPC could be seconded and join the University programmes for the taught part and design project. They would take a selection of courses and gain a diploma certificate, then return to QGPC for their individual project i.e. absent for only some seven months.

Entrance requirements

Any candidate for the degree programme would be required to meet all requirements of the University for admissions to the programme. A student should hold a good BSc degree in Engineering from the University of Qatar or other University. Conditional admission could be granted to industrially experienced candidates who do not meet the cumulative grade point average requirement upon recommendation of the programme chairman and approval of the graduate programme committee. Good performance on the core courses would be essential for any candidates to continue to the specialist courses.

University leadership

The setting-up of the necessary bureaucratic leadership is essential before the programme can be implemented. This would give the correct signals to industry and a conduit for communication between the Government, the University and Industry. The University statutes and regulations would have to be in place and the examinations recognised for higher degrees and professional qualification. Already the College of Engineering of the University of Qatar possesses many of the facilities needed to implement the advanced degree programme. Fuller details are available in a companion paper [1].

The University's Organisational Structure for Postgraduate Studies

The College of Engineering would set-up a separate post-graduate unit. A postgraduate steering board would be formed to ensure that the correct procedures were being followed. The structure would be:- The President, the Vice-President for Academic Affairs, the Dean for Graduate Studies, the Dean of Engineering and members from the Education and Industry ministries and from industry (JIAAC).

Graduate programme committee

A graduate programme committee consisting of a programme faculty (course leader and industry nominees), an assistant Registrar for postgraduate studies and general course tutors would be responsible for the development of the detailed graduate programme curriculum, graduate course instructions, and graduate student advising. The student's project supervisor would be chosen within the programme faculty and industry mentors and supporters.

Faculty

Faculty would be needed to ensure that the courses could function, at least two faculty per option, a course leader and an assistant. There would have to be a number of permanent staff to give the core course education and act as continuity. They need to have the right aptitude for teaching, some experience in the industry and a regard for research and recent advances in the industry. There would also have to be guaranteed strong part-time support from industry. Other teaching staff would be contracted (for payment or donated by companies) from industry or from the undergraduate teaching faculty or world-wide e.g. those that give short courses. For specialised topics suitable programmes from other universities could be brought in or specialists come to spend a sabbatical term. The University would monitor such courses and programmes and examinations would be sat under University regulations.

Costs

For the programme to run successfully, the income must exceed the outgoings. Outline resource details have been presented in appendix 1. Some contingency funding and underwriting must be available either from industry or from the Ministry of Education. If the curriculum could be run so that each module within the degree was 'open' as short course modules to industry for payment the cost of these could be low to the State. Undoubtedly donations of 'unearmarked' funds would be welcome to the programme organisers for them to be able to make commitments which involve some financial risk e.g. payment of short course lecturers.

Implementation

The higher degree programme has to run for at least 5 years to establish itself and achieve credibility. It is essential that the programme is underwritten by the university, government and industry, particularly to ensure that there is this continuity. To achieve this the University will have to gain from the University funding body and Industry the longer term financial support for the programmes with sponsorships of faculty and studentships as well as commitment implications. Any sponsorship of industrial Chairs or other sponsorship to attract suitable faculty needs to be guaranteed for sufficient time for continuity to see the initial programme established and students graduated. This guarantee of continuity is essential before establishing the programme. There is clearly a risk of cost escalations even though the plan is to offset costs by short course revenue and course fees. In return for sponsorship, sponsors could be offered reduced rates for enrolled students (even a zero rate). There must be such guarantees for the staff. If these guarantees are in place then a rapid start of the programme may be possible.

Industry Input Into Professional Post-Graduate Studies

A typical programme

A preliminary curriculum for a Petroleum Engineering advanced degree programme is presented in Appendix 2. Any other course would follow the same plan.

