ARAB ACADEMY FOR SCIENCE, TECHNOLOGY AND MARITIME TRANSPORT

COLLEGE OF ENGINEERING AND TECHNOLOGY

(ALEXANDRIA)

GRADUATE STUDIES:

(Addendum)

Master of Engineering Programs

(M.Eng)

STATUS REPORT

2009

COLLEGE OF ENGINEERING AND TECHNOLOGY

(ALEXANDRIA)

VISION

Our vision is to excel as one of the best engineering colleges locally and regionally and to maintain internationally recognized programs with an advanced academic rank. We also envision to provide the highest quality educational programs, research, and community services and to play a leading role in all our engineering activities, as a foremost engineering school in the Arab world.

MISSION

Our mission is to efficiently integrate all of our facilities and resources to proactively provide competitive, intellectual, and market-driven academic programs, research, and community services and pledge strong collaboration between our faculty, staff members, students, researchers, alumni, and industrial and business leaders. Further to maintain and develop long term and lasting partnerships with Arab institutions, and internationally acknowledged bodies.

COLLEGE MESSAGE: CURRENT STATUS AND FUTURE PROSPECTUS

In a world of tough competition, innovation, and technological advances, our College is always aiming at international excellence and recognition for its academic and research programs at the undergraduate and graduate levels.

Since its founding in 1991, the College has grown continuously in gaining reputation with its graduates participating everywhere in the development efforts of the country, the Arab world and beyond.

Currently, the College delivers several academic programs in: mechanical, marine, construction and building, industrial and management, architecture and environmental design, electrical and control, electronics and communications, computer engineering, basic and applied science and the graduate studies in different engineering disciplines.

Similar to other academic entities of the AASTMT, we strictly apply the quality policy and assurance system of ISO 9001-2000 which effectively and efficiently guarantees the highest attainable eminence of world class engineering education.

Further, the programs offered by the College are acknowledged by the Supreme Council of Egyptian Universities (SCU) on 1996 and renewed on 2002 and 2007, respectively.

On the other hand, the year 2005 marks a significant milestone for the College, as we obtained the full accreditation from the British Professional Institutes; (IMechE), (IMarEST), (IET), (ICE), (IStructE), and (IHT) for all the engineering programs, beside the accreditation from the Royal Institute of British Architects (RIBA) parts 1 and 2 for our architectural engineering program.

It is a main concern to keep our programs in pace with developing technologies and to seek innovative methods to recruit, hire, develop, and retain faculty with excellent teaching and research capabilities. Meanwhile, to have academic and research focus areas in line with national goals and to develop lasting international, regional, and domestic partnerships to support the College efforts in teaching, research, and service. Such a focal objective is interpreted by building strong relationships with industry and international institutions to promote our academic program development, research projects, and employment opportunities of our graduates.

Developing new academic programs that reflect the demand for engineering graduates in the present and future market is crucial. Inter and multidisciplinary research proposals, project teams, and special task forces are central in our main activities.

In order to maintain and achieve the delivery of its quality services, the College is currently acquiring and continues to develop top-notch educational resources, lab facilities and academic infrastructure.

Attracting high quality students through a competitive system of scholarships and maintaining a College life that preserves our traditions and values, and equips our

graduates with solid knowledge in different cultural aspects, are always considered vital to our success.

The College's substantial progress has resulted from the support and beliefs of the AASTMT administration, the efforts of its faculty, staff members, and industry working in concert to develop the finest quality education, research and outreach programs.

In the next coming period, the College of Engineering is strategically targeting to maintain its central and significant contribution to the AASTMT unique initiatives in education, research, consultation and community services to the Arab region.

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Background and Evolution

1.0 THE ACADEMY

Since its inception in 1972 as an organization under the umbrella of the Arab League, the Arab Academy for Science, Technology and Maritime transport has been providing educational and training services in a wide range of disciplines, sciences, and technologies related to the Maritime sector. Bachelor's degree programs in both Maritime Transport and Marine Engineering, together with courses leading to certificates of competency for deck officers, marine engineers, and radio officers, have been mastered by AASTMT and constantly delivered serving a multinational body of students over the past thirty six years (1972–2008).

Through a strategic vision correlating the mission of AASTMT to the local, regional, and international ever-changing demands, AASTMT has broadened its scope to offering Bachelor's Degree Programs in Engineering and Management. The College of Engineering and Technology offers Master of Engineering programs in the following eight engineering disciplines: Electronics and communications; Computer; Mechanical; Marine; Industrial and management; Electrical and control; Construction and building; and Architectural engineering and environmental design.

The Programs of Bachelor's Degree in Management are offered in business administration and in tourism and hotel management. Programs leading to Master's degrees in various related disciplines are also offered.

In response to the community requirements for diversity, AASTMT established the Sea Training Institute; Productivity and Quality Institute, Advanced Management Institute, Technical and Vocational Institute and Port Training Institute. These Institutes have developed strong connections with various sectors of industry in terms of postgraduate studies, training, and constancy services.

Programs offered by AASTMT are accredited by the Supreme Council of Egyptian Universities (SCU) according to the decree number 135 issued on August 27, 1996. On the other hand, AASTMT is a fully accredited member of both the Association of Arab Universities and the International Association of Universities.

AASTMT has also established and hosted a number of professional and scientific societies among which are the Arab Institute of Navigation; the Egyptian Marine Engineering Institute, the Society, United Nations Development Program (UNDP), Japan International Cooperation Agency (JICA), and hosts of other organizations, institutions, colleges, and universities.

AASTMT provides its graduate students with the following:

- An excellent opportunity to interact with senior specialists and faculty members on modern issues and concepts in the emerging new areas of research and development in varieties of managerial, maritime, scientific, engineering and technological fields.
- Advanced knowledge in different topics, fields and disciplines based on the Creative and Critical Thinking skills.
- Ways to enhance the students' thinking and research capabilities in the chosen major field of study using the most recent advances in scientific and engineering methodologies and techniques.
- Chances for participants to prove their own developed capabilities by submitting written theses in specific topics of interest.

- Ways to assist the participants in career development.

AASTMT offers various educational facilities such as advanced audiovisual classroom facilities, laboratories, workshops and simulators. A substantial amount of financial resources had been properly invested in establishing and updating these facilities since the inception of AASTMT in 1972. Donations from foreign countries such as Japan and the USA as well as from international agencies such as IMO and UNDP estimated by US$8 million were invested in the late 70's and early 80's in order to provide the required equipment for education and training at AASTMT. This investment is continuously increasing through the annual budgetary revenues of AASTMT.

Stressing the concern of the Academy about providing the latest techniques and simulators, the College of Management and Technology was provided with advanced educational laboratories of CD ROM and CDI. In addition, the College of Maritime Transport and Technology established the integrated simulators complex, which is used in training on different forms of ships, maneuvering as well as the protection of marine environment from pollution. The College of Engineering and Technology is also equipped with more than 50 laboratories serving different engineering domains.

2.0 College of Engineering and Technology

The issue of educational development is of growing international interest. It has also become of increasing concern to different sectors of the society and is not only limited to the small number of specialists and professionals involved.

New ideas have recently emerged causing current educational systems to being no longer adequate to prepare the new generations for their new world. Meeting this kind of educational challenge and suggesting solutions for the present educational problems should take priority over other problems—whether economic, social or political. Hence, improving and developing educational systems should be given the full attention of the administration.

Many of the world countries have vied for educational development. For instance, the United States has launched an educational campaign entitled 'America 2000'. In order not to be a research dependent state, Japan, for the third time round in the last two decades, is further developing its educational system. South Korea has embarked on innovating and revolutionizing its educational system. It has carried out comparative educational studies and has adopted the educational innovations of other countries, such as Japan, Sweden, Britain, Spain, the United States and Israel, as a model for development.

AASTMT administration has realized the importance of educational innovation and development, since the early days of its establishment in 1972. Before the inauguration of the College of Engineering and Technology in 1991, the opportunity of engineering education was offered to students of engineering who were accepted for enrolment and registration at the Department of Trade and Commerce, College of Maritime Transport and Technology, in September 1972.

This called for the development of programs and courses in the Department of Trade and Commerce, College of Maritime Transport and Technology to catch up with counterpart British colleges.

Background and Evolution

In a further attempt to develop its educational system, AASTMT took the initiative of granting Bachelor's degrees in Engineering to its students upon successfully taking a four-and-half-year academic program, instead of the six-year program that was originally offered in accordance with a ministerial decree 215 of 1974, after which they are granted a Certificate of Second Marine Engineer.

In 1975, AASTMT adopted the Credit-Hour System. The efforts of specialized committees resulted in designing new curricula for the students who were admitted in October 1977.

The Bachelor of Engineering programs were soon put into effect after the implementation of the Credit Hour System. These programs were prepared in collaboration with the Faculty of Engineering, Alexandria University, and the members of Engineering Sector Committee, at the Supreme Council of Universities.

The Supreme Council of Universities issued two decrees (numbered 4 of 1984 and 11 of 1985) stating that the Bachelor's degrees granted by AASTMT are equivalent to those granted by other Egyptian State Universities in similar specialties. AASTMT started granting the following Bachelor's degrees in Engineering:

- Bachelor of Marine Engineering Technology
- Bachelor of Marine Electronic Engineering Technology
- Bachelor of Maritime Transport (Commercial)

Attempting to keep up with the accelerating pace of technological progress, AASTMT administration held a series of seminars under the title of ‘ACAD 2000’ during the period from 1986 to 1988. These seminars emphasized that AASTMT must start to seriously consider the revision of its academic goals. It also presented a number of suggested recommendations for the improvement of teaching curricula and teaching methods.

In order to meet the challenges of its growing institutional needs, AASTMT started to implement the suggested recommendations by establishing the College of Engineering and Technology in 1991, where all the different engineering programs and related preparatory interdisciplinary courses were taught, under the auspices of one institution with standardized courses and a decentralized and developed infrastructure, comprising four different departments specialized in four engineering areas:

- Marine Engineering
- Electronics and Computer Engineering
- Electrical and Control Engineering
- Basic and Applied Sciences

The teaching of the different engineering programs was launched to offer the following university degrees and certificates:

- Bachelor of Marine Engineering Technology
- Bachelor of Marine Machinery Technology
- Bachelor of Electronics and Computer Engineering Technology
- Bachelor of Electronic Systems Technology
- General Certificate of Radio and Communication
- Certificate of Radio Officer

Background and Evolution

- Certificate of 3rd, 2nd, and Chief Marine Engineer

Since its inauguration in 1991, AASTMT started to develop its teaching programs according to two basic principles. First, that the student body, staff members and administrators are the main driving force of the educational process and its source of creativity and innovation. Second, that the educational activities should challenge students intellectual abilities and stimulate discussion and new ideas, whether these educational activities are carried out in university lecture rooms, laboratories or workshops.

In 1991, the programs and courses in the Electronics and Computer Engineering Department were updated to meet the rapid progress in this field of engineering science. The department, therefore, started teaching curricula for three undergraduate divisions:

- The Electronics Section
- The Communications Section
- The Computer Section

In 1993, Bachelor's degrees in the following branches of Mechanical engineering were offered:

- Mechanical Engineering (Power)
- Mechanical Engineering (Refrigeration and Air Conditioning)

Similarly, the inauguration of another program of Marine Engineering necessitated the opening of a branch that offers a Bachelor's degree in Offshore Structures by the Marine Engineering Department in order to meet the growing developments in the field. It is worth noting that this new Bachelor's degree in Offshore Structures accepted students who wished to earn a Bachelor's degree in Marine Engineering. In 1994, several new departments were established to offer Bachelor's degrees in the following fields of engineering:

- Electrical and Control Engineering: Electrical Power
- Electrical and Control Engineering: Automatic Control
- Construction and Building Engineering
- Industrial and Management Engineering

In October 1997, the Architectural Engineering and Environmental Design program was initiated followed by the Computer Science program in October 1999.

Engineering education is a major driving force that affects the progress of humanity at large. It does not only influence academic and technological progress, but also the economic and social development of any given country. Hence, AASTMT has found it essential, as one of its first priorities, to standardize the teaching programs and courses it offers to the different sectors of its student body. This is meticulously carried out following a framework in accordance with international criteria recognized by the American Accreditation Board for Engineering Technology (ABET) and the Committee of the Engineering Sector at the Supreme Council of Universities (SCU), which issued the decree No. 135 of 1996 stating that AASTMT Bachelor's degrees in the different branches of Engineering are equivalent to those offered by the State Egyptian universities in the same specialties.

Background and Evolution

In April 1997, the College acquired accreditation from the International Institute of Marine Engineering in London, stating that its Bachelor's degrees in the following areas meet the European standards as recognized by the British Engineering Council:

- Marine Engineering
- Electronics and Communications
- Mechanical Engineering
- Electrical Engineering
- Power Control

This gave AASTMT graduates opportunities to work and study in the countries of the European Union without having to go through any further examinations or accreditations. On January 1, 2001, the Bachelor's Degree in Mechanical Engineering has similarly been accredited by the British Engineering Authority and the Institute of British Engineers in London.

In August 1999, the College of Engineering obtained the ISO-9000 certification in education attesting the high quality control of its teaching programs, courses, academic staff, administration and educational resources, which were all up to internationally set criteria.

On 4 April 2001, the Supreme Council of Universities issued the decree No. 26 of 2001 stating that AASTMT Bachelor's Degree in Architecture Engineering and Environmental Design is equivalent to that offered by the State Egyptian universities.

The Committee of Computer and Information Sector, at the Supreme Council of Universities, paid the College a preliminary visit on 25 February 2001, in order to prepare for the Bachelor's Degree in Computer Science equivalence process with that of the counterpart degrees offered by State Egyptian Universities.

In August 2001, the Committee of the Engineering Sector at the Supreme Council of Universities paid AASTMT another visit to accredit its Bachelor's degrees and to support the decision taken by the Computer and Information Committee. The Engineering Committee also stated that all AASTMT Bachelor's degrees are equivalent to those offered by State Egyptian Universities.

Graduate studies leading to Master's degrees in the following engineering specialty areas started to be offered in September 1994:

- Marine Engineering
- Electronics and Communications Engineering
- Computer Engineering
- Management Engineering
- Electrical and Control Engineering
- Mechanical Engineering
- Construction and Building Engineering
- Architectural Engineering and Environmental Design

On 9 November 2000, the Committee of the Engineering Sector at the Supreme Council of Universities visited the College to evaluate the graduate programs, and collected data on laboratories, libraries and other college facilities. It also asked for

data describing the performance of staff members and researchers on overseas scholarships.

On 28 April 2001, the Supreme Council of Universities issued the decree No. 30 of 2001 stating that the Master of Science degrees offered by AASTMT in (1) Electronics and Communications Engineering, (2) Computer Engineering, (3) Electrical Engineering and Control, (4) Mechanical Engineering, (5) Marine Engineering, (6) Engineering Management, and (7) Construction and Building Engineering are all equivalent for 5 years to those offered by State Egyptian Universities.

The course programs achieved the set of objectives in accordance with the standards, criteria and requirements of the Degree Accreditation Board for Chartered Engineers (DABCE), UK and the Royal Institute of British Architects (RIBA), UK. The AASTMT ISO9001/ 2000 procedures related to the accreditation criteria were a concrete base to implement the required standards. In February 2005, the Royal Institute of British Architects (RIBA) at the UK validated the program of B.Sc. in Architectural Engineering and Environmental Design. In June 2005, the Degree Accreditation Board for Chartered Engineers (DABCE) at the UK accredited all the other engineering programs.

On 19 June 2006, the Supreme Council of Universities (SCU) issued the decree No. 70 of 2006 stating that the Master of Science degree offered by AASTMT in Architectural Engineering and Environmental Design is equivalent for 3 years to that offered by the state Egyptian universities.

On 19 June 2006, SCU issued the decree No. 79 of 2006 to pursue the decree No. 30 of 2001 and to renew for 3 years the equivalence of the Master of Science degrees offered by AASTMT at Alexandria in (1) Electronics and Communications Engineering, (2) Computer Engineering, (3) Electrical Engineering and Control, (4) Mechanical Engineering, (5) Marine Engineering, and (6) Construction and Building Engineering to those offered by the State Egyptian Universities.

On 24 July 2006, SCU issued the decree No. 97 of 2006 to pursue the decree No. 30 of 2001 and to renew for 3 years the equivalence of the Master of Science degree in Industrial and Management Engineering offered by AASTMT at Alexandria in the divisions of (1) Industrial Engineering, and (2) Engineering Management to those offered by the State Egyptian Universities.

MAIN EDUCATIONAL BUILDINGS
LABORATORY FACILITIES

1. ARCHITECTURAL AND ENVIRONMENTAL DESIGN

No.	LABORATORY	Allocation Building-Room #	Area (m^2)	Capacity (Students)
1	Museum Exhibition	E-080	120	--
2	Studio	E-190	250	60
3	Environmental Design	E-270	250	60
4	Sculpture Studies	E-280	50	20
5	Painting Studio	E-288	50	20
6	Studio	E-290	250	60
7	Studio	E-390	250	60
8	Models Workshop	E-474	120	25
9	Computer Lab	E-480	80	25
10	Studio	E-470	250	60

2. BASIC AND APPLIED SCIENCES

No.	LABORATORY	Allocation Building-Room #	Area (m^2)	Capacity (Students)
1	Physics 1 (Electrical and Magnetisms)	B-114	70	20
2	Physics 2 (Heat and Sound)	B-116	100	30
3	Physics 3 (Sound, Optics & Magnetisms)	C-146	70	20
4	Chemistry 2	C-150	70	25
5	Chemistry 1	B-214	70	25

3. COMPUTER ENGINEERING

No.	LABORATORY	Allocation Building-Room #	Area (m^2)	Capacity (Students)
1	Network Center	C-234 B	70	--
2	Computer 1	B-300	70	25
3	Computer 2	B-312	70	25
4	Microprocessors	C-326	70	25
5	Computer 3	C-328	70	25
6	Computer 4	C-330	70	25
7	Digital Circuits Design	D-441	70	25

4. CONSTRUCTION AND BUILDING

No.	LABORATORY	Allocation Building-Room #	Area (m^2)	Capacity (Students)
1	Light Structures	C-036 A	35	20
2	Heavy Structures	D-035	70	20
3	Concrete	D-037	70	20
4	Construction Surveying and Geology	D-039	70	20
5	Construction Materials and Asphalt	D-041	70	20
6	Soil Mechanics	D-045	70	20
7	Transportation Engineering	D-047	70	20

5. ELECTRICAL AND CONTROL

No.	LABORATORY	Allocation Building-Room #	Area (m^2)	Capacity (Students)
1	Electrical Circuits	C-036 A	70	25
2	Power Systems	C-042	70	16
3	Electrical Workshop	C-044	70	16
4	Digital Automatic Control	A-101	100	20
5	Analog Automatic Control	A-103	25	20
6	Electrical Machines	A-201	125	20

6. ELECTRONICS AND COMMUNICATIONS

No.	LABORATORY	Allocation Building-Room #	Area (m^2)	Capacity (Students)
1	Fiber Optics and Acoustics	C-036 B	35	16
2	Solid State Electronics	C-038	60	21
3	Analogy Communications	C-130	70	21
4	Digital and Optical Communications	C-132	70	21
5	Electronics	C-230	70	21
6	Electronic Circuits	C-232	70	21
7	Digital Electronics and Signal Processing	C-234 A	70	16
8	Antenna and Microwave	C-426	70	18
9	Radar	C-428	70	20
10	GMDSS/ VLSI	C-430	70	21

7. INDUSTRIAL AND MANAGEMENT

No.	LABORATORY	Allocation Building-Room #	Area (m^2)	Capacity (Students)
1	Work Analysis and Ergonomics	C-424	70	15
2	See Industry Service Center			

8. MECHANICAL AND MARINE

No.	LABORATORY	Allocation Building-Room #	Area (m^2)	Capacity (Students)
1	Heat Transfer and Thermodynamics	A-05	150	25
2	Fluid Mechanics and Hydraulics	A-07	150	25
3	Testing of Materials	A-011	150	25
4	Refrigeration and Air Conditioning	B-08-010	120	25
5	Mechatronics	B-012	30	25
6	Metallurgy and Non Destructive Tests	A-107	70	25
7	Engineering Drawing	D-139-141	150	60
8	Vibrations	A-205	70	25
9	Engineering Drawing	D-339-141	150	60
10	Engine Room Simulator (located in the College of Maritime Transport Building)	028	120	25
11	Internal Combustion Engines	Workshop	300	25
12	Automotive Engineering	Workshop	150	25

9. OTHERS

No.	LABORATORY	Allocation Building-Room #	Area (m^2)	Capacity (Students)
1	Language	B-216	70	20

INDUSTRIAL SERVICE CENTER

LABORATORY FACILITIES

No.	LABORATORY	ROOM	AREA (m^2)	Capacity (students)
(I)	**ELECTRONICS and COMMUNICATIONS**			
1	Electronics	106	65	25
2	Electronic Circuits	314	65	25
(II)	**COMPUTER**			
1	Computer Applications	207	78	25
(III)	**MECHANICAL and MARINE**			
1	Marine Engineering Workshop (2)	004	45	12
2	Maintenance Workshop	008	345	25
3	Steam Power Plant	006	50	12
4	Automotive Engineering	007	136	25
5	Marine Engineering Simulator	005	45	12
6	Mechatronics	006	67	6
7	Marine Engineering Workshop (1)	108	179	25
8	Mechatronics (PLC)	205	45	25
9	Hydraulics	208	45	25
10	Truck Simulator	209	45	25
11	Refrigeration and Air Conditioning	305	113	25
12	Ship Construction	315	45	25
(IV)	**INDUSTRIAL and MANAGEMENT**			
1	Metrology	005	74	12
2	Metal Cutting Workshop (1)	008	366	25
3	Advanced Metal Cutting Workshop	107	179	25
4	Metal Cutting Workshop (2)	109	65	12
5	Computer Integrated Manufacturing (CIM)	213	70	25

MAIN EDUCATIONAL BUILDINGS

NEW LABORATORY FACILITIES

(I) ELECTRONICS AND COMMUNICATIONS

1	Analog and Digital Communications

(II) COMPUTER

1	Generic PC and Printers
2	Digital Systems and Computer Architecture
3	Microprocessors
4	Computer Networks

(III) ELECTRICAL AND CONTROL

1	Electrical Machines
2	Power Electronics

(IV) MECHANICAL

1	Renewable Energy
2	Shock and Vibration Testing
3	Refrigeration and Air Conditioning
4	Steam Engineering
5	Fluid Dynamics Lab (Refrigeration)
6	Mechanical Vibration and Theory of Machines
7	Thermodynamics and Heat Transfer
8	Mechatronics Systems

(V) INDUSTRIAL AND MANAGEMENT

1	Computer Numerical Control (CNC)

LIBRARIES AND INFORMATION SERVICES

Libraries of educational organizations play a major role in supporting educational activities and enriching the academic life of students and faculty members.

Since its inception in 1972, AASTMT saved no effort in supporting the educational process, and therefore a specialized library was established in order to make use of the information published in different media. The library of AASTMT is considered one of the most sophisticated and specialized libraries in Egypt that serves AASTMT academic community and visiting scholars and researchers. The collection of AASTMT library comprises 20 text databases covering the main fields of interest of the users.

In order to offer a distinguished information service, AASTMT library established an integrated information system. This system enables the users to perform direct search through a computerized catalog, bibliographic databases on CD-ROM's or through direct connection with the Internet.

AASTMT library also offers photocopying services, either locally or through subscription in the British Library Document Supply Center (BLDSC), in addition to other services like computerized charging and reservation.

The Library serves the academic community in all branches of the Academy. It consists of the Main Library, Architecture Library, Maritime Library, Management Library, Advanced Management Institute Library, Cairo Engineering Library, and Cairo Management Library.

THE COLLEGE OF ENGINEERING AND TECHNOLOGY LIBRARY

The College of Engineering and Technology Library, or the central library, in Abu-Quir campus, consists of three floors, comprising a selected collection of books and references in both the engineering and maritime fields, serving the courses and research work which takes place at the College of Engineering and Technology. The Main Library comprises a selected collection of books and references in different engineering specializations, in addition to Periodicals, Dissertations, Projects, Online Databases, and Databases on CD-ROM.

The Main Library building consists of 3 floors. The building has undergone a development process that added to the pre-established facilities. The Library can host (300) users at the same time.

The first floor comprises the references, periodicals, projects and dissertations. It also comprises an Internet lab for users to retrieve information from the Internet, OPAC, and Online databases subscribed to by the Library. The lab can serve (10) users at the same time.

The second floor comprises English books in the fields of: Mechanical, Marine, Construction, and Industrial Engineering. A computer lab with (10) terminals is also available, in addition to a photocopy unit.

The third floor comprises English and Arabic books. English books are in the fields of: Computer, Electrical, and Electronic Engineering and Basic & Applied Science. It also comprises a silent area that can host (15) users at the same time, in addition to a photocopy unit.

Users can browse the Internet and the Online Public Access Catalog (OPAC) of the Library. They can also scan and save or print images from books or periodicals available in the library

The Main Library comprises a selected collection of books and references in different engineering specializations. Its collection consists of (20000) titles, (80) Periodicals, (130) Online Journals, (362) Dissertations, and (413) Projects, In addition to Databases, electronic encyclopedias and dictionaries on CD-ROM. All dissertations are available in both hard copy form and on CD-ROM, which is considered the start of the digital library.

THE ARCHITECTURAL ENGINEERING AND ENVIRONMENTAL DESIGN LIBRARY

The Architectural Library is found on the ground floor of the Architectural Engineering and Environmental Design department building located within the College of Engineering and Technology in Abu-Quir campus. It is one of AASTMT libraries and has proven itself in the architectural field lately. The Architectural Library serves the undergraduate students, faculty members, researchers and professionals in all fields of architecture.

It holds within its racks 1670 foreign books, 250 Arabic books, and 11 periodicals. The books, references and periodicals, whether in Arabic or foreign languages, are of the latest editions and cover a wide range of topics in the fields of the profession including urban planning, urban design, design data, landscape design, housing, interior design, architects and architectural firms. It also covers the fields of building construction, building materials, project management and building technologies, history of architecture, artistic works, architectural presentations, environmental studies, fine arts, architectural criticism, and the field of computer applications in architecture.

The library houses an electronic library of 12 personal computers, 8 of them may be used in surfing the Web (linked to the main campus net server) and as a digital book library. The other 4 PCs serve as a bibliographic database search, 2 of them for faculty and students and the other 2 for staff members. The library also includes photocopying service provided by two fast photocopying machines and one magnetic-card-operated machine.

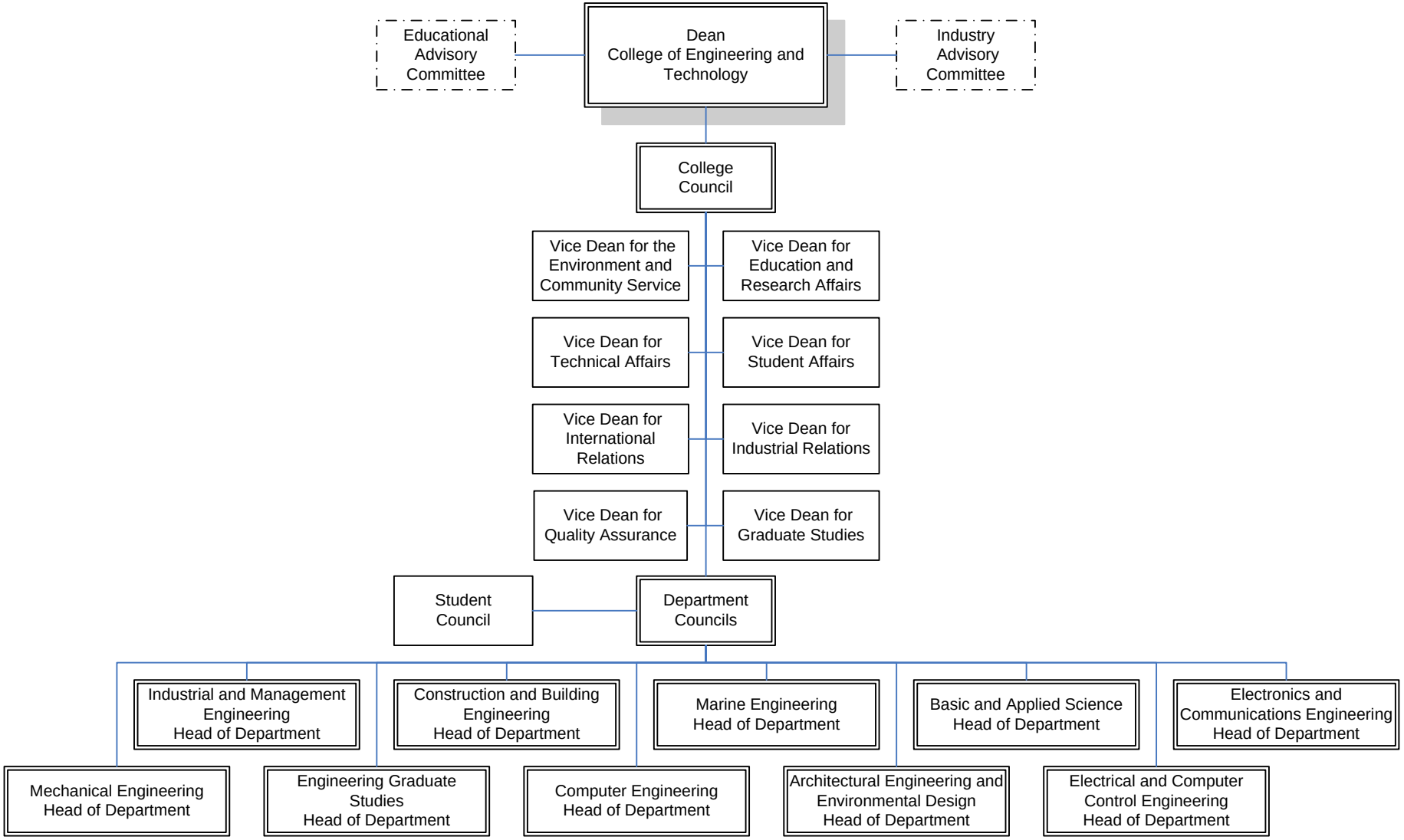
AASTMT LIBRARY IN MIAMI

AASTMT library in Miami serves the academic community in Miami campus. The library in Miami serves specialization of the College of Management and Technology with its departments. It comprises a collection of the most recent titles (550 foreign titles, 2500 Arabic titles and 55 periodicals) in the fields of business administration, hotel and tourism, in addition to the publications of the International Labor Organization (ILO) and the United Nations Conference in Trade and Development (UNCTAD).

All AASTMT libraries are connected with the Central library in Abu-Quir through its online interactive terminals, to ensure easy access to library in-house database.

COLLEGE OF ENGINEERING AND TECHNOLOGY

ORGANIZATIONAL CHART



3. Graduate Studies: Rules and Regulations

3.1 Admission

Applicants to the Master of Engineering program in Engineering must hold a university undergraduate Bachelor's degree from an accredited university or college. An overall Grade Point Average (GPA) of at least 2.40/4.00 (or Good) in the undergraduate degree is required. Otherwise, the applicant may be accepted if (s)he holds a post-Bachelor's Diploma in a relevant area with a minimum GPA of 3.00/4.00 (or Very Good).

The Department of Engineering Graduate Studies at the College of Engineering and Technology identifies the applicants who are eligible for enrollment into the program. The academic department then interviews the applicants individually to select those who will be recommended for admission.

Applications of newly admitted applicants are valid for two semesters. If an admitted applicant does not enroll by the second semester, (s)he must reapply for admission.

Members of the staff and employees of the Academy who wish to register as graduate students should consult the appropriate staff handbooks concerning admission regulations and fee information.

3.1.1 Application Documents

The graduate admissions process of the College of Engineering and Technology seeks to select applicants whose credentials attest to their outstanding ability, preparation, and potential for successful completion of their graduate studies. Applicants must submit the following documents to the Department of Graduate Engineering Studies:

- Official Transcripts: An official transcript must be submitted for each of the colleges and/or universities attended. Transcripts should include an explanation of the grade scale used by the colleges and/or universities attended. All copies should be officially certified as identical to the original. Transcripts and/or copies cannot be returned.
- Copy of passport or identification card
- Financial Plan (if sponsored)
- Completed Application Form

3.1.2 Deadline

The application and all required documents must be received before the following deadlines:

Semester	Deadline
Fall	September 15
Spring	February 15

Individuals submitting applications later than the above dates are not guaranteed consideration for admission to the program in the semester applied for. Their applications will be only processed if time and resources permit.

3.2 REGISTRATION

Applicants may register after the College of Engineering and Technology has approved their application for admission. Registration must be accomplished according to schedules and procedures established by the College of Engineering and Technology.

The registration of a graduate candidate is the responsibility of the candidate. Candidates must register for each course. Registration for a course also includes registration for the examination for that course. Course registration takes place within the first week of classes.

Note:

- The minimum period from the beginning of the first class registered by the student until graduation is 18 months.

3.3 GRADES

The student shall be credited a total score and a corresponding letter grade by the end of each course. The College uses a system of letter grades and equivalent grade points for evaluating the course work, as shown in the following chart:

Score	Grade	Points
90–100	**A**	**4**
85–89	**A–**	**$3^2/_3$**
80–84	**B+**	**$3^1/_3$**
75–79	**B**	**3**
70–74	**B–**	**$2^2/_3$**
65–69	**C+**	**$2^1/_3$**
60–64	**C**	**2**
< 60	**F**	**0**
I	**I**	**–**
W	**W**	**–**

Grades are calculated as a Grade Point Average (GPA) by dividing the sum of weighted achieved points by the sum of credit hours attempted. An Incomplete (I) grade is not included until required work is completed and a grade is assigned. Withdrawal (W) is given no grade or points and courses with W do not contribute to the GPA. Only the highest grade of a course registered twice or more is calculated in the Grade Point Average (GPA).

3.3.1 Incomplete Coursework

If, after the instructor and candidate have conferred, the candidate presented an acceptable excuse for not completing the coursework on schedule, and the instructor has assigned a date by which time all course requirements must be completed, the candidate receives a grade (I). If the coursework remains incomplete on the assigned date the grade will be changed automatically to a grade (F).

3.3.2 Withdrawal of a Course

The candidate may withdraw a course(s) within 3 weeks from the beginning of the semester as a condition for partial refund.

3.4 Examinations

Course examinations are given at the instructor's discretion. Final examinations are given only during the scheduled examination period (16th week). If applicable, there will be exams during the 7th week and/or 12th week. If the candidate is absent with an acceptable excuse from a final exam and wants a credit for the course, after the instructor and candidate have conferred, the candidate must complete a special exam before the end of the semester immediately following his/her absence.

3.5 Attendance

Candidates are expected to attend each class session unless they have a valid and acceptable excuse for being absent. Candidates may be required at any time to account for undue irregularity in attendance. Any student who has been excessively absent from a course may be forced to withdraw from that course without credit or refund.

3.6 Transfer of Credits

Credit gained in a previous graduate education may be transferred to the College of Engineering and Technology graduate program and would therefore sufficiently substitute a similar Master's course.

Only courses with grade B (Good) or higher are eligible for transfer. A maximum of 6 credit hours from an accredited Master's program may be transferred into the Master's program of the College of Engineering and Technology. No course that has been taken more than 2 years before the student's acceptance may be transferred into the program of study.

3.7 Academic Standards of Work

A student must maintain a cumulative GPA of 3.00/4.00 during his/her study at the College of Engineering and Technology in order to graduate. No unresolved (I) grades may be part of the program of study. At the beginning of the final semester the student should review the program of study as necessary and obtain approval to ensure that all graduation requirements are met.

3.8 READMISSION

A regularly admitted graduate candidate who has not registered for two semesters must apply for readmission. A candidate is not guaranteed continuing graduate status if (s)he does not enroll for a period of two consecutive semesters.

3.8.1 WITHDRAWAL

An applicant who is forced to withdraw from the program during the academic year or at the end of any semester may be granted the opportunity to return. However the period of withdrawal should not be for more than two consecutive academic semesters.

3.8.2 LEAVE OF ABSENCE

The College has adopted a leave of absence policy that permits the candidate to continue his/her education. The following principles govern the leave of absence policy:

- An applicant must make a written request for a leave of absence to the Dean. The request must include the reasons for the leave and the time the student plans to be away. Leave of absence will generally be granted for one or two academic semesters. A leave may be further extended upon written application and approval of the Dean.
- An applicant who is granted a leave of absence due to medical reasons may be requested to submit a clinical evaluation to the College before being reinstated to the Program.

3.9 ACADEMIC INTEGRITY

Candidates with different academic and cultural backgrounds may have different perceptions of what constitutes acceptable academic behavior.

The following specific ethics should assist students in avoiding immoral practices when preparing a written assignment:

- A candidate's paper (examination, essay, theme, etc) may not be prepared in whole or in part by someone else.
- Candidate should never attempt to present another person's work, statements, ideas, etc as their own, whether they use an author's actual words or paraphrase the author.
- Candidate may use the actual words of an author if they acknowledge that they are doing so. Quotations should usually be short and infrequent.
- Collaboration between candidates may be helpful and desirable. In these instances the instructor should clearly specify the nature and limits of collaboration in reports and other work. (S)He should be certain that the candidates understand what constitute unacceptable practice in their course.

Graduate candidates at the College of Engineering and Technology are expected to maintain generally accepted standards of academic honesty and professional integrity. Failure to do so will lead to dismissal from the College. Instructors who believe an unethical practice has occurred should take the following steps:

- The instructor will advise the student orally as soon as possible after the offense is noticed.
- If the instructor remains convinced that an offense has occurred, a written statement of the offense will be sent to the Dean.
- The candidate's academic Dean should advise the student of the appealing procedures which are available.

3.10 Dismissal from the Graduate Program

Candidates who fail to maintain satisfactory academic grades, academic performance in the major field or a satisfactory performance in the required examinations shall be dismissed from the graduate program.

The candidate's registration for the Master's degree shall be cancelled by the College after the Dean's approval. Cancellation shall be effected in the following cases:

- If the candidate fails to obtain the degree within three years starting from the date of registration.
- If the candidate fails to meet the requirements of the study courses, if his final cumulative grade point average is less than 3.00/4.00, if the number of courses in which the candidate's grade is (C) exceeds two courses, or if the number of courses in which the candidate's grade is (F) exceeds one course.
- The candidate shall be officially notified if the supervisor(s) submits a report requesting cancellation of registration for reasons accepted by the Dean.
- If the candidate requests cancellation of registration in writing or fails to pay the tuition fees.

3.11 Student Appeals

The candidate is entitled to an explanation of the details of the grade achieved in any examination. This explanation can be given either orally or in writing by one of the examiners. A request for such an explanation must be based on facts. A grade can be appealed against. Such an appeal must be submitted no later than one week after the explanation of the grade has been given. Oral presentations and examinations cannot be appealed.

Candidates may petition the College for an appeal relating to grades. A petition for an appeal must be submitted by the candidate with full justification for the request.

3.12 Tuition Fees

The tuition fees for every course shall be paid at the beginning of each semester. If the student, or his sponsor, fails to pay the tuition fees at the indicated time, the student's registration shall be cancelled and the student shall not attend any lectures. The Dean of Admissions and Registration shall determine the tuition fees at the beginning of each semester.

The tuition fees of the programs using the credit hour system shall be determined on the basis of the credit hour and shall be paid either collectively for a full semester or according to the number of credit hours registered for.

Architectural Engineering and Environmental Design

M.ENG. PROGRAM

OVERVIEW

The increase of population in Egypt and most Arab countries has considerably increased the need for housing, public buildings, and urban services. On the other hand several problems appear, such as: upgrading, renewal, development of deteriorated areas, creation of new towns and settlements as well as problems of restoration, preservation, conservation, and enhancement of the built heritage. These problems led to a tremendous increase in the national investment in building and construction and consequently the need for professionals in this field. The preparation of engineers specialized in architecture and environmental design is necessary for the pursuit and success of the national building and construction policy .

To cope with the needs of the Egyptian and Arab societies as well as the regional and international market demands, the College of Engineering and Technology at the Arab Academy for Science, Technology and Maritime Transport, decided in 2000 to establish the Department of Architectural Engineering and Environmental Design.

Program Detailed Structure

M.ENG. PROGRAM

M.Eng. in Architectural Engineering and Environmental Design

Program Structure

CORE COURSES:

Course Code	Course Title	Credit Hours
AR 713	Environmental Studies in Architecture and Urban Design	3
AR 715	Architectural Design—The Process	3
AR 717	Urban Design	3
AR 736	Research Methods	3
AR 791	Practical Research 1	3
AR 792	Practical Research 2	3
Subtotal	**6 Courses * 3 Credit Hours**	**18**

ELECTIVE COURSES:

Course Code	Course Title	Credit Hours
AR 721	Passive and Active Environmental Control Systems	3
AR 722	Environment and Behavior: Applications in Architecture and Urban Design	3
AR 723	Site Development and Landscape Studies	3
AR 724	Theory of Architecture: Advanced Topics	3
AR 726	Environmental Design Approaches	3
AR 727	Egyptian Regions and Architecture	3
AR 728	Sustainability and Urban Form	3
AR 729	Architectural Criticism	3
AR 731	Urban Development and Urban Renewal	3
AR 732	Mediterranean Cities: History, Spirit and Contemporary Architecture	3
AR 733	Computer Applications in Design and Presentation	3
AR 734	Geographic Information Systems	3
AR 737	Urban Environmental Planning	3
AR 738	Urban Landscape	3
AR 739	Conservation of Architectural Heritage	3
CB 711	Value Engineering in the Construction Industry	3
CB 712	Advanced Construction Management	3
CB 717	Project Planning and Control	3
CB 710-C	Construction Productivity	3
Subtotal	**4 Courses * 3 Credit Hours**	**12**
Total		**30**

Courses

Course Code : **AR 713**

Course Title : **Environmental Studies in Architecture and Urban Design**

Credit Hours : **3**

Course Description

This course discuses the issue of environmentally conscious design. It consists of four main parts:

(1) the philosophy of environmental design;
(2) the Physical Environmental including Geology, Geomorphology, Energy Resources and Climate, and their influence on building and site design;
(3) the natural environment including Soils, Materials, Energy and Ecology; and,
(4) the Principles of Strategic Environmental Assessment.

Course Objectives

Upon completion of the course, student should be able to perform an environmental site analysis of various projects based on their knowledge of user requirements and different physical aspects. Student would also be able to understand natural and built environment.

Course Topics

- What is meant by the phase “environment”?
- What constitutes an Environmentally Conscious Design?
- Environmental Ethics
- The Physical Environment
- The Natural Environment
- The Social Environment

References

- BEER, Anne R. *Environmental Planning for Site Development*. E&FN Spon, London, 1990.
- MACY Christine. *Architecture and Nature: Creating the American Landscape*. Routledge, London, 2003.

Course Code : **AR 715**

Course Title : **Architectural Design—The Process**

Credit Hours : **3**

Course Description

The course focuses on how architectural graduates should be committed to the rationales of the design process, approach, and proposal. It defines, tests, and justifies how a design proposal is appropriate and relevant in a particular physical, social, cultural, economic or environmental context. It also rehearses the student's ability to deliver a well developed, ambitious and resolved design proposal which has taken into account the complex and unpredictable conditions of a particular context and embodies within its rationale, scale, scope and remit, a well developed ambition for architecture.

Course Objectives

Architecture has become more complex by the introduction of various design approaches and trends. This course discusses the nature and role of architectural design in a wide range analysis extending from thinking methods to diverse contemporary approaches to design, outlining the relationship between some current perceptions of science, art, and philosophy and their effect upon architectural design.

Course Topics

- Design Thinking
- Approaches to Architectural Design
  - Architectural Design and Information Technology
  - Architectural Design and Sustainability
  - Architectural Design and Identity
- Researches and Projects

References

- Rowe, P. (1987) *Design Thinking*, The MIT Press
- Lawson, B. (2001) *How Designers Think: the design process demystified*, The Architectural Press
- Baker (1996) *Design Strategies in Architecture*, Van Nostrand Reinhold, E&FN Spon
- Steele (2001) *Architecture and Computers*, Laurance King Publishing
- Kolarevic (2003) *Architecture in the Digital Age – Design and Manufacturing*, Spon Press
- Sassi, P. (2005) *Strategies for Sustainable Architecture*, Routledge
- Williamson, T; A. Radford and H. Bennetts (2002) *Understanding Sustainable Architecture,* Spon Press
- Bay, J. and B. Ong (2006) *Tropical Sustainable Architecture, Social and Environmental dimensions*, The Architectural Press

- Stang, A. and C. Hawthorne (2005) *The Green House: New Directions in Sustainable Architecture*, Princeton Architectural Press
- Abel, C. (1997) *Architecture and Identity*, The Architectural Press
- Butina-Watson, G. and I. Bentley (2007) *Identity by Design*, The Architectural Press

Course Code : **AR 717**

Course Title : **Urban Design**

Credit Hours : **3**

Course Description

The Egyptian city and the Global city

Urban design is mainly concerned with cities. It focuses on the creation of places where buildings relate to each other in a meaningful way to enhance and inspire the human lives. Cities are places where human civilizations were made in the first place. It is the place where writing was invented, the rule of law manifested and where architecture was established, meeting with others (civilizations, foreigners) was possible.

In a world that is growing with more than 50% of the population already living in cities rising to 75% in the near future, cities become the prime destinations for human beings. Cities are also the place where the major advances in science and technology occurs causing an unprecedented development since the industrial revolution. This comes with a high price of environmental degradation that threatens the very existence of the humankind.

Cities are not bound to their local conditions, in fact history and current situation points to the importance and the amount of influence that other cultures, places inflict in every aspect of our cities. Cities are now competing in a global scale to attract not only tourists, but rather to attract investments.

In such circumstances it is important that any attempts to intervene in our cities and especially the public places to be grounded on a solid understanding of the urban context. This proper understanding has to explore the origins of urban form, the relevant theories dealing with urban places and spaces and appreciate the amount of challenges facing the human beings in our cities and how are they driven by the political, social and economical situation. It is also important to examine the most recent trends in urban design to critically review the possible scenarios of the urban future being lead before us.

Course Objectives

- To be aware of contemporary urban design theories.
- To be able to critically examine and review contemporary urban design theories.
- To relate urban design realities to the global and theoretical context.
- To be able to identify challenges of urban design in the Egyptian city.
- To develop personal views regarding these urban challenges

Course Topics

- Urban Origins
- Modern Urbanism
- An Integrative Theory of Urban Design
- Theories of Urban Spatial Design
- Cities in Evolution and Urban Scale
- Cairo 2050: A vision, From Walled city to gated communities

- Challenges of urban growth in Cairo.
- Public spaces in Cairo
- Cairo: Political, Social and Economical context
- Cairo's Urban Déjà vu: Globalization and Urban Fantasies
- New Urbanism
- Avant Garde Urbanism (The Junk space)
- Applications

References

- TRANCIK, ROOGER. *Finding Lost Space: Theories of Urban Design*. Van Nostrand Reinhold, 1986.
- TIBBALS, FRANCIS. *Making People-Friendly Towns: Improving the Public Environment in Towns and Cities*. Spon Press, 2001.
- Kostof, Spiro, '*The City Shaped: Urban Patterns and Meanings Through History'*, Bulfinch Press, 1991
- Trancik, Roger, '*Finding lost space: Theories of Urban Design'*, Van Nostrand Reinhold, 1986
- Lynch, Kevin, '*The Image of the City'*, The MIT Press, 1960
- Jacobs, Jane, '*The Death and Life of Great American Cities'*, 1961
- Ernest Sternberg, *'An Integrative Theory of Urban Design'*, APA Journal, Summer 2000, Vol. 66 No. 3
- Eduardo E. Lozano, '*Community Design and the Culture of Cities: The Crossroad and the Wall'*, Cambridge University Press, 1990
- Khaled Adham, "*Cairo's Urban Déjà vu: Globalization and Urban Fantasies*", Planning Middle Eastern cities an urban kaleidoscope in a globalizing world, Yasser Elsheshtawy, Eds., London ; New York : Routledge, 2004
- David Walters and Linda Brown, "*Design First: Design-Based Planning for Communities*", Architectural Press, Jun 2004
- Rem Koolhaas, "*Junkspace*", MIT press Journals, Spring 2002, No. 100

Course Code : **AR 721**

Course Title : **Passive and Active Environmental Control System**

Credit Hours : **3**

Course Description

This course deals with a number of passive and active environmental systems topics. First, it presents empirical environmental design guidelines in literature and their applications. Second, it introduces methods of calculating thermal loads and ways of minimizing these loads in buildings. Third, the course then introduces the concept of energy consumption software as a design tool. Finally, it looks at active energy generation opportunities and how to integrate them in building and site design.

Course Objectives

On completion of the course, student should be able to perform computerized load calculations and utilize ways of reducing energy consumption. They should also be able to analyze energy consumption components and choose the best solution out of a list of alternatives.

Course Topics

- Human Comfort and Health Requirements
- Thermodynamic Principles
- Thermal Dynamics of Buildings
- Load Calculations: Heating Load Calculations, Cooling Load Calculations
- Selecting Design Temperatures and Humidity Conditions
- Solar Gain Through Fenestration
- Transmission through the Envelope
- Internal Loads, Outside Air
- Annual Energy Use Calculations
- Hourly Computer Simulations
- Active HVAC Systems, Load Reductions

References

- BRADSHOW, Vaughn. *Building Control Systems*. New York: Wiley, 1993.
- BAKER, Nick. *Energy and Environment in Architecture*. E&FN Spon, London, 2000.

Course Code : **AR 722**

Course Title : **Environment and Behavior: Applications in Architecture and Urban Design**

Credit Hours : **3**

Course Description

This course introduces graduate students to the field of human behavior. The course draws from theories of environmental psychology and environmental ecology. Perception, cognition, evaluation and attitudes are examples for some topics to be explored at different scales and settings.

Course Objectives

The course aims at getting students acquainted with terms and theories of environment and behavior, and deepening their understanding to human behavior in multi-cultural settings. It also works to bridge a presumed gap of theory and practice; and enhances students' performance and understanding in relation to design discourse.

Course Topics

- Environmental psychology, focus and fields of interest.
- Behavior as a response to physical characteristics of the environment.
- Spatial behavior: personal space, territoriality, privacy and place attachment.
- Image of the city.
- The physical environment and urban living in cities.
- Public spaces and human behavior.
- Cultural aspects of environment and behavior.
- Environment-disturbing behavior: environmental stress, light, noise and temperature.
- Personality and the environment
- Environmental attitudes
- Evaluating environmental qualities
- Environmental perception, cognition and evaluation.
- Cognitive mapping and spatial organisation of the physical environment.

References

- Bechtel, R. (1997) *Environment and Behavior: An Introduction*. CA: Sage.
- Bechel, R. (2002) *Handbook of Environmental Psychology*. New York: John Willy and Sons.
- Holahan, C. (1982) *Environmental Psychology*. New York: Random House.
- King, A. (Ed.) (1980) *Buildings and Society: Essays on the Social Development of the Built Environment.* London: Routledge and Keegan Paul.
- Krupat, E. (1999) People *in Cities: The Urban Environment and its Effects*. Cambridge: Cambridge University Press.

- Lang, J. (1987) *Creating Architectural Theory: The Role of the Behavioral Sciences in Environmental Design.* New York: Van Nostrand Reinhold.
- Lynch, K. (1960) *Image of the City*. Cambridge: MIT Press.
- Moore, K. D. (2000) *Culture, Meaning, Architecture: Critical Reflections on the Work of Amos Rappaport*. Aldershot: Avebury.
- Preiser, W. F. E. (Ed.) (1985) *Programming the Built Environment*. New York: Van Nostrand Reinhold.
- Rappaport, A. (1969) *House Form and Culture*. NJ: Prentice-Hall.
- Stokols, D. and Altman, I. (Eds.) (1987) *Handbook of Environmental Psychology*. New York: Wiley
- Readings are separately available for each week.

Course Code : **AR 723**

Course Title : **Site Development and Landscape Studies**

Credit Hours : **3**

Course Description

This course places an emphasis on the rehabilitation, redevelopment and conservation of urban environments. Projects include the application of urban ecology, environmental psychology and historic evolution. The course also encourages students to generate ideas regarding the transformation of our ailing cities into thriving and efficient urban environments.

Course Objectives

The main objective of landscape is to improve the quality of life through learning the knowhow of planning and designing the natural and built environment from gardens and plazas to national parks. Such an objective is achieved through the understanding of the relation between people and place and the human uses of landscapes. The course aims to:

- Teach the skills of landscape design through a comprehensive understanding of the historical, technical, cultural and practical aspects of successful landscape design,
- Equip student with the theoretical skills to carry out successful research in the area of landscape,
- Provide students with a theoretical view on the human use of space and the role of place in people's lives. This will result from a series of related subjects e.g., environmental psychology, sociology, urban design, and
- Enable students to apply the gained knowledge through a design project and a written report.

Course Topics

- Part I: From gardening to landscaping
  - Evolution of modern landscape (a foot in the past)
  - Visions of landscape design (into the future)
- Part II: The used vocabulary (with reference to human activities)
  - Landscape designing process
  - Ecological landscape design
- Part III: Sharpening design skills in practice:
  - Undertaking a dissertation/design project usually includes design work and a written report. Projects range from national parks to city streets and squares and up to gardens

References

- THOMPSON, J. William and SORVIG, Kim, *Sustainable Landscape Construction*. Island Press, USA, 2000.

- NEWMAN, Peter and KENWORTHY, Jeffrey. *Sustainability and Cities,* Island Press, USA, 2000.
- SIMONDS, John O. *Garden Cities 21*, McGraw- Hill, Inc. USA, 1994.
- HUGH, Michael. *City Form and Natural Process*. Croom Helm, London and Sydney, 1984.
- McHARG, Ian L. *Design with Nature*, Natural History Press, 1971.
- POWELL, Kenneth. *City Transformed*. Laurence King, London, 2000.
- Austin, R. *Designing with plants*, Van no strand Reinhold, New York.
- Bell, S, 1993, *Basic elements in visual landscape design*, E&FN Spons, USA.
- Bell, S, 1999, *Landscape: pattern, perception and process*, E&FN Spons, USA.
- Dee, K.2001 *Form and fabric in landscape architecture*, Spons press. London
- Hobhouse, Penelope, 2002, *The Story of Gardening*, Dorling Kindersley
- Lyall, Sutherland, 1991, *Designing the New Landscape*, Thames and Hudson Ltd
- Pierceall, G.1990, *Sitescapes: outdoor rooms for outdoor living*, Prentice Hall, NJ
- Treib, Marc, 1993, *Modern Landscape Architecture*, the MIT Press, Cambridge
- Walker, Peter and Melanie Simo, 1994, *Invisible Gardens, the search for modernism in the America landscape*, Massachusetts Institute of Technology
- Walker, Peter and partners, 2005, *Landscape Architecture Defining the Craft*, Thomas and Hudson
- Waymark, Janet, 2005, *Modern Garden Design, innovation since 1900*, Thames and Hudson

Course Code : **AR 724**

Course Title : **Theory of Architecture**

Credit Hours : **3**

Course Description

This course introduces students to the era of modernism and the master designers of these schools. It provides a critical viewpoint for several architectural ideological trends and approaches which have evolved since the 1960s, until modern times. This course leads to a better understanding of the late 20th Century and the beginning of the 21st Century.

Course Objectives

This course increases the understanding of new architectural trends and their founders in the very recent past, the running present and the coming future.

Course Topics

- Theories of architecture and design approaches
- Approaches to analysis and synthesis of forms
- New trends and architectural design theories
- The role of symbolism in architectural forms
- Architectural theories between culture and environment
- Articulation of functions, forms and technology
- Analytical studies of the latest projects

References

- NESBITT Kate. *Theorizing a New Agenda of Architecture*. Princeton Architectural Press, 1996.

Course Code : **AR 726**

Course Title : **Environmental Design Approaches**

Credit Hours : **3**

Course Description

In this course the students will develop an understanding of the relationships among the ecosystem, energy, resource flows and human social and cultural values. Various methods of preserving, protecting and improving the quality of the environment through rational utilization of natural resources will be discussed as well as protecting human health by reducing air pollution through better design and urban development.

Course Objectives

The course introduces graduate students to the principles of environmental design and how the site, form, materials and structure can be used to design comfortable, healthy and energy efficient buildings.

Course Topics

- Comfort, health, environmental physics
- Energy strategy method:
- Building planning and design
- Energy sources
- Services design
- Energy conservation:
- Active and passive methods
- New technologies,
- Intelligent building
- Waste minimization and recycling technology
- Case studies of environmental buildings

References

- EDWARDS Brian, *Sustainable Architecture*. Architectural Press – Oxford 1996.
- PORTEOUS Colin, *The New Eco-Architecture*. Spon Press – London and New York 2002.
- RANDALL Thomas, *Environmental Design*. E&FN Spon – London and New York 1999.

Course Code : **AR 727**

Course Title : **Egyptian Regions and Architecture**

Credit Hours : **3**

Course Description

The course discusses a variety of regions in Egypt (Sinai, Nubian Regions, Delta, Western Desert, and Eastern Desert) by presenting the evolution, transformation and the development of architecture in each of these regions. A group of students will choose a region to be studied according to their scope of interest in the field. The chosen topic will be dealt with, on two stages. The First Stage is theoretical background of the chosen subject, which would be prepared by the lecturer. Through Second Stage, the Student will make a research work of a Case Study on which to apply the theories and criteria extracted from the theoretical background of stage one. The students will present their work for discussion and criticism.

Course Objectives

The course aims to enhance the students' understanding of Egyptian regions by focusing upon several aspects related to various scopes of interest in several areas (historical, climatic, construction, etc…).

Course Topics

- Dwellings and Settlements in African Architecture
- Dwellings and Settlements in the Egyptian Regions
- Historic Building in Egyptian Regions (Methods and Techniques)
- Building Cultures and Sustainable Developments
- Vernacular Architecture
- Traditional Environments

References

- According to the topic to be addressed.

Course Code : **AR 728**

Course Title : **Sustainability and Urban Form**

Credit Hours : **3**

Course Description

This course highlights various sub-ecological approaches. It helps provide a clear understanding of the urban form and its different types. Students will develop knowledge about the factors affecting energy consumption and consequently affecting the urban form.

Course Objectives

The course aims to elaborate the concept of sustainable development and energy consumption and their direct influence on the urban form.

Course Topics

- Definition of sustainability
- The built environmental and sustainability
- Ecological dimension of sustainability
- Sustainable urban form
- Different approaches of achieving sustainable urban form

References

- Godchild, Barry, *Housing Design, Urban Form and Sustainable Development*, Third world planning Review, 62 N 2, 1994.
- Hildebrand Frey, *Designing the city towards a more sustainable urban form*, E&FN Spon, London, 1999.
- Katie Williams, Elizabeth Burton and Mike Jenks, *Achieving Sustainable Urban Form,* E&FN Spon, London, 2000.
- Josef Leitmann, *Sustainable Cities, Environmental Planning and Management in Urban Design,* McGraw-Hill, 1999.
- PETER Smith. *Sustainability at the Cutting Edge*. Arch. Press, London, 2003.

Course Code : **AR 729**

Course Title : **Architectural Criticism**

Credit Hours : **3**

Course Description

This seminar-like course introduces graduate students to the realm of architectural criticism. Students' curiosity to the subject is based on their experience with architectural design classes and instructors' evaluations. The course deals with the topic as a methodology and expression of ideology.

Course Objectives

Criticism is judgment flavored by one's sphere of interaction. Students should learn how to look and interpret behind-the-scene phenomena, and not to be biased by tempting forms or presentations. The objectives that students should gain: knowledge about criticism and its importance for theory and practice of architecture, curiosity, Suspicion, Link knowledge in different fields (art, science, …etc.), the ability to view things as "wholes", the way of Developing a "theoretical" model for understanding architectural form as synthesis for a multiplicity of forces or factors (socio-cultural, political, environmental, technological…etc.), learning about development of architectural theory and practice of the twentieth century, learning that architecture goes hand in hand with urban design as concrete formulations to prevailing discourses.

Course Topics

- Introduction to criticism in the fields of the social sciences, and art (art, music, and architecture)
- Architectural theory and practice I
- Language of architecture I
- Modernity, Positivism and the post-positivism era I
- A model for understanding criticism

References

- KANIN, Blair. *Why Architecture Matters: Lessons from Chicago*. University of Chicago Press, 2001.

Course Code : **AR 731**

Course Title : **Urban Development and Urban Renewal**

Credit Hours : **3**

Course Description

This seminar-like course introduces graduate students to different philosophies of urban development and renewal. The course initiates discussion and different concepts of development and renewal in different areas of the world with various world views.

Course Objectives

Following the philosophical background of this specific degree (Master in Architecture and Environmental Design), the course tackles a cornerstone of policy and action that affects the surrounding environment. Dealing with developmental issues raises the student's awareness toward the environment and furnishes solid ground for future research.

Course Topics

- Development vs. Growth Conceptualization, epistemology and philosophies
- Meanings of urbanity and urbanization theories
- Dimensions of development: social, economic, political, environmental, etc…
- Scales and contexts of urban development
- New towns policy and implementation
- Urban renewal programs
- International and national examples, critique
- Ecological perspectives of development

References

- TUNG, Anthony M. *Preserving the World's great Cities: The Destruction and Renewal of the Historic Metropolis*. Clarkson Review, London, 2001.
- COHEN, Nahoum. *Urban Planning Conservation and Preservation*. McGraw Hill, NY, 2001.
- Readings are assigned for each week and selected from journals and textbooks dealing with the topic of development.

Course Code : **AR 732**

Course Title : **Mediterranean Cities: History, Spirit and Contemporary Architecture**

Credit Hours : **3**

Course Description

The aims of this course are to understand the different physical, social and temporal aspects that have shaped the different common characteristics of Mediterranean cities. Detailed analysis of one Mediterranean city will take place as a case study. The analysis will include the different geographic, historical, social, political and cultural factors that have shaped the physical aspects of the city. Relationships between economic growth and urban development will be introduced. General and common physical characteristics of Mediterranean cities will be emphasized.

Course Objectives

To understand the different physical, social and temporal aspects which have shaped the different common characteristics of the Mediterranean cities. Also to understand the applications of the different spatial design theories.

Course Topics

- Choice of the case study
- Urban development through different periods
- Physical characteristics of the city
- Detailed analysis of key sites of the city
- General identity of the city and specific identity of its parts
- Contemporary issues of conservation
- Expectations and future directions

References

- GUPTA, Avijit, *Environment and the developing world: Principles, Policies and Management*, Wiley, 1998
- HAWKES, *The Environmental Tradition: Studies of the Architecture of the Environment,* Thames and Hudson, London, 1996
- KOSTOF, Spiro. *The City Shaped: Urban Patterns and Meaning through History*, Thames and Hudson, London, 1991

Course Code : **AR 733**

Course Title : **Computer Applications in Design and Presentation**

Credit Hours : **3**

Course Description

This course provides students with advanced knowledge in the use of computers in architecture. It introduces them to new concepts and software applications beyond traditional CAD and common 3D modeling. Examples of such software include Sketchup, Piranesi, and Revit.

Course Objectives

The course aims to raise the student's expectations and understanding of the role of computers in architectural design. It explores new concepts such as Building Information Models (BIM), 3D sketching, and non-realistic rendering. Hands-on experiments provide in-depth knowledge of cutting edge software.

Course Topics

- The role of computers in the design stage
- 2D and 3D sketching
- Realistic and non-realistic rendering techniques
- Building Information Models (BIM)

References

- The course relies on handouts and online resources as needed.

Course Code : **AR 734**

Course Title : **Geographic Information Systems**

Credit Hours : **3**

Course Description

This course provides graduate students with an opportunity to gain advanced knowledge of the application of geographical information systems (GIS) on environmental problems with particular reference to planning and resource management. Students will become familiar with the strengths and limitations of this rapidly developing approach to the analysis of spatial data.

Course Objectives

By the end of that course, student will gain an understanding of the concept of GIS and its applications. (S)He will be able to deal with different types of data and know the way to transfer this data to the language of GIS and, finally, how to obtain different results using that package.

Course Topics

With application on a case study, the following topics would be introduced:

- Overview of Geographic Information System
- Maps, Map Projection and Coordinate System
- Spatial Data Model
- Data Quality, Sources, Input and Output
- Database Concept
- Spatial Analysis
- Making and Producing Maps
- Implementation
- The Future of GIS

References

- DEMERS, Michael N., *Fundamentals of Geographic Information Systems*, Wiley, New York. 1997.
- ESRI, *Getting to Know Arc View GIS*, 2nd Ed, 1997.
- ERSI, *Understanding GIS, the Arc/Info Method*, Environmental Systems Research Institute, New York, 1998.
- Menno-Jan Kraak and Ferjan Ormeling. *Cartography: Visualization of Geospatial Data*, 2nd Edition. Prentice Hall, 2003. www.cartographybook.com
- Ian Heywood, Sarah Cornelius and Steve Carver. *An introduction to Geographical Information Systems*. www.booksites.net/heywood , Prentice Hall, 2002.

Course Code : **AR 736**

Course Title : **Research Methods**

Credit Hours : **3**

Course Description

The course provides graduate students with an overall understanding of the nature of academic research. It highlights the principal basics of doing research, its requirements and logic. Students would develop their skills in carrying out research work in different situations, address diverse topics, formulate research questions, and design research programs that suit particular contexts.

Course Objectives

The course aims to present a brief overview of the field of academic research. It introduces various methods and techniques for conducting research and producing complete research documents. The seminar-like course helps post-graduate students develop their ability to devise specific research programs, tackle different problems throughout the stages of work, analyze data, induce statements and conclusions, and finally organize findings into thoroughly written dissertations and theses. The course presents further insight into research methodologies, critical investigations, qualitative and quantitative methods, and provides a broad understanding of the research fundamentals, standards, and common procedures.

Course Topics

1. Academic Writing and Reading Research
   - Reading Research
   - Academic/Scientific Writing
   - Documenting Sources: Alternative Styles
   - Research Communication
2. Science and Architectural Research
   - The Nature of Science and Scientific Research
   - Research in Architecture
   - Academic Research: Concepts and Keywords
   - Logical Reasoning in Research
3. Systems of Inquiry
   - Frameworks of Systems of Inquiry
   - Standards of Research Quality
4. Research Planning
   - The Research Problem and the Research Question
   - The Review of the Related Literature
5. Research Designs
   - Experimental and Quasi-Experimental Research Designs
   - Survey/Correlational Research Designs
   - Qualitative Research Designs

- Interpretive-Historical Research
- Simulation and Modeling Research
- Logical Argumentation
- Case Study Research and Combined Strategies

6. Research Procedures and Techniques
   - Sampling
   - Data Collection (interviews, questionnaires, observations, …)
   - Data Analysis (descriptive and inferential statistics, qualitative data analysis, etc, …)

7. Applied Research Methods

References

- DEES, Robert. *Writing the Modern Research Paper*. Boston, Allyn and Bacon, 2000.
- Groat, L. and Wang, D. (2002). *Architectural Research Methods*. New York: John Wiley and Sons.
- Huck, S., Cormier, W., and Bounds, W. (1974). *Reading Statistics and Research*. New York: Harper and Row.
- Judd, C., Smith, E., and Kidder, L. (1991). *Research Methods in Social Relations.* New York: Holt, Rinehart, and Winston.
- Leedy, P. (1993). *Practical Research: Planning and Design*. New York: Macmillan.
- Miles, M. and Huberman, A. (1994). *Qualitative Data Analysis*. Thousand Oaks, CA: Sage.
- Patton, M. (2002). *Qualitative Research and Evaluation Methods*. Thousand Oaks, CA: Sage.
- Rosa, A. and Escholz, P. (1999). *The Writer's Brief Handbook*. Boston: Allyn and Bacon.
- Sommer, B. and Sommer, R. (1991). *A Practical Guide to Behavioral Research: Tools and Techniques.* New York: Oxford University Press.
- Wehrli, R. (1986). *Environmental Design Research: How to Do It and How to Apply It.* Melbourne, FL: Krieger.
- Zeisel, J. (1990). *Inquiry by Design: Tools for Environment-Behavior Research*. New York: Cambridge University Press.
- ZEISEL, John. *Inquiry by Design*. New York, Cambridge University Press, 1990.
- Readings from journal articles and chapters from other books will be made available to students as needed.

Course Code : **AR 737**

Course Title : **Urban Environmental Planning**

Credit Hours : **3**

Course Description

Urban environmental planning is planning that includes environmental criteria in decision making, as well as filtering steps that lead to a completion of a design. To achieve environmental planning it is imperative that the entire planning method, approach and discipline be overhauled. Every component, guideline and mark of the pen must consider the implications of the environmental objective. As such, the course deals with different aspects related to the planning of urban areas. It explains how uncontrolled urbanization has altered the natural and social systems, and how it is possible through evolving environmentally conceived concepts in planning, to formulate a better urban environment.

Course Objectives

The aim of the course is to prepare graduates for lifelong learning and professional careers in environmental planning; provide the knowledge and skills required to obtain professional entry level positions in environmental planning; promote land use and environmental planning as a social learning process; and provide graduates with a critical perspective of the legislation, policies and practices affecting land use and the environment.

Course Topics

- Background
- Environmentally Oriented Planning: Sectoral Aspects
- Land Suitability Assessment
- Environmental Management Systems (EMS)
- Case Studies

References

- Marsh, W. M. *Landscape Planning: Environmental Applications*. Addison-Wesley Publishing Company, Inc., Reading, Massachusetts, 1983.
- Lyle, J. T. *Design for Human Ecosystems*. Van Nostrand Reinhold, New York, 1985.
- Hough, M. *Cities and Natural Process*. Routledge, London, 1995.
- Lyle, J. T. *Regenerative Design for Sustainable Development*. New York: Wiley, 1994.
- McHarg, I. L. *Design with Nature*. New York: Natural History Press, 1969.

Course Code : **AR 738**

Course Title : **Urban Landscape**

Credit Hours : **3**

Course Description

This course explores landscape design theories and application in the urban context. It looks at site structure relationships for private buildings, urban open spaces, plazas, pedestrian malls and other public spaces. Case studies will be used to apply and develop these principles under the supervision and guidance of the instructor.

Course Objectives

The course aims to introduce students to the concept of landscape architectural design theories and applications on different scales of urban environments.

Course Topics

- Perception of urban landscape
- Structure of urban space
- Development of spatial order
- Radial and Neoclassic form

References

- CLIFF Loughton, JAMES C. Moughtin. *Urban Design: Green Dimensions*. 1996.
- GARRET Eckbo (Editor). *People in a Landscape*. 1997.
- CROSBIE, Michael J. *Green architecture: A Guide to Sustainable Design*. - Rockport, Massachusetts, ROCKPORT PUB. INC., 1994.
- DUTTON John A., *New American Landscape*. Skira, Italy, 2000.
- SPENS Michael. *Modern Landscape*. Phaidon Press, 2003.

Course Code : **AR 739**

Course Title : **Conservation of Architectural Heritage**

Credit Hours : **3**

Course Description

The course introduces the students to the field of historic preservation covering issues from the history of the field, the development of its theories, the different levels of intervention. It also provides an overview on the technical conservation matters covering a brief on the traditional building techniques, and the compatible approaches to conserve historic buildings. It develops a critical approach towards the current practice, and opens a discussion on the means to enhance and to appropriate conservation methods according to the cases.

Course Objectives

This course enhances the understanding of the complex characteristics of heritage structure, values, authenticity, and opens up discussions to evaluate frameworks for planning and managing heritage conservation. The course also tackles the problem of cultural discontinuity and demonstrates contemporary trends towards re-assuring local cultural continuum development.

Course Topics

- Introduction and definitions
- Historic preservation as a profession
- Readings in classical sources on preservation
- Theories and levels of preservation
- Ruins and archaeological sites
- Heritage and development
- Building and urban conservation in Cairo
- Conservation terminology
- Waqf as a preservation institution
- Cities: museums and archives
- Methodologies and regional experiences in conservation

References

- TYLER, Norman. *Historic Preservation: An Introduction to its History Principles and Practice.* W.W. Norton, New York, 1999.
- FEILDEN, M Bernard. *Conservation of Historic Building*. Arch. Press, London, 2000.
- Getty, "*Nature of Conservation, a Race Against Time*"
- Getty. "*Historical and Philosophical Issues*," (ARCE/n8555H57, 1996)
- Massari (ARCE/TH9031M2813, 1977)
- *Conservation of Historic Stone Buildings and Monuments* (ARCE/TH3411C65, 1982)

- *Static Restoration of Monuments* (ARCE/TH1095L59, 1982)
- David Dean, *Museum Exhibition*, (ARCE/AM151D43, 1994)
- Aga Khan (ARCE/NA109T9C65, 1980).
- Meinecke (ARCE/NA109E39I84, 1980)
- Mahdy, *A Glossary of Arabic Terms for the Conservation of Cultural Heritage*. A downloadable PDF from www.iccrom.org

Course Code : **AR 791**

Course Title : **Practical Research 1**

Credit Hours : **3**

Course Description

This course introduces graduate students to research processes in architecture, research paradigms, relationships to theories, research designs, sampling and research instrument design, and qualitative and quantitative analytical methods. Finally, the student makes a proposal presentation to explain his/her research project. The required research project should cover an environmental problem. After presentation and discussion the department may accept the student's proposal, refuse it or redirect him/her to the correct track to cover one of the branches of the post-graduate studies in the department.

Course Objectives

The student should be able to compose knowledge in the area of interest and conduct research skill of selective advanced topic in architecture and related disciplines to integrate knowledge and practice research skills (under supervision).

Course Topics

- An introduction discussing the idea
- The questions and assumptions of the study
- Statement of the problem
- The main objectives
- Research delimitation
- Significance of the study
- The skeleton of the study
- Research methodology
- References

References

- Huck, S., Cormier, W., and Bounds, W. (1974). *Reading Statistics and Research*, Harper and Row, NY
- Judd, C., Smith, E., and Kidder, L. (1991). *Research Methods in Social Relations*, Holt, Rinehart, and Winston, NY
- Leedy, P. (1993). *Practical Research: Planning and Design.* Macmillan, NY
- Miles, M. and Huberman, A. (1994). *Qualitative Data Analysis*. Thousand Oaks, CA: Sage
- Patton, M. (2002). *Qualitative Research and Evaluation Methods*. Thousand Oaks, CA: Sage

Course Code : **AR 792**

Course Title : **Practical Research 2**

Credit Hours : **3**

Course Description

The student should select a topic related to his branch (Architectural Design, Urban Design or Project Management) in order to cover all the project fields. He/ She should practice presentation and discussion about the topic in different stages including the processes of research design, data collection and analysis, and paradigm adjustment under advice and supervision of course instructor. Finally the student shall make a presentation and the accepted protocol should be approved by the department council.

Course Objectives

The course aims to present the development of research with continued topic. Practice analysis, test, develop and conclude applied advanced specific research in architecture using measurements of reliability, validity, research implications and research recommendation to compose body of knowledge and create innovation under supervision of course instructors.

Course Topics

- How to research in a special problem according to the student's interest under supervision of advisor
- How to present and discuss research at different stages including conclusion and completion of research under advice and supervision of course instructor
- Approved proposal

References

- Groat, L. and Wang, D. (2002). Architectural Research Methods. Wiley, NY
- Huck, S., Cormier, W., and Bounds, W. (1974). Reading Statistics and Research, Harper and Row, NY
- Judd, C., Smith, E., and Kidder, L. (1991). Research Methods in Social Relations, Holt, Rinehart, and Winston, NY
- Leedy, P. (1993). Practical Research: Planning and Design. MacMillan, NY
- Miles, M. and Huberman, A. (1994). Qualitative Data Analysis. Thousand Oaks, CA: Sage.

Course Code : **CB 711**

Course Title : **Value Engineering in the Construction Industry**

Credit Hours : **3**

Course Description

Development of value engineering concept: its history, definitions, incentive provisions and applications. Value engineering methodology and tools: functional analysis; level of abstraction and alternative evaluation techniques. The process and procedures of a value study. Whole life cycle costing and its effect of value engineering. Case studies and applications.

Course Objectives

To provide students with and understanding of the concepts of value engineering and its applications in the construction industry.

Course Topics

- Value engineering concepts and definitions
- Value engineering study process and procedures
- Function analysis
- Level of abstraction and selection of alternatives
- Evaluation techniques
- Presenting value studies
- Whole life cycle costing
- Construction case studies and applications

References

- Dell'Isola, A. "*Value Engineering: Practical Applications for Design, Construction, Maintenance and Operations*", MRS. Means Company Ltd, 1997.
- Kelly, J., Male, S. and Graham, D. "*Value Management of Construction Projects*" Blackwell Sciences, 2004.
- Parker, D. E., "*Management Application of Value Engineering: For Business and Government*", The Value Foundation, Washington D.C., 1994.
- Kumar, S., "Val*ue Engineering: A Fast Track to Profit Improvement and Business Excellence*", Narosa Publishing House, 2004.
- Barrie, D. S. and Paulson, B. C., "*Professional Construction Management*", McGraw-Hill, 1992.

Course Code : **CB 712**

Course Title : **Advanced Construction Management**

Credit Hours : **3**

Course Description

General characteristics of the construction industry and the general aspects and nature of construction management. Further management and business topics include: strategic management; risk management; human resources management; health and safety in construction; organizational behavior; business performance management; quality management, environmental management and process management.

Course Objectives

To develop an understanding of general management and business topics relating to construction.

Course Topics

- Characteristics of the construction industry
- Aspects and nature of construction management
- Strategic management
- Risk management
- Human resources management
- Health and safety in construction
- Organizational behavior
- Business performance management
- Quality management
- Environmental management
- Process management

References

- Ellis, R. and Fryer, B. G., "*The Practice of Construction Management*", Blackwell Publishing, 2004.
- Ritz, G. J., "*Total Construction Project Management*", McGraw Hill Co., New York, 1994.
- Harris, F. and McCaffer, R. "*Modern Construction Management*", Blackwell Sciences, Oxford, 2001.
- Coble, R. J., Haupt, T, C. and Hinze, J. "T*he Management of Construction Safety and Health*", Balkema, Rotterdam, 2000.
- Cooper, R. et al., "*Process Management in Design and Construction*", Blackwell Publishing, Oxford, 2004.

Course Code : **CB 717**

Course Title : **Project Planning and Control**

Credit Hours : **3**

Course Description

Advanced planning and scheduling methods in construction. Scheduling with resource constraints and under uncertainty, and line-of-balance. Cost planning in projects and design of costing systems. Acceleration of construction projects. Control of time and costs in construction projects. Forecasting and controlling cash flows of projects. Earned-value systems in controlling construction projects.

Course Objectives

To provide students with advanced knowledge and skills concerned with planning and control of construction projects.

Course Topics

- Advanced planning and scheduling methods in construction
- Resource constrained scheduling, probabilistic scheduling and line-of-balance.
- Cost planning and design of costing systems in construction projects
- Acceleration of construction projects
- Tracking project progress – time and costs
- Forecasting and controlling project cash flows
- Earned-value systems in controlling construction projects

References

- Oberlender, G. D., "*Project Management for Engineering and Construction*", McGraw-Hill, New York, 2000.
- Hinze, J., "*Construction Planning and Scheduling*", Prentice Hall, New York, 2003.
- Cooke, B. and Williams, P. "*Construction Planning, Programming and Control*", Blackwell Publishing, Oxford, 2004.
- Halpin, D. W., Woodhead, R. W. "*Construction Management*", Wiley, New York, 1997.
- Barrie, D. S. and Paulson, B. C., "*Professional Construction Management*", McGraw-Hill, 1992.

Course Code : **CB 710-C**

Course Title : **Construction Productivity**

Credit Hours : **3**

Course Description

Factors affecting productivity. Productivity engineering and management. Productivity measurement. Work study. Method study. The total productivity model. Optimum allocation of resources. Productivity improvement techniques, technology based, material based, employee based, product based, and task based.

Course Objectives

To provide a knowledge of the productivity concepts and in the construction industry.

Course Topics

- Productivity engineering and management
- Factors of productivity
- Productivity measurement methods
- Total productivity model
- Optimum allocation of resources
- Productivity improvement techniques

References

- Adrian, J., "*Construction Productivity: Measurement and Improvement*", Stipes Pub., 2004.
- Olomolaiye, P., Jayawardane, A., and Harris, F. C., "*Construction Productivity Management*", Longman and Chartered Institute of Building, 1998.
- Oglesby, P. and Howell, G. "*Productivity Improvement in Construction*", McGraw Hill, 1994.
- Pilcher, R., "*Principles of Construction Management*", McGraw-Hill, 1992.

Faculty Members

(in alphabetical order)

- **ABBAS YEHIA,** Head of Department
  D.P.L.G. (1969) Beaux-Arts Paris, France
  D.I.U.P. (1967) Institut d'Urbanisme, Paris, France
  Architecture and Urbanism

- **ADEL EL-MENSHAWY**
  Ph.D. (1997), Alexandria University, Egypt
  Tourism Urbanization

- **AHMED B. ELSERAGY**
  Ph.D. (2003) University of Nottingham, UK
  Sustainable Architecture and Environmental Design

- **ALAA-ELDIN SARHAN**
  Ph.D. (1994) Alexandria University, Egypt
  Architecture and Urban Design

- **AMAL MAMDOUH**
  Ph.D. (2004) Alexandria University, Egypt
  Child Educational Environment

- **AMIRA ELNOKALY**
  Ph.D. (2004) University of Nottingham, UK
  Sustainable Architecture and Environmental Design

- **GIHAN MOSAAD**
  Ph.D. (2002) Alexandria University, Egypt
  Sustainable Architecture and Environmental Design

- **MAY A. YEHIA**
  Ph.D. (2007) Alexandria University, Egypt
  Architecture and Urban Design

- **MOHAMED A. ELHAMY**
  Ph.D. (2002) Alexandria University, Egypt
  Architectural Design and Theories of Architecture

- **MOHAMED EL-KOFTANGUI**
  Ph.D. (1991) Université de Toulouse, France
  Environmental Engineering

- **MOHAMED GOMAA**
  D.P.L.G. (1982) Beaux-Arts Paris, France
  Architecture and Urban Design

- **MOHAMED WAHBA**
  Ph.D. (2002) Alexandria University, Egypt
  Urban Design

- **MOSTAFA GABR**
  Ph.D. (1990) Edinburgh University, UK
  Landscape Architecture

- **RANIA ABDELGALIL**
  Ph.D. (2007) Sheffield University, UK
  Sustainability, North and South Divide

- **SHERINE SHAFIK ALY**
  Ph.D. (2008) Alexandria University, Egypt
  Sustainability and Urban Design

- **WAEL M. HASSAB**
  Ph.D. (2004) Alexandria University, Egypt
  Environmental Architecture

- **YASSER FARGHALY**
  Ph.D. (2005) Alexandria University, Egypt
  Architectural Education

COMPUTER ENGINEERING

M.ENG. PROGRAM

M.Eng. in Computer Engineering

OVERVIEW

The Department of Computer Engineering is part of the College of Engineering and Technology, at the Arab Academy for Science, Technology and Maritime Transport. It offers a graduate program of study for men and women who will engage in the professional practice of computer engineering as it relates to design, development, research, other engineering functions, and teaching in industry, government, or a university.

In this specialization, students learn to:

- Design special and general-purpose processors
- Design digital systems
- Design communications' protocols for the Internet
- Write computer programs for various applications
- Design systems for data acquisition
- Design Micro-controller-based applications

The responsibilities of the graduate of the computer engineering program encompass:

- Specifying the most suitable computer equipment for a certain function,
- Offering opinion and consultation in the field, supervising computer installations and operations, planning their sites and environment
- Designing and implementation of software packages in data communication and other applications.
- Designing and implementing special purpose processors and interface cards

The major consulting activities of the department include feasibility studies, analysis, design and specifications of Information Systems:

HARDWARE-ORIENTED APPLICATIONS

- Design and Implementation of Interface cards
- Special-purpose processor design and implementation using FPGA and ASIC
- Realization of embedded systems used in control applications
- Data Acquisition Systems
- Computer-based digital control and Robotics
- Computer-based security systems

SOFTWARE-BASED APPLICATIONS

- Analysis, design and implementation of Data Base systems
- Intelligent Systems analysis and design
- Applications of Artificial Neural Networks
- Analysis and design of Local Area Networks
- Internet-based applications and web programming
- Micro-controller programming
- Digital signal processing
- Data Communication Security

OPTIONS OF THE MASTER'S PROGRAM

Master's degree students may choose one of two graduate degrees offered by the computer engineering department:

1. MASTER OF SCIENCE IN COMPUTER ENGINEERING (THESIS OPTION)

In order to earn the Master of Science (M.Sc.) degree, the student must achieve 24 credit hours of coursework and a thesis equivalent to 12 credit hours. The coursework requires a total of eight 700-level courses: 4 core courses and any 4 courses from the elective group.

2. MASTER OF ENGINEERING IN COMPUTER ENGINEERING (COURSEWORK NON-THESIS OPTION)

In order to earn the Master of Engineering (M.Eng.) degree, the student must achieve 30 credit hours of coursework. This coursework requires a total of ten 700-level courses: 4 core courses and any 6 courses from the elective group. The holder of the M.Eng. degree cannot apply for a Ph.D. program in Egypt.

Program Detailed Structure

M.ENG. PROGRAM

CORE COURSES:

Course Code	Course Title	Credit Hours
CC 711	Advanced Programming Languages	3
CC 721	Advanced Computer Architecture	3
CC 731	Computer Networks and Security	3
CC 741	Systems Science and Engineering	3
Subtotal	**4 Courses * 3 Credit Hours**	**12**

ELECTIVE COURSES:

Course Code	Course Title	Credit Hours
CC 712	Advanced Database Systems	3
CC 713	Software Engineering	3
CC 714	Computer Systems Security	3
CC 715	Neural Networks Systems	3
CC 716	Pattern Recognition	3
CC 722	Advanced Digital Systems	3
CC 723	Embedded Systems Design	3
CC 725	VLSI System Design	3
CC 727	Application-Specific Architectures	3
CC 729	Computer Design and Performance Evaluation	3
CC 732	CAD for Computer Communications Networks	3
CC 733	Analysis and Design of Computer Networks	3
CC 734	Network Security	3
CC 735	Sensor Networks	3
CC 737	Mobile, Wireless and Ad-Hoc Networks	3
CC 742	Real-Time Systems	3
CC 743	Data Compression and Image Processing	3
CC 746	Multimedia Engineering	3
CC 747	Advanced Computer Controlled Systems	3
CC 753	Advanced Topics in Artificial Intelligence	3
CC 755	Distributed and Parallel Systems	3
CC 756	DSP Hardware and Software System Design	3

continued/…

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CC 757	Modeling and Simulation	3
CC 758	Advanced Applications of Digital Signal Processing	3
CC 759	Advanced Robotics	3
CC 760	Computer Engineering Seminars	3
Subtotal	**6 Courses * 3 Credit Hours**	**18**

Total	**30**

Students in the M.Eng. program are required to select 2 courses from the list of elective courses in place of the thesis hours. Thus, the M.Eng. Program student must successfully pass six elective courses in addition to the four core courses bringing the total credit hours of the program to 30 hours.

Courses

Course Code : **CC 711**

Course Title : **Advanced Programming Languages**

Credit Hours : **3**

Course Description

Different paradigms of programming languages. Introduction to programming languages, history of programming languages, language design principles, syntax, basic semantics, data types, control and abstract data types. Difference between object oriented, functional logic, parallel programming and visual programming.

Course Objectives

To introduce the major principles and concepts underlying all programming languages with no concentration on one particular language.

Course Topics

- History and Programming Languages
- Language design principles
- Syntax
- Basic Semantics
- Data Types
- Control
- Abstract Data Types
- Object Oriented Programming
- Functional Programming
- Logic Programming
- Parallel Programming
- Visual Programming

References

- Kenneth Louden, "*Programming Languages: Principles and Practice*", 2nd edition, 2002.
- Raphael A. Finkel, "*Advanced Programming Languages Design*", Addison Wesley, 1995.
- Ravi Sethi, "*Programming Languages, Concepts and Constructs*", Addison Wesley, 2000.
- IEEE Transactions on Software Engineering
- R. C. Martine, *Agile Software Development, Principles, Patterns, and Practices*, Prentice Hall 2002.
- R. Sebesta, *Concepts of Programming Languages*, Addison Wesley, 2003.
- Peters Van Ray, Seif Haridi, *Concepts, Techniques, and Models of Computer Programming*, MIT Press, 2004.

Course Code : **CC 712**

Course Title : **Advanced Database Systems**

Credit Hours : **3**

Course Description

This course introduces material related to current advancements and research topics in the area of distributed heterogeneous database.

Course Objectives

To be able to write survey papers covering a contemporary topic, and implement software tools to enable exchanges among heterogeneous database systems.

Course Topics

- Heterogeneous Database Systems
- Data Warehouse and Data Mining
- Database and World Wide Web
- Object Database
- Active, Temporal, and Deductive Database
- Client Server and Distributed Database Systems
- Digital Library and Multimedia Database

References

- Ramez ElMasri, Shamkant B. Navathe, "*Fundamentals of Database Systems*", Addison Wesley, 2000
- Paolo Atzeni, S. Ceri, "*Database Systems*", McGraw-Hill, 2000
- Barry Eaglestone, Mick Riddley, "*Object Databases*", McGraw-Hill, 2000
- Ahmed Elmagarmid, "*Heterogeneous and Autonomous Database Systems*", Morgan Kaufmann Pub., 1999

Course Code : **CC 713**

Course Title : **Software Engineering**

Credit Hours : **3**

Course Description

This course introduces software engineering as a concept, software development and the development life cycle. It also introduces different topics of software engineering like software quality, reusability, reliability, maintenance, security, testing, and software psychology. Also requirement analysis software tools and software design topics explained.

Course Objectives

To introduce students to the systematic approach to development, operation, maintenance and retirement of software engineering and its different topics.

Course Topics

- Software Development Life Cycle
- Systems Analysis "Requirement Analysis and Specification"
- Systems Design and Functional Oriented and Object Oriented
- Validation and Verification
- Software Maintenance
- Project Management
- Software Quality
- Software Reliability
- Software Reusability
- Computer Aided Software Engineering (CASE) Tools
- Software Engineering

References

- IAN Sommerville, "*Software Engineering*", 7th Edition, Addison Wesley, 2004.
- Randall W. Jensen, "*Software Engineering*", Prentice Hall, 1979.
- Hans Van Villet, "*Software Engineering: Principle and Practice*", J. Wiley, 2nd edition, 2000.
- IEEE Transactions on Software Engineering
- ACM publications
- Roger, Pressman, *Software Engineering: A Practitioner Approach*, McGraw Hill, 2004.

Course Code : **CC 714**

Course Title : **Computer Systems Security**

Credit Hours : **3**

Course Description

Conventional encryption (classical and modern algorithm techniques), public-key cryptography, number theory, message authentication and hash functions, hash and MAC algorithm, digital signatures and authentication protocols, mail security, IP security, web security, system security firewalls, projects for teaching cryptography and network security.

Course Objectives

To provide a practical survey of both the principles and practice of cryptography and network security including practical applications previously implemented in encryption techniques and firewalls.

Course Topics

- Network Security Practice
- Encryption Algorithms and Cryptography
- System Security
- Research Projects and Programming Projects
- Internet Security
- Cryptography and Data Security
- Cryptography and Network Security
- Maximum Security (Anonymous)
- Web Security
- Computer Security Policies
- Disappearing Cryptography

References

- William Stallings, "*Cryptography and Network Security: Principles and Practice*", 2nd Edition, 1998.
- K. M. Jackson and Jottruska, "*Computer Security Reference Book*", Linarce House, 1992
- Bruce Schneier, *Applied Cryptography*, John Wiley, 1996

Course Code : **CC 715**

Course Title : **Neural Networks Systems**

Credit Hours : **3**

Course Description

Introduction to intelligent systems. How does the brain of humans work? Parallel processing through multi nodes and nontraditional processing approach are clarified. Applications in various fields.

Course Objectives

- Introduce main ideas of Neural Networks.
- Construction and concepts.
- Learning as important in the paradigm is considered.

Course Topics

- Introduction
- Theoretical Foundations of Neural Networks
- Networks Approximation and Learning
- Overview of Back propagation and its variants
- Convergence properties of Hopefield model
- Decision regions of multilayer perceptrons
- Entropy nets: From decision trees to Neural Networks
- Applications

References

- No specific references

Course Code : **CC 716**

Course Title : **Pattern Recognition**

Credit Hours : **3**

Course Description

This course provides in-depth review of various methodologies and techniques used in pattern recognition. This includes: feature extraction, reduction and representation to building complex algorithms for handling problems of data analysis. Concepts used in structural and statistical pattern recognition are also explored.

Course Objectives

To introduce the student to the analysis of difficult data structures, for which no prior models is available in order to be able to grasp basic techniques and learn where to learn more about advanced application-specific techniques.

Course Topics

- General approaches: learning from examples, measurements and features
- Classification Problem
- Clustering techniques
- Structural Pattern Recognition
- Statistical Pattern Recognition
- Image Analysis
- Advanced Applications

References

- R. O. Dude, P.E. Hart and D. G. Stork, *Pattern Classification*, 2nd edition, 2001.
- IEEE. Transactions on Pattern Analysis and Technique Intelligence.
- Journal of Pattern Recognition.
- Journal of Pattern Recognition Letters.
- S. Theodoris, and K. Koutroumbas, *Pattern Recognition*, Academic Press, 1999.

Course Code : **CC 721**

Course Title : **Advanced Computer Architecture**

Credit Hours : **3**

Course Description

Overview of parallel architectures and programming techniques, parallel processes, models and semantics, parallel, concurrent and distributed programming. Task scheduling, shared memory parallel programming, complexity aspects, parallel processor design considerations, and pipelined processor design consideration, special-purpose parallel architecture design

Course Objectives

To introduce first-year graduate students in computer science and computer professionals to the theory and applications of advanced parallel architectures and programming.

Course Topics

- Parallel Computational Models
- Parallel Processors Design Considerations
- Instruction-Level Parallel Processor (ILP)
- Thread and Process-Level Parallel Architecture

References

- Michael Flynn, Jones and Bartlett, "*Computer Architecture, Pipelined and Parallel Processor Design*", Computer Science series, 1995
- Krishnamurthy, "*Parallel Programming: Principles and Practice*", 1989
- S. G. Shiva, "*Pipelined and Parallel Computer Architectures*", Addison Wesley, 1997
- Khatanga, "*Parallel and Cluster Computing: Scalable Architecture*", 1998
- W. Petersen, P. Arbenz, "*Introduction to Parallel Computing*", Oxford University Press, 2004
- Deszso Sima et al., *Advanced Computer Architectures*, Addison Wesley, 1997

Course Code : **CC 722**

Course Title : **Advanced Digital Systems**

Credit Hours : **3**

Course Description

This course introduces a range of aspects of advanced digital design. It starts with an introduction to the VHDL, Verilog and ABEL hardware description languages. The course provides techniques for designing and implementing synchronous and asynchronous digital circuits. It explains briefly the various design parameters and tradeoffs such as area, timing and cost of die. Advanced processor design paradigms and architectures such as dataflow, reconfigurable, asynchronous and processor-in-memory are also discussed.

Course Objectives

To become familiar with the major principles and concepts including all aspects of synchronous and asynchronous digital circuit design with emphasis on new processor design paradigms.

Course Topics

- The VHDL, Verilog, and ABEL language constructs and applications
- Design tradeoffs such as area, time, and cost
- Asynchronous circuit design fundamentals
- Static dataflow structures
- Handshake implementations
- Processor design and implementation

References

- J. Spareso, S. Furber, *Principles of Asynchronous Circuit Design*, Kluewer Academic Publishers, 2001.
- J. Silc, B. Robic, T. Ungerer, *Processor Architecture,* Springer-Verlag, 1999.

Course Code : **CC 723**

Course Title : **Embedded Systems Design**

Credit Hours : **3**

Course Description

Processors, chipsets, busses, and I/O devices for high-end embedded systems. Embedded operating systems; device drivers and applications for embedded systems.

Course Objectives

To present the theory and tools of Embedded systems and invoke students in different aspects of Embedded system design through projects.

Course Topics

- Introduction to Embedded Systems
- Embedded Products (PDAs, Transaction Terminals, Industrial PC Controllers)
- Hardware for Embedded Systems Design
    - Processors and Chipsets
    - X86 ISA - I/O devices and interfaces
    - Common Bus Standards and Interfaces (ISA, PCI, AGP)
    - Programmed I/O - Interrupts
    - DMA - Example Design (i.e. Celeron motherboard)
- Software for Embedded Systems Design
    - Role of an Embedded Operating System
    - Multitasking and Threads
    - Example Operating Systems (Windows CE, NT embedded, Linux, BOS, Wind River)
    - Overview of Windows CE
- Proposed Project Design Review
- Design Project Implementation
- Project Demo and Presentation

References

- J. Henkel and S. Parameswaran, *Designing Embedded Processors: A Low Power Perspective*. 2007
- Herman Kopetz, *Real-Time systems: Design Principles for Distributed Embedded Applications*, Springer, 1997

Course Code : **CC 725**

Course Title : **VLSI System Design**

Credit Hours : **3**

Course Description

This course focuses on a range of current VLSI design methods, testing and design-for-test techniques. The course presents designs for datapath subsystems including adders, shifters, multipliers, counters and others. Moreover, the course describes memory subsystems and special-purpose subsystems including clocking, I/O, mixed-signal blocks and routing techniques.

Course Objectives

To become versed in VLSI design to face the encountered growing challenges of power consumption and productivity of CAD tools.

Course Topics

- Logic Verification Principles
- Manufacturing Test Principles
- Datapath Subsystems
- Memory Subsystems
- Special-purpose Subsystems
- Analog Circuits
- Power Dissipation
- Clock Generation and Distribution

References

- N. Weste, D. Harris, "*CMOS VLSI Design: A Circuits and Systems Perspective*", Addison Wesley, 2005.
- N. Weste, K. Eshraghian, "*Principles of CMOS VLSI Design*", 2nd Ed., Addison Wesley, 1993.
- R. Troutman, "*Latchup in CMOS Technology: The Problem and its Cure*", Kluwer Academic Publishers, 1986.

Course Code : **CC 727**

Course Title : **Application-Specific Architectures**

Credit Hours : **3**

Course Description

This course tackles the micro-architectures that are non Von Neumann architectures. These architectures are dataflow, processor-in-memory, reconfigurable computing and asynchronous processor approaches. The course also discusses special-purpose architectures

Course Objectives

To become familiar with the design principles associated with non von Neumann architectures, and special-purpose machine design.

Course Topics

- Basic Pipeline and Simple RISC Processors
- Dataflow Processors
- Processor in Memory (PIM)
- Asynchronous Processors
- Artificial Neural Net (ANN)
- Reconfigurable Processors
- Finite Element and Finite Difference Processors
- Steganographic Processor
- Encryption Processors
- Genetic Optimization Processors
- Design Project

References

- J. Sparso, S. Furber, "*Principles of Asynchronous Circuit Design: A Systems Perspective*", Kluwer Academic Publishers, 2001
- J. Silc, B. Robic, T. Ungerer, "*Processor Architecture: From Dataflow to Superscalar and Beyond*", Springer Verlag, 1999.
- M. J. Flynn, "*Computer Architecture, Pipelined and Parallel Processor Design*", Jones and Bartlett Publishers, Subury, 1995.

Course Code : **CC 729**

Course Title : **Computer Design and Performance Evaluation**

Credit Hours : **3**

Course Description

This course compares between the two major design methodologies based on ISA (Instruction Specific Architecture) and Special-purpose Architecture. The course covers the topics of queuing theory and Markov processes as a tool for computer system performance evaluation. Moreover, the students are introduced to operational analysis techniques regarding performance of computer systems. The course introduces the student to the principles of design, build and test of special-purpose processors. Moreover, the students are introduced to the concepts of evaluating the performance of such processors. It is intended for first year graduates specializing in computer engineering. These include Markov continuous and discrete processes. Benchmarking processor and computer system architectures have become extremely difficult due to the complexity of the processors and the complexity of the applications that run on the computers. This course will focus on quantitative and analytical characterization of processors and applications from general purpose and scientific computing. Several papers from recent computer architecture, performance evaluation, and workload characterization related conferences will be used as supplemental material.

Course Objectives

To become familiar with the principles of design, build and test of special-purpose processors, and to be able to evaluate the performance of such processors.

Course Topics

- Introduction to ISA-based Computer Design, Sequencing and Control
- Hardwired and Micro-Programmed Control
- Pipelined Control and Performance Evaluation
- Instruction Set Architecture and Addressing Architecture
- Central Processing Unit Design
- High Performance CPU Concepts
- Design Parameters; Area, Time, and Cost
- Operational Analysis
- M/G/1 Queuing Model
- Discrete-Time Markov Chains
- Benchmark System Evaluation
- Design Project

References

- Mano, M. M., *Computer System Architecture*, 3rd Ed. Englewood Cliffs, NY, Prentice Hall, 1993.
- Patterson, D.A., and Hennessy, J. L., *Computer Organization and Design: The Hardware/Software Interface*, 2nd Ed., San Francisco, CA: Morgan Kaufmann, 1998

- Desrochers, G. R, *Principles of Parallel- and Multi-Processing*, McGraw-Hill, 1989.
- Hayes, J.P., *Computer Architecture and Organization*, McGraw Hill, 1998.
- David Lilja, "*Measuring Computer Performance: A Practitioner's Guide*", Cambridge, University Press, 2000.
- A Collection of papers from conferences and journals. Reading list to be posted on course web page.

Course Code : **CC 731**

Course Title : **Advanced Computer Networks**

Credit Hours : **3**

Course Description

Fundamental concepts of computer network architectures and protocols with Internet as case study.

Course Objectives

To give the student the required background in the field of computer networks by studying the fundamental concepts of network architectures, protocols.

Course Topics

- Network architecture and protocols
- Network applications
- Transport Layer
  - Transport Protocol Mechanisms
  - Examples of Transport Protocols (UDP, TCP)
- Network Layer
  - Routing and IP
- Data Link Layer
  - ARQ protocols
- Physical Layer
- Internet case study

References

- Kurose and Ross, *Computer Networking: A Top Down Approach*, 4th Ed., Prentice Hall, 2007.
- Garcia, *Communication Networks: Fundamental Concepts and Key Architectures* (2nd ed.), McGraw Hill, 2003.
- Eric Maiwad, *Fundamentals of Network Security*, McGraw Hill
- William Stallings, *Data and Computer Communications*, 8th Ed., Prentice Hall, 2007

Course Code : **CC 732**

Course Title : **CAD for Computer Communications Networks**

Credit Hours : **3**

Course Description

The course illustrates how computer-aided-design (CAD) tools can be used to simulate computer communications networks and systems. A student hands on series of lab sessions will be used to demonstrate how the various properties of networks affect the quality of the service, and shows how modern computer-aided design (CAD) software can be used to evaluate and optimize the design of a communication networks in general.

Course Objectives

- To investigate the methodologies and algorithms used for designing and optimizing computer/communications networks.
- To focus on the algorithmic aspects of network design.
- To use various CAD tools for the analysis and evaluation of networks

Course Topics

- Modeling Networks as Graphs
  - Representations of Networks
  - Computational Complexity
- Fundamental Graph Algorithms
- Topological Design
- Algorithms
  - Flow Deviation Algorithm
  - Bertsekas-Gallager Algorithm
  - Generalized Cut-Saturation Algorithm for Distributed Computer
- Communications Network Optimization
- Communication Networks
  - Algorithm for the Access Facility Location Problem
  - Dimensioning Schemes
- Mesh Topology Optimization
- MENTOR Algorithm (Mesh Network Topology Optimization and Routing)
- CAD software to support the monitoring and analysis of networks

References

- IEEE/ACM Transactions on Networking
- IEEE/ACM Transactions on CAD and Modeling and simulation

Course Code : **CC 733**

Course Title : **Analysis and Design of Computer Networks**

Credit Hours : **3**

Course Description

To provide the advancements in research and technology of the field of computer networking to emphasize the hot research topics of the analysis, design, architecture and methodology of computer networking and their standards.

Course Objectives

- To build solid knowledge of network protocols, HDLC, X.25, Frame relay, ISDN, ATM implementation and performance evaluation.
- To highlight the research topics in these areas.

Course Topics

- Computer Networks Taxonomy
- WAN Protocol and Standards
- LAN Protocol and Standards
- MAN Protocol and Standards
- HDLC
- Routing Protocol and Congestion Control
- X.25
- Frame Relay
- ISDN
- ATM
- Student Seminars of Selected Topics

References

- Andrew S. Tanenbaum, "*Computer Networks*"
- William Stallings, "*Data and Computer Communication*", Pearson P. Hall, 2004
- IEEE/ACM Transactions on Networking

Course Code : **CC 734**

Course Title : **Networks Security**

Credit Hours : **3**

Course Description

Fundamental concepts of computer network security and computer networks security issues.

Course Objectives

To give the student the required background in the field of networks security by studying the fundamental concepts of security in network architectures, protocols and network management.

Course Topics

- Network Reconnaissance Techniques
  - Network Mapping and Vulnerability Assessment
- Network Security Problems and Schemes
- Identifying Threats to Network Devices
- Network Intrusion Detection Systems, Firewalls and VPN
- Network Security services and Tools
- Wireless Network Security
- Risk Analysis and Management

References

- Eric Maiwad, *Fundamentals of Network Security*, McGraw Hill
- William Stallings, *Cryptography and Network Security: Principles and Practice*, Prentice Hall

Course Code : **CC 735**

Course Title : **Sensor Networks**

Credit Hours : **3**

Course Description

Basics of sensor network communications. Applications, architectures, and communication protocols for sensor networks are treated in depth.

Course Objectives

- To become familiar with the basics of sensor network communications.
- To become versed in applications, architectures, and communication protocols for sensor networks in depth.

Course Topics

- Introduction
- Sensor Networks Architecture and Protocol Stack
- Factors influencing the design of sensor networks
- Sensor Network Applications
- Application Layer
- Transport Layer Protocols
- Routing Algorithms
- Medium Access Control Protocols
- Error Control Algorithms
- Physical Layer Solutions
- Localization and Target Detection Algorithms
- Time Synchronization Algorithms
- Sensor and Actor (Actuator) Networks
- Coordination and Communication Problems

References

- Holger Karl, A. Willig, *Protocols and Architectures for Wireless Sensor Networks*, Wiley, 2005.

Course Code : **CC 737**

Course Title : **Mobile, Wireless and Ad-Hoc Networks**

Credit Hours : **3**

Course Description

Mobile and wireless networking. Architectures and communication protocols for wireless local area networks, ad-hoc networks, cellular systems, WiMAX, and Wireless Mesh Networks.

Course Objectives

The student will be familiar with the fundamental concepts of mobile wireless networking and gain technical details of emerging wireless network standards.

Course Topics

- Wireless Sensor Networks
  - Network Architecture, Applications, Factors Influencing Network Design
  - Application Layer Framework, Transport Layer Solutions
  - Routing Algorithms, Medium Access Control Schemes, Error Control
- Ad Hoc Networks
  - Topologies and Characteristics, Routing Algorithms
  - Proactive and Reactive Routing Protocols
- Wireless Local Area Networks (WLANs)
  - Reference Architecture, Protocol Architecture
  - Family of Wireless LAN Standards and Details (IEEE 802.11; a; b; d; e; f; g; h; I; n)
  - Physical Layer Functions, CSMA and its Problems for WLANs, MAC Layer Solutions
- Wireless Personal Area Networks (Bluetooth)
- Mobile IP
  - Agent Discovery/Advertising Care-of Addresses
  - Registration, Tunneling (Encapsulation), Triangle Routing, Optimized Routing
  - Mobility Management, Handovers
- 2.5 Generation Wireless Systems (GPRS)
  - Reference Architecture, Devices and Terminal Types
  - Location Management and Handoffs in GPRS
  - Short Messages Services (SMS)
- Third Generation Wireless Systems
  - IMT-2000 (International Mobile Telephone)
  - UMTS (Universal Mobile Telephone Systems)
  - Evolution from 2G to 3G; Differences
- WiMAX
  - Motivation, Architecture and IEEE 802.16 Standards
- Wireless Mesh Networks
  - Architecture (Mesh Clients, Mesh Routers), WMNs vs. Ad Hoc Networks (Differences)
  - Application Scenarios, Critical Factors Influencing Network Design

- Physical Layer Solutions, Existing MAC Solutions, Routing Protocols, Research Challenges
- IEEE Standard Activities and their Status

References

- George Aggelou, *Mobile Ad Hoc Networks from Wireless LANs to 4G Networks*, McGraw-Hill, 2005.

Course Code : **CC 741**

Course Title : **Systems Science and Engineering**

Credit Hours : **3**

Course Description

This course introduces a range of techniques for analyzing continuous and discrete linear time invariant systems. It starts with a review to techniques of solving differential and difference equations using Fourier and the Z-transforms. Subsequently, the course veers to applications involving digital filter design. Afterward, it provides an introduction to the Discrete Fourier Transform (DFT), and Fast Fourier Transform (FFT) with various applications. In addition, the course introduces students to the theory and applications of wavelets transforms.

The course also covers the following bodies of knowledge: Phenomena of real world systems, different imposed boundary conditions as well as symbolic systems manipulations and analysis.

Course Objectives

To become familiar with the major principles and concepts behind discrete and continuous linear time-invariant system analysis with emphasis on wavelet theory and applications.

Course Topics

- Linear Systems and Signal Analysis
- Difference Equations
- The Z-transform
- Solution of D.E
- A/D Conversion
- Digital Filters
- Fourier Transform
- DFT, FFT
- Discrete Cosine Transform, Hartely Transform
- Wavelets (Haar, Daub, Coiflet, Gabor)

References

- N. Sinha, *Linear Systems*, Wiley, 1991.
- J. S. Walker, *The Fourier Transform*, 2nd Edition, McGraw Hill, 1992
- R.N. Bracewell, *The Fast Fourier Transform*, McGraw Hill, 2000
- J. S. Walker, *A Primer on Wavelets and Their Scientific Applications*, Chapman and Hall, 1999.

Course Code : **CC 742**

Course Title : **Real-Time Systems**

Credit Hours : **3**

Course Description

Real-time systems are characterized by the fact that it is not only the result of the calculation that is of importance but also the time when the result is available. A computer used for controlling a process is a good example of a real-time system. It must operate in a time-scale that is determined by the time scale of the process. At the same time it should be reactive to external events, often with time constraints on the reaction time.

Course Objectives

To study methods for design and implementation of computer control systems with focus on the application classes mentioned and to implement some systems in a project.

Course Topics

- Real-time programming
- Synchronization and mutual exclusion
- Real-time kernels and operating systems
- Periodic controller tasks
- Computer implementation of control algorithms
- Scheduling theory
- Formal methods
- Sequence control
- Set-point handling
- Industrial control systems
- Real-time communication

References

- Giorgio C. Buttazzo, "*Hard Real-time Computing Systems: Predictable Scheduling Algorithms and Applications* (Real-Time Systems Series)", Springer-Verlag Telos, 2nd Edition, 2004.
- Phillip A. Laplante, "*Real-Time Systems Design and Analysis*", Wiley-IEEE Press, 3rd Edition, 2004.
- Jane W. S. Liu, "*Real-Time Systems*", Prentice Hall, 1st Edition, 2000.

Course Code : **CC 743**

Course Title : **Data Compression and Image Processing**

Credit Hours : **3**

Course Description

Theory and algorithms of signal encoding and decoding for data compression. Applications in information systems, digital telephony, digital television, and multimedia Internet.

Course Objectives

- To cover the theory and algorithms of signal encoding and decoding for data compression.
- To study applications in information systems, digital telephony, digital television, and multimedia Internet.

Course Topics

- Introduction: signal compression, lossless and lossy compression
- Quantization theory
    - Uniform quantization, distortion and bit rates
    - Amplitude distribution and high-rate quantization theory
    - Bennett approximations and optimal performance, Lloyd's code optimality and algorithm
    - Elementary distortion-rate theory
- Architecture for data compression and introduction to data modeling
    - Signal models and spectral analysis
    - Quantization with memory
    - Fixed-rate vs. variable-rate code
    - Entropy, estimated entropy, complexity and typical sequence of an ergodic source
    - Variable rate quantization: lossless codes, prefix code
- Lossless Coding Techniques
    - Huffman coding, arithmetic coding
    - Universal lossless codes, adaptive and predictive lossless coding
- Distortion and Similarity Measures
    - Sample difference, sum of squared deviations and Euclidean distance
    - Lp-norm, city-block distance, Mahalanobis distance
    - Transformation and transformation invariant similarity measures
    - Spectral distortion measures
    - Mutual-information, divergence, and Kullback-Liebler number
    - Perceptual issues
- Coding algorithms scalar quantization
    - Clustering algorithms for quantizer design
    - The Lloyd algorithm and its generalization
    - Entropy-constrained quantizers
- Coding algorithms - vector quantization (VQ)
- Sphere packing and optimal uniform lattice quantizers
- Progressive vector quantization
- Variations of vector quantization

    - Finite-state VQ and Markov models
    - Tree and Trellis encoding
- Applications
    - Speech and audio coding
    - Image and video coding
- Compression standards and formats
    - Historical and evolutional aspects behind development of standards
    - Application areas

References

- K. Sayood, *Introduction to Data Compression* (2nd edition), Morgan Kaufmann, 2000.
- A. Gersho, R. M. Gray, *Vector Quantization and Signal Compression*, Kluwer Academic Press, 1992.
- Gibson, Berger, Lookabaugh, Lindbergh and Baker, *Digital Compression for Multimedia: Principles and Standards*, Morgan Kaufmann, 1998.

Course Code : **CC 746**

Course Title : **Multimedia Engineering**

Credit Hours : **3**

Course Description

Introduce multimedia concepts, how to build and face technical complications of multimedia. Design and implementation of multimedia facilities.

Course Objectives

To study the important and new technology of multimedia facilities and transmission.

Course Topics

- Multimedia Basics and Technology
- Steps to producing a multimedia application
- Staffing and skills for multimedia production
- Multimedia hardware
- Designing the application:
    - Graphic design
    - Capturing still images
    - Creating Full-Motion videos
    - Creating soundtracks and bringing all together with programming or authoring
- Object oriented multimedia programming

References

- No specific references

Course Code : **CC 747**

Course Title : **Advanced Computer Controlled Systems**

Credit Hours : **3**

Course Description

Introduction to the concepts of computer as a part of the system working as the brain which play the decision maker of the system.

Course Objectives

To study how to integrate the computer in controlling dynamic systems within system limitations and specific design conditions.

Course Topics

- Computer interfacing with systems.
- Operating systems for specialized computers.
- Time scheduling.
- Distributed computing using several processors.
- Hierarchical implementation of computer control.
- Case studies.

References

- *Computer-Controlled Systems: Theory and Design*, 3rd Ed., Prentice Hall, Information and SysScience Series.

Course Code : **CC 753**

Course Title : **Advanced Topics in Artificial Intelligence**

Credit Hours : **3**

Course Description

This course allows the introduction of material relating to current artificial intelligence research topics, and current advances in artificial intelligence technology.

Course Objectives

To write-up survey papers about a narrow topic, and implement software tools to practice the different advanced topics.

Course Topics

- Learning Systems
- Fuzzy Logic
- Genetic Algorithm
- Hybrid Intelligent Systems
- Case Based Reasoning
- Knowledge Discovery in Database Systems
- Intelligent Agents

References

- Russel, S., Peter Norvig, "*Artificial Intelligence: A Modern Approach*", 2nd ed., 2002.
- Elaine Riche, K. K, "*Artificial Intelligence*", McGraw Hill, 1983.
- M. T. Jones, *AI Applications Programming*, Charles Rives Media, 2003.

Course Code : **CC 755**

Course Title : **Distributed and Parallel Systems**

Credit Hours : **3**

Course Description

This course studies the fundamental aspects of distributed systems and applications. Early foundations and recent developments in distributed systems will be investigated. Both client-server and peer-to-peer application designs will be discussed. Other topics include sockets, reliability, replication, group membership protocols, clock synchronization, and logical timestamps.

Course Objectives

To introduce the students to the studies of distributed and parallel systems.

Course Topics

- Distributed architectures
- Communication among systems
- Naming
- Synchronization
- Consistency
- Replication
- Fault tolerance
- Distributed systems: object-based, file, web-based, coordination-based

References

- Andrew S. Tanenbaum, Maarten van Steen, *Distributed Systems: Principles and Paradigms*, Prentice Hall

Course Code : **CC 756**

Course Title : **DSP Hardware and Software System Design**

Credit Hours : **3**

Course Description

A study of theory and practice in the design and implementation of DSP algorithms on programmable processors, multiprocessors, and ASICs. Specification, evaluation, and implementation of real time DSP applications on embedded DSP-based environments.

Course Objectives

- To study the theory and practice in the design and implementation of DSP algorithms on programmable processors, multiprocessors, and ASICs.
- To present the specification, evaluation, and implementation of real time DSP applications on embedded DSP-based environments.

Course Topics

- Introduction to Programmable DSPs
  - Skillikorn's taxonomy and classification
  - Architectures of DSP; Examples of DSPs
  - Memory architectures; External interface units
- Data Path Design for DSP
  - SISC architectures; Reservation tables and optimization
  - Pipeline control; Synchronous data path design and retiming
  - Arithmetic circuits for DSP; Multiprocessor scheduling theory
- DSP ASIC design and VHDL
  - Introduction to VHDL and Language Fundamentals
  - Modeling DSP data and control path in VHDL
- DSP Chip Synthesis
  - Design recommendations; Compilation and coding issues
  - Joint simulation and synthesis issues
  - Synthesis Examples
  - DSP processor design
- Specification of DSP algorithms and processors
  - Programming models and virtual machines
  - Graphical specification and requirements capture
  - Textual specification and requirements capture
  - Compilation and execution environments
  - Fixed point and floating point issues
- Software architecture for DSP boards and systems
  - Host interfaces
  - I/O interfaces
  - Real-time operating systems
- DSP program framework and API
- Real-time program architecture
- Operating system dependencies
- Application modules and libraries
- Implementation of virtual machines

- Virtual prototyping of DSP applications: Examples
  - Single processor implementations
  - Multiprocessor implementations
  - Code development and debugging
- DSP Application Demonstrations
  - Sample implementations: equalizers, coders.
  - Performance measurement and optimization

References

- Meyer-Baese, Uwe, *Digital Signal Processing with Field Programmable Gate Arrays* (2nd edition), Springer-Verlag, 2004.

Course Code : **CC 757**

Course Title : **Modeling and Simulation**

Credit Hours : **3**

Course Description

To emphasize the topics of fundamental importance concerning the broad field of modeling and simulation to demonstrate the different stages included in conducting a simulation study, suing the discrete event simulation model.

Course Objectives

- To highlight system models and corresponding simulation methodology.
- To demonstrate the discrete event simulation model and its implementation.
- To discuss random number generators, generating random distributions, selecting input distributions, output analysis and comparing alternative system configurations.

Course Topics

- Systems Models and Simulation
- Discrete Event Simulation
- Single Server System
- M/M/1 Simulation
- Stage of Conducting a Simulation Study
- Random Number Generators
- Generating Random Distribution
- Selecting Input Probability Distribution
- Data Analysis of Simulation Outputs
- Building Valid and Credible Simulation Models

References

- Averill M. Low and W. David Kelton, "*Simulation Modeling and Analysis*", 1991
- IEEE Modeling and Simulation Transactions
- Barry L. Nelson, "*Stochastic Modeling: Analysis and Simulation*", 1995

Course Code : **CC 758**

Course Title : **Advanced Applications of Digital Signal Processing**

Credit Hours : **3**

Course Description

Discrete time transfer function, realization topology, IIR filter design, FIR filter design, DFT, FFT, Floating Point, sub-band transform and sub-band coding, sinusoidal signal generation, compression techniques, Multi-rate signal processing, Filter Banks, Wavelets and Applications to mp3 and JPEG 2000.

Course Objectives

To become versed in advanced techniques of filter and hardware design.

Course Topics

- Overview of DSP: LTI systems, Z-transform and DTFT.
- Connecting Analog and Digital Worlds: Sampling, A/D, D/A, Cost-Benefit trade-offs of over-sampling.
- Multi-rate signal processing.
- Filter Banks, Wavelets and Applications to mp3 and JPEG 2000.
- Overview of FIR and IIR filter design techniques.
- DFT, FFT, and role of DCT in MPEG and JPEG.
- Spectral Analysis.

References

- Oppenheim, Alan V., Schafer, Ronald W., and Buck, John R., "*Discrete-Time Signal Processing*," 2nd Edition, Prentice Hall, 1999.
- Proakis, John G., Manolakis, Dimitris G., "*Digital Signal Processing: Principles, Algorithms, and Applications*," 3rd Ed., Prentice Hall, 1996.
- Mitra, Sanjit K., "*Digital Signal Processing: A Computer-Based Approach*," 2nd Edition, McGraw Hill, 2001
- McClellan, James H., Schafer, Ronald W., and Yoder, Mark A., "*DSP First: A Multimedia Approach*," Prentice Hall, 1998
- G. Strang and T. Q. Nguyen, *Wavelets and Filter Banks*. Cambridge, MA: Wellesley-Cambridge Press, 1996

Course Code : **CC 759**

Course Title : **Advanced Robotics**

Credit Hours : **3**

Course Description

Robot algorithms are abstractions of for controlling motion and perception in the physical world. In this course the student will study advanced topics related to current research in robotics. Planning and control issues for realistic robot systems, taking into account: dynamic constraints, control and sensing uncertainty and non-holonomic motion constraints. Analysis of friction for assembly and grasping tasks. Sensing systems for hands including tactile and force sensing. Environmental perception from sparse sensors for dexterous hands. Grasp planning and manipulation.

Course Objectives

To explore the kinematics, dynamics, and control of robotic manipulators, and to briefly discuss other areas including machine vision, CAD and AI in recent research topics.

Course Topics

- Rigid Motion and Homogeneous transformations
- The Denavit-Hartenberg representation
- Inverse and velocity kinematics
- Dynamics
- Independent joint control
- Multivariate control
- Force control
- The feedback linearization
- Variable and adaptive control
- Optimal control
- Stochastic control
- Advanced research topics

References

- W. Chung, "*Nonholonomic Manipulators* (Springer Tracts in Advanced Robotics)", Springer Verlag, 2004.
- Thomas R. Kurfess, "*Robotics and Automation Handbook*", CRC Press, 2004.
- J. H. Kim, K. T. Seow, "*Soccer Robotics* (Springer Tracts in Advanced Robotics)", Springer-Verlag, 2004.
- M. W. Spong, *Robot Dynamics and Control*, Wiley, 1989.

Course Code : **CC 760**

Course Title : **Computer Engineering Seminars**

Credit Hours : **3**

Course Description

A series of seminars with topics related to different fields of computer engineering such as networking and computing fields: mobile ad hoc networks, voice and video over IP, state of the art in computer architecture design, etc…

Course Objectives

The student will gain knowledge about new trends in the field of computer engineering and be aware of the current research topics. The student will prepare a seminar on selected topic(s), present the seminar and get feedback from academic members and classmates.

Course Topics

- Voice and Video over IP
- MANET
- Cognitive Radio
- Computer vision
- System on a Chip

References

- According to the seminar subject

Faculty Members

(in alphabetical order)

- **ABD EL-BAES MOHAMED**
  Ph.D. (1992) Vienna University, Austria
  Computer System Security

- **FATMA ZADA**
  Ph.D. (1994) Mansura University, Egypt
  Intelligent Robotics

- **HESHAM EL-ZOUKA**
  Ph.D. (2006) University of Nottingham, UK
  Network Security

- **KHALID MAHAR**
  Ph.D. (1996) Cairo University, Egypt
  Image Processing, Pattern Recognition

- **MAGDY SAEB**
  Ph.D. (1985) University of California, Irvine, USA
  Advanced Computational Techniques

- **MEDHAT FAKHRY**
  Ph.D. (1982) Université Paul Sabatier, France
  Computer Database Systems Management

- **MEER HAMZA**
  Ph.D. (1998) Paisley University, UK
  Software Engineering

- **MOHAMED ABOU EL-NASR,** Head of Department
  Ph.D. (2003) Georgia Institute of Technology, USA
  Computer Networks Architecture, Security and Control

- **MOHAMED KHOLIEF**
  Ph.D. (2003) Old Dominion University, USA
  Digital Libraries, Database Systems and Web Applications

- **MOHAMED TAHER EL-SONNI**
  Ph.D. (1978) University of Illinois, Urbana-Champaign, USA
  Computer Architecture and Pattern Recognition

- **OSSAMA BADAWY**
  Ph.D. (1992) Ain Shams University, Egypt
  Intelligent Systems

- **OSSAMA ISMAIL**
  Ph.D. (1994) Queens University, Canada
  Robotics, Mechatronics, Computer Control

- **SHERIN YOUSSEF**
  Ph.D. (2004) University of Nottingham, UK
  Artificial Intelligence, Intelligent Mobile Agents, Swarm Intelligence

- **WAEL HOSNY**
  Ph.D. (2006) University of Western Ontario, Canada
  Feedback Control, Optical Burst Switching

- **YASSER HANAFY**
  Ph.D. (1995) Duke University, USA
  Computer Aided Design

CONSTRUCTION AND BUILDING ENGINEERING

M.ENG. PROGRAM

OVERVIEW

Construction is one of the largest nation's industries, encompassing an incredibly wide range of activities, from high-rise buildings construction to homes, from highways to power plants. Indeed modern construction projects have become so large, complex, expensive and time-consuming that special educational programs now are being offered to prepare students for entry into this important and challenging industry.

The mission of the Construction and Building Engineering Department at the AASTMT is to provide the educational, research, and training programs that serve both the needs of our students and those of the construction industry. The curriculum objective is to prepare individuals for a professional career in construction engineering and management and for continued learning through post-graduate education or self study.

The department offers a B.Sc., a diploma, and a Master's degree in Construction Engineering. As a student in construction engineering, you will learn to identify the best methods and techniques of construction, to determine construction costs and set schedules, to apply methods of quality control and to supervise construction projects.

The program is designed to prepare our students to become outstanding construction engineers, whose job is to devise and design construction facilities, coordinate and direct the efforts of labor and equipment, and control the time and cost demands of field operations.

As they gain experience, construction engineers become construction managers who combine engineering, management, and field construction skills in the administration and management of field construction.

Graduates of the Construction and Building Engineering degree program design and manage construction processes that create living and working environments such as office buildings, industrial buildings, airports, housing, roads, bridges, utilities, and dams. Graduates fill positions in construction companies, engineering consulting firms, government agencies, and large construction corporations. The positions usually involve the planning, design, and management of the construction process for a general, specialty, or mechanical contractor, or the coordination, inspection, and management of design, contracts, or facilities for a business, industry or government owner.

When you ask top managers in construction and engineering firms why they selected this career, you can hear the excitement of the construction industry in their responses. Some say they like to conceive an idea and then engineer and manage it through to reality. Others say that they like the combination of computerized planning, process design, cost engineering, and scheduling with the gratification of seeing a job well done.

Graduates of this degree program enjoy a wide range of opportunities to apply their technical knowledge with tremendous variety in the day-to-day work. Some choose design, planning, or financial management positions working in an office environment, while others prefer to direct field operations or some combination of the above.

Program Detailed Structure

M.Eng. Program

M.Eng. in Construction and Building Engineering

The courses of M.Eng. in Construction and Building Engineering are divided into the following 4 groups:

(A) Construction Engineering and Management
(B) Environmental, Water Resources and Coastal Engineering
(C) Geotechnical and Transportation Engineering
(D) Structural Engineering

All courses are elective. To earn the M.Eng. degree, a student must take a total of at least 10 courses (equivalent to 30 credit hours). The student can choose any number of courses from one (or more) group(s). If the student takes six (or more) courses from one group, this group will be the concentration area of his/her M.Eng. degree.

(A) Construction Engineering and Management Group

ELECTIVE COURSES:

Course Code	Course Title	Credit Hours
CB 710	Advanced Construction Engineering	3
CB 711	Value Engineering in the Construction Industry	3
CB 712	Advanced Construction Management	3
CB 713	Construction Equipment Management	3
CB 714	Advanced Systems Analysis for Construction Engineers	3
CB 715	Special Topics in Concrete Construction	3
CB 716	Estimating, Tendering and Contracting in Construction	3
CB 717	Project Planning and Control	3
CB 718	Financial Management in Construction	3
CB 719	Construction Economics and Feasibility Studies	3
CB 710-C	Construction Productivity	3
CB 713-C	Quality Management in Construction	3
CB 717-C	Information Technology Applications in Construction	3
CB 718-C	Health and Safety in Construction	3

(B) Environmental, Water Resources and Coastal Engineering Group

ELECTIVE COURSES:

Course Code	Course Title	Credit Hours
CB 720	Water Quality Management and Waste Water Treatment	3
CB 721	Air Pollution and Indoor Air Quality	3
CB 722	Management of Solid, Hazardous and Radioactive Waste	3
CB 723	Environmental Impact Assessment of Civil Engineering Projects	3
CB 726	Noise Pollution	3
CB 727	Marine Pollution	3
CB 729	Energy and Natural Resources Conservation	3
CB 763	Advanced Hydrology and Climatology	3
CB 764	River Engineering	3
CB 768	Water Resources Planning and Management	3
CB 769	Structures for Sustainable Water Resources Management	3
CB 763-I	Ocean and Coastal Processes for Project Engineers	3
CB 764-I	Hydrographic Surveying and Coastal Measurements and Analysis	3
CB 765-I	Management of Water Resources and Coastal Projects	3
CB 766-I	Integrated Management of Ports and Coastal Zones	3
CB 767-I	Port Planning and Development	3

(C) Geotechnical and Transportation Engineering Group

ELECTIVE COURSES:

Course Code	Course Title	Credit Hours
CB 731	Advanced Geotechnical Engineering	3
CB 733	Earth Works and Dewatering	3
CB 736	Foundation on Problematic Soils	3
CB 737	Piling Engineering	3
CB 738	Special Geotechnical Structures	3
CB 733-G	Elastic Analysis of Soil–Foundation Interaction	3
CB 751	Fundamentals of Traffic Flow Theories	3
CB 752	Structural Design for Highway and Airport Pavements	3
CB 753	Transportation Planning and Management	3
CB 756	Special Topics in Transportation and Highway Engineering	3
CB 758	Highway Construction and Management	3
CB 759	Traffic Engineering and Environment	3
CB 752-T	Advanced Construction Surveying	3
CB 753-T	Geographic Information Systems for Construction Engineering	3

(D) Structural Engineering Group

ELECTIVE COURSES:

Course Code	Course Title	Credit Hours
CB 740	Advanced Construction Materials	3
CB 741	Advanced Structural Analysis	3
CB 743	Concrete Durability	3
CB 744	Fiber Reinforced Composites	3
CB 745	Advanced Strength of Materials	3
CB 746	Advanced Design of Reinforced Concrete Structures	3
CB 747	Advanced Prestressed Concrete	3
CB 748	Repair of Concrete Structures	3
CB 749	Bridge Structures	3
CB 740-S	Finite Element Method	3
CB 741-S	Theory of Elasticity	3
CB 742-S	Plastic Analysis and Design of Structures	3
CB 743-S	Structural Dynamics and Earthquake Engineering	3
CB 744-S	Design of Special Metallic Structures	3
CB 745-S	Composite Structures	3
CB 746-S	Reliability in Civil Engineering	3

Courses

Course Code : **CB 710**

Course Title : **Advanced Construction Engineering**

Credit Hours : **3**

Course Description

Advanced topics in the area of construction engineering including underground construction: dewatering systems; shoring systems; and underpinning. Formwork systems in building construction: horizontal formwork; and vertical formwork systems. Cranes works. Belt-conveyor systems. Tunnel construction: driving tunnels in rock, drilling rock, drill jumbos, drilling patterns, and driving tunnels with tunnel-boring machines. Bridge construction: traditional construction; cantilever carriage method; and flying shuttering. Dam construction.

Course Objectives

To provide students with an understanding of advanced topics in the field of construction engineering: building construction; bridge construction; and tunnel construction.

Course Topics

- Underground construction including dewatering systems, shoring systems and underpinning.
- Formwork systems in building construction including horizontal and vertical formwork systems.
- Crane works in construction.
- Belt-conveyor systems.
- Tunnel construction: driving tunnels in rock; drilling rock; drill jumbos; drilling patterns; and driving tunnels with tunnel-boring machines.
- Bridge construction: traditional construction of bridges; cantilever carriage method; and flying shuttering.
- Dam construction

References

- Peurifoy, R. L. and Schexnayder, G. J., "*Construction Planning, Equipment, and Methods,*" McGraw Hill Co., New York, 2002.
- Peurifoy, R. L. and Oberlender, G. D., "*Formwork for Concrete Structures*", McGraw Hill Co., New York, 1996.
- Allen, E. and Iano, J., "*Fundamentals of Building Construction: Materials and Methods*", Wiley, New York, 2003.
- Nunnally, S. W., "*Construction Methods and Management*", Prentice Hall, 2003.
- Girmscheid, G. and Reilly, J., "*Fundamentals of Tunnel Construction*", Wiley, 2005.
- Institution of Civil Engineers, "*Current and Future Trends in Bridge Design, Construction and Maintenance: Safety, Economy, Sustainability and Aesthetics*", Thomas Telford, 2001.

Course Code : **CB 711**

Course Title : **Value Engineering in the Construction Industry**

Credit Hours : **3**

Course Description

Development of value engineering concept: its history, definitions, incentive provisions and applications. Value engineering methodology and tools: functional analysis; level of abstraction and alternative evaluation techniques. The process and procedures of a value study. Whole life cycle costing and its effect of value engineering. Case studies and applications.

Course Objectives

To provide students with and understanding of the concepts of value engineering and its applications in the construction industry.

Course Topics

- Value engineering concepts and definitions
- Value engineering study process and procedures
- Function analysis
- Level of abstraction and selection of alternatives
- Evaluation techniques
- Presenting value studies
- Whole life cycle costing
- Construction case studies and applications

References

- Dell'Isola, A. "*Value Engineering: Practical Applications for Design, Construction, Maintenance and Operations*", MRS. Means Company Ltd, 1997.
- Kelly, J., Male, S. and Graham, D. "*Value Management of Construction Projects*" Blackwell Sciences, 2004.
- Parker, D. E., "*Management Application of Value Engineering: For Business and Government*", The Value Foundation, Washington D.C., 1994.
- Kumar, S., "*Value Engineering: A Fast Track to Profit Improvement and Business Excellence*", Narosa Publishing House, 2004.
- Barrie, D. S. and Paulson, B. C., "*Professional Construction Management*", McGraw-Hill, 1992.

Course Code : **CB 712**

Course Title : **Advanced Construction Management**

Credit Hours : **3**

Course Description

General characteristics of the construction industry and the general aspects and nature of construction management. Further management and business topics include: strategic management; risk management; human resources management; health and safety in construction; organizational behavior; business performance management; quality management, environmental management and process management.

Course Objectives

To develop an understanding of general management and business topics relating to construction.

Course Topics

- Characteristics of the construction industry
- Aspects and nature of construction management
- Strategic management
- Risk management
- Human resources management
- Health and safety in construction
- Organizational behavior
- Business performance management
- Quality management
- Environmental management
- Process management

References

- Ellis, R. and Fryer, B. G., "*The Practice of Construction Management*", Blackwell Publishing, 2004.
- Ritz, G. J., "*Total Construction Project Management*", McGraw Hill Co., New York, 1994.
- Harris, F. and McCaffer, R. "*Modern Construction Management*", Blackwell Sciences, Oxford, 2001.
- Coble, R. J., Haupt, T, C. and Hinze, J. "T*he Management of Construction Safety and Health*", Balkema, Rotterdam, 2000.
- Cooper, R. et al., "*Process Management in Design and Construction*", Blackwell Publishing, Oxford, 2004.

Course Code : **CB 713**

Course Title : **Construction Equipment Management**

Credit Hours : **3**

Course Description

Factors affecting the selection of construction equipment. Fundamentals of construction equipment. Construction equipment costs, sizing operation and maintenance. Construction equipment productivity. Evaluation and selection of appropriate construction technology.

Course Objectives

To provide students with the fundamentals of equipment in the construction industry, and to acquaint students with the productivity of the major equipment used in construction.

Course Topics

- Factors affecting the selection of construction equipment.
- Fundamentals of construction equipment
- Construction equipment costs, sizing, operation and maintenance
- Construction equipment productivity
- Applications on excavation, concrete and road pavement equipment
- Evaluation and selection of appropriate construction technology

References

- Peurifoy, R. L. and Schexnayder, G. J., "*Construction Planning, Equipment, and Methods,*" McGraw Hill Co., New York, 2002.
- Edwards, D. G., Harris, F. C. and McCaffer, R., "*Management of Off-Highway Plant and Equipment*", Spon Press, 2003.
- Harris, F., "*Modern Construction and Ground Engineering Equipment and Methods*", Prentice Hall, 1994.
- Nunnally, S. W., "*Managing Construction Equipment*", 1999.

Course Code : **CB 714**

Course Title : **Advanced Systems Analysis for Construction Engineers**

Credit Hours : **3**

Course Description

Modeling and analysis of systems for decision making in construction. Optimization using mathematical programming and sensitivity analysis. Decision-making under uncertainty and multi-criteria decision-making. NP-Hard Problems and applications in resource allocations. Heuristics and near-optimal solutions. Queuing theory and simulation. Transportation and assignment problems.

Course Objectives

To provide students with an understanding of optimizing quantitative models and decision-making.

Course Topics

- Modeling and analysis of systems for decision making in construction
- Mathematical programming and sensitivity analysis
- Decision making under uncertainty
- Multi-criteria decision-making
- NP-Hard problems and applications in resource allocations
- Heuristics and near-optimal solutions
- Queuing theory and simulation
- Transportation and assignment problems

References

- Tang, S. L., Ahmad, I. U., Ahmed, S. M., and Lu, M., "*Quantitative Techniques for Decision Making in Construction*", Hong Kong University Press, Hong Kong, 2004.
- Oseenbruggen, P. J., "*Systems Analysis for Civil Engineers*", Wiley, New York 1984.
- Anderson, D. R., Sweeney, D. J. and Williams, T. A., "*An Introduction to Management Science – Quantitative Approaches to Decision Making*", Thomson - South-Western College Publishing, Kentucky, 2002.
- Pilcher, R., "*Principles of Construction Management*", McGraw-Hill, 1992.

Course Code : **CB 715**

Course Title : **Special Topics in Concrete Construction**

Credit Hours : **3**

Course Description

Design of form work for concrete structures: horizontal formwork and vertical formwork; Causes of failure; Analysis of loads, deflections and stresses of formwork systems. Assessment of removal times. Shoring and unshoring systems. Health and safety in concrete construction. Concreting under water; Concrete in marine environment. Special concretes: Hot weather concrete, Mass concrete, ready mix concrete, self compacting concrete, high performance concrete.

Course Objectives

To provide knowledge of the construction and design of different formwork systems, and to be acquaint with the construction systems in building construction.

Course Topics

- Design of form work for concrete structures
- horizontal formwork
- vertical formwork
- Analysis of loads, deflections and stresses of formwork systems
- Health and safety in concrete construction.
- Concrete in marine environment
- Hot weather concrete
- Mass concrete
- Ready mix concrete
- Self compacting concrete

References

- Peurifoy, R. L. and Oberlender, G. D., "*Formwork for Concrete Structures*", McGraw Hill Co., New York, 1996.
- Dobrowolski, J. A., "*Concrete Construction Handbook*", McGraw Hill Co., New York, 1998.
- Hurd, M. and Hurd, M. K., "*Formwork for Concrete*", American Concrete Institute, Detroit, 1995.
- Nawy, E. G., "*Concrete Construction Engineering Handbook*", CRC Press, 1997.

Course Code : **CB 716**

Course Title : **Estimating, Tendering and Contracting in Construction**

Credit Hours : **3**

Course Description

Construction quantity and cost estimation by various contractual parties. Procurement paths and apportionment of risks. The tendering process and documentation. Contractor selection and pre-qualification. Contract law and construction forms of contracts. Sub-contractors and nominated suppliers. Managing variations in construction contracts - change orders and claims. Dispute resolution and arbitration.

Course Objectives

To provide students with the knowledge concerned with estimating quantities and costs, the construction tendering process and contractual issues in construction.

Course Topics

- Construction quantity and cost estimation by different contractual parties
- Procurement paths and apportionment of risks
- Tendering process and documentation
- Contractor selection and pre-qualification
- Contract law and forms of contracts in construction
- Sub-contractors and nominated suppliers
- Managing variations in construction contracts – change orders and claims
- Dispute resolution and arbitration

References

- Brook, M., "*Estimating and Tendering for Construction Contracts*", Butterworth and Heinemann, Oxford, 2001.
- Clough, R. H. and Sears, A., "*Construction Contracting*", John Wiley and Sons, New York, 1994.
- Halpin, D. W. and Woodhead, R. W., "*Construction Management*", Wiley, New York, 1997.
- Broome, J. "*Procurement Routes for Partnering: A Practical Guide*", Thomas Telford, London, 2002.
- Murdoch, J. and Hughes, W., "*Construction Contracts: Law and Management*", Spon Press, London, 2000.

Course Code : **CB 717**

Course Title : **Project Planning and Control**

Credit Hours : **3**

Course Description

Advanced planning and scheduling methods in construction. Scheduling with resource constraints and under uncertainty, and line-of-balance. Cost planning in projects and design of costing systems. Acceleration of construction projects. Control of time and costs in construction projects. Forecasting and controlling cash flows of projects. Earned-value systems in controlling construction projects.

Course Objectives

To provide students with advanced knowledge and skills concerned with planning and control of construction projects.

Course Topics

- Advanced planning and scheduling methods in construction
- Resource constrained scheduling, probabilistic scheduling and line-of-balance.
- Cost planning and design of costing systems in construction projects
- Acceleration of construction projects
- Tracking project progress – time and costs
- Forecasting and controlling project cash flows
- Earned-value systems in controlling construction projects

References

- Oberlender, G. D., "*Project Management for Engineering and Construction*", McGraw-Hill, New York, 2000.
- Hinze, J., "*Construction Planning and Scheduling*", Prentice Hall, New York, 2003.
- Cooke, B. and Williams, P. "*Construction Planning, Programming and Control*", Blackwell Publishing, Oxford, 2004.
- Halpin, D. W., Woodhead, R. W. "*Construction Management*", Wiley, New York, 1997.
- Barrie, D. S. and Paulson, B. C., "*Professional Construction Management*", McGraw-Hill, 1992.

Course Code : **CB 718**

Course Title : **Financial Management in Construction**

Credit Hours : **3**

Course Description

Basics of accounting: accounting terms; accounting systems and transactions; and compilation of financial statements. Reading and understanding financial statements. Basics of financial analysis for profitability, liquidity, leverage and efficiency. Company financial failure and bankruptcy analysis. Cash flow analysis of construction companies. Investor analysis of construction companies.

Course Objectives

To introduce students to the basics of financial management in construction.

Course Topics

- Basics of accounting: accounting terms; accounting systems and transactions; and compilation of financial statements.
- Reading and understanding financial statements.
- Financial analysis - basic financial ratios for profitability, liquidity, leverage and efficiency.
- Failure / bankruptcy analysis for construction firms.
- Cash flow analysis of construction companies.
- Investor analysis of construction companies.

References

- Peterson, S. J. "*Construction Accounting and Financial Management*", Prentice Hall, New York, 2004.
- Palmer, W., Palmer, W. J., Coombs, W. E. and Smith, K. A., "*Construction Accounting and Financial Management*", McGraw Hill, New York, 1999.
- Pilcher, R., "*Principles of Construction Management*", McGraw-Hill, 1992.
- Gibson, C. H., "*Financial Statement Analysis*" International Thomson Publishing, 1998.
- Brigham, E. F., Gapenski, L. C. and Erhardt, M. C., "Fin*ancial Management: Theory and Practice*", The Dryden Press, 1999.

Course Code : **CB 719**

Course Title : **Construction Economics and Feasibility Studies**

Credit Hours : **3**

Course Description

Introduction to economics of the construction industry: role of industry in the economy; and demand and supply in construction. Introduction to microeconomics of construction firms. Introduction to engineering economics and discounting principles. Economic comparisons and influences on economic analysis. Feasibility studies and construction projects appraisal: cost and benefits analyses; economic evaluation techniques and sensitivity analysis.

Course Objectives

To provide an understanding of construction economics and feasibility studies.

Course Topics

- Introduction to economics of the construction industry – role of construction in the economy and demand and supply in construction.
- Introduction to the theory of the firm and microeconomics of construction firms.
- Introduction to engineering economics and discounting principles.
- Economic comparisons and influences on economic analysis.
- Feasibility studies and construction projects appraisal – analyses of costs and benefits, economic evaluation techniques and sensitivity analysis.

References

- Gruneberg, S. "*Construction Economics: An Introduction*", Palgrave McMillan, 1997.
- Rogers, M. "*Engineering Project Appraisal – The Evaluation of Alternative Development Schemes*", Blackwell Publishing, London, 2001.
- Flanagan, R. and Jewell, C. "*Whole Life Appraisal for Construction*", Blackwell Science, 2004.
- Gruneberg, S. L. and Weight, D. H. "*Feasibility Studies in Construction*", Mitchell, London, 1990.
- Pilcher, R., "*Principles of Construction Management*", McGraw-Hill, 1992.

Course Code : **CB 710-C**

Course Title : **Construction Productivity**

Credit Hours : **3**

Course Description

Factors affecting productivity. Productivity engineering and management. Productivity measurement. Work study. Method study. The total productivity model. Optimum allocation of resources. Productivity improvement techniques, technology based, material based, employee based, product based, and task based.

Course Objectives

To provide a knowledge of the productivity concepts and in the construction industry.

Course Topics

- Productivity engineering and management
- Factors of productivity
- Productivity measurement methods
- Total productivity model
- Optimum allocation of resources
- Productivity improvement techniques

References

- Adrian, J., "*Construction Productivity: Measurement and Improvement*", Stipes Pub., 2004.
- Olomolaiye, P., Jayawardane, A., and Harris, F. C., "*Construction Productivity Management*", Longman and Chartered Institute of Building, 1998.
- Oglesby, P. and Howell, G. "*Productivity Improvement in Construction*", McGraw Hill, 1994.
- Pilcher, R., "*Principles of Construction Management*", McGraw-Hill, 1992.

Course Code : **CB 713-C**

Course Title : **Quality Management in Construction**

Credit Hours : **3**

Course Description

The history, role and definition of quality in construction leading to the differentiation of the basic quality concepts / approaches. The management of inspection and testing, in addition to process improvement techniques of statistical process control and six sigma. Quality assurance systems with application to ISO 9000:2000 in construction. The implementation of total quality management and the introduction of excellence models. The importance of continuous improvement through effective benchmarking and performance measurement.

Course Objectives

To provide an understanding of the role of quality in construction projects and organizations and the main techniques associated with improving customer satisfaction and quality in construction.

Course Topics

- The history, role and definition of quality in construction
- Differentiating inspection, quality control, quality assurance and total quality management
- Managing inspection and testing in construction
- Process improvement techniques in construction - Statistical process control and six sigma
- Quality assurance systems – ISO 9000:2000
- Total quality management in construction
- Excellence models in construction – EFQM and Baldrige
- Continuous improvement, benchmarking and performance measurement

References

- Thorpe, B. and Sumner, P. "*Quality Management in Construction*" Gower Publishing Limited, 2005.
- ASCE, "*Quality in the Constructed Project: A Guide for Owners, Designers, and Constructors*", American Society of Civil Engineers, 2004.
- McCabe, S. L. "*Benchmarking in Construction*", Blackwell Science, 2001.
- McCabe, S. L. "Q*uality Improvement Techniques in Construction: Principles and Methods*", Harlow: Longman, co-published with The Chartered Institute of Building through Englemere Ltd., 1998.
- British Quality Foundation "*How to Use the Model. The EFQM Excellence Model*", British Quality Foundation, 2002.

Course Code : **CB 717-C**

Course Title : **Information Technology Applications in Construction**

Credit Hours : **3**

Course Description

Construction and office management applications. Database management and information systems in construction. Internet based applications including E-Commerce in construction. Knowledge management in construction. Artificial intelligence and expert systems. Neural networks. Optimization packages including genetic algorithms. Introduction to software development including: programming principles, process, and testing; and principles of algorithm design and data structures.

Course Objectives

To introduce students to the modern methods of information technology (IT) and its applications in construction.

Course Topics

- Construction and office management applications
- Database management and information systems in construction
- Internet based applications in construction – use of web publishing, intranets and E-Commerce in construction
- Knowledge management in construction
- Artificial intelligence and expert systems
- Neural networks
- Optimization packages and genetic algorithms
- Software development – programming principles, programming phases and steps, verification and validation of software / programs, principles of algorithm design and data structures

References

- Sun, M. and Howard, R., "*Understanding IT in Construction*", F.N. Spon, 2001.
- Hegazy, T., "*Computer-based Construction Management*", Prentice Hall, 2001.
- Anumba, C. J., Egbu, C. and Carrillo, P., "*Knowledge Management in Construction*", Blackwell Publishing, London, 2004.
- Pressman, R. S. and Pressman, R., "*Software Engineering: A practitioners Approach*", McGraw-Hill Science, 2004.
- Waterman, D. A., "*A Guide to Expert Systems*", Addison Wesley, 1986.
- Russell, S. J., and Norvig, P., "*Artificial Intelligence: A Modern Approach*", Prentice Hall, 2002.
- Finch, E. "Ne*t Gain in Construction, Using the Internet in Construction Management*", Butterworth-Heinemann, 2000.

Course Code : **CB 718-C**

Course Title : **Health and Safety in Construction**

Credit Hours : **3**

Course Description

Introduction to occupation health and safety in construction. Health and safety laws and codes. Organizing for health and safety. Procedures for health and safety. Health and safety management system. Construction site issues. Working at heights – hazards and control. Excavation work – hazards and control. Work equipment – hazards and control. Electrical and fire – hazards and control.

Course Objectives

To provide an understanding of the role of health and safety in construction projects and organizations and the main techniques associated with improving health and safety in construction.

Course Topics

- Introduction to occupation health and safety in construction
- Health and safety laws and codes
- Organizing for health and safety
- Procedures for health and safety
- Health and safety management system
- Construction site issues
- Working at heights – hazards and control
- Excavation work – hazards and control
- Work equipment – hazards and control
- Electrical and fire – hazards and control

References

- Hughes, P. and Ferrett, E. "*Health and Safety in Construction*", Butterworth-Heinemann, Oxford, UK, 3rd Ed., 2008.

Course Code : **CB 720**

Course Title : **Water Quality Management and Waste Water Treatment**

Credit Hours : **3**

Course Description

Water quality standards, water quality management in rivers and lakes, water pollutants sources, water and waste-water treatment systems, pollution of natural water bodies, ground water pollution, effects of water pollution on health and vegetation, development and implementation of pollution prevention programs.

Course Objectives

To enable the student to acquire the steps of water and waste water treatment, identify the characteristics of different water pollutants, and evaluate the effects of water pollution on health and vegetation.

Course Topics

- Water quality standards
- Water quality management in rivers and lakes
- Water pollutants sources, water and waste-water treatment systems
- Pollution of natural water bodies
- Ground water pollution
- Development and implementation of pollution prevention programs

References

- Haigh, "Water *and Environmental Management: Design and Construction of Works*", Wiley, 1991.
- Salvato, Joseph A., "*Environmental Engineering and Sanitation*", Prentice Hall, 1992.
- Corbitt, Roberts A., "*Standard Handbook of Environmental Engineering*", McGraw-Hill, 1998.
- Peavy, "*Environmental Engineering*", McGraw-Hill, 1997.

Course Code : **CB 721**

Course Title : **Air Pollution and Indoor Air Quality**

Credit Hours : **3**

Course Description

Air pollution sources and identification, modeling of air pollution, monitoring and control instruments, green house effect, air-water exchange, emission standards from industrial sources, atmospheric dispersion, effects of air pollution on health and vegetation, automotive exhaust emissions, meteorology, acid rains, sources and control of indoor air pollution.

Course Objectives

To enable the student to identify the characteristics of different air pollutants, acquire the methods of air pollution control, and evaluate the effects of air pollution on health.

Course Topics

- Air pollution sources and identification
- Modeling of air pollution
- Air-water exchange
- Atmospheric dispersion
- Effects of air pollution on health and vegetation, meteorology
- Sources and control of indoor air pollution, measurement techniques

References

- Sink, Michael K., "*Control Technologies for Hazardous Air Pollutants: A Handbook*", DIANE Publishing Company, 1994.
- Schmidt, "*Air Pollution Assessment and Control*", Wiley, 1998.
- Maslansky, Carol J., "*Air Monitoring Instrumentation: A Manual for Emergency, Investigatory, and Remedial Responders*", Prentice Hall, 1993.
- Market Intelligence Staff, "W*orld Indoor Air Quality Monitoring and Building Control System*", Frost and Sullivan Market Intelligence, 1994.

Course Code : **CB 722**

Course Title : **Management of Solid, Hazardous and Radioactive Waste**

Credit Hours : **3**

Course Description

Sources and characteristics of solid waste and hazardous, collection and transportation systems, solid waste storage and recycling, waste minimization, resource conservation and recovery, treatment technologies, ground water contamination and remediation, management of radiological solid waste, effects of radioactive waste on health and vegetation.

Course Objectives

To enable the student to identify the characteristics of different Solid waste and hazardous, acquire the methods of solid waste storage and recycling, and evaluate the effects of radioactive waste on health and vegetation.

Course Topics

- Sources and characteristics of solid waste and hazardous
- Collection and transportation systems
- Solid waste storage and recycling
- Waste minimization, resource conservation and recovery
- Treatment technologies
- Ground water contamination and remediation
- Management of radiological solid waste

References

- Bigelow, Charles R., "*Hazardous Materials Management in Physical Distribution*", Prentice Hall, 1994.
- Hickman, H. Lanier, "*Exercise Manual to Accompany Principles of Integrated Solid Waste Management*", American Academy of Environmental Engineers, 1999.
- Liu, David H., "*Environmental Engineers Handbook*," C R C Press LLC, 1997.
- Peavy, "*Introduction to Environmental Engineering*", McGraw-Hill, 1991.

Course Code : **CB 723**

Course Title : **Environmental Impact Assessment of Civil Engineering Projects**

Credit Hours : **3**

Course Description

Origins of Environmental Impact Assessment, EIA procedure, policy options, legislative options, methods of project screening for EIA, preparation and review of an EIA, contribution of Civil Engineer in environmental control, case study.

Course Objectives

To enable the student to learn the procedure for conducting an Environmental Impact Assessment (EIA), understand the civil engineer role in environmental control, and evaluate the environmental impact of civil engineering projects

Course Topics

- Origins of Environmental Impact Assessment
- EIA procedure
- Policy and legislative options
- Methods of project screening for EIA
- Preparation and review of an EIA
- Contribution of Civil Engineer in environmental control
- Case studies

References

- Cheremisinoff, Paul N., "*Ecological Issues and Environmental Impact Assessment*", Gulf Publishing Company, 2004.
- ReVelle, Charles S., "*Civil and Environmental Engineering Systems: An Advanced Applications*", Penguin Books, 2003.
- Bowman, Valcar A., "*Effective Environmental Management Systems (EMS)*", Cahners Business Information, 2002.
- Soares, Claire, "*Environmental Engineering and Management: ISO 14000 Standards, Regulating Compliance: A Practical Approach*" Penguin Books, 2002.
- Liu, David H., "*Environmental Engineers Handbook*", CRC Press LLC, 1997.

Course Code : **CB 726**

Course Title : **Noise Pollution**

Credit Hours : **3**

Course Description

Physical properties of sound, effects of noise on people, noise sources and criteria, noise standards, noise measurement, outdoor propagation of sound, noise section of an Environmental Impact Assessment, traffic noise prediction, noise pollution control and prevention, noise regulation.

Course Objectives

To enable the student to learn the physical properties of sound, identify the noise sources and the means of noise reduction, and evaluate the effects of noise on human beings.

Course Topics

- Physical properties of sound
- Effects of noise on people
- Noise sources, criteria, and noise standards
- Outdoor propagation of sound
- Noise section of an Environmental Impact Assessment
- Traffic noise prediction
- Noise pollution control and prevention
- Noise regulation

References

- Cowan, James P., "*Handbook of Environmental Acoustics*", Van Nostrand Reinhold Inc, 1994.
- Solomon, Norman, "*Environmental Analysis, Air Quality, Noise, Energy, and Alternative Fuels*", National Research Council, 1994.
- Liu, David H., "*Environmental Engineers Handbook*", C R C Press LLC, 1997.
- Soares, Claire, "*Environmental Engineering and Management: ISO 14000 Standards, Regulating Compliance: A Practical Approach*", Penguin Books, 1997.

Course Code : **CB 727**

Course Title : **Marine Pollution**

Credit Hours : **3**

Course Description

Sources of marine pollution, marine ecology, oil and seashore pollution, monitoring and control instruments, modeling of marine pollution, ecological effects, prevention and regulation in marine sector, effect of marine pollution on birds and aquatic beings, marine pollution costs, case studies.

Course Objectives

To enable the student to identify the sources of marine pollutants, learn new techniques of monitoring and control instruments, and evaluate the effects of marine pollution on health and economy.

Course Topics

- Sources of marine pollution
- Monitoring and control instruments
- Modeling of marine pollution
- Prevention and regulation in marine sector
- Effect of marine pollution on birds and aquatic beings
- Marine pollution costs, case studies

References

- Walker, C. H., "*Persistent Pollutants in Marine Ecosystems*", Pergamon Chess, 1992.
- Good, James W., "Co*astal Natural Hazards: Science, Engineering, and Public Policy*", Oregon Sea Grant, 1993.
- Earle, Sylvia A., "*Sea Change: The Message of the Oceans*", Fawcett Book Group, 1998.
- April P., "*Seashore"*, Twenty-First Century Books, 1995.

Course Code : **CB 729**

Course Title : **Energy and Natural Resources Conservation**

Credit Hours : **3**

Course Description

Methods of energy conservation in buildings, natural resources conservation, environmental architecture, selection of green materials, resource recovery, recycling, life cycle strategy, elements of waste minimization strategy, benefits of waste minimization, waste reduction techniques, case study

Course Objectives

To enable the student to acquire the methods of energy conservation and selection of green materials, understand the vitality of natural resources conservation, and learn new techniques of recycling and waste minimization.

Course Topics

- Methods of energy conservation in buildings
- Natural resources conservation, environmental architecture
- Selection of green materials
- Resource recovery, recycling, life cycle strategy
- Elements of waste minimization strategy
- Benefits of waste minimization
- Waste reduction techniques
- Case study

References

- Hart, "*Energy and the Environment: Physics Principles and Applications*", Kendall/Hunt Publishing Company, 1998.
- Owen, Oliver S., "*Natural Resources Conservation: Management for a Sustainable Future*", Wiley, 1997.
- ReVelle, Charles S., "*Civil and Environmental Engineering Systems: An Advanced Applications*", Penguin Books, 1997.
- Krigger, John T., "*Residential Energy: Cost Savings and Comfort for Existing Buildings*", Saturn Resource Management, 1996.

Course Code : **CB 763**

Course Title : **Advanced Hydrology and Climatology**

Credit Hours : **3**

Course Description

The hydrologic cycle, Application of the hydrologic budget, precipitation, average precipitation, Evaporation, Transpiration, Evapotranspiration, Rainfall water losses, Stream flow, Stream flow estimation, Morphological and hydrological studies of watersheds, Introduction to ground water, Types of aquifers, Two-dimensional flow equation, Initial and boundary conditions, Groundwater flow net, Analytical solution, Simplified solution for flow equations, Pumping tests, Evaluation of ground water resources, Ground water pollution control.

Course Objectives

To enable practicing engineers to understand different elements of hydrology, Establish rainfall-runoff relationship, and understand channel routing methods. To comprehend the effects of climatic changes on the globe hydrologic cycle.

Course Topics

- The hydrologic cycle,
- Application of the hydrologic budget
- Evaporation, transpiration, and evapotranspiration
- Morphological and hydrological studies of water sheds or basins
- Stream flow and stream flow estimation,
- Introduction to ground water
- Two-dimensional flow equation
- Analytical solution and simplified solution for flow equations
- Evaluation of ground water resources and pumping tests / artificial recharge

References

- Barndorff-Nielsen, Ole E; "Stoch*astic Methods in Hydrology: Rain, Landforms and Flood Guanajuato*"; 1996; World Scientific Publishing Co Ptc. Ltd.
- Serrano, Sergio E.: Hydro*logy for Engineers, Geologists, and Environmental Professionals: Integrated Treatment of Surface, Subsurface, and Contaminant Hydrology*"; 1997; HydroScience Incorporated.
- Manning, John C.; "*Applied Principles of Hydrology*"; 1996; Prentice-Hall Regents.
- Lal, R., ed., "*Integrated Watershed Management in the Global Ecosystem*"; 2000; CRC Press, Boca Raton, USA

Course Code : **CB 764**

Course Title : **River Engineering**

Credit Hours : **3**

Course Description

River morphology, local scour and accretion, introduction to sediment transport theory, river training, river bank protection, river navigation enhancement, field data collection and analysis. Morphology of river mouth and estuary hydrodynamics. Applications of computer models to river flow and hydraulic structures.

Course Objectives

To enable the student to deal with river morphological problems, analyze local scour, align and plan river navigation, and collect river field data.

Course Topics

- River morphology
- Local scour and accretion
- Sediment transport theory and computer applications
- River training and river bank protection
- River navigation enhancement and port planning
- Field data collection and analysis

References

- Barndorff-Nielsen, Ole E; "*Stochastic Methods in Hydrology: Rain, Landforms and Floods Guanajuato*"; 1996; World Scientific Publishing Co Pte. Ltd.
- Carling, P. A.; "*Advances in Fluvial Dynamics and Stratigraphy*"; 1996; Wiley-Liss Inc., U. S.
- Per Brunn, "*Port Engineering*"; 1981; Gulf Publishing Co.; Houston, USA
- Gunge, J.A., Holly, F.M., and Verwey A.; "*Practical Aspects of Computational River Hydraulics*"; 1991; Pitman Publishing Limited; London; U.K.

Course Code : **CB 768**

Course Title : **Water Resources Planning and Management**

Credit Hours : **3**

Course Description

Watershed Hydrology, surface and subsurface water resources management, irrigation and drainage. Problems related to water resources utilization, optimal conjunction use of water resources, water conservation and capacity building. Ecological and economical considerations for water resources planning and management using linear and dynamic programming. Introduction to climatology and effects of climatic changes on water resources.

Course Objectives

To enable practicing engineers to be capable of managing available water resources, solve problems related to water resources utilization, and apply linear and dynamic programming for water resources management.

Course Topics

- Water quality of surface and groundwater
- Surface and subsurface water resources management and climatic effects
- Problems related to water resources utilization and water availability
- Optimal conjunction use of water resources and use of information technology
- Linear programming
- Dynamic programming
- Computer applications

References

- Van Hofwegen, Paul: "*Analytical Framework for Integrated Water Resources*"; 1999: Balkema (A.A.) Publishers.
- Abousleiman, Y.; "*Computer Methods and Water Resources*"; 1999; WIT Press.
- Bouwer, Herman; "*Groundwater Recharge: Natural and Artificial Technologies and Water Reuse Management*"; 1999; Lewis Publishers.
- Mays, L.W.; "*Water Resources Engineering*"; 2004; John Wiley
- Loucks, Daniel P.; "*Sustainability Criteria for Water Resource Systems*"; 1999; Cambridge University Press.

Course Code : **CB 769**

Course Title : **Structures for Sustainable Water Resources Management**

Credit Hours : **3**

Course Description

Application of hydrology, hydraulics, principles of project formulation, and system analysis, in the selection of integrated water resources systems. Water resources management systems include water supply components for urban and agricultural usage, structures for flood and storm water management and drainage or reuse of wastewater. Discussion of technical papers and computer models related to case studies on sustainable development of surface and groundwater, system selection, construction and operation, maintenance and other topics.

Course Objectives

To prepare graduate students and industry professionals with the fundamental concepts and techniques to identify integrated hydraulic structures required for a water resources management system realizing today's associated environmental, climate, economic and water demands considerations in the region including coastal zones.

Course Topics

- Management in the Water Industry: review of basic engineering and economic planning concepts.
- Water and the Environment: use of information technology for sustainable development of water recourses (Hydroinformatics)
- Hydrology Frequency Analysis
- Modeling Watershed Hydrology: surface water, ground water, and water quality
- Water Management in Estuaries and Coastal Zone
- Water Resources System Analysis
- Hydraulic Structures Management Systems and Infra-Structure
- Case studies of Water Resources Management in Arid, Semi-Arid Regions and Coastal Zone

References

- Holly, F.M. and Alsaffar, A., eds., "*Managing Water: Coping with Scarcity and Abundance*", Proceedings of 27th Congress of the International Association for Hydraulic Research and ASCE, San Francisco, CA, U.S.A., August 1997.
- Goodman, A.S., "*Principles of Water Resources Planning*," Prentice-Hall, Inc., N.J., U.S.A., 1984.
- Grigg, N.S., "*Water Resources Management*", McGraw-Hill, N.Y., U.S.A., 2003.
- Journal of Water Resources Planning and Management, *Proceedings* American Society of Civil Engineers, Reston, VA, U.S.A., Vol. 129, (No. 1 to 6), 2003 and Vol. 130 (No. 1 to 6), 2004.
- Novak, P., Moffat, A.I.B., Nalluri, C., and Narayanan, R., "Hydraulic *Structures* ", Spon Press, London and New York, 2001.
- Wurbs, R.A., and James, W.P., "*Water Resources Engineering*", Prentice-Hall, Inc., N.J., U.S.A., 2002.

Course Code : **CB 763-I**

Course Title : **Ocean and Coastal Processes for Project Engineers**

Credit Hours : **3**

Course Description

Introduction to the physical properties and behavior of seawater, interactions of seawater with the ocean basins, and the practices of ocean research and engineering. Introduction to the physical properties and behavior of wind and impulsively generated surface gravity waves, measurements and characterizations of ocean wave climate, and interactions of ocean waves with structures and natural coastal features. Introduction to non-linear dynamic interaction between waves and structures and the use of design computer tools.

Course Objectives

The objective of this course is to provide construction engineers with the basic principles and design parameters related to the design of marine structures in the coastal and near shore waters.

Course Topics

- Coastal and ocean environment
- Water waves; wind and impulsively generated waves
- Short term wave analysis
- Tides and water levels
- Wave transformation
- Basic shore processes
- Design of structures and fluid structure interaction
- Risk analysis and damage
- Introduction to coastal management

References

- Reeve D., Chadwick A. and Fleming C.; "*Coastal Engineering – processes, theory and design practice*"; Spon Press, London and New York, 2004.
- Simm J. and Cruickshank I, Thomas Telford; "C*onstruction Risk in Coastal Engineering*", U.K.; 1998.
- U.S. Army; "*Coastal Engineering Manual* (http://chl.erdc.usace.army.mil/, formerly: "*Shore Protection Manual*", Corps of Engineering, Coastal Engineering Research Center, Vicksburg, USA, 1984.
- Wiegel R.L.; "*Oceanographical Engineering*", Dove Publication; New York; USA; 2006.

Course Code : **CB 764-I**

Course Title : **Hydrographic Surveying and Coastal Measurements and Analysis**

Credit Hours : **3**

Course Description

The course provides students with knowledge of and skills to apply physical principles, instrumentation, data analysis methods, and visualization products associated with hydrographic surveying, chart publication, and related marine measurement practices of government and industry. Review of and practice with modern instrumentation, equipment, sampling and measurement techniques, and methods of analysis for quantitative study of spectral coastal ocean physical processes.

Course Objectives

To provide project engineers with the capability to collect oceanographic and engineering marine data, which include water level measurements and hydrographic surveys, analyze data, and interpret analytical results to define near shore bathymetry, waves, tides, and coastal processes.

Course Topics

- Overview of physical design parameters for water and sediments
- Equipment and measuring techniques; in place and remote: Waves, currents, water levels and sediment transport rates
- Short term analysis for design parameters
- Long term analysis for design parameters

References

- Ochi, M.K.; "*Ocean Waves: The Stochastic Approach*"; 2005; Cambridge University Press, Cambridge; UK.
- American Society of Civil Engineers; "*Ocean Waves Measurement and Analysis*"; 1995; N.Y.; USA.

Course Code : **CB 765-I**

Course Title : **Management of Water Resources and Coastal Projects**

Credit Hours : **3**

Course Description

The course provides an overview for project execution steps from the early stages of formulation to project start up; overview of environmental design parameters related to ambient water, soil and air; design criteria and construction aspects methods and equipments for major river and estuary structures which include river training, bridge piers, flow control structures, submerged tunnel and storm surge barriers; design criteria and construction methods of some selected coastal structures are presented which embrace pile-supported structure, bulkheads & quaywalls, breakwaters and submarine pipelines. Techniques and equipment for dredging and beach nourishment.

Course Objectives

Provide the project engineer in industry with the design criteria and construction methods of major structures and operations in rivers, estuary and coastal waters.
Introduce the physical environmental design parameters related to the design and construction of hydraulic and coastal structures.
The course outlines design criteria, material selection and construction methods of selected structures in rivers and along the coastline.
The course lays the ecological and social impacts of construction which are required to assess the sustainability of proposed water related projects.

Course Topics

- Engineering projects for river and estuary structures
- Engineering projects for coastal structures
- Design criteria and construction of lined open channels
- Design and construction of water intake and navigation structures
- Design criteria and construction of piers for over water bridges and scour mitigation methods
- Design criteria and construction of river flow diversion structures
- Design and construction of drainage structures
- Integrated coastal zone management
- Design criteria and installation of marine pile-supported and bulkhead structures
- Design criteria and types of coastal protection works (rigid and flexible)
- Construction methods of shore-connected and offshore protection structures
- Beach nourishment techniques and equipment
- Ecological and social impacts of river and coastal construction

References

- Gerwick, Ben C. Jr.; "*Construction of Marine and Offshore Structures*"; CRC Publisher Press; New York; USA; 2nd edition; 2002

- Simm, J. and Gruickshank, I.; "*Construction Risk in Coastal Engineering*"; Thomas Telford; UK; 1998.
- Brampton A., "*Coastal Defense – ICE design and practice guide*", Thomas-Telford; London; 2002.

Course Code : **CB 766-I**

Course Title : **Integrated Management of Ports and Coastal Zones**

Credit Hours : **3**

Course Description

The marine environment and shoreline processes and their use and management, with special emphasis on the integrated management of ports and coastal zones and their mutual interaction.

Course Objectives

- To offer an outstanding opportunity to gain detailed knowledge of concept of the Integrated Coastal Zone Management.
- To ensure a solid foundation in these keys aspect of Integrated Coastal Zone Management.

Course Topics

- An introduction to coastal zones.
- Dynamics of Geophysical Fluids
- Littoral Processes and Coastal Evolution
- Planning and Management
- Integrated Management of Coastal Zones and Port Areas; definitions, objectives, urgencies and benefits.
- Approach of ICZM; integration and arrangements
- Practice of ICZM; stages, initiation, planning, implementation, monitoring and evaluation
- Methods, tools and techniques of ICZM
    - Classes of useful methods, tools and techniques
    - Environmental Impact assessment (EIA) techniques
    - Policy tools
- General overview of ICZM
- Case study

References

- Kamphuis, J.W.; "Introduction to Coastal Engineering and Management", World Scientific; New Jersey; USA; 2006.
- Brampton A., "Coastal Defense – ICE design and practice guide", Thomas-Telford; London; 2002.
- Cicin-Sain, B. & Knecht, R., "Integrated Coastal and Ocean Management Concepts and Practices" Publisher: Island Press, pp 543, 1998.

Course Code : **CB 767-I**

Course Title : **Port Planning and Development**

Credit Hours : **3**

Course Description

The course provides an overview for the keys aspects of port planning and development in the context of water theory, port planning and its items, on shore marine terminal facilities, dredging and reclamation and guidelines for ports developments. All major aspects of the design and maintenance of port facilities, including port planning, design loads for today's larger vessel size, seismic design guidelines, and breakwater design.

Course Objectives

Provide the project engineer in industry with the following:

- A solid foundation in the keys aspect of port development and planning and the design of port structures.
- An outstanding opportunity to gain detailed knowledge of the contractual framework and practical application of port development and planning and practical application of the design of port structures.

Course Topics

- Wave theory, Wave diffraction inside Ports
- Port Planning; definition and strategic planning
- Items of port planning; breakwaters, navigation channel, port entrance, turning basin, Dock structures (Quays, Jetties and Dolphins), berths and on-shore facilities.
- On shore marine terminals facilities
- Dredging and reclamation
- Guidelines for ports developments
- Ports mitigation measures and monitoring plans
- Beach nourishment
- Breakwaters; definition and types (vertical, rubble mound, composite breakwater, reef breakwater, detached breakwater and floating breakwater).
- Breakwater failures types.
- Breakwater design methods.
- Dock structures (Quays, Jetties and Dolphins)
- Design of gravity quay wall.
- Design of sheet pile wall.
- Fender systems; wood fenders, rubber fenders and foam filled fenders
- Dredging and reclamation; definition and Equipments.
- Case study

References

- Gregory P. Tsinker, 2004. *Port Engineering: Planning, Construction, Maintenance, and Security*, ISBN: 978-0-471-41274-8, 896 pages
- Agerschou, H., Dand, I & Ernst, T., 2004. *Planning and design of ports and marine terminals*, Thomas Telford, ISBN: 0727732242, pp. 384.
- Goda, Y., 2000. *Random Seas and Design of Maritime Structures*, University of Tokyo Press, Tokyo
- Reeve, D.E., Chadwick, A.J. & Fleming, C.A., 2004. *Coastal Engineering: Processes, Theory and Design Practice*, SPON Press.
- Sorensen, R. M., 1997. *Basic Coastal Engineering*, Chapman & Hall.
- Gerwick, Ben C. Jr.; "*Construction of Marine and Offshore Structures*"; CRC Publisher Press; New York; USA; 2nd edition; 2002

Course Code : **CB 731**

Course Title : **Advanced Geotechnical Engineering**

Credit Hours : **3**

Course Description

Planning of soil exploration program; Site improvement and soil stabilization techniques; Methods of dewatering; Geotechnical problems associated with dewatering; Design of filters; Planning for site preparation: Site investigation for piling; Contiguous-piles and Secant-piles; Retaining walls; Problems in pile construction; Integrity testing; Pile testing; Types of problematic soils; Collapsible soils; Types, Field tests for collapsible soils, Laboratory experiments, Foundations on collapsible soils.

Course Objectives

To develop an understanding of a variety of state-of-art advanced techniques in geotechnical engineering utilized in construction projects.

Course Topics

- Planning an exploration program.
- Field tests: SPT, CPT, Plate load test.
- Compaction, precompression, vibroflotation, vibro-replacement.
- Sand drains; Prefabricated Vertical Drains (PVDs) or wick drains.
- Sand compaction piles, stone columns, and dynamic compaction.
- Purpose of grouting: advantages and disadvantages, planning the grouting projects.
- Methods of dewatering; Geotechnical problems associated with dewatering.
- Selection of the dewatering method; Design of filters.
- Planning for site preparation.
- Contiguous-piles and Secant-piles; Retaining walls.
- Problems in pile construction: Integrity testing; Pile testing; Pile dynamics.
- Types of problematic soils.
- Collapsible soils; Types, Field tests for collapsible soils. Laboratory experiments.
- Foundations on collapsible soils.

References

- J.E. Bowles, "*Foundation Analysis and Design*", 5th Ed., McGraw-Hill, 1996
- J. Cernica, "*Geotechnical Engineering: Foundation Design*", Wiley, 1995
- Abramson, Lee, Sharma and Boyce, "*Slope Stability and Stabilization Methods*", Wiley, 1996
- H.G. Poulos and E.H. Davis, "*Pile Foundation Analysis and Design*", Wiley, 1980.
- M.J. Tomlinson and R. Boorman, "*Foundation Design and Construction*", 6th Ed., Longman, 1995
- Permanent Committee for Preparation of Egyptian Code of Soil Mechanics, Design and Construction of Foundations, "*Egyptian Code for Soil Mechanics, Design and Construction of Foundations*", 6th Ed., Akhbar Alyoum Press, 2003

Course Code : **CB 733**

Course Title : **Earth Works and Dewatering**

Credit Hours : **3**

Course Description

Specifications of earth works and dewatering; Methods of excavations; Methods of embankment construction; Methods for slope stabilization; Analysis of slope stability; Use of geomembranes for slope stability; Specifications of the filling materials; Seepage problems; Methods of dewatering; Geotechnical problems associated with dewatering; Design of filters; Planning for site preparation.

Course Objectives

To illustrate to the student procedures and special precautions in the earth works with emphasis on soil stability considerations and dewatering techniques and safety measures.

Course Topics

- Specifications of earth works and dewatering;
- Different methods of excavations;
- Methods of embankment construction;
- Methods for slope stabilization;
- Analysis of slope stability
- Use of geomembranes for slope stability
- Specifications of the filling materials
- Two- and three-dimensional seepage problems
- Methods of dewatering
- Geotechnical problems associated with dewatering
- Selection of the dewatering method
- Design of filters
- Planning for site preparation

References

- Permanent Committee for Preparation of Egyptian Code of Soil Mechanics, Design and Construction of Foundations, "*Egyptian Code for Soil Mechanics, Design and Construction of Foundations*", 6th Ed., Al–Ahram Press, 2001
- Abramson, Lee, Sharma and Boyce, "*Slope Stability and Stabilization Methods*", Wiley, 1996
- V.N.S. Murthy, "*Soil Mechanics and Foundation Engineering*", 4th Edition, UBS, New Delhi, 1992

Course Code : **CB 736**

Course Title : **Foundation on Problematic Soils**

Credit Hours : **3**

Course Description

Types of problematic soils; Swelling soil; Types of swelling soils, Basic definitions and characteristics, Classification, Laboratory experiments, methods for foundations on swelling soils; Collapsible soils; Types, Field tests for collapsible soils, Laboratory experiments, Foundations on collapsible soils; Soft clay soils; Basic definitions; Field tests for soft clays; Laboratory experiments; Foundations on soft clays.

Course Objectives

To introduce the student to the types of problematic soils and the special considerations taken when constructing projects on each type.

Course Topics

- Types of problematic soils;
- Swelling soil; Types of swelling soils,
- Basic definitions and characteristics, Classification,
- Laboratory experiments, methods for foundations on swelling soils;
- Collapsible soils; Types, Field tests for collapsible soils,
- Laboratory experiments,
- Foundations on collapsible soils;
- Soft clay soils; Basic definitions; Field tests for soft clays; Laboratory experiments;
- Foundations on soft clays.

References

- J.E. Bowles, "*Foundation Analysis and Design*", 5th Ed., McGraw-Hill, 1996
- Permanent Committee for Preparation of Egyptian Code of Soil Mechanics, Design and Construction of Foundations, "*Egyptian Code for Soil Mechanics, Design and Construction of Foundations*", 6th Ed., Al–Ahram Press, 2001
- J.N. Cernica, "*Geotechnical Engineering: Foundation Design*", Wiley, 1995

Course Code : **CB 737**

Course Title : **Piling Engineering**

Credit Hours : **3**

Course Description

Site investigation for piling; Basic piling methods; Design of single piles; Design of pile groups; Design of piles subjected to lateral loads; Special considerations for design and construction of offshore piles; Tension leg platforms; Load distribution among group piles; Retaining walls; Problems in pile construction; Integrity testing; Pile testing; Pile dynamics; Choice of pile construction method and economics of design.

Course Objectives

To illustrate to the student the types of piled foundations and the advantages and limitations in construction and performance for each type.

Course Topics

- Site investigation for piling; Basic piling methods
- Capacity of single piles; Capacity of pile groups
- Piles subjected to lateral loads
- Contiguous-piles and Secant-piles Retaining walls
- Problems in pile construction
- Integrity testing; Pile testing; Pile dynamics
- Choice of pile construction method and economics of design

References

- Fleming, Weltman, Randolph and Elson, "*Piling Engineering*", Blackie, 1992
- H.G. Poulos and E.H. Davis, "*Pile Foundation Analysis and Design*", Wiley, 1980.
- M.J. Tomlinson and R. Boorman, "*Foundation Design and Construction*", 6th Ed., Longman, 1995
- Permanent Committee for Preparation of Egyptian Code of Soil Mechanics, Design and Construction of Foundations, "*Egyptian Code for Soil Mechanics, Design and Construction of Foundations*", 6th Ed., Akhbar Alyoum Press, 2003

Course Code : **CB 738**

Course Title : **Special Geotechnical Structures**

Credit Hours : **3**

Course Description

Cofferdams: Types; Single raw sheet pile cofferdam; method of analysis; construction sequence; Geotechnical construction considerations; Double raw sheet pile cofferdam; Construction sequence; Geotechnical construction considerations; Cellular cofferdams; Required data for cellular structure design and installation; design procedure; Field procedures and problems; Caissons: Types of caissons; Sinking and control; Carrying capacity of caisson as a foundation element.

Course Objectives

To introduce to the student types of special geotechnical structures implemented in large complex projects with emphasis on special considerations in the design and construction method of each type.

Course Topics

- Cofferdams: Types; Single raw sheet pile cofferdam;
- Method of analysis; construction sequence;
- Geotechnical construction considerations;
- Double raw sheet pile cofferdam; Method of analysis;
- Construction sequence; Geotechnical construction considerations;
- Cellular cofferdams; Required data for cellular structure design and installation; design procedure;
- Field procedures and problems;
- Caissons: Types of caissons; Caisson design considerations; Sinking and control; Carrying capacity of caisson as a foundation element.
- Diaphragm walls.

References

- J.E. Bowles, "*Foundation Analysis and Design*", 5th Ed., McGraw-Hill, 1996
- M.J. Tomlinson and R. Boorman, "*Foundation Design and Construction*", 6th Ed., Longman, 1995
- Permanent Committee for Preparation of Egyptian Code of Soil Mechanics, Design and Construction of Foundations, "*Egyptian Code for Soil Mechanics, Design and Construction of Foundations*", 6th Ed., Akhbar Alyoum Press, 2003

Course Code : **CB 733-G**

Course Title : **Elastic Analysis of Soil–Foundation Interaction**

Credit Hours : **3**

Course Description

Introduction to soil-foundation interaction problems; Idealized soil response models for analysis of soil–foundation interaction; Plane-strain analysis of an infinite plate and an infinitely long beam; Analysis of beams of finite length; Axisymmetric three–dimension problem of an infinite plate; Analysis of finite plates; Determination of soil parameters; Experimental investigation and field studies.

Course Objectives

To introduce to the student the analysis methods of elastic interaction between soil and foundations.

Course Topics

- Introduction to soil-foundation interaction problems;
- Idealized soil response models for analysis of soil–foundation interaction
- Plane-strain analysis of an infinite plate and an infinitely long beam
- Analysis of beams of finite length;
- Axisymmetric three–dimensional problem of an infinite plate;
- Analysis of finite plates;
- Determination of soil parameters;
- Experimental investigation and field studies.

References

- A.P.S. Selvadurai, "*Elastic Analysis of Soil-Foundation Interaction*", Elsevier, 1979
- R. Scott, "*Foundation Analysis*", Prentice Hall, 1981
- J.E. Bowles, "*Foundation Analysis and Design*", 5th Ed., McGraw-Hill, 1996.

Course Code : **CB 751**

Course Title : **Fundamental of Traffic Flow Theories**

Credit Hours : **3**

Course Description

The course covers topics in the area of traffic flow characteristics, volume, flow, PHF, variation of traffic volume, AADT, ADT, DHV, speed-density model, flow-density model and speed-flow model. It also covers topics in the area of fundamental principles of traffic flow, level of service, basic freeway capacity, multilane highway capacity, two lane highway capacity, flow interruptions, intersection control and design, traffic signals, intersection capacity.

Course Objectives

To provide better understanding in the area of fundamental elements of traffic flow theories and traffic analysis tools for important highway segments as in two-lanes, multi-lanes and intersections.

Course Topics

- Traffic flow characteristics, volume, flow, PHF and variation of traffic volume
- AADT, ADT, DHV, speed-density model, flow-density model and speed-flow model
- Fundamental principles of traffic flow, level of services
- Basic freeway capacity
- Multilane highway capacity and two lane highway capacity
- Flow interruptions
- Intersection control and design
- Traffic signals
- Intersection capacity

References

- Drew, D. R. "*Deterministic aspects of freeway operations and control*", Highway research record 99, 1965.
- Pipes, L. A. "*Car following models and the fundamental diagram of road traffic*", transportation research, Vol.1, no. 1, 1967.
- Transportation Research Board "*Traffic flow theory: A monograph*," Special Report 165, National Research Council, Washington DC, 1975.

Course Code : **CB 752**

Course Title : **Structural Design for Highway and Airport Pavements**

Credit Hours : **3**

Course Description

The course covers topics in the area of pavement types, flexible and rigid pavement, principles for flexible pavements, calculation of flexible pavement stresses and deflections, the AASHTO flexible pavement design procedure, serviceability concept, structural number, principles for rigid pavements, calculation of rigid pavement stresses and deflection, the AASHTO rigid pavement design procedure, pavement rehabilitation management, the FAA method of design for flexible and rigid airport pavements, CBR method of design for flexible airport pavements, pavement design using elastic layer theory.

Course Objectives

To provide a complete analysis in the area of stress distribution in pavement due to different traffic loads, cover the major design methods for flexible pavements, and cover the major design methods for rigid pavements.

Course Topics

- Pavement types, flexible and rigid pavement
- Flexible pavement stresses and deflections
- The AASHTO flexible pavement design procedure
- Serviceability concept, structural number
- Principles for rigid pavements
- The AASHTO rigid pavement design procedure
- Pavement rehabilitation management
- The FAA method of design for flexible and rigid airport pavements
- CBR method of design for flexible airport pavements, pavement design using elastic layer theory

References

- *Principles of highway engineering and traffic analysis*, F. Mannering and W. Kilareski, Wiley, Inc. 1998.
- *Principles of pavement design*, Yoder, E. J., M. W. Witczak, New York Wiley 1975
- *AASHTO Guide for design of pavement structures*, Washington DC 1993.
- Carey, W. and P. Irick "*The Pavement Serviceability – Performance Concept*", Highway Research, Board Special Report 61E, AASHTO Road Test 1962.

Course Code : **CB 753**

Course Title : **Transportation Planning and Management**

Credit Hours : **3**

Course Description

The course covers topics in the area of transportation planning (transportation problems, trends in transportation planning), urban transportation planning (elements of planning, planning process, goods movement planning), forecast of urban transport demand (data collection and analysis, goals and objectives, aggregate sequential demand models), sketch planning and project planning (generation, analysis and evaluation of alternative plans, risk and uncertainty).

Course Objectives

To provide basis of transportation planning and to grasp the sequential demand forecasting modeling.

Course Topics

- Transportation planning
- Urban transportation
- Forecast of urban transport demand
- Sketch planning and project planning

References

- Ben-Akiva, M. and S. Lerman, *Discrete Choice Analysis: Theory and Application to Travel Demand*, Cambridge M. A.: MIT Press, 1985.
- Neter J. and W. Wasserman, *Applied Linear Statistical Models*, Home Wood IL: Richard Irwin, 1973.
- Meyer, M. and E. Miller, *Urban Transportation Planning: A Decision-Oriented Approach,* New York: McGraw-Hill, 1984.
- Sheffi, Y. *Urban Transportation Networks: Equilibrium Analysis with Mathematical Programming Models*, Englewood Cliffs, N. J. Prentice-Hall, 1985.

Course Code : **CB 756**

Course Title : **Special Topics in Transportation and Highway Engineering**

Credit Hours : **3**

Course Description

The course covers topics in the area of transportation and the environment, transpiration safety, intelligent transportation systems, geographic information system application GIS, global positioning systems applications GPS, computer applications for transportation, computer simulators for transportation, energy efficiency and use, mass transit transportation, noise pollution fundamentals.

Course Objectives

To present different applications of computer technology in the field of transportation, such as GIS and GPS, Computer Modeling and Simulation.

Course Topics

- Transportation and the environment
- Transpiration safety
- Intelligent transportation systems
- Geographic information system application GIS
- Global positioning systems applications GPS
- Computer applications and simulators for transportation
- Energy efficiency and use, mass transit transportation
- Noise pollution fundamentals

References

- The U.S. Department of Transportation Internet Web Site (www.dot.gov).
- The Diebold Institute for public policy studies, Inc., Transportation Infrastructure, *The development of Intelligent Transportation Systems* Praeger, Westport, CT, 1995.
- Rolfe, J.M., "*Flight Simulator Research*", Applied Ergonomics, Vol.4, No., 1973.
- Hulbert, S. "*Human Factors in Transportation*", Transportation Traffic Engineering Handbook, and ed. W. Homburger, Prentice Hall, Englewood, Cliffs, N.J., 1982.

Course Code : **CB 758**

Course Title : **Highway Construction and Management**

Credit Hours : **3**

Course Description

The course covers topics in the area of aggregates (source - classification - properties - evaluation tests - combining of aggregates), bituminous materials (native asphalts - manufacture of asphalts - asphalt cement - liquid asphalt - emulsions), asphalt tests (liquid asphalt test, emulsion tests), highway machinery (earth moving, compaction, aggregates crushing), asphalt machinery (plants, spreaders,...).

Course Objectives

To review material properties, testing in association with highway construction, different methods of construction and involved equipments.

Course Topics

- Aggregates (source - classification - properties - evaluation tests - combining of aggregates)
- Bituminous materials
- Asphalt tests (liquid asphalt test, emulsion tests)
- Highway machinery (earth moving, compaction, aggregates crushing)
- Asphalt machinery (plants, spreaders, etc...)

References

- Standard Specifications for Transportation Materials and Method of Sampling and Testing, AASHTO, Washington DC.
- The AASHTO Road Test: Pavement Research, Special Report No. 61E, Highway Research Board, Washington DC, 1962.
- Annual Book of Standards: Bituminous Materials, Soils, Skid Resistance, American Society for Testing and Materials, Philadelphia, PA.

Course Code : **CB 759**

Course Title : **Traffic Engineering and Environment**

Credit Hours : **3**

Course Description

This course covers topics in the area of basic principles of sound waves in free fields and enclosures, effect of noise on people, adding and subtracting sound levels, traffic noise descriptors, traffic noise prediction techniques, prediction procedure, mathematical algorithm, correction for road gradient, source height, source position, mitigation measures, sound barriers, pavement types, principles of sound barrier design, reduction in sound barrier performance due to holes, silts or gaps, examples of sound barrier analysis.

Course Objectives

To review basis of traffic noise, to provide traffic noise prediction techniques, and to provide noise barrier design methods.

Course Topics

- Basic principles of sound waves in free fields and enclosures
- Effect of noise on people, adding and subtracting sound levels
- Traffic noise descriptors, traffic noise prediction techniques
- Mathematical algorithm
- Correction for road gradient, source height, source position, mitigation measures
- Sound barriers, pavement types, principles of sound barrier design
- Silts or gaps
- Examples of sound barrier analysis

References

- Perkins, H.C., *Air Pollution*, McGraw – Hill, New York, 1974.
- Environmental Protection Agency, *User's Guide to Mobile 1: Mobile Source Emissions model, office of air, noise and radiation*, Washington DC, 1978.
- Wesler, J.E. "*Introduction and History of Highway noise Prediction methods*", Transportation Research Circular 174, Transportation Research Board, National Research Council, Washington DC, 1975.

Course Code : **CB 752-T**

Course Title : **Advanced Construction Surveying**

Credit Hours : **3**

Course Description

The different types of projects traverses, the purpose and types of cadastral surveying traverses in cities and countries, the field traverse and its procedure, the public work traverse and methods of fixing boundary marks, the city traverse and its requirements, the three points problem and the mechanical, legman and three circles methods, cadastral and town mapping. Adjustment of structure verticality, study of crustal movement and geodetic techniques for detecting horizontal and vertical structural deformations. Laser instruments and techniques in various surveying applications such as leveling, land reclamation, etc. Precise methods for measuring horizontal angles.

Course Objectives

To provide the graduate with most advanced equipments in the field of construction surveying. In addition to, different methods of analysis and correction of coordinate systems.

Course Topics

- Projects traverses
- The three points problem and the mechanical
- Legman and three circles methods
- Cadastral and town mapping
- Adjustment of structure verticality
- Study of crustal movement and geodetic techniques for detecting horizontal and
- Vertical structural deformations
- Laser instruments and techniques in various surveying applications such as
- Leveling, land reclamation, etc.
- Precise methods for measuring horizontal angles

References

- Pryor, Williams T., 1967,"*Precision in Surveys by Use of Plan Coordinates*", Highway Research Record 201:51-81, Washington DC, Transportation Research Board, National Research Council.
- Burnside, C.D., 1976,"*Electromagnetic Distance Measurements*", Crochy lookwod staples.
- Jack McCormack, 1995, "*Surveying*", Prentice Hall Inc.
- Edward M. Mikhail and G. Grancie, 1981,"*Analysis and Adjustment of Survey Methods*", Litton Educational Publishing Inc.

Course Code : **CB 753-T**

Course Title : **Geographic Information Systems for Construction Engineering**

Credit Hours : **3**

Course Description

Basics of GIS. Components of GIS. Spatial data. Attribute data. Types of attribute data. Data entry and tools. Themes generation. Building a system. Why GIS for some construction problems. Analytical functions. Overlay function. Buffering function. Search function. Techniques for analysis.

Course Objectives

To introduce and illustrate how the Geographic Information System (GIS) can be built up to analyze and understand various problems in construction engineering.

Course Topics

- Basics and components of GIS
- Types of data entry and tools
- Sequence of building GIS system
- Analytical functions and how to use them
- General applications for construction engineering
- GIS for transportation engineering
- GIS for highway engineering
- GIS for geotechnical engineering
- GIS for environmental engineering

References

- Tolley, R. and Turton, B., "Tran*sport Systems, Policy and Planning: A Geographical Approach*", Longman, Burnt Mill, Harlow, 1995.
- Miller, H. J. and Shaw, S. L., "*Geographic Information Systems for Transportation: Principles and Applications*", Oxford University Press, 2001.
- Lo, C. P. and Yeung, A. K. W., "*Concepts and Techniques of Geographic Information Systems*", Prentice Hall, New Jersey, 2002.
- Thill, J. C. (ed.) "*Geographic Information Systems in Transportation Research*", Elsevier Science, Oxford, 2000.
- Nyerges, T., "Geographi*cal Information Systems Support for Urban / Regional Transportation Analysis".* In Hanson, S. "The Geography of Urban Transportation", Guilford Press, New York, 1995.
- DeMers, M. N., "*Fundamentals of Geographic Information Systems*", Wiley, New York, 1997.

Course Code : **CB 740**

Course Title : **Advanced Construction Materials**

Credit Hours : **3**

Course Description

Properties and strength of light weight concrete, massive concrete, high strength concrete, hot weather concrete, high performance concrete. Waterproofing materials. Sound insulating materials, advances in concrete technology.

Course Objectives

To familiarize the students with properties, specifications and requirements for special purpose concretes as well as insulating materials.

Course Topics

- Properties and strength of light weight concrete
- Massive concrete, high strength concrete
- Hot weather concrete
- High performance concrete
- Waterproofing materials
- Sound insulating materials
- Advances in concrete technology

References

- Mehta, P.K., and Monterio, P.J.M., "*Concrete: Structure, Properties, and Materials*," Second Edition, Prentice-Hall, Englewood Cliffs, USA, 1994.
- Neville, A.M., "*Properties of Concrete*," Fourth Edition, Longman Scientific and Technical, England, 1996.
- Illston, J.M., "*Construction Materials: Their Nature and Behavior*," E. and F.N. Spon, 1994.
- American Concrete Institute, "*Manual of Concrete Practice*," Parts 1-5, Detroit, USA, 2003.
- ASTM standards, 2004.

Course Code : **CB 741**

Course Title : **Advanced Structural Analysis**

Credit Hours : **3**

Course Description

Matrix analysis of two-dimensional frames by the stiffness method. Force and displacement methods; formulation of different types of element flexibility, stiffness matrices. Temperature effects. Shear deformation in beams. Non-linear structural analysis. Computer applications.

Course Objectives

To present the methods of matrix analysis to the students with emphasis on application to determinate and indeterminate problems.

Course Topics

- Matrix analysis of two-dimensional frames by the stiffness method
- Force and displacement methods
- Formulation of element flexibility and stiffness matrices.
- Temperature effects
- Shear deformation in beams
- Non-linear Structural analysis
- Computer applications

References

- Wang, C.K., "*Indeterminate Structural Analysis,*" Prentice-Hall, Englewood Cliffs, USA, 1984.
- Charles, A., "*Structural Analysis*," Second Edition, Prentice-Hall, Englewood Cliffs, USA, 1990.
- Ghali, A., and A.M. Neville, "*Structural Analysis*," McGraw-Hill, New York, USA, 1986.
- Wang, C.K., "*Matrix Methods of Structural Analysis*," International Text Book Company, PA, USA, 1970.
- Arbabi, F., "*Structural Analysis and Behavior*," McGraw-Hill, New York, USA, 1991.
- Ghali, A., "*Concrete Structures: Stresses and Deformations*," Chapman and Hall, London, 1986.
- Nelson, J.K., and J.C. McCormack, "Str*uctural Analysis: Using Classical and Matrix Methods*," Third Edition, John Wiley and Sons, 2003.

Course Code : **CB 743**

Course Title : **Concrete Durability**

Credit Hours : **3**

Course Description

Design of concrete mixtures for durability, permeability of concrete and factors affecting it, organic and inorganic acid attack of concrete, effect on sulfates on concrete, effect of chlorides on the durability of concrete, effect of sea water on concrete, corrosion of steel reinforcement and its protection.

Course Objectives

To introduce the students with the long-term properties of concrete materials, prevention of deterioration and sustainability for long term.

Course Topics

- Design of concrete mixtures for durability
- Permeability of concrete and factors affecting it
- Organic and inorganic acid attack of concrete
- Effect of sulfates on concrete
- Effect of chlorides on the durability of concrete
- Effect of sea water on concrete
- Corrosion of steel reinforcement and its protection

References

- Mehta, P.K., and Monterio, P.J.M., "Conc*rete: Structure, Properties, and Materials*," Second Edition, Prentice-Hall, Englewood Cliffs, USA, 1994.
- Neville, A.M., "*Properties of Concrete*," Third Edition, Longman Scientific and Technical, England, 1983.
- Illston, J.M., "*Construction Materials: Their Nature and Behavior*," E. and F.N. Spon, 1994.
- American Concrete Institute, "*Manual of Concrete Practice*," Parts 1-5, Detroit, USA, 1995.
- ASTM standards, 2004.
- Ulm, F.J., "*Creep, Shrinkage, and Durability Mechanics of Concrete and Other Quasi Brittle Materials*," Pergamon Press Inc., 2001.

Course Code : **CB 744**

Course Title : **Fiber Reinforced Composites**

Credit Hours : **3**

Course Description

Fiber reinforcement of cement based matrices; continuous and discontinuous fibers and meshes. Fiber reinforced concrete and Ferro-cement. Behavior and mechanical properties. Mechanics of fiber reinforcement. High strength, high performance fiber composites. Fiber reinforced plastic reinforcement.

Course Objectives

To introduce the students to different properties of FRC, their behavior and application. New Developments of FRP are to be targeted.

Course Topics

- Fiber reinforcement of cement-based matrices
- Continuous and discontinuous fibers and meshes
- Fiber reinforced concrete and ferro-cement
- Behavior and mechanical properties
- Mechanics of fiber reinforcement
- High strength high performance fiber composites
- Fiber reinforced plastic reinforcement

References

- Shah, S.P., and G.B. Batson, "*Fiber Reinforced Concrete, Properties and Applications*," American Concrete Institute, Detroit, USA, 1987.
- Nanni, A., "*Fiber Reinforced Plastic Reinforcement for Concrete Structures: Properties and Applications*," Elsevier Publishers, New York, 1993.
- Banthia, N., C. Macdonald, and P. Tatnall, "St*ructural Applications of Fiber Reinforced Concrete*," American Concrete Institute, Farmington Hills, MI, 1999.
- Stevens, D.J., "*Testing of Fiber Reinforced Concrete*," American Concrete Institute, Farmington Hills, MI, 1995.
- *Manual of Concrete Practice*, American Concrete Institute, Farmington Hills, MI, 1995.
- Stang, H., "*Mechanics of Fiber Reinforced Concrete: Materials Design for Structural Applications*," Research Studies Press, 2005.

Course Code : **CB 745**

Course Title : **Advanced Strength of Materials**

Credit Hours : **3**

Course Description

General theory of torsion, nonsymmetrical bending, transverse shear, thin-walled beams, beams on elastic foundations, thick-walled cylinders. Basic contact mechanics. Failure criteria of solids.

Course Objectives

To familiarize the students with the behavior of the materials under various advanced types of loadings as well as failure mechanisms of structure.

Course Topics

- General theory of torsion
- Nonsymmetrical bending
- Transverse shear
- Thin-walled beams, beams on elastic foundations
- Thick-walled cylinders
- Basic contact mechanics
- Failure criteria of solids

References

- Bickford, W.B., "*Advanced Mechanics of Materials*," Addison-Wesley, CA, USA, 1998.
- Cook, R.D., "*Advanced Mechanics of Materials*," Prentice-Hall, NJ, 1999.
- Popov, E.P., "*Mechanics of Materials*," Second Edition, Prentice-Hall, Englewood Cliffs, USA, 1976.
- Gere, J.M., and S.P. Timoshenko, "*Mechanics of Materials*," Third Edition, PWS-Kent Publishers, Boston, USA, 1990.

Course Code : **CB 746**

Course Title : **Advanced Design of Reinforced Concrete Structures**

Credit Hours : **3**

Course Description

Inelastic behavior of reinforced concrete beams and columns. Combined bending, shear and torsion in beams. Behavior of beams, columns, and walls under seismically induced load reversals. Analysis and design of connections.

Course Objectives

To introduce the students to the advanced design concepts of the reinforced concrete structures.

Course Topics

- Inelastic behavior of reinforced concrete beams and columns
- Combined bending
- Shear and torsion in beams
- Behavior of beams, columns, and walls under seismically induced load reversals
- Analysis and design of connections

References

- Kong, F.K., and R.H. Evans, "*Reinforced and Prestressed Concrete*," Chapman and Hall, London, 1987.
- Wang, C.K., and C.G. Salmon, "*Reinforced Concrete Design*," Fourth Edition, Harpor and Row Publishers, NY, 1998.
- Park, R., and T. Paulay, "*Reinforced Concrete Structures*," Wiley, 1990.
- *Building Code Requirements for Reinforced Concrete*, ACI 318-04.
- *Egyptian Code of Practice for Reinforced Concrete*, 2004.
- McCormack, J.C., and J.K. Nelson, "*Design of Reinforced Concrete*," Sixth Edition, John Wiley and Sons, 2004.

Course Code : **CB 747**

Course Title : **Advanced Prestressed Concrete**

Credit Hours : **3**

Course Description

Prestressing in statically indeterminate structures; design of prestressed concrete slabs; analysis and design of partially prestressed concrete beams; nonlinear analysis; analysis of members prestressed with unbonded tendons; prestressed compression members; special research and/or application related topics.

Course Objectives

To familiarize the students to concepts of analysis and design of indeterminate prestressed concrete structures.

Course Topics

- Prestressing in statically indeterminate structures
- Design of prestressed concrete slabs
- Analysis and design of partially prestressed concrete beams
- Nonlinear analysis
- Analysis of members prestressed with unbonded tendons
- Prestressed compression members
- Special research and/or application related topics

References

- Lin, T.Y., and N.H. Burns, "*Design of Prestressed Concrete Structures*," Wiley, NY, USA, 1981.
- *PCI Design Handbook*, Precast and Prestressed concrete, Precast-Prestressed Institute, Chicago, 1999.
- Naaman, A.E., "*Prestressed Concrete Analysis and Design: Fundamentals*," McGraw Hill Publishers, NY, 1982.
- *Building Code Requirements for Reinforced Concrete*, ACI 318-83.
- Kong, F.K., and R.H. Evans, "*Reinforced and Prestressed Concrete*," Chapman and Hall, London, 1987.
- Hilal, M., "*Fundamentals of Reinforced and Prestressed Concrete*," J. Macro Publishers, Cairo, 1971.
- Gerwick, B., "*Construction of Prestressed Concrete Structures*," Second Edition, Wiley, NY, 1993.
- Nawy, E.G., "*Prestressed Concrete: A Fundamental Approach*," Fourth Edition, Prentice Hall, 2002.

Course Code : **CB 748**

Course Title : **Repair of Concrete Structures**

Credit Hours : **3**

Course Description

Concrete behavior: embedded metal corrosion, disintegration mechanics, moisture effects, load effects, concrete evaluation, surface repair, strengthening and stabilization, protection.

Course Objectives

To introduce the students to different causes and methods of repair in reinforced concrete structures.

Course Topics

- Concrete behavior
- Embedded metal corrosion
- Disintegration mechanics
- Moisture effects and load effects
- Concrete evaluation
- Surface repair
- Strengthening and stabilization
- Protection

References

- Son, L.H., and G.C.S. Yuen, "*Building Maintenance Technology*," MacMillan Press, London, 1993.
- Mailvaganam, N.P., "*Repair and Protection of Concrete Structures*," CRC Press, Florida, USA, 1991.
- Krstulovic-Opara, N., "*SP-185 High Performance Fiber Reinforced Concrete in Infrastructure Repair and Retrofit*," American Concrete Institute, Farmington Hills, MI, USA, 2000.

Course Code : **CB 749**

Course Title : **Bridge Structures**

Credit Hours : **3**

Course Description

Advanced concepts and modern trends in design of bridges. Rehabilitation, repair, and retrofit of existing bridges. Use of relevant codes. Study of Alternative structural forms and materials for efficiency and economy. Design problems and reports.

Course Objectives

To present the modern approach of bridge design, analyses and health evaluation.

Course Topics

- Advanced concepts and modern trends in design of bridges
- Rehabilitation, repair, and retrofit of existing bridges
- Use of relevant codes
- Study of Alternative structural forms and materials for efficiency and economy
- Design problems and reports

References

- Bakht, B., and L.G. Jaeger, "*Bridge Analysis Simplified*," McGraw-Hill, NY, USA, 1985.
- Rockey, K., and H.R. Evans, "*The Design of Steel Bridges*," Granada Publishers, London, 1981.
- Heins, C., and R. Lawric, "*Design of Modern Highway Concrete Bridges*," Krieger Publication Company, Florida, 1992.
- Liu, T.C., "*Strength Evaluation of Existing Concrete Bridges*," American Concrete Institute, Detroit, 1985.
- Jagadeesh, T.R., and M.A. Jyaram, "*Design of Bridge Structures*," Prentice Hall of India, 2004

Course Code : **CB 740-S**

Course Title : **Finite Element Method**

Credit Hours : **3**

Course Description

Introduction to the finite element method; Formulation of various finite element stiffness in one, two, and three dimensions; presentation of the principles of modeling and analysis of civil engineering problems using linear, planar, plate, and solid elements; application of the finite element principles to practical problems; introduction to a typical finite element software package.

Course Objectives

To introduce the students to the concepts and methods of finite element analysis of structures.

Course Topics

- Introduction to the finite element method
- Formulation of various finite element stiffness in one, two, and three dimensions
- Presentation of the principles of modeling and analysis of civil structures
- Application to practical problems
- Introduction to a typical finite element software package

References

- Rockey, K., "*The Finite Element Method: A basic Introduction*," Wiley, Née, USA, 1983.
- Bickford, W., "*A first Course in the Finite Element Method*," Irwin Publishers, Illinois, 1994.
- Huebner, K., "*The Finite Element Method for Engineers*," Wiley, NY, USA, 1995.
- Logan, D., "*A First Course in the Finite Element Method*," PWS Publishing company, Boston, 1993.
- Zienkiewicz, O.C., and R.L. Taylor, "*Finite Element Method: Volume 2, Solid Mechanics*," Fifth Edition, Butterworth-Heinemann, 2000.

Course Code : **CB 741-S**

Course Title : **Theory of Elasticity**

Credit Hours : **3**

Course Description

Fundamentals of isotropic linear elasticity. Solution of plane elasticity problems. Saint-Venant bending and torsion. Basic three-dimensional solutions.

Course Objectives

To introduce the students to the concepts and methodologies of elasticity theory.

Course Topics

- Fundamentals of isotropic linear elasticity
- Solution of plane elasticity problems
- St. Venant bending and torsion
- Basic three-dimensional solutions

References

- Novozhilov, V., "*Foundations of the Nonlinear Theory of Elasticity*," Dover Publications, Née, USA, 1999.
- Reismann, H., "*Elasticity: Theory and Applications*," Krieger Publications Company, Florida, USA, 1991.
- Saada, A., "*Elasticity: Theory and Applications*," Krieger Publications Company, Florida, USA, 1993.
- Timoshenko, S., "*Theory of Elasticity*," McGraw-Hill, New York, USA, 1978.

Course Code : **CB 742-S**

Course Title : **Plastic Analysis and Design of Structures**

Credit Hours : **3**

Course Description

Plastic analysis of structural frames. Rules of practice for the plastic design of steel and reinforced concrete structures. Design problems and reports.

Course Objectives

To introduce the students to the concepts and methodologies of limit state analysis and design of structures.

Course Topics

- Plastic analysis of structural frames
- Rules of practice for the plastic design of steel and reinforced concrete structures
- Design problems and reports

References

- *Manual of Steel Construction*, Ninth Edition, American Institute of Steel Construction, USA, 2004.
- Moy, S., "*Plastic Methods for Steel and Concrete Structures*," Wiley, NY, 1981.
- Disque, R.O., "*Applied Plastic Design in Steel*," Van Nostrand Reinhold, 1978.
- Jirasek, M., and Z.P. Bazant, "*Inelastic Analysis of Structures*," John Wiley and Sons, 2001.
- *Load and Resistance Factor Design Manual (LRFD)*, Third Edition, American Institute of Steel Construction, AISC 325-01, 2005.

Course Code : **CB 743-S**

Course Title : **Structural Dynamics and Earthquake Engineering**

Credit Hours : **3**

Course Description

Development of a rational basis for design of earthquake resistant design. Engineering characterization of earthquakes; dynamics of inelastic systems; response of inelastic structures; structural system design considerations; modeling and analysis of buildings; performance-based design; an advanced seismic design topic of choice, time permitting. Application of relevant design specifications.

Course Objectives

To introduce the students to the design of structures that would sustain dynamic loading (earthquake forces).

Course Topics

- Engineering characterization of earthquakes
- Dynamics of inelastic systems; response of inelastic structures
- Structural system design considerations
- Modeling and analysis of buildings
- Performance-based design
- Application of relevant design specifications

References

- Chopra, A.K., "Dy*namics of Structures: Theory and Applications to Earthquake Engineering,*" Prentice-Hall, USA, 2006.
- Chopra, A.K., and B. Zeiders, "*Earthquakes Dynamics of Structures, a Primer*," Second Edition, Earthquake Engineering Research Institute, 2005.
- Paz, M., and W. Leigh, "*Structural Dynamics: Theory and Computation*," Fifth Edition, Kluwer Academic Publishers, NY, 2004.
- Naeim, F., "*The Seismic Design Handbook*," Kluwer Academic Publishers, Second Edition, 2001
- Fanella, D., "*Design of Low-Rise Concrete buildings for Earthquake Forces*," Portland Cement Association, Illinois, USA, 1997.
- Ambrose, J., "*Simplified Building Design for Wind and Earthquake Forces*," Wiley, NY, 1995.
- Paulay, T., and M. Priestly, "*Seismic Design of Reinforced Concrete and Masonry Buildings,*" Wiley Inter Science, NY, 1992.
- Ghosh, S., "*Earthquake-Resistant Concrete Structures*," American Concrete Institute, Detroit, USA, 1991.

Course Code : **CB 744-S**

Course Title : **Design of Special Metallic Structures**

Credit Hours : **3**

Course Description

Design of special steel structures (towers, masts, tanks, etc), torsion of open and box members. Design of tall buildings. Behavior of steel and aluminum structural members is studied with reference to their code design procedures.

Course Objectives

To introduce the students to the design concepts of special steel structures.

Course Topics

- Design of special steel structures (towers, masts, tanks, etc)
- Torsion of open and box members
- Behavior of steel and aluminum structural members
- Code design procedures

References

- Johnston, B.G., F.J. Lin, and T.V. Galambos, "*Basic Steel Design*," Third Edition, Prentice-Hall, Englewood Cliffs, USA, 1986.
- American Institute of Steel Construction, "*Manual of Steel Construction*," Ninth Edition, 2001.
- *Egyptian code requirements for steel structures*.
- Cooper, S.E., and A.C. Chen, "*Designing Steel Structures: Methods and Cases*," Prentice-Hall, Englewood Cliffs, USA, 1985.
- Salmon, C.G., and R.P. Johnson, "*Steel Structures: Design and Behavior*," Second Edition, Harper and Row, 1980.

Course Code : **CB 745-S**

Course Title : **Composite Structures**

Credit Hours : **3**

Course Description

Full interaction of simple and continuous composite beams, types of connections, partial interaction theory of simple and continuous beams, effect of slip and uplift at the interface concrete slab-steel beams, analysis of composite columns.

Course Objectives

To familiarize the students with the advanced concepts of design and analysis of composite structures.

Course Topics

- Full interaction of simple and continuous composite beams
- Types of connections
- Partial interaction theory of simple and continuous beams
- Effect of slip and uplift at the interface concrete slab-steel beams
- Analysis of composite columns

References

- Johnson, R.P., "*Composite Structures of Steel and Concrete, Volume 1: Beams, Slabs, Columns, and Frames for Buildings*," Second Edition, Blackwell Scientific Publications, London, 1994.
- Narayanan, R., "*Steel-Concrete Composite Structures*," Elsevier Applied Science, NY, 1988.
- Kalamkarov, A., "*Analysis, Design, and Optimization of Composite Structures*," John Wiley and Sons, England, 1997.
- Wang, C.K., and C.G. Salmon, "*Reinforced Concrete Design*," Fourth Edition, Harpor and Row Publishers, NY, 1985.
- Kollár, L.P., and G.S. Springer, "*Mechanics of Composite Structures*," Cambridge University Press, 2003.

Course Code : **CB 746-S**

Course Title : **Reliability in Civil Engineering**

Credit Hours : **3**

Course Description

The role of risk and probability in Civil Engineering is described and basic probability concepts are presented. Probability distribution functions commonly used to model and analyze Civil Engineering problems are discussed. Methods for estimating parameters and determining distribution models from observational data are introduced. Monte Carlo simulation methods are practiced. Detailed examples of the application of probabilistic methods to structural, transportation, hydrological, and environmental system design are presented throughout the course.

Course Objectives

This course aims to introduce civil engineers to studying reliability and its applications in different fields of civil engineering. A variety of related problems that may evolve in the site is studied and explained.

Course Topics

- Fundamental Concepts related to structural reliability
- Probabilistic treatment of civil engineering systems
- Sample statistics, parameter estimation, and confidence intervals
- Test if a distribution fits sampled data
- Regression analysis

References

- Ang, A.H-S., and W.H. Tang (1975), "Pr*obability Concepts in Engineering Planning and Design, Basic Principles*", Vol. I. Wiley, NY.
- Andrews J. D., and T. R. Moss (2000), "*Reliability and Risk Assessment*", Second Edition, Professional Engineering Publishing, London.
- Modarres, M. (1993), "*Reliability and Risk Analysis: What Every Engineer Should Know About Reliability and Risk Analysis*", Marcel Dekker, Inc., NY.
- Ushakov, A., and R. A. Harrison (1994), "*Handbook of Reliability Engineering*", Wiley, NY.

Faculty Members

(in alphabetical order)

- **AHMED AWAD**
  Ph.D. (2006) Nottingham University, UK
  Construction Management

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  Ph.D. (1994) Rensselaer Polytechnic Institute, USA
  Geotechnical Engineering

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  Ph.D. (2003) Nottingham University, UK
  Coastal Engineering and Hydraulics

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  Ph.D. (1994) Michigan State University, USA
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  Ph.D. (2001) Dundee University, UK.
  Structural Engineering

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  Ph.D. (2004) Loughborough University, UK
  Construction Management

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  Ph.D. (2007) University of Manitoba, Canada
  Structural Engineering

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  Construction Engineering

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  Ph.D. (1988) McGill University, Canada
  Transportation and Highway Engineering

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  Ph.D. (2004) University of Southern California, USA
  Structural Engineering

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  Structural Engineering and Metallic Structures

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  Ph.D. (2002) Georgia Institute of Technology, USA
  Construction Materials

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  Ph.D. (1981) University of California, Berkeley, USA
  Coastal Engineering and Water Resources

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  Ph.D. (2007) Alexandria University, Egypt
  Geotechnical Engineering

- **USAMA ELSHAMY**
  Ph.D. (2005) Rensselaer Polytechnic Institute, USA
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- **WAEL KAMEL,** Head of Department
  Ph.D. (1994) University of Paul Sabatier, France
  Environmental Engineering

ELECTRICAL AND CONTROL ENGINEERING

M.ENG. PROGRAM

OVERVIEW

With electrification projects forging ahead in developing countries and peak demand forecast doubling every ten years, projects of super grids emerged to link all Arab nations from Iraq in the east to Morocco in the west and across the continent from North Africa to South Africa with eventual interconnection with Europe. Consequently, there is a pressing need for experts in research areas of generation, transmission, distribution, and utilization of electrical power.

On the other side, the fast development of sensors, actuators, Programmable logic controllers, Discrete control systems, power electronic devices and electric drive systems together with the rising need for highly complicated automatic control systems in military, industrial, commercial and electrical power systems areas raised in turn the need of control systems and electric drives research experts.

Program Detailed Structure

M.ENG. PROGRAM

PRE-MASTER'S COURSES:

Course Code	Course Title	Credit Hours
EE 511	Discrete Control Systems	0
EE 512	Automated Industrial Systems (I)	0
EE 514	Robotics	0
EE 543	Electrical Power Distribution	0
EE 544	Power Systems (3)	0
EE 522	Electrical Drives (2)	0
Subtotal		**0**

CORE COURSES:

Course Code	Course Title	Credit Hours
EE 703	Advanced Engineering Mathematics	3
EE 704	Digital Circuit Design	3
EE 705	Electrical Measurement systems	3
Subtotal	**3 Courses * 3 Credit Hours**	**9**

GROUP (I) : CONTROL ELECTIVE COURSES

Course Code	Course Title	Credit Hours
EE 712	Linear Control systems	3
EE 713	Digital control Systems	3
EE 714	System Identification and Adaptive Control	3
EE 715	Optimal Control	3
EE 716	Fuzzy Systems	3
EE 717	Neural Networks and Neurocontrol	3
EE 718	Process Control	3
EE 719	Intelligent Control Systems	3
EE 710-C	Advanced Automated Industrial Systems	3

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GROUP (II) : POWER AND MACHINES ELECTIVE COURSES

Course Code	Course Title	Credit Hours
EE 721	Dynamics of Electrical Machines	3
EE 722	Computer–Aided Analysis of Electrical Machines	3
EE 723	Advanced Analysis and Design of Electric Motors	3
EE 724	Electrical Drives (3)	3
EE 725	Power Electronics (3)	3
EE 726	Vector Control of Electrical Drives	3
EE 727	Advanced Electrical Machines	3
EE 728	Industrial Power Conversion systems	3
EE 729	Generalized Theory of Electrical Machines	3
EE 740	Transients in Power Systems	3
EE 741	HVDC Power Transmission	3
EE 742	Electrical Insulation Engineering	3
EE 743	Power System Reliability	3
EE 744	Reactive Control in Electrical Power Systems	3
EE 745	Power System Control and Stability	3
EE 746	Computer Control of Power System	3
EE 747	Solid State Relays and their Applications	3
EE 748	Power System Analysis	3
EE 749	Renewable Energy Systems	3
EE 740-P	Advanced Power Quality	3
EE 741-P	Energy Conservation Systems	3
Elective Subtotal	**7 courses * 3 Credit Hours**	**21**

Total	**30**

Courses

Course Code : **EE 703**

Course Title : **Advanced Engineering Mathematics**

Credit Hours : **3**

Course Description

Probability theory and stochastic models. Probability and random variables, probability distributions and densities. Conditional probability and densities. Functions of random variable. Expectations and moments of random variables Conditional expectations. Gaussian random vectors, linear operators of Gaussian random variables. Estimation with static linear Gaussian system models. Markov chains. Stochastic process and linear dynamic system models. Error analysis and computer related problems. Numerical Methods. Numerical methods in matrix algebra. Curve fitting. Optimization techniques.

Course Objectives

The student should become acquainted with:

- Various methodologies for solving mathematical problems related to stochastic processes, numerical methods, curve fitting and optimization.

Course Topics

- Probability theory and stochastic models
- Probability and random variables
- Probability distributions and densities
- Conditional probability and densities
- Functions of random variable
- Expectations and moments of random variables
- Conditional expectations
- Gaussian random vectors
- Linear operators of Gaussian random variables
- Estimation with static linear Gaussian system models
- Markov chains
- Stochastic process and linear dynamic system models
- Error analysis and computer related problems
- Numerical Methods
- Numerical methods in matrix algebra
- Curve fitting
- Optimization techniques

References

- R. E. Walpole, "*Probability and Statistics for Engineers and Scientists*", Pearson Education. N.J., 2007.
- S. Chappa and Canale, "*Numerical Methods for Engineers with Software and Programming Applications*", McGraw-Hill, London, 2002.

Course Code : **EE 704**

Course Title : **Digital Circuit Design**

Credit Hours : **3**

Course Description

Data Conversion: Data domain, digitalization. A/D and D/A conversion. Real time data processing: peripheral adaptors (synchronous and asynchronous). Inputs and output operations. Addressable switches. Data storage. Microprocessor based systems: sequence control; three term controllers; switching implementation motor position and speed control.

Course Objectives

The student should be able to:

- Know how the data is converted and digitalized.
- Learn methods of real time data processing and peripheral adaptors (synchronous and asynchronous)
- Deal with inputs and output operations, addressable switches and data storage.
- Microprocessor implementation in motor position and speed control.

Course Topics

- Data Conversion:
  - Data domain
  - Digitalization
- A/D and D/A conversion
- Real time data processing
- Peripheral adaptors:
  - synchronous
  - asynchronous
- Input and output operations
- Addressable switches
- Data storage
- Microprocessor based systems:
  - sequence control
  - three term controllers
  - switching implementation motor position and speed control

References

- F. Halsall and P. F. Lister, *'Microprocessor Fundamentals'*, UCL press 1993.
- A. P. Godse, *'Advanced Microprocessor and Microcontroller'*, Technical Publications Pune, 2004.

Course Code : **EE 705**

Course Title : **Electrical Measurement Systems**

Credit Hours : **3**

Course Description

Introduction, discrete event sensors, proximity sensors, photoelectric sensors, limit switches, fiber optics in instrumentation, single mode sensors, multi mode sensors, fiber optic magneto meter, fiber sensor design consideration, signal processing and transmission, signal amplification, signal attenuation, signal linearization, signal filtering, signal manipulation, sources of noise, measuring noise, noise reduction techniques.

Course Objectives

The student should be able to:

- Present different sensing element to different physical quantities.
- Update their knowledge of sensing elements and different components of instrumentation systems.

Course Topics

- Discrete event sensors
- Proximity sensors
- Photoelectric sensors
- Limit switches
- Fiber optics in instrumentation
- Single mode sensors
- Multi mode sensors
- Fiber optic magnetometer
- Fiber sensor design consideration
- Signal processing and transmission
- Signal amplification, signal attenuation
- Signal linearization, signal filtering, signal manipulation
- Sources of noise
- Measuring noise
- Noise reduction techniques.

References

- John P. Bently, "*Principles of measurement systems*, Longman Group Limited, UK, 1995.
- David E. Johnson and John L. Hilburn, "*Rapid practical Designs of Active Filters,* Wiley, New York, 1989.
- *Instrumentation Reference Book*, Walt Boyes, 3rd Edition, 2003

Course Code : **EE 712**

Course Title : **Linear Control System**

Credit Hours : **3**

Course Description

Review of SISO systems. Multivariable systems time varying systems. Controllability and observability, state variable feedback pole placement. System observer. Large scale systems. Introduction to optimum control Application.

Course Objectives

The student should be able to:

- Generalize the knowledge of students in the field of linear systems.
- Deal with linear multivariable systems and to get through practical models from the analysis and design point of view.

Course Topics

- Review of SISO systems
- Multivariable systems time varying systems
- Controllability and observability
- State variable feedback pole placement.
- System observer
- Large scale systems
- Introduction to optimum control application

References

- C.T. Chen. *Linear system theory and Design*, Oxford University Publisher, 1999.
- J.J. D'AZZO. and C. Houpis "*Linear control system analysis and design*", McGraw-Hill, 1995.
- I. Postethwaite and S. Skoestad, "*Multivariable Feedback Control: Analysis and Design*", Wiley, Chichester, 2005.

Course Code : **EE 713**

Course Title : **Digital Control Systems**

Credit Hours : **3**

Course Description

Review of systems analysis using the z-transform. Discrete system representation and modeling. State space representation. Controllability and observability. Observers. Controllers in discrete and digital forms.

Course Objectives

The student should be able to:

- Define digital system and its performance.
- Design, analyze and use controllers in discrete and digital forms.

Course Topics

- Review of systems analysis using the Z-transform
- Discrete system representation and modeling
- State space representation
- Controllability and observability
- Observers
- Controllers in discrete and digital forms

References

- Gene F. Franklin, J. D. Powell, "*Digital Control of Dynamic Systems*", 3rd Edition, 2008.
- B.C. Kou "*Digital Control Systems* ", Hotz Sanders, 1992.
- C.T. Chen, "*Analog and Digital Control System Design*", Saunders College Pb., 1992.
- C. Phillips, "*Digital Control System Analysis and Design*", Prentice Hall, 1990.

Course Code : **EE 714**

Course Title : **System Identification and Adaptive Control**

Credit Hours : **3**

Course Description

Statistical and optimization fundamentals. Impulse response identification. Parameter estimation. Frequency response estimation. Experimental methods. Correlation technique. Regression technique. Quasi-linearization method. Adaptive systems. Model reference adaptive systems. Self tuning regulators. Robust adaptive control.

Course Objectives

The student should be able to:

- Apply different methods of systems identification to control systems.
- Learn what adaptive control is, and how it can be applied.

Course Topics

- Statistical and optimization fundamentals
- Impulse response identification
- Parameter estimation
- Frequency response estimation
- Experimental methods
- Correlation technique
- Regression technique
- Quasi-linearization method
- Adaptive systems
- Model reference adaptive systems
- Self tuning regulators
- Robust adaptive control
- Gain Scheduling

References

- M.S. Santina, A.R. Stabberud and G.H. Hostetter, "*Digital Control System Design*", Saunders College Pub., 1994
- G.F. Franklin, I.D. Powell and M. Workman, "*Digital Control of Dynamic Systems*", Addison Wesley, 1998
- Benjamin C. Kuo, "*Digital Control Systems*", Saunder College Publishing, 1992
- C.L. Philip, "*Digital Control System Analysis and Design*", Prentice Hall Inc, 1990
- F. Nekoogar and G. Moriarty, "*Digital Control Using Digital Signal Processing*", Prentice Hall 1996

Course Code : **EE 715**

Course Title : **Optimal Control**

Credit Hours : **3**

Course Description

Review of unconstrained optimal control problems. Constrained mathematical programming. Variation problems. Maximum principle. Computer methods in optimal control. Geometric optimization.

Course Objectives

The student should be able to:

- Learn and apply optimization techniques in control systems.
- Use computer to optimize the controller.

Course Topics

- Performance measure
- Review of unconstrained optimal control problems
- Constrained mathematical programming
- Variation problems
- Maximum principle
- Computer methods in optimal control
- Geometric optimization
- Linear Quadratic Regulator (LQR)
- Stability review of linear systems

References

- G. F. Lawler, "*Optimal Control Theory for Applications*", Springer-Verlag, N.Y., 2003.
- J. B. Burl, "*Linear Optimal Control: H_2 and H [Infinity] Methods*," Addison Wesley, California, 1999.
- D. E Kirk, "*Optimal Control Theory: An Introduction*", 2004.

Course Code : **EE 716**

Course Title : **Fuzzy Systems**

Credit Hours : **3**

Course Description

Elementary introduction to fuzzy sets. Basic operations on fuzzy sets. Fuzzy logic knowledge based versus classical models. Self Organizing Fuzzy Logic Control SOFLC. Approach of fuzzy control. The Approach of Mamdani. The approach of Takagi and Sugeno Design parameters of fuzzy controllers. Variable domains. Linguistic rules. Defuzzification process. Case studies.

Course Objectives

The student should be able to:

- Know new approaches in design of controllers, of control systems.
- Principle of Fuzzy concepts.
- Fuzzy controllers.
- Usage of Fuzzy controller.

Course Topics

- Elementary introduction to fuzzy sets
- Basic operations on fuzzy sets
- Fuzzy logic knowledge based versus classical models
- Self Organizing Fuzzy Logic Control SOFLC
- Approach of fuzzy control
- The Approach of Mamdani
- The approach of Takagi and Sugeno
- Design parameters of fuzzy controllers
- Variable domains
- Linguistic rules
- Defuzzification process
- Case studies

References

- R. Kruse, J. Gebhardt ad F. Klawonn, “*Foundations of Fuzzy Systems*”, J. Wiley, 1994.
- RR. Yager and D.P. Filey, “*Essentials of Fuzzy Modeling and Control*”, J. Wiley, 1994.
- Witold Perdryz, “*Fuzzy Control and Fuzzy Systems*”, J. Wiley, 1993.
- R. Belohlarek, "Fuzzy *Relational Systems: Foundation and Principles*", 2002

Course Code : **EE 717**

Course Title : **Neural Networks and Neurocontrol**

Credit Hours : **3**

Course Description

Elementary biophysical background for signal propagation in natural and neural systems. Artificial Neural networks (ANN). Hopfield. Feed forward. Learning techniques of McCulloch and Pitts Model. Connectionist model. The random neural network model. Associative memory. Learning algorithm application to Control engineering.

Course Objectives

The student should be able to:

- Learn the graduate new techniques in control system
- Update the graduate an objective on neural networks and how it is applied in control system

Course Topics

- Elementary biophysical background for signal propagation in natural and neural systems
- Artificial Neural networks (ANN)
- Hopfield
- Feed forward
- Learning techniques of McCulloch and Pitts Model
- Connectionist model
- The random neural network model
- Associative memory
- Learning algorithm
- Application to Control engineering
- Self organized map
- Learning vector quantization radial bias

References

- R. Beale and T. Jackson, "*Neural computing: An introduction*", Institute of Physics Publishing, 1990.
- J. Hertz, A Krogh and R.G. Palmer, "*Introduction to the Theory of Neural Computation*", Addison Wesley, Redwood City, CA 1992.
- M. N. O Ravn, N. K. Hansen, "*Neural Networks for Modeling and Control of Dynamic Systems*", 2008

Course Code : **EE 718**

Course Title : **Process Control**

Credit Hours : **3**

Course Description

Mathematical modeling of chemical processes. Dynamic elements in the control loop. Characteristic of real process. Nonlinear control elements. Control system instrumentation. Feedback controller tuning. Continuous cycling method. Process reaction curve method. Feed-forward and ratio control design and tuning. Direct digital control (DDC). Minimal prototype algorithm. Internal model control. Degrees of freedom for process control. Process control design considerations. Industrial case study.

Course Objectives

The student should be able to:

- Apply modeling methods for different process and methods of tuning
- Model the process control (chemical, electromechanical, etc), Tuning of controller
- Design the process control

Course Topics

- Mathematical modeling of chemical processes
- Dynamic elements in the control loop
- Characteristic of real process
- Nonlinear control elements
- Control system instrumentation
- Feedback controller tuning
- Continuous cycling method
- Process reaction curve method
- Feed-forward and ratio control design and tuning
- Direct digital control (DDC)
- Minimal prototype algorithm
- Internal model control
- Degrees of freedom for process control
- Process control design considerations
- Industrial case study

References

- D.E. Seborg, T.F. Edgar and D.A. Mellichamp, "*Process Dynamics and Control*", John Wiley, 2004.
- P.S. Buckley, "*Techniques of Process Control*", Robert E. Kriegre Publishing Company, N.Y., 1979.

Course Code : **EE 719**

Course Title : **Intelligent Control Systems**

Credit Hours : **3**

Course Description

Knowledge representation techniques. Function of an expert system. Main structure of an expert system. Rule base. Inference engine. Reasoning module. Artificial intelligence and expert system application studies.

Course Objectives

The student should be able to:

- Construct the intelligent and expert system
- Get knowledge of expert system
- Apply the expert and artificial intelligent in control system

Course Topics

- Knowledge representation techniques
- Function of an expert system
- Main structure of an expert system
- Rule base
- Inference engine
- Reasoning module
- Artificial intelligence and expert system application studies
- Soft computing

References

- P. Jackson, "*Introduction to Expert Systems*", Addison Wesley, 1990.
- Dean, "*Artificial Intelligence (Theory and Practice)*", The Benjamin/ Cummings Publishing Company, 1995.
- J. S Albus and A. M. Meysrel, "*Intelligent Systems: Design and Control*", 2001
- Zi-Xing Cai, "*Intelligent Control: Principles, Techniques and Applications*", 1998

Course Code : **EE 710-C**

Course Title : **Advanced Automated Industrial Systems**

Credit Hours : **3**

Course Description

Supervisory Control and Data Acquisition (SCADA) systems fundamentals. SCADA protocols. Identification of system functional requirements. Communication system principles. Application of SCADA systems to transmission and distribution systems. Cost/Benefit analyses of alternative schemes

Course Objectives

The student should be able to design and apply supervisory control and data acquisition systems.

Course Topics

- Supervisory Control and Data Acquisition (SCADA) systems fundamentals
- SCADA protocols
- Identification of system functional requirements
- Communication system principles
- Application of SCADA systems to transmission and distribution systems
- Cost/Benefit analyses of alternative schemes

References

- J. Stenerson, “Fundamentals of Programmable Logic Controllers, Sensors and Communications”, Prentice Hall, 1999.

Course Code : **EE 721**

Course Title : **Dynamics of Electrical Machines**

Credit Hours : **3**

Course Description

Conventional analysis of machine dynamics. Generalized equation of machines. Active and passive transformation. Transient performance of various machines including three-phase and unbalanced short circuits. Dynamics of regulated machines. The effects of voltage regulator and governor on synchronous generators. Stability analysis using various stability criteria.

Course Objectives

The student should be able to:

- Represent the electric machines in their non linear models.
- Analysis and monitor the machine performance in both transient and steady state modes.
- Construct a complete model for the whole system and study the effect of disturbances.

Course Topics

- Conventional analysis of machine dynamics
- Generalized equation of machines
- Active and passive transformation
- Transient performance of various machines including three-phase and unbalanced short circuits
- Dynamics of regulated machines
- The effects of voltage regulator and governor on synchronous generators
- Stability analysis using various stability criteria

References

- C. Ong, "*Dynamic Simulation of Electric Machinery Using Matlab/Simulink*", Prentice-Hall, N.J., 1998.
- J. J. Cathey, "*Electric Machines Analysis and Design Applying MATLAB*", McGraw-Hill, London, 2001.

Course Code : **EE 722**

Course Title : **Computer Aided-Analysis of Electrical Machines**

Credit Hours : **3**

Course Description

Application of Maxwell's Equation in electric machines analysis in d-q representation of special quantities. An electric machine as a circuit element. The role of magnetic energy in electromechanical energy conversion. Steady-state performance of induction machines. Steady-state performance of commutator machines. Steady-state performance of synchronous machines. Electric machine dynamics. Description and utilization of mathematical software of electric machines analysis and design.

Course Objectives

The student should be able to:

- Represent any rotating electric machines in d-q model.
- Extract the output power; either electrical or mechanical from the model.
- Use the latest software packages to represent the models such as MATLAB or ANSOFT.

Course Topics

- Application of Maxwell's equation in electric machines analysis in d-q representation of special quantities
- An electric machine as a circuit element
- The role of magnetic energy in electromechanical energy conversion
- Steady-state performance of induction machines
- Steady-state performance of commutator machines
- Steady-state performance of synchronous machines
- Electric machine dynamics
- Description and utilization of mathematical software of electric machines analysis and design

References

- V. Ostovic, "*Computer-Aided Analysis of Electric Machines*", Prentice-Hall, 1994.
- A. K. Mukhopadhyay, "*Matrix Analysis of Electrical Machines*", New Age International, New Delhi, 1996.

Course Code : **EE 723**

Course Title : **Advanced Analysis and Design of Electric Motors**

Credit Hours : **3**

Course Description

Induction motor analysis and design. Synchronous motor analysis and design. Direct-current analysis and design. Testing for performance. Motor insulating systems. Motor control and motor protection. Energy-efficient motors. Economics of energy-efficient motors and systems. Environmental considerations. Reliability.

Course Objectives

The student should be able to:

- Select and design the appropriate motor for the chosen load.
- Design each element in the motor including protection components
- Study the economic aspects in conjunction with performance optimization.

Course Topics

- Induction motor analysis and design
- Synchronous motor analysis and design
- Direct-current analysis and design
- Testing for performance
- Motor insulating systems
- Motor control and motor protection
- Energy-efficient motors
- Economics of energy-efficient motors and systems
- Environmental considerations
- Reliability

References

- R. H. Engelmann and W. H. Middendorf, "*Handbook of Electric Motors*", M.Dekker Inc. N.Y., 1995.
- J. C. Andreas, "*Energy-Efficient Electric Motors*", M. Dekker Inc. N.Y., 1994.
- J. Hindmarsh, "*Electrical Machines and their Applications*", Pergamon Press, 1970.

Course Code : **EE 724**

Course Title : **Electrical Drives 3**

Credit Hours : **3**

Course Description

Review of Power semiconductor devices and circuits. Matching between motor and load characteristics, DC or AC drives?, AC and DC machines for drives. Voltage and Current fed converters driving DC and AC motors. Control techniques in Advanced drive systems.

Course Objectives

The student should be able to:

- Choose the power electronic device suitable for the nature of the selected power supply and drive.
- Understand the different techniques for driving DC and AC machines.
- Simulate and analyze different electric drive systems.
- Study the new trends in electric machine drives.

Course Topics

- Review of power semiconductor devices and circuits
- Matching between motor and load characteristics,
- DC or AC drives?
- AC and DC machines for drives
- Voltage and current fed converters driving DC and AC motors
- Control techniques in advanced drive systems

References

- B. Gray, "*Electrical Machines and Drive Systems*", Longman, 1990.
- B. K. Bose, "*Modern Power Electronics and AC Drives*", Prentice Hall, 2002.

Course Code : EE 725

Course Title : Power Electronics 3

Credit Hours : 3

Course Description

Review for recent power electronic devices, Practical considerations for gate drive signals, New trends in converter topology, Applications of power electronics: Electric machine drives, utilities and power systems.

Course Objectives

The student should be able to:

- Study the new trends in Power electronic devices and circuits.
- Simulate and analyze different types of power electronic converters.
- Understand recent applications of power electronics.

Course Topics

- Review for recent power electronic devices
- Practical considerations for gate drive signals
- New trends in converter topology
- Applications of power electronics
- Electric machine drives
- Utilities and power systems

References

- M. H. Rashid, "*Power Electronics Circuits, Devices and Applications*," Prentice Hall, 2004.
- N. Mohan, T. Undeland and W. Robbins, "*Power Electronic Converters: Applications and Design*", Wiley, 2003.
- F.L. Luo, H. Ye and M. Rashid, "*Digital Power Electronics and Applications*", Elsevier, 2005.

Course Code : **EE 726**

Course Title : **Vector Control of Electrical Drives**

Credit Hours : **3**

Course Description

AC Motor models for drive application. Fundamentals of induction motors. Vector control of voltage source inverter fed induction motor and synchronous motor drives. Vector control of current source inverter fed induction motor and synchronous motor drives. Vector control of cyclo-converter-fed synchronous motor drives.

Course Objectives

The student should be able to:

- Learn to represent the electric machines in their complex vector models.
- Analysis and extract the machine parameters in both transient and steady state modes.
- Compare vector control performance with any other technique such as constant V/F control.

Course Topics

- AC Motor models for drive application
- Fundamentals of induction motors
- Vector control of voltage source inverter fed induction motor and synchronous motor drives
- Vector control of current source inverter fed induction motor and synchronous motor drives
- Vector control of cyclo-converter-fed synchronous motor drives

References

- Boldea and S. A. Nasar, "*Vector control of AC Drives*", CRC Press, 1992.
- S. Yamamura, "*Spiral Vector Theory of AC Circuit and Machines*", Clarendon Press, Oxford, 1992.
- P. Vas, "*Electrical Machines and Drives: A Space Vector Theory Approach*", Clarendon Press, Oxford, 1992.

Course Code : **EE 727**

Course Title : **Advanced Electrical Machines**

Credit Hours : **3**

Course Description

Permanent magnet technology. Brushless DC motors and PM machines. Theory and performance of: Variable reluctance stepper motors, Permanent magnet stepper motors, Hybrid stepper motor. Casting construction. Drive circuit. Operation modes. Application. Solid rotor machines theory and their application. Homo-polar and hetero-polar machines

Course Objectives

The student should be able to:

- Study magnetic characteristics of permanent and excited magnets.
- Represent the saliency effect of singly excited machines.
- Simulate special machines in friendly user soft ware packages.

Course Topics

- Permanent magnet technology
- Brushless DC motors and PM machines
- Theory and performance of:
    - Variable reluctance stepper motors
    - Permanent magnet stepper motors
    - Hybrid stepper motor
- Casting construction
- Drive circuit
- Operation modes and Applications
- Solid rotor machines theory and their application
- Homo-polar and hetero-polar machines

References

- T. Kenjo, A. Sugwara, "*Stepping Motors and their Microprocessors Controls*", Clarendon Press, Oxford, 1994.
- J. F. Gieras and M. Wing, "*Permanent Magnet Motor Technology: Design and Applications*", Marcel Dekker, N.Y., 1997.

Course Code : **EE 728**

Course Title : **Industrial Power Conversion Systems**

Credit Hours : **3**

Course Description

Open loop control of DC drives. Series connected converters. Reversible drives. Dynamic braking. Closed loop control of DC drives. Regenerative braking. Phase locked loop control. Micro computer control. Open loop control of AC drives: induction, synchronous and permanent magnet motors. Closed loop control of AC drives. Current source and voltage source inverter-fed motor systems.

Course Objectives

The student should be able to:

- Simulate power electronic drive circuit in conjunction with the selected motor.
- Analyze the drive performance to be ready for controlling.
- Build the appropriate interfacing between the drive and the digital controller such as PLC or Microprocessor.

Course Topics

- Open loop control of DC drives
- Series connected converters
- Reversible drives
- Dynamic braking
- Closed loop control of DC drives
- Regenerative braking
- Phase locked loop control
- Micro computer control.
- Open loop control of AC drives:
    - Induction motor
    - Synchronous and permanent magnet motors
- Closed loop control of AC drives
- Current source and voltage source inverter-fed motor systems

References

- C. B. Gray, "*Electrical Machines and Drive Systems*", Longman, 1990.
- V. Subrahmanyam, "*Thyristor Control of Electric Drives*", Tata McGraw Hill, New Delhi, 1988.
- G. C. Barney and AG Laher, "*Elevator Electric Drives: Concepts and Principles, Control and Practice*", Ellis Harwood Ltd., New York, 1990.

Course Code : **EE 729**

Course Title : **Generalized Theory of Electrical Machines**

Credit Hours : **3**

Course Description

Application of matrix algebra to static electrical networks. The matrix equation of the basic rotating machine. The torque expressions. Linear transformation in circuits and machines. Steady state performance in DC, single-phase commutator machines and poly phase machines. Steady state performance. Transient in AC machined. Reference frames and applications.

Course Objectives

The student should be able to:

- Analysis any global rotating machine into perpendicular d and q axes.
- Extract the machine output in both transient and steady state modes.
- Build a complete model for the machine either in soft ware package or in ready-made block diagram packages such as SIMULINK inside MATLAB.

Course Topics

- Application of matrix algebra to static electrical networks
- The matrix equation of the basic rotating machine
- The torque expressions
- Linear transformation in circuits and machines
- Steady state performance in DC, single-phase commutator machines and poly phase machines
- Steady state performance
- Transient in AC machined
- Reference frames and applications

References

- A. K. Mukhopadhyay, "*Matrix Analysis of Electrical Machines*", New Age International, New Delhi, 1996.
- Boldea and S. A. Nasar, "*Vector control of AC Drives*", CRC Press, 1992.

Course Code : **EE 740**

Course Title : **Transients in Power Systems**

Credit Hours : **3**

Course Description

Nature and characteristics of switching and lightning over voltages. Abnormal transient phenomena: Re-strike, arcing faults, Current chopping, Ferro-resonance, etc. lightening phenomena in the atmosphere. Methods of computation of transients: frequency domain and time domain analysis techniques. Basis of EMTP and its application. Shielding. Surge protection devices. Insulation coordination. Transient measuring techniques.

Course Objectives

The student should be able to:

- Know transient phenomena in power system.
- Understand the sources of transients in power systems.
- Design the methods for computing and analyzing transients.
- Understand Surge Protection devices and Insulation Coordination.

Course Topics

- Nature and characteristics of switching and lightning over voltages
- Abnormal transient phenomena:
    - Re-strike, arcing faults
    - Current chopping, Ferro-resonance,
    - Lightening phenomena in the atmosphere
- Methods of computation of transients:
    - frequency domain
    - time domain analysis techniques
- Basis of EMTP and its application
- Shielding
- Surge protection devices
- Insulation coordination.
- Transient measuring techniques.

References

- A. Greenwood, "*Electrical Transients in Power Systems*", Wiley, N.Y., 1991.
- P. Chowdhuri, "*Electromagnetic Transients in Power Systems*", Research studies publisher, Taunton, 1996.

Course Code : **EE 741**

Course Title : **HVDC Power Transmission**

Credit Hours : **3**

Course Description

Problems of long distance power transmission. Advantages of HVDC. Combined AC, DC transmission systems. Terminal apparatus, converters, inverters, thyristor bridge circuits, thyristor valves. Performance requirements and control circuit features. Protection schemes. Digital simulation techniques. Switching and fault-clearance over voltages. RIV and corona in DC transmission lines.

Course Objectives

The student should be able to:

- Thoroughly understand the HVDC system transmission system and its components.
- Get the performance requirements of DC transmission line.
- Simulate the HVDC system.

Course Topics

- Problems of long distance power transmission
- Advantages of HVDC
- Combined AC, DC transmission systems
- Terminal apparatus, converters, inverters, thyristor bridge circuits, thyristor valves
- Performance requirements and control circuit features
- Protection schemes
- Digital simulation techniques
- Switching and fault-clearance over voltages
- RIV and corona in DC transmission lines

References

- E. W. Kimbark, "*Direct Current Transmission, Vol. I and II*", J. Wiley, 1971.
- J. Arrilage, "*High Voltage Direct Current Transmission*", IEE, London, 1998.

Course Code : **EE 742**

Course Title : **Electrical Insulation Engineering**

Credit Hours : **3**

Course Description

Vacuum, gases, liquids and solids as electrical insulating media. Concept of electrical breakdown. Breakdown in gases, liquids and solids. Uniform and non-uniform fields. Insulation systems in bushings, transformers, cables, capacitors and circuit breakers. Partial discharges. Phenomenological theory of ageing: ageing mechanisms under electrical, thermal and combined stresses. Techniques for electrical non-destructive evaluation of materials. High voltage test techniques.

Course Objectives

The student should be able to:

- Know the types of insulating materials and the phenomenon of electric breakdown insulation materials.
- Illustrate the systems for different components of electric power systems.
- Test the electric equipment.

Course Topics

- Vacuum, gases, liquids and solids as electrical insulating media
- Concept of electrical breakdown
- Breakdown in gases, liquids and solids
- Uniform and non-uniform fields
- Insulation systems in bushings, transformers, cables, capacitors and circuit breakers
- Partial discharges
- Phenomenological theory of ageing: ageing mechanisms under electrical, thermal and combined stresses
- Techniques for electrical non-destructive evaluation of materials
- High voltage test techniques

References

- M. Khalifa, "*High Voltage Engineering*", M. Dekker, N.Y. 1990.
- Bradewell, "*Electrical Insulation*", Peter Peregrinus, London, 1983.
- M. Abdel-Salam, H. Anis ,A. El-Morshedy and R. Radwan, "*High Voltage Engineering - Theory and Practice*", Marcel Dekker Inc. , NY, 2nd Edition, 2000

Course Code : **EE 743**

Course Title : **Power System Reliability**

Credit Hours : **3**

Course Description

Review of basic probability theories. Basic reliability concepts and definitions. Static generation capacity reliability. Spinning generation capacity reliability. Composite system reliability. Overall reliability and Economic planning.

Course Objectives

The student should be able to:

- Understand power system reliability definitions.
- Apply reliability calculations of power generation.
- Apply system reliability calculations for transmission networks.
- Plane the overall power system reliability.

Course Topics

- Review of basic probability theories
- Basic reliability concepts and definitions
- Static generation capacity reliability
- Spinning generation capacity reliability
- Composite system reliability
- Overall reliability
- Economic planning

References

- R. Billington and R. N. Allan, "*Reliability Evaluation of Power Systems*", Pitman Publishers, 1984.
- E. E. Lewis, "*Introduction to Reliability Engineering*", Wiley, 1996.

Course Code : **EE 744**

Course Title : **Reactive Control in Electrical Power Systems**

Credit Hours : **3**

Course Description

Introduction to VAR control theory of load compensation. Practical considerations. VAR control in transmission networks under steady state. Series and shunt compensators. Dynamic shunt compensation. Static compensation: types and characteristics. Static VAR compensators in AC and HVDC systems. Typical applications of dynamic compensation and distribution systems. Harmonics. Reactive power management.

Course Objectives

The student should be able to:

- Apply the VAR control theory of load compensation and its practical considerations. Get acquainted with the different types of load compensators and know its characteristics and modeling.
- Design the thyristor controllers and its application in both transmission and distribution systems.

Course Topics

- Introduction to VAR control theory of load compensation
- Practical considerations
- VAR control in transmission networks under steady state
- Series and shunt compensators
- Dynamic shunt compensation
- Static compensation: types and characteristics
- Static VAR compensators in AC and HVDC systems
- Typical applications of dynamic compensation and distribution systems
- Harmonics
- Reactive power management

References

- T. J. Miller, "*Reactive Power Control in Electric Power Systems*", J. Wiley, N.Y., 1982.
- P. Kundur, "*Power System Stability and Control*", McGraw Hill Inc., 1994.
- C. Taylor, "*Power System Voltage Stability*", EPRI series, 1994.

Course Code : **EE 745**

Course Title : **Power System Control and Stability**

Credit Hours : **3**

Course Description

Machine voltage control: Exciters. System voltage control. Modeling of interconnected systems. System dynamics. Stability concepts. Steady state and Transient stability. Multi-machine systems. Dynamic stability. Power system stabilizers. Static VAR systems. DC links. Phenomenon of synchronous resonance.

Course Objectives

The student should be able to:

- Understand the excitation systems and their modeling.
- Understand the main concepts of stability – steady state – transient – dynamic.
- Understand the operation of VAR systems.
- Understand the DC links.

Course Topics

- Machine voltage control
- Exciters
- System voltage control
- Modeling of interconnected systems
- System dynamics
- Stability concepts
- Steady state
- Transient stability
- Multi-machine systems
- Dynamic stability
- Power system stabilizers
- Static VAR systems
- DC links
- Phenomenon of synchronous resonance

References

- O. L. Elgerd, "*Electric Energy System and Theory*", McGraw-Hill, N.Y. 1982.
- P. M. Anderson and A. A. Fouad, "*Power System Control and Stability*", IEEE Computer Society Publisher, 1994.

Course Code : **EE 746**

Course Title : **Computer Control of Power Systems**

Credit Hours : **3**

Course Description

State transition diagram. Security oriented functions. Data acquisition (SCADA systems). State estimation. Load forecasting. Economic load dispatch. Reactive power control. Contingency evaluation. Real time control and protection.

Course Objectives

The student should be able to:

- Understand data acquisition, transmission and processing (SCADA systems).
- Understand reactive power control and protection.

Course Topics

- State transition diagram
- Security oriented functions
- Data acquisition (SCADA) systems
- State estimation
- Load forecasting
- Economic load dispatch
- Reactive power control
- Contingency evaluation
- Real time control and protection

References

- P. M. Anderson and A. A. Fouad, "*Power System Control and Stability*", IEEE Computer Society Publisher, 1994.
- T. J. Miller, "*Reactive Power Control in Electric Systems*", J. Willey, N. Y. 1982.

Course Code : **EE 747**

Course Title : **Solid State Relays and Its Applications**

Credit Hours : **3**

Course Description

General review of static relays. Comparators and associated elements. Type of relays. Multi-input comparators circuit and associated relays. Non-conventional types of comparators. Computer applications to protective relaying. Microprocessor applications to protection. Reliability, testing and maintenance.

Course Objectives

The student should be able to:

- Know new techniques in relay industries.
- Understand the types of static relays and its components.
- Apply the different types of digital relays.

Course Topics

- General review of static relays
- Comparators and associated elements
- Type of relays
- Multi-input comparators circuit and associated relays
- Non-conventional types of comparators
- Computer applications to protective relaying
- Microprocessor applications to protection
- Reliability, testing and maintenance

References

- T.S.M. Rao, "*Power System Protection: Static Relays with microprocessor Applications*", Tata McGraw-Hill, New Delhi, 1989.
- P. M. Anderson, "Power System Protection", IEEE Computer Society Pr., N.Y., 1999.
- E.W. Kimbark, "*Power System Stability*, Vol. IV, Power Circuit Breakers and Protective Relays", IEEE Press, 1995.
- A.T. Jones and S.K. Salama, "*Digital Protection for Power Systems*", IEE, London, 1994.

Course Code : **EE 748**

Course Title : **Power System Analysis**

Credit Hours : **3**

Course Description

System modeling and load flow analysis. Optimum operation and control. Data acquisition, transmission and processing (SCADA system). Frequency, voltage and VAR control. Optimum control. Introduction to power system reliability. Unbalanced system analysis. Transient stability analysis. Harmonics; measuring, elimination with passive and active filters.

Course Objectives

The student should be able to:

- Build confidence and understanding of those concepts of power system analysis that are likely to be encountered in the study and practice of electric power engineering.
- Develop network models based on the admittance and impedance representations.
- Studying applications commonly encountered in electric power system engineers practice.

Course Topics

- System modeling and load flow analysis
- Optimum operation and control
- Data acquisition, transmission and processing (SCADA system)
- Frequency, voltage and VAR control
- Optimum control
- Introduction to power system reliability
- Unbalanced system analysis
- Transient stability analysis
- Harmonics measuring
- Harmonics elimination with passive and active filters

References

- O.L. Elgerd, "*Electric Energy System Theory*", McGraw-Hill, N.Y., 1982.
- P.M. Anderson and A.A. Fouad, "*Power System Control and Stability*", IEEE Computer Society Publisher, 1994.
- L. L. Grisby, "*Power System Stability and Control*", CRC PR., 2007.

Course Code : **EE 749**

Course Title : **Renewable Energy Systems**

Credit Hours : **3**

Course Description

Introduction to Renewable Energy Sources: Geothermal energy, Bio-Energy, Tidal sources of energy, Ocean energy, Solar energy, Wind Energy. – Solar Energy: Characteristics of solar radiation, Solar thermal energy (active solar heating, solar thermal energies, passive solar heating), Solar Photovoltaic: Basic considerations, Electrical Characteristics, PV system components and types, PV system sizing and applications, Present and future status of solar systems. – Wind Energy: Wind speed and Energy distribution (Speed / Power relation, Power extracted from the wind), System components, Electricity generation systems, Present and future status of wind systems. – Economics of Energy systems. – Environmental aspects of energy systems.

Course Objectives

The student should be acquainted with:

- The various renewable energy systems.
- Decision making based on energy systems economics and environmental aspects.

Course Topics

- Introduction to Renewable Energy Sources: Geothermal energy, Bio-Energy, Tidal sources of energy, Ocean energy, Solar energy, Wind Energy
- Solar Energy:
    - Characteristics of solar radiation
    - solar thermal energy active solar heating
    - solar thermal energies passive solar heating
- Solar Photovoltaic: Basic considerations, Electrical Characteristics, PV system components and types, PV system sizing and applications, Present and future status of solar systems
- Wind Energy: Wind speed and Energy distribution (Speed / Power relation, Power extracted from the wind), System components, Electricity generation systems, Present and future status of wind systems
- Economics of Energy systems
- Environmental aspects of energy systems

References

- Bent Sørensem, "*Renewable Energy*", ELSEVIER Academic press, 2004.
- Godfrey Boyle, "*Renewable Energy*", Open University, Oxford, 2004.
- John Twidell, "*Renewable Energy Resources*", Spon press, London, 2004.

Course Code : **EE 740-P**

Course Title : **Advanced Power Quality**

Credit Hours : **3**

Course Description

Definition of Power Quality. Types of power quality disturbances. Major causes of power quality disturbances. Effect of PQ disturbances on power systems. Power factor correction. Mitigation of PQ disturbances. Power filters: passive and active. SVC & DVR for reactive power compensation and voltage support.

Course Objectives

The student should be acquainted with:

- Different types of power quality disturbances.
- Effect of power quality disturbances on different elements of electrical power system
- The different mitigation techniques for power quality disturbances (passive and active)

Course Topics

- Definition of Power Quality
- Types of power quality disturbances
- Major causes of power quality disturbances
- Effect of PQ disturbances on power systems
- Power factor correction
- Mitigation of PQ disturbances
- Power filters: passive and active
- SVC & DVR for reactive power compensation and voltage support

References

- Barry W. Kennedy, "*Power Quality Primer*", McGraw-Hill, NY, 2000.
- R.C. Dugan, M.F. McGranaghan & H.W. Beaty, "*Electrical Power Systems Quality*", 2nd Ed., McGraw-Hill, NY, 2002.

Course Code : **EE 741-P**

Course Title : **Energy Conservation Systems**

Credit Hours : **3**

Course Description

Importance and benefits of electrical energy saving. Introduction to concept of energy saving tools. Consumption optimization. Cost allocation. Energy usage analysis: Pumps, Energy saving in lighting systems, Energy saving in HVAC systems. Energy purchasing optimization: Peak demand reduction, Electricity procurement optimization. Electrical distribution automation and remote control. Asset optimization.

Course Objectives

The student should be acquainted with:

- The concept of energy conservation
- Electrical power distribution automation and optimization

Course Topics

- Importance and benefits of electrical energy saving
- Introduction to concept of energy saving tools
- Consumption optimization
- Cost allocation
- Energy usage analysis:
    - Pumps
    - Energy saving in lighting systems
    - Energy saving in HVAC systems
- Energy purchasing optimization:
    - Peak demand reduction
    - Electricity procurement optimization
- Electrical distribution automation and remote control
- Asset optimization

References

- IEEE Bronze Book, "*Recommended Practice for Energy Conservation and Cost Effective Planning in Industrial Facilities*", IEEE, USA.
- Turner, Wayne C., "*Energy Management Handbook*", 2nd Ed.
- Donald R. W., "*Energy Efficiency Manual*", Energy Institute Press.

Faculty Members

(in alphabetical order)

- **AHMED EL-KASHLAN**
  Ph.D. (1984) Alexandria University, Egypt
  Control Engineering

- **AHMED HELAL**
  Ph.D. (2004) Heriot-Watt University, UK
  Electrical Machines and Drives

- **AHMED LOTFY**
  Ph.D. (1997) Alexandria University, Egypt
  Electrical Power

- **ALAA KHALIL**
  Ph.D. (1999) Ain Shams University, Egypt
  Electrical Machines and Drives

- **AMANY EL-ZONKOLY**
  Ph.D. (2003) Tanta University, Egypt
  Power Systems Engineering

- **EZZ-ELDIN ZAKZOUK**
  Ph.D. (1977) Antonim Zapotocky Academy, Czechoslovakia
  Stochastic Control Engineering

- **HAMDY ASHOUR**
  Ph.D. (1999) Heriot-Watt University, UK
  Electrical Machines and Drives

- **HUSSEIN DESSOUKI**, Head of Department
  Ph.D. (1990) Suez Canal University, Egypt
  Electric Power Systems

- **IBRAHIM EL-MOHR**
  D.Sc. (1986) George Washington University, USA
  Power Systems

- **MAHMOUD ABOUZEID**
  Ph.D. (1991) Alexandria University, Egypt
  Electrical Machines and Drives

- **MOSTAFA SHAHEEN**
  Ph.D. (2006) University of Mannheim, Germany
  Control Engineering

- **SAMAH EL-SAFTY**
  Ph.D. (1998) Ain Shams University, Egypt
  Electrical Power

- **SHADY ELKASHLAN**
  Ph.D. (2006) Ain Shams University, Egypt
  Electrical Power and Machines

- **WALID GHONEIM**
  Ph.D. (2003) Heriot-Watt University, UK
  Electrical Machines and Drives

- **YASSER GABER**
  Ph.D. (1998) Heriot-Watt University, UK
  Electrical Machines and Drives

ADJUNCT FACULTY MEMBERS

- **ABDELAAL ASRAN**
  Ph.D. (2003) Alexandria University, Egypt
  Adaptive Automatic Control

- **AHMED AMER**
  Ph.D. (1989) Lille University, France
  Control Engineering

- **MEDHAT EL-SINGABY**
  Ph.D. (1987) Alexandria University, Egypt
  Automatic Control Engineering

- **MOHAMED ABDEL-RAHIM**
  Ph.D. (1994) Alexandria University, Egypt
  Automatic Control Engineering

ELECTRONICS AND COMMUNICATIONS ENGINEERING

M.ENG. PROGRAM

M.Eng. in Electronics and Communications Engineering

OVERVIEW

Established in 1987, the department is considered to be the first Electronics and Communications Engineering Department all over Non-State universities in Egypt, with its primary mission to cope with the rapid progress in the area of electronics and communications which has been reflected on all aspects of life and led to a new era of advanced technology.

This mandates the creation of national specialists capable of coping with the future advancement in this area, and contributing positively to the solution of problems hindering the optimum use of such technologies in different applications.

The objectives of the Electronics and Communications Engineering Department are:

- To teach students how to analyze and implement interdisciplinary engineering projects.
- To prepare the students for competitive and challenging industrial applications in the areas of Wireless Communications, Biomedical Engineering, Analog and Digital Signal Processing Systems, Computer Controlled Automated Industrial Systems, Mobile Communication Systems, Microcontrollers and Embedded Systems, Antennas and Microwave Systems.
- To give students a strong foundation for graduate studies in the field of Electronics and Communications Engineering.
- To teach students how to use state-of-the-art computer aided design tools for solving electronics and communications engineering problems.
- To expose students to hands-on engineering experience through laboratory sessions, design and research projects.
- To cultivate the ability of the students to communicate and work effectively in teams.
- To help students develop an understanding of the ethical issues arising in the practice of the engineering profession.

In order to accomplish the aforementioned objectives, the Electronics and Communications Engineering program offers the following graduate degrees:

- M.Eng. in Electronics and Communications Engineering.
- Diploma in one of the following areas:
    - Advanced Communications Engineering
    - Microelectronics
    - Biomedical Engineering

The program of study towards the M.Eng. degree aims at providing the student with scientific and technical background necessary for the electronics and communications engineer. This includes mathematics, physics, electrical engineering, and computer science, in addition to a great depth of knowledge of the generation, transmission, and radiation of electronic signals, and the design of electronic systems.

Job opportunities for the graduate of the electronic and communications engineering program cover a whole spectrum of fields including civilian and military applications, concerned with specifying the most suitable equipment for a certain function, offering expert opinion and consultation in the field, designing electronics and communications systems, equipments, and circuits.

Application areas include consumer electronics, fixed and mobile telephony systems, biomedical systems, electronic computers, Radio and television, GPS, radar systems, and satellite communications systems.

Program Detailed Structure

M.ENG. PROGRAM

M.Eng. in Electronics and Communications Engineering

DIVISION (A): ELECTRONICS ENGINEERING

CORE COURSES:

Course Code	Course Title	Credit Hours
EC 721	Advanced Digital Communications	3
EC 731	Advanced Digital Signal Processing	3
EC 732	Automated Measurements	3
Subtotal	**3 Courses * 3 Credit Hours**	**9**

DIVISION (B): COMMUNICATIONS ENGINEERING

CORE COURSES:

Course Code	Course Title	Credit Hours
EC 721	Advanced Digital Communications	3
EC 731	Advanced Digital Signal Processing	3
EC 742	Microwave Antennas Systems	3
Subtotal	**3 Courses * 3 Credit Hours**	**9**

Divisions (A) and (B)

ELECTIVE COURSES:

Course Code	Course Title	Credit Hours
EC 713	Biomedical Engineering	3
EC 720	Modern Techniques in Pattern Recognition	3
EC 722	Optical Communications	3
EC 723	Satellite Communication Systems	3
EC 724	Mobile and Spread Spectrum Communications	3
EC 725	Speech Signal Processing and Digital Telephony	3
EC 726	Adaptive Signal Processing	3
EC 727	Communications Intelligence	3
EC 728	Communication Seminar	3
EC 729	Applications of SAW and CCD in Communication Systems	3

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Course Code	Course Title	Credit Hours
EC 730	Audio and Video Compression	3
EC 733	Photonic Devices	3
EC 734	Non-Silicon Semiconductors	3
EC 735	Electronics Seminar	3
EC 736	Neural Networks Applications	3
EC 737	Advanced Digital VLSI Design and Testing	3
EC 738	Advanced Electronic Devices	3
EC 739	Analog VLSI Design	3
EC 742	Microwave Antennas Systems	3
EC 743	Antennas for Mobile Communications	3
EC 744	Wireless Communications	3
EC 745	Telecommunication Networks	3
EC 746	Mobile Data Management	3
EC 747	Advanced Digital Image Processing	3
EC 748	Multimedia Communications Systems	3
EC 749	Computer-Aided Design and Analysis of Communication Systems	3
EC 750	Smart Antenna Technology	3
EC 751	Computational Electromagnetics using Finite Difference Method	3
Elective Subtotal	**7 Courses * 3 Credit Hours**	**21**

Total	**30**

M.Eng. in Electronics and Communications Engineering
DIVISION (C): BIOMEDICAL ENGINEERING

CORE COURSES:

Course Code	Course Title	Credit Hours
BE 711	Introduction to Biomedical Engineering	3
BE 712	Elementary Human Anatomy	3
BE 713	Elementary Human Physiology	3
Subtotal	**3 Courses * 3 Credit Hours**	**9**

Elective Courses:

Course Code	Course Title	Credit Hours
BE 715	Biological Systems Modeling and Analysis	3
BE 716	Biomedical Measurements	3
BE 717	Medical Imaging	3
BE 718	Biomedical Signal Processing	3
BE 719	Statistics for Biomedical Engineering	3
BE 720	Magnetic Resonance Imaging	3
BE 721	Biosensors	3
BE 722	Biomedical Seminar	3
BE 723	Neural Networks	3
BE 724	Advanced Patient Monitoring and Safety	3
BE 725	Telemedicine Networks	3
BE 726	Special Topics in Biomedical Engineering	3
Subtotal	**7 Courses * 3 Credit Hours**	**21**

Total	**30**

Courses

Course Code : **EC 713**

Course Title : **Biomedical Engineering**

Credit Hours : **3**

Course Description

Biomedical electronics in patient-care medical support equipment. Student projects in biomedical research topics include biomedical sensors, electromyography, biomagnetism, defibrillators, electromyography devices, biomedical lasers, biomedical signal analysis, computer tomography, nuclear medicine, ultrasound, and magnetic resonance imaging.

Course Objectives

The students should be able to apply their knowledge in electronics and communications into the analysis and design of patient-care biomedical equipment.

Course Topics

- Biomedical electronics in patient-care medical support equipment
- Biomedical sensors
- Electromyography
- Biomagnetism
- Defibrillators
- Electromyography devices
- Biomedical lasers
- Biomedical signal analysis
- Computer tomography
- Nuclear medicine
- Ultrasound
- Magnetic resonance imaging

References

- J. D. Branzino, *The Biomedical Engineering Handbook*, CRC and IEEE Press, 2000.
- R. Khandpur, *Handbook of Biomedical Instrumentation*, McGraw-Hill, 1995.

Course Code : **EC 720**

Course Title : **Modern Techniques in Pattern Recognition**

Credit Hours : **3**

Course Description

Features extraction techniques, classifiers, speech speaker recognition, image recognition.

Course Objectives

To become acquainted with all pattern recognition techniques.

Course Topics

- Features extraction
- Bayes's decision: Theory and traditional classifiers
- Neural Network classifiers
- Speech/speaker recognition and hidden Markov Models
- Image recognition

References

- K. Fukunaga, *Introduction to Statistical Pattern Recognition*, Academic Press, 1996
- Rabines, Juarg**,** *Fundamentals of Speech Recognition*, Englewood Cliffs, Prentice–Hall, 1993
- Duda and Hart**,** *Pattern Classification and Scene Analysis*, Wiley, 1973
- Chris Bishop**,** *Neural Networks for Pattern Recognition*, Oxford University Press, 1995.
- Vladimir N. Vapnick, *The Nature of Statistical Learning Theory*, Springer Verlag.

Course Code : **EC 721**

Course Title : **Advanced Digital Communications**

Credit Hours : **3**

Course Description

Characterization of signals and systems. Orthogonal expansions. Representations and spectra of digital modulated signals. Modulation and demodulation for AWGN channels signal waveforms. Optimum coherent detectors. Error probability for different M-array signals. Carrier recovery systems. Symbol synchronization methods. Noncoherent detection of M-array signals. Binary coding. M-array coded signals. Linear block coding. Soft and hard decision decoding. Convolution codes. Generation and decoding. Viterbi algorithm. Trellis code modulation.

Course Objectives

The student should become versed in the mathematical techniques used in dealing with modulation and synchronization as well as the different techniques of M-array digital signaling. Also, the student should be able to deal with channels coding either block or convolutional.

Course Topics

- Characterization of Signals and Systems
- Modulation and demodulation of M-array Signals
- Coding: binary, nonbinary block codes, convolution codes, TCM

References

- J. Proakis and M. Salehi, *Digital Communications*, McGraw-Hill, 5th ed., 2007.
- S. Haykin, *Digital Communications*, Wiley, 1988.
- Lin and Costello, *Error Correcting Codes*, Prentice Hall, 2nd edition, 2004.

Course Code : EC 722

Course Title : Optical Communications

Credit Hours : 3

Course Description

Optical Fiber Waveguides. Transmission Characteristics. Fiber and cable fabrication. Fiber connectors. Optical detectors. Optical amplifiers. Optical Multiplexing in optical systems. Optical Communication Systems. FTTH (Fiber-To-The-Home). Wireless Optical Communication

Course Objectives

- The student should have a very good background about the elements of the optical communication system, including: fiber, light source and detector and optical amplifier. He would be able to construct and adjust:
- A complete optical fiber communication system
- A simple optical network

Course Topics

- Optical Fiber Waveguides
- Transmission Characteristics
- Fiber and cable fabrication
- Fiber Connectors
- Optical Source
- Optical Detectors
- Optical Amplifiers
- Optical Multiplexing in optical systems
- Optical Communication Systems
- FTTH (Fiber-To-The-Home)
- Wireless Optical Communication

References

- J. M. Senior, *Optical Fiber Communications: Principles and Practice*, Prentice Hall, 2nd ed., 1992.
- E. Desurivire, *Erbium-Doped Fiber Amplifiers*, Wiley, 1st ed., 1994.
- J.C. Palais, *Fiber Optic Communications*, Prentice Hall, 4th ed., 1998.
- E. Iannone, F. Matera, A. Mecozzi and M. Settembre, *Nonlinear Optical Communication Networks*, Wiley, 1st ed., 1998.

Course Code : **EC 723**

Course Title : **Satellite Communication Systems**

Credit Hours : **3**

Course Description

Orbit dynamics, frequency allocations, satellite antennas propagation effects, power budget and noise. Modulation techniques, digital modulation and coding, multiplexing and multiple-access techniques. Satellite transponders. Applications.

Course Objectives

The student should be able to understand the launching, detailed structure of the space and earth station and the different multiple access techniques that are used.

Course Topics

- Orbit dynamics
- Link budget parameters and calculations
- antenna types and coverage foot prints
- Frequency allocations
- Modulation and coding, multiple access techniques
- Satellite transponders
- Applications:
    - Internet via satellite
    - VSAT (Very Small Aperture Satellites)
    - Remote-sensing satellites
    - GPS (Global Positioning System)
    - GMDSS
    - Search and Rescue

References

- Feher, K., *Satellite Communications Conference*, 1983.
- Moral, G., *Satellite Communications Systems: Techniques and Technology*, J. Wiley, 1993.
- Richharia, M., *Satellite Communications Systems*, MacMillan Press, 1995.
- Roddy Dennis, *Satellite Communication*, McGraw-Hill, 1995.

Course Code : **EC 724**

Course Title : **Mobile and Spread Spectrum Communications**

Credit Hours : **3**

Course Description

Types and properties of different Spread Spectrum Techniques: DS, FH, Chirp and hybrid systems. Performance of DS systems in noise and interference. Processing Gain and Jamming Margin. Performance of FH systems. Spreading codes: M-sequences, Gold and Kassami codes, Walsh orthogonal codes. Analysis of DS-CDMA systems. Applications of spread-spectrum systems: GPS, wireless LANs, Spread-spectrum mobile systems (IS-95). Cellular mobile systems. Frequency reuse. Propagation effects on mobile channels: Attenuation, fading, multipath, shadowing and scattering. Teletraffic engineering impact on cellular systems. Co-channel interference and its reduction. Sectorization, handoff, channel sharing, micro and macro cells. GSM mobile systems. Spread-spectrum mobile communications. Student presentations and literature search on advanced topics including: Code optimization. Synchronization and tracking. 2.5 G mobile systems: WAP, GPRS and EDGE. 3G mobile systems based on spread-spectrum, CDMA2000 and UMTS. WCDMA. Considerations for 4G systems. Multi-user and Rake receivers. Multi-carrier CDMA systems.

Course Objectives

Students will be able to understand the types and properties of different spread spectrum techniques and spreading codes.

Course Topics

- Types and properties of different Spread Spectrum Techniques
- Performance of SS systems in noise and interference
- Spreading codes
- Applications of spread-spectrum systems
- Cellular mobile systems
- Propagation effects on mobile channels
- Teletraffic engineering impact on cellular systems
- GSM mobile systems — Spread-spectrum 2G mobile communications (IS-95)
- 2.5G and 3G mobile systems
- Selection of advanced topics

References

- Lee, W.C.Y., *Mobile Communication Engineering*, McGraw-Hill, 1982.
- Steele, R. and Hanzo, L., *Mobile Radio Communications*, 2nd Ed., Wiley, 1999.
- Cooper, G. and McGillem, C., *Modern Communications and Spread Spectrum*, McGraw-Hill, 1998.
- Dixon, R., *Spread Spectrum with Commercial Applications*, Wiley, 1994.
- Jakes, W., *Microwave Mobile Communications*, Wiley, 1974.
- Holma, H. and Toskala, A., *WCDMA for UMTS; Radio Access for Third Generation Mobile Communications*, Wiley, 2000.

Course Code : **EC 725**

Course Title : **Speech Signal Processing and Digital Telephony**

Credit Hours : **3**

Course Description

Speech signals. Digital model of speech. Digital representation of the speech waveform. Linear predictive coding of speech. Digital speech processing for machine communication. Speech and speaker recognition. Digital telephony network hierarchy. Standard CCITT regulations. Circuit switching. Space division switching. Different protocols. Performance analysis of switched systems.

Course Objectives

The student should be versed in:

- Digital techniques and systems in the field of telephony
- Evolution of the telephony system from the analog form to the digital form

Course Topics

- Speech signals
- Coding of speech; speech and speaker recognition
- Digital telephony network
- Different protocols, performance of switched systems

References

- Douglas O'Shaughnessy, *Speech Communications*, IEEE Press 2000.
- Thomas F. Quatieri, *Discrete-Time Speech Signal Processing*, Prentice Hall PTR 2001.
- Bellamy, *Digital Telephony*, Wiley, 1997.

Course Code : **EC 726**

Course Title : **Adaptive Signal Processing**

Credit Hours : **3**

Course Description

Procedures of Optimal Signal Processing and its applications. Introduction to Adaptive Signal Processing. Applications (Adaptive Noise Canceling, Adaptive Line Enhancer, Adaptive Echo Canceling). Algorithms and structures of adaptive signal processing. IIR Adaptive Filters, Lattice, Frequency Domain Implementation. Seminars given by the students.

Course Objectives

To provide a broad perspective of adaptive filtering techniques and their implementation, theoretical foundation, limitations, and practical constraints

Course Topics

- Review.
- Random signal analysis: Discrete Random Signals, Spectral Representations, Response of Linear Systems to Random Input, Random Signal Models, Estimation of Moments
- Optimal Signal Processing: Procedures, Filter Design, Applications
- Adaptive Signal Processing: Introduction, Least Mean Square Algorithm, LMS Performance
- Applications: Adaptive Noise Canceling, Adaptive Line Enhancer, Adaptive Echo Canceling, Adaptive Filters for Time-Delay, Applications to Communications
- Adaptive Signal Processing: Algorithms and Structures, LMS, RLS (Recursive Least Squares), IIR Adaptive Filters, Lattice, Frequency Domain Implementation

References

- Peter M. Clarkson, *Optimal and Adaptive Signal Processing*, by CRC Publishing
- B. Farhang-Boroujeny, *Adaptive Filtering: Theory and Applications*
- J.R. Treichler, C.R. Johnson, Jr., and M.G. Larimore, *Theory and Design of Adaptive Filters*
- Simon Haykin, *Adaptive Filter Theory*, 4th ed.

Course Code : EC 727

Course Title : Communications Intelligence

Credit Hours : 3

Course Description

Theory of Cryptography, theoretical approach, some early cipher systems, mono and poly Alphabetic ciphers, statistical analysis, Mechanical Cryptography Devices, cipher systems, pure cipher, perfect cipher, Random cipher, Cryptoanalysis, Channon's Five criteria, worst case conditions, one time pad, stream cipher, linear shift register, finite state machine, nonlinear shift registers, techniques, nonlinearity, periodicity, Randomness, implementation, Block cipher systems, feedback cipher systems, Data Encryption Standard DES, key structure, key management, signature, Public key Cryptography, RSA, Taher El-Gamal and Elliptic curve cryptosystems, Encryption and Signature and hashing and implementation, Advanced encryption standard AES, voice Encryption, Scramblers and speech security systems, Digital watermarking, theoretical approach, techniques, Algorithms and implementation.

Course Objectives

The student will become versed in the theory of cryptography, Scrambling, key management, Protocols, stream cipher, data encryption standards, public key systems and digital watermarking.

Course Topics

- Cryptography
- Random Ciphers, Shannon's Criteria
- Block cipher
- Key structure, Data encryption standards
- Public key
- Digital Watermarking

References

- Henry Becker and Fred Pioer, *Cipher Systems*.
- William Stallings, *Cryptography and Network Security*.
- I.J. Cox, M.L. Miller, J.A. Bloo, *Digital Watermarking*.

Course Code : **EC 728**

Course Title : **Communications Seminar**

Credit Hours : **3**

Course Description

A series of seminars with topics related to the field of communications such as spread spectrum, mobile communications, wireless communication networks, communications security, optical communications, Satellite Communications, Multi-media Communications, digital telephony, voice over IP, digital television and teleconference ISDN, ADSL and packet switching, application of digital Signal processing techniques in communications

Course Objectives

The student will gain knowledge about new trends in communications and be aware of the current research topics in that field. The student will prepare a seminar on one of the selected topic(s), present the seminar and get feedback from the academic staff as well as his/her colleagues in the course. A neatly written report with detailed analysis and references as well as comparisons and possibly simulations is also expected to be presented by the student.

Course Topics

- Spread Spectrum Techniques and applications
- Next G mobile Communication Systems
- Wireless Communication Networks
- Communications Security
- Optical communications (Topics different than those in EC 722)
- Satellite Communications (Topics different than those in EC 723)
- Application of Digital Signal Processing Techniques in Communications
- Multi-media Communication Systems
- Digital Telephony and Voice over IP (Topics different than those in EC 725)

References

- According to the subject of the seminar.

Course Code : **EC 729**

Course Title : **Applications of SAW and CCD in Communication Systems**

Credit Hours : **3**

Course Description

Part 1: Surface Acoustic Wave (SAW) devices, interdigital transducer, dispersive, no dispersive, models, fabrication, matching networks, delay lines, bandpass filters, dispersive, nondispersive, filter design, phase coded, correlates, convolvers, reflecting grating, FM chip filters, resonators, radar equipments, sensors, antenna duplexers and oscillators in Mobile and wireless communication.

Part 2: Charge-coupled devices (CCD), technologies, MOS capacitor, transfer mechanism, surface channel, buried channel, transfer electrodes. Applications of CCD, analog delay lines, time division multiplexing, filters, correlators, digital memories, logic arrays, imaging sensors, CCD camera.

Course Objectives

The student should be versed in surface acoustic wave (SAW), SAW devices, SAW components in mobile and wireless communications, charge-coupled devices (CCD), CCD devices, CCD in imaging and analog signal processing.

Course Topics

- Surface acoustic wave (SAW)
- SAW devices
- SAW components in mobile and wireless communications
- Charge coupled devices (CCD)
- CCD devices

References

- H. Mathews, *Surface Wave Filters*.
- *Surface acoustic wave devices for mobile and wireless communications*.
- A. H. W. Beck, J. Jamb, *Charge coupled devices*.

Course Code : EC 730

Course Title : Audio and Video Compression

Credit Hours : 3

Course Description

Multimedia has become an essential part of modern computer and communication technology. In this course, students will be introduced to principles and current technologies of multimedia systems. Issues in effectively representing, processing, and retrieving audio and video data. The students will gain hands-on experience in those areas by implementing some components of a multimedia streaming system as their term project. Latest standard technologies and some advanced topics in current multimedia research will also be discussed.

Course Objectives

To provide a broad treatment of the fundamentals of speech, image, audio and video processing.

Course Topics

- Introduction to Multimedia
- Audio/Video fundamentals including analog and digital representations, human perception, and audio/video equipment
- Topics in data compression including coding requirements, source, entropy, and hybrid coding
- Elements of Image Compression System
- Video Coding: Fixed-length and Variable-length Codes
- Lossless and Lossy Compression
- Discrete cosine transforms
- Short-term Fourier Transform and Continuous Wavelet Transform
- CWT, Discrete Wavelet Transforms and 2D Wavelet Transforms
- Motion Estimation: Matching Criteria and Generalized Matching
- Still image compression standards: JPEG, JPEG-2000
- Video Compression Standards: overview, H.261
- MPEG-1, MPEG-2 and MPEG-4 Standards: specifications

References

- Ze-Nian Li and Mark S. Drew, "*Fundamentals of Multimedia*", Pearson Education, 2004.

Course Code : **EC 731**

Course Title : **Advanced Digital Signal Processing**

Credit Hours : **3**

Course Description

Applications of DSP Discrete Transform Domains. Introduction to Multirate signal processing. Application of Multirate signal processing as: Quadrature Mirror Filterbank (QMF), multirate filterbank, and transmultiplexers. Adaptive filters. Wavelet Transforms and some of its applications. Spectrum Estimation. Theory and traditional classifier. Seminars given by the students.

Course Objectives

To become familiar with multirate signal processing and its applications, Adaptive filters, wavelet transform and traditional classifiers used in biometric recognition techniques

Course Topics

- Review (Z-transform, Correlation, Digital filter design)
- Discrete Transform domains (DCT, Walsh, Hadamard Transforms)
- Multirate signal processing
- Multirate filterbanks (QMF – M-filterbanks – Multiplexers)
- Adaptive filters
- Wavelet Transform
- Spectrum Estimation
- Theory and traditional classifiers of biometric recognition techniques

References

- E. C. Ifeachor and B. W. Jervis, *Digital Signal Processing: A Practical Approach,* Prentice Hall, 2002
- Steven W. Smith, *The Scientist and Engineer's Guide to Digital Signal Processing*
- Saeed V. Vaseghi, *Advanced Digital Signal Processing and Noise Reduction*, 3rd Ed., Wiley, 2006

Course Code : **EC 732**

Course Title : **Automated Measurements**

Credit Hours : **3**

Course Description

Sensing and measurements of non-electrical quantities. Different types of sensors. Signal conditioning. Data acquisition systems. Data storage and processing. Projects.

Course Objectives

The student should become versed in:

- the theory of operation of different transducers.
- the theory of operation of instrumentation amplifiers
- the data acquisition system concept and theory of operation of its components
- the design of automated measurement systems

Course Topics

- Transducers and Sensors
- Signal conditioning and Data accession and logging
- Computer Interfacing
- Data Communications and Computer Networking for Telemetry

References

- Arnold, H. and Van Doren, *Data Acquisition Systems*, Reston Publishing Co., 1982.
- R. Pallas and J. G. Webster, *Sensors and Signal Conditioning*.
- Steven Grengo, *Interfacing: A Lab Approach*, Prentice Hall.
- Omega Instrumentation, *Reference Year Book*, V. 127.

Course Code : **EC 733**

Course Title : **Photonic Devices**

Credit Hours : **3**

Course Description

Radiative transition and optical absorption. Light-emitting diodes, visible and infra-red LED's. Semiconductor laser. Electronic and optical properties of semiconductor materials. Semiconductor heterostructures and quantum wells. Laser structures, operation and characteristics. Photodetectors and photoconductors. Photodiodes and avalanche Photodiodes. Optoelectronic integrated circuits (OEIC's). Solar cells: solar radiation, homojunction and heterojunction solar cells.

Course Objectives

The student should understand the theory and operation of different semiconductor devices used in optical communication as well as in other optoelectronic applications.

Course Topics

- Semiconductor devices for photonic applications
- Fabrication of photonic devices
- Characteristics of photonic devices
- Applications of photonic devices

References

- S. M. Sze, *Semiconductor Devices: Physics and Technology*, J. Wiley, 1988.
- J. Singh, *Semiconductor Optoelectronics: Physics and Technology*, McGraw-Hill, 1995.
- E. Rosencher and B. Vinter, *Optoelectronics*, Cambridge University Press, 2002.

Course Code : **EC 734**

Course Title : **Non-Silicon Semiconductors**

Credit Hours : **3**

Course Description

II-VI Compound semiconductors: nature, properties, crystal growth, optical properties, transport properties, and applications. III-V Compound semiconductors: nature, properties, crystal growth, optical properties, transport properties, and applications.

Course Objectives

The student is introduced to II-VI and III-V compounds semiconductors and should be able to understand their preparation, properties and applications.

Course Topics

- Properties of II-VI and II-V Compounds
- Single-crystal growth and properties
- Optical properties
- Transport properties
- Applications of II-VI and II-V Compounds

References

- S. M. Sze, *VLSI Technology*, 2nd Ed., McGraw-Hill, 1988.
- S. M. Sze, *Semiconductor Devices: Physics and Technology*, Wiley, 1985.
- Selected papers

Course Code : **EC 735**

Course Title : **Electronics Seminar**

Credit Hours : **3**

Course Description

VLSI integrated circuits fabrication technology, Integrated circuit fabrication process simulation, Analog integrated circuits, Digital integrated circuits, RF integrated circuits, Low-power devices and circuits, Nanostructures: devices and circuits, MEMs and NEMs, Integrated optoelectronics, Data converters, Electronic filters and switched-capacitor circuits, Solar cell fabrication, GaAs Devices, Speech and Image Signal Processing, and Neural Networks.

Course Objectives

The student should be familiar with the processes used in VLSI technology, and different applications in analog, digital, and RF integrated circuits, OR A/D and D/A converters, OR electronic filters, OR Speech or Image processing.

Course Topics

- One of the following topics:
- VLSI integrated circuit technology
- Data Converters
- Electronic Filters
- Speech or Image Signal Processing

References

- P.R. Gray, R.G. Meyer, *Analysis and Design of Analog Integrated Circuits*, 2nd Ed., 1984
- S.M. SZE, *VLSI Technology*, McGraw-Hill, 1988.
- Seetzer, Prezk, Hamdy, *Electronic Analog to Digital Converters*, Wiley
- L. Ludeman, *Fundamentals of DSP*, Harper and Row.
- Selected papers

Course Code : **EC 736**

Course Title : **Neural Networks Applications**

Credit Hours : **3**

Course Description

Computing Methods based on Structure and Operation of the Human Brain, Physiological Principles and Neural Architectures, Interconnected Networks, Back-propagation Learning, Medical Applications of Artificial Intelligence and Expert Systems.

Course Objectives

Students should become acquainted with principles of biomedical computing in Signal Processing.

Course Topics

- Computing Methods based on Structure and Operation of the Human Brain
- Physiological Principles and Neural Architectures
- Interconnected Networks Back-propagation Learning
- Medical Applications of Artificial Intelligence and Expert Systems

References

- P. R. Lippman, J. E. Moody, and D. S. Touretzky, *Advances in Neural Information Processing Systems*, Morgan Kauffman, 1991.

Course Code : EC 737

Course Title : Advanced Digital VLSI Design and Testing

Credit Hours : 3

Course Description

This course scopes on design of VLSI digital circuits, Stick diagrams, design rules, CAD system, speed and power considerations, floor planning, layout techniques. Also, it gives a deep knowledge about VLSI testing techniques and design for testability.

Course Objectives

The student should gain knowledge and develop skills in:

- Design of Digital VLSI Circuits, Stick Diagram, Design Rules, CAD Systems, Speed and Power Considerations, Floor Planning, Layout techniques.
- Choice of circuit technology, process circuits associated with various types of components, testing techniques and design for testability

Course Topics

- MOS Theory
- Stick Diagrams
- CAD Tools, Introduction to CAD, SPICE Modeling
- Speed and Power considerations
- Resistance estimation
- MOS capacitor and switching characteristics
- Floor planning, layout techniques and design rules
- Design techniques for testability
- Fault Diagnosis and Simulation, Testing Equipment
- Test Program and Test Pattern, Test Flowchart, Plan and Strategy

References

- R. L. Geiger, P. E. Allen and N. R. Strader, "*VLSI Design Techniques for Analog and Digital Circuits*", McGraw-Hill, 1990.
- P. Allen, D. Holberg, "*CMOS Analog Circuit Design*", 2nd ed., Oxford University Press, 2002.
- Glasler, Dobberpuhi, "*The Design and Analysis of VLSI Circuits*", AW, 1988.
- S.M. Sze, "VLSI Technology", 2nd ed., McGraw-Hill, 1988.

Course Code : **EC 738**

Course Title : **Advanced Electronic Devices**

Credit Hours : **3**

Course Description

Electronic and photonic materials including semiconductors, superconductors, ferroelectrics, liquid crystals, conducting polymers, organic and superconductors, conductors, nonlinear optical and optoelectronic materials, electrochromic materials, laser materials, photoconductors, photovoltaic and electroluminescent materials. Deep knowledge of synthesis, processing, fabrication, spectroscopy, physical properties and applications of electronic and photonic materials in advanced electronic devices covering everything for today's and developing future technologies.

Course Objectives

Acquire deep knowledge of different types, synthesis, processing, fabrication, spectroscopy, physical properties and applications of electronic and photonic materials in advanced electronic devices covering everything for today's and developing future technologies.

Course Topics

- Electronic and photonic materials
- Synthesis, processing, fabrication, spectroscopy, physical properties and applications of electronic and photonic materials

References

- Hari Singh Nalwa, *Handbook of Advanced Electronic and Photonic Materials and Devices*, Academic Press; 1st ed., 2000

Course Code : **EC 739**

Course Title : **Analog VLSI Design**

Credit Hours : **3**

Course Description

Analog CMOS building blocks, layout design for high performance, and realization of analog arrays. CMOS OpAmp's. A/D and D/A converters. Phase-Locked Loops. Switched-capacitor filters. Neural network realizations. Projects.

Course Objectives

The student should be able to design and analyze Analog Integrated Circuits systems using CMOS technology.

Course Topics

- Analog CMOS Building blocks
- VLSI Layout
- Data converters and electronic filters
- Design for high performance and Design examples

References

- P. Allen and D. Holberg, *CMOS Analog Circuit Design*, 2nd Ed., 2002.
- P.R. Gray, R.G.Meyer, *Analysis and Design of Analog Integrated Circuits*.
- R. Gregordean and D. Temes, *Analog MOS Integrated Circuits for Signal Processing*.
- N. Weste and K. Eshraghian, *Principles of CMOS VLSI Design*, 2nd Ed.
- L. Glaser and D. Dobberpuhl, *The Design and Analysis of VLSI Circuits*.
- Selected papers

Course Code : **EC 742**

Course Title : **Microwave Antennas Systems**

Credit Hours : **3**

Course Description

Uniform and Non-Uniform illuminated apertures. Horn, slot and microstrip antennas. Curved Surface reflector antennas. Doubly curved surface reflector antennas. Ray optics, asymptotic techniques, and lens antennas. Non-uniformly feed arrays. Array synthesis techniques. Engineering mathematics (Matrices, QR Decomposition, and Gaussian Elimination). Phased arrays, non-uniform arrays, adaptive arrays and beam forming, signal processing arrays.

Course Objectives

The student should be able to design the following types of antennas:

- Wide band Antennas
- Microstrip patches
- Adaptive Antennas

Course Topics

- Aperture Antennas
- Horn Antenna
- Surface Reflector Antennas
- Slot and Microstrip Antennas
- Non-uniformly Feed Arrays
- Engineering Mathematics
- Phased Arrays
- Adaptive Arrays and Beam Forming

References

- Milligan, T.A. *Modern Design*, McGraw-Hill, 1981.
- Monzing, R. and T., *Introduction to Adaptive* Arrays, Wiley
- J. Bahl and P. Bhatia, "*Microstrip Antennas*", Artech House, INC., Massachusetts 1980.
- Simon Haykin, "*Adaptive Filter Theory*", 2nd edition.

Course Code : **EC 743**

Course Title : **Antennas for Mobile Communications**

Credit Hours : **3**

Course Description

Fundamental parameters of antennas, Linear wire antennas, Helical antenna, Inverted F-antenna, Log periodic antenna, Conical and Biconical antennas, and Slotted waveguide.

Course Objectives

- To introduce the students to the basics of antennas.
- Students should be versed in the different types of antennas that are used for mobile communications.

Course Topics

- Fundamental parameters of antennas
- Linear wire antennas
- Helical antenna
- Inverted F-antenna
- Log periodic antenna
- Conical and Biconical antennas
- Planar Inverted F-antenna
- Slotted waveguide

References

- I. J. Bahl, P. Bhatia, "*Microstrip Antennas*", Artech House.
- Constantine A. Balanis, "*Antenna Theory, Analysis and Design*", 2nd ed., Wiley

Course Code : **EC 744**

Course Title : **Wireless Communications**

Credit Hours : **3**

Course Description

This course covers the fundamental issues impacting all wireless communications and reviews virtually most of the important new wireless standard and technological development. Comprehensive coverage of the spread spectrum multiple access techniques and its applications in 2G and 3G mobile systems and wireless local area networks (WLAN) and satellite networks.

Course Objectives

The student should be familiar with the fundamental treatment about many practical and theoretical concepts that form the basis of modern wireless communication systems. Also, be familiar up to the minute technical details of the many emerging wireless standards throughout the world.

Course Topics

- Introduction to Digital Wireless RF Communications: Historical background
- Frequency allocations, Examples of wireless and Personal communications Systems
- Basic Concepts in Radio wave Propagation, Wireless system components
- Source coding, channel coding, interleaving, Digital modulation techniques for Mobile Radio
- Multiple Access and Spread Spectrum Techniques
- Code Division Multiple Access technique
- Multi-carrier CDMA and OFDM, MIMO-OFDM
- Mobile Radio Propagation, path loss, small-scale fading, multipath, spatial temporal channel
- The Cellular Radio Concept
- Second Generation (2G) cellular networks (IS95) and GPRS
- Third Generation (3G) Wireless Networks: WCDMA, CDMA2000 and EDGE
- Bluetooth and Personal Area Networks (PANs)
- New WLAN technologies: IEEE 802.11 a, b, and g standards, HIPERLAN, WIMAX
- UWB, Fixed wireless and Local Multipoint Distribution Services (LMDS), DECT systems

References

- Theodore Rappaport, "*Wireless Communications: Principles and Practice*", 2nd Edition, Prentice Hall PTR, 2002. (0-13-042232-0)
- Simon Haykin, "*Communication Systems*", 2nd Edition, Wiley, 1994. (0-741-57178-8)

Course Code : **EC 745**

Course Title : **Telecommunication Networks**

Credit Hours : **3**

Course Description

This course covers these topics: Motivations and objectives of computer networks; overview of layered architecture and the ISO Reference Model; network functions, circuit-switching and packet-switching; physical level protocols; data link protocols including HDLC and multi-access link control. Network control, transport, and session protocols including routing flow control; end-to-end communication and inter-networking. Presentation layer protocols including web, virtual terminal and file transfer protocols, cryptography, and text compression. It also introduces some important merging technologies, such as, integrated voice and data networks (VOIP) and the integration of wireless and wired networks. Specific examples and standards will be cited throughout the course.

Course Objectives

The student should be familiar with the fundamental concepts of networking and how network is modeled from the physical layer up to the transport layer. Also, he will be familiar with how these layers are implemented in LAN, WLAN and cellular networks.

Course Topics

- OSI and TCP/IP models
- Switching techniques
- Physical layer
- MAC layer
- Network layer
- Transport layer
- LAN, cellular and WLAN as network models

References

- According to material contents and simulation tools

Course Code : EC 746

Course Title : Mobile Data Management

Credit Hours : 3

Course Description

The course covers emerging topics in database systems and related technologies. Hands-on experience is gained through an emerging technology-driven semester long project in the field of mobile and wireless communications.

Course Objectives

The student should be familiar with the fundamental concepts of mobile networking and mobile data management as well as how data is stored, retrieved, replicated and updated.

Course Topics

- Overview of emerging database applications and challenges
- Mobile Database Management
- Mobile Location based Services
- Spatial Indexing Techniques
- Data Clustering Algorithms
- Stream databases
- Data Mining and Privacy Preserving Data Mining
- Web Search and Web IR
- Role based Access Control
- Data Warehouse and OLAP
- RFID data management
- Workflow Management

References

- According to material contents and simulation tools

Course Code : **EC 747**

Course Title : **Advanced Digital Image Processing**

Credit Hours : **3**

Course Description

Introduction to Human Visual System, digital image sensing and basic operations on digital images. 2D Systems: 2D spatial and frequency domain operations. Image Restoration. Image Transforms. Image coding and compression. Multi-resolution coding, subbands and wavelets. Low-level image analysis: edge detection and segmentation. Image watermarking. Non-linear Image Processing. Applications of non-linear filters in image enhancement, edge detections, and noise removal.

Course Objectives

Students should become familiar with image filtration, transform, and analysis methods. Also, students should become able to deal with various image enhancement and restoration techniques. Furthermore, students will gain knowledge about other related topics such as image watermarking and image coding.

Course Topics

- Image acquisition
- Image filtration
- Image transforms
- Image coding
- Image analysis
- Image watermarking

References

- Anil K. Jain, *Fundamentals of Digital Image Processing*, Prentice Hall.
- R. C. Gonzalez and R. E. Woods, *Digital Image Processing*, Prentice Hall.

Course Code : **EC 748**

Course Title : **Multimedia Communications Systems**

Credit Hours : **3**

Course Description

Multimedia Communication Model, Elements of Multimedia Systems, Digital Media. Challenges of Multimedia Information Processing. Audio Coding for Multimedia Applications. Image Coding. Video Coding. Watermarking. Signal Processing for Networked Multimedia. MPEG Approach to Multimedia Standardization: MPEG-1, MPEG-2, and MPEG-4 coding systems. JPEG and JPEG 2000 Image Compression Standards. MPEG-7 Systems. MPEG-21 Multimedia Framework. ITU-T Standardization of Audiovisual Communication Systems. Multimedia across IP Networks. MPEG Video Transmission on the Internet. Video Coding for Multimedia across IP. Multimedia across Wireless. Speech Transmission in GSM. Video across GSM. Wireless Multimedia Delivery. Digital Video Broadcasting (DVB). Broadband Multimedia Satellite Systems.

Course Objectives

To gain knowledge in this important area. The comprehensive information presented during the course should serve as a valuable resource to multimedia communications systems. Students should become familiar with multimedia communication standards such as MPEG and ITU standards, as well as understand transmission of multimedia through various communication networks.

Course Topics

- Multimedia communications
- Multimedia processing in communications
- Multimedia communication standards
- Multimedia communications across networks

References

- K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, *Multimedia Communication Systems: Techniques, Standards, and Networks*, Prentice Hall, 2002.

Course Code : EC 749

Course Title : Computer-Aided Design and Analysis of Communication Systems

Credit Hours : 3

Course Description

This course covers simulation techniques for communication systems operating in random environments. Simulation models for stochastic signals and system components including coders, decoders, modulators, nonlinear amplifiers, bit and carrier synchronizers, equalizers and receivers. Techniques for modeling time-varying channels. Monte Carlo simulation, semi-analytic simulation and variance reduction techniques applied to the analysis, design and performance evaluation of communication systems.

Course Objectives

The student will be familiar with the fundamental techniques and algorithms used to model and analyze communication systems using simulations.

Course Topics

- Introduction to simulation concept in communication systems
- Different algorithms used to model digital communications
- Defining main parameters that to be measured and methods of representation
- Applying simulation to different communication systems and test validation and accuracy
- Techniques for modeling time-varying channels

References

- According to material contents and simulation tools

Course Code : **EC 750**

Course Title : **Smart Antenna Technology**

Credit Hours : **3**

Course Description

Types of smart antenna systems: switched beam and adaptive array systems. Benefits of smart antenna technology. Adaptive beamforming: some traditional adaptive beamforming approaches such as side lobe cancellers, linearly constrained minimum variance, least mean squares. Direction of arrival (DOA) algorithms such as multiple signal classification (MUSIC), estimation of signal parameters via rotational invariance technique (ESPRIT). Electromagnetic (EM) analysis utilized to compute the mutual coupling effects between the finite size antenna elements.

Course Objectives

The student will be familiar with:

- the fundamental concepts of smart antennas,
- methods of performing the adaptive processing and DOA algorithms using certain criteria, and
- methods of measuring and compensating undesired EM effects..

Course Topics

- Types of smart antenna systems
- Adaptive beamforming
- Direction of Arrival (DOA) algorithms
- Accounting for the mutual coupling among an array of dipoles

References

- R. Monzingo and T. Miller, *Introduction to Adaptive Arrays*, Wiley, NY, 1980.
- T. K. Sarkar, M. Wicks, M. Salazar-Palma and R. Bonneau, *Smart Antennas*, Wiley, 2003

Course Code : **EC 751**

Course Title : **Computational Electromagnetics using Finite Difference Method**

Credit Hours : **3**

Course Description

Tremendous developments in computational power and facilities have made numerical solution of complex practical problems in electromagnetic field possible. Numerical methods such as the Finite Difference Method (FDM), Finite Element Method (FEM), Boundary Element Method (BEM), Method of Moment (MoM), Finite Difference Time Domain (FDTD) are now popular amongst researchers and practicing engineers. The course focuses on the FDM for numerical analysis of electromagnetics problems. Emphasis is placed on the formulation of physical problems into mathematical boundary value problems, numerical discretization of continuous problems into discrete problems, and development of rudimentary computer codes for simulation of electromagnetic fields in engineering problems.

Course Objectives

The student will be familiar with the contemporary and emerging application areas in electromagnetic wave technology, the concepts and analysis approaches for numerical stability of FD electromagnetic wave simulations, the theory and numerical implementation of widely used analytical absorbing boundary conditions for FD grids.

Course Topics

- Introduction to MATLAB and how to deal with it
- Review of vector analysis fundamentals of electromagnetic theory:
    - Maxwell's equations
    - Boundary conditions
    - Vector and scalar potentials
    - Radiation condition
    - Radar cross section
- Finite Difference Method
    - Finite difference frequency domain
    - FDTD
    - Absorbing boundary conditions
    - Perfectly matched layers
- Project presentations

References

- A. Taflove and S. C. Hagness, *Computational Electrodynamics (The Finite-Difference Time-Domain Method*, Boston: Artech House, 2000.
- M. H. Al Sharkawy, V. Demir and A. Z. Elsherbeni, *Electromagnetic Scattering Using the Iterative Multiregion Technique*, Morgan & Claypool, December 2007

Course Code : **BE 711**

Course Title : **Introduction to Biomedical Engineering**

Credit Hours : **3**

Course Description

Overview of Biomedical Systems. Medical Transducers. Biopotential Amplifiers. Electrocardiographs. Pacemakers. Electroencephalographs. Individual Student Projects in Biomedical Engineering.

Course Objectives

Students should be able to apply their knowledge in electronics, computers and communications in the analysis and design of patient–care biomedical systems.

Course Topics

- Overview of Biomedical Systems
- Medical Transducers
- Biopotential Amplifiers
- Electrocardiographs
- Pacemakers
- Electroencephalographs
- Individual Student Projects in Biomedical Engineering

Prerequisites

None

References

- J.D. Bronzino, " *Introduction to Biomedical Engineering*," Academic press, 2000

Course Code : **BE 712**

Course Title : **Elementary Human Anatomy**

Credit Hours : **3**

Course Description

An Introduction to Basic Anatomy of the Human Body for Engineers. The Role of Physical Principles and Phenomena as they are known to exist and apply to living systems will be highlighted in engineering terms.

Course Objectives

Students should be acquainted with various levels of structural organization of the human body.

Course Topics

- An introduction to basic anatomy of the human body for engineers
- The role of physical principles and phenomena as they are known to exist and apply to living systems will be highlighted in engineering terms

Prerequisites

None

References

- G.J. Tortora and S.R. Grabowski, "*Principles of Anatomy and Physiology*" Harper Collins, 1993.

- D.J. Schnech, "*Engineering Principles of Physiologic Functions*," New York University Press, 1990

Course Code : **BE 713**

Course Title : **Elementary Human Physiology**

Credit Hours : **3**

Course Description

An Introduction to Basic Physiology of the Human Body for Engineers. The Role of physical principles and phenomena as they are known to exist and apply to living systems will be highlighted in engineering terms.

Course Objectives

Students should be acquainted with various levels of structural organization of the human body.

Course Topics

- An introduction to basic physiology of the human body for engineers
- The role of physical principles and phenomena as they are known to exist and apply to living systems will be highlighted in engineering terms

Prerequisites

None

References

- G.J. Tortora and S.R. Grabowski, "*Principles of Anatomy and Physiology*," Harper Collins, 1993.

- D.J. Schnech, "*Engineering Principles of Physiologic Functions*," New York University Press, 1990

Course Code : **BE 715**

Course Title : **Biological Systems Modeling and Analysis**

Credit Hours : **3**

Course Description

Electrical Properties of Excitable Tissue. Bio-Fluid Mechanics of Cardiovascular Systems. Control of Human Posture and Locomotion.

Course Objectives

Students should be acquainted with quantitative methods in key areas that emphasize the similarities between biomedical and conventional engineering science.

Course Topics

- Electrical Properties of Excitable Tissue
- Bio-fluid Mechanics of Cardiovascular Systems
- Control of Human Posture and Locomotion

Prerequisites

BE 711: Introduction to Biomedical Engineering

References

- R. Plonsey, "*Bioelectric Phenomena*," McGraw Hill, 1996.
- K.B. Chandran, "*Cardiovascular Biomechanics*," New York Univ. Press, 1992

Course Code : **BE 716**

Course Title : **Biomedical Measurements**

Credit Hours : **3**

Course Description

Biomedical Instrumentation. Electrodes, Biochemical Sensors, Lasers. Measurement of Blood Pressure, Cardiac Output, and Respiratory Parameters. Biostimulation in Pacemakers, Defibrillators, and Functional Neuromuscular Systems.

Course Objectives

Students should be introduced to principles of biophysical measurement and instrumentation.

Course Topics

- Biomedical Instrumentation
- Electrodes
- Biochemical Sensors
- Lasers
- Measurement of Blood Pressure
- Cardiac Output and Respiratory Parameters
- Biostimulation in pacemakers
- Defibrillators and functional Neuromuscular Systems

Prerequisites

BE 711: Introduction to Biomedical Engineering

References

- J.G. Webster, "*Medical Instrumentation, Application and Design*," Houghton Mifflin, 1992

- R. Khandpur, "*Handbook of Biomedical Instrumentation*," McGraw-Hill, 2000

Course Code : **BE 717**

Course Title : **Medical Imaging**

Credit Hours : **3**

Course Description

Human Visual System, Image Formation, Continuous and Discrete Images Sampling and Quantization, Image Coding and Enhancement Methods, Image Quality, Conventional and Digital X-Ray Imaging Systems. Ultrasound, Computed Tomography, Positron Emission Tomography, Magnetic Resonance Imaging

Course Objectives