SUMMARY

- The College of Engineering proposes an industry supported advanced Degree programme. It will consist of a number of conversion courses suggested and needed by the local industry of Qatar with syllabus content defined by academic-industry committees (JIAAC). It will give the technical essentials for graduates from other technical disciplines so that the graduates can enter Qatar's industries and be immediately productive. This professional development would enhance their job skills and improve their opportunities for advancement. The employer would benefit from an employee with these better technical and problem solving skills.
- Strong industry support would be essential. Topics would be decided by a high level committee of Government, University and Industry members (JIAAC).
- The courses would be one year full time 36 credit hour programme, consisting of 21 credit hours of course work (9 hours of core course work, 12 hours of specialised coursework) and 9 hours of group project work and assisted by industry mentors, and 6 hours of an individual project with thesis, suggested by industry.
- Course leaders, topic leaders and other staff with suitable industrial and teaching experience will have to be appointed.
- If the curriculum could be run so that each topic was 'open' as a short course module to industry for payment then these funds plus course fees could be used to bring in specialists to teach the advanced parts.
- It is expected that sufficient properly qualified students would come forward.
- A rapid start of the programme may be possible, but the programme has to run for at least 5 years to establish itself and achieve credibility.

ACKNOWLEDGEMENTS

We thank the former Dean of Engineering, Professor Ismail Tag, and the staff of the College of Engineering, particularly colleagues in the Chemical Engineering Department for helpful and constructive discussions and support.

REFERENCE

1. **Al-Naimi, I.S. and Dawe, R.A.**, 1999, Graduate courses for professional development at the University of Qatar, supplementary paper available from the authors.

APPENDIX 1

Resource Needs and Facilities

In order to run an advanced degree programme there are a number of administrative and resource needs.

- The University must appoint the necessary administrative leadership e.g. Dean for Graduate Studies,
- Provision of necessary course leaders, faculty members and supporting staff, including visiting industrial specialists,
- Lecture-room space, faculty staff rooms,
- Support such as administration and secretarial services, communication facilities, technical workshops, computer assistance, visual aids facilities and consumables,
- Library resources and visual aids in order to enhance and to facilitate the educational process,
- relevant computer software and facilities using the latest technological advances,
- The establishment of a laboratory for the study of any practical aspects of the topic education with suitable technical back-up, and, of course good students able to communicate in good spoken and written English.

Timetable flexibility

Because of the interaction with Industry and availability of lecturers from industry, a flexibility of timetable will be paramount. This flexibility of timetable may need to require that some courses be taken outside University premises e.g. short courses on company premises, computing simulators only available on company premises etc.

APPENDIX 2.

Advanced Course in Petroleum Engineering

Industry Input Into Professional Post-Graduate Studies

A typical course is presented here, that for Petroleum Engineering. It would convert students in Qatar from other science and engineering subjects to understand and contribute to the technical essentials of Qatar's needs. A student will cover the Upstream essentials of Qatar's Oil and Gas industries. As requested by Industry in Qatar this course would establish the key concepts and methodologies required to exploit hydrocarbon reservoirs with the specialisation in upstream Petroleum Engineering. The oil and gas fields of Qatar would be used as examples and background.

The course is aimed at those professionals who will be involved in applications within the petroleum industry where a fundamental knowledge is needed. The course is designed to:

- Review and apply the basic principles of upstream petroleum and natural gas operations, and then to specialise in upstream petroleum engineering,
- Familiarise the participant with the oil and gas field practices of Qatar,
- Give aspects of management skills in the design part of the course.
- The short courses would be useful to those who do not have a basic degree in the specialised topics but are involved in the management and operation of the upstream oil and natural gas business.

Curriculum summary for the Advanced Programme in Petroleum Engineering

Course	Credit hours	Core topics
1	3	Essentials of Petroleum Engineering
2	6	Advanced Hydrocarbon Thermodynamics, Applied Fluid Mechanics, Numerical Analysis for Computer Methods
		Specialist topics; in discussion with industry
3	3	Reservoir Mechanics; PVT; IOR; Well Testing; Reservoir Simulation
4	3	Petrophysics; Petroleum Geology; Well Logging
5	3	Drilling Engineering; Production Cased Hole Logging
6	3	Production & Process Engineering.
		Group Project
7	9	Group project of development plan of a field, including management skills and economics; <i>with assistance from industry mentors</i>
		Individual Research Project
8	6	Research Project with thesis; <i>topics from industry</i>
	Total 36	Special Features
		Field/site visits, Seminars from industry, Communication skills

1 contact hour \approx 15 classroom hours or 1 week short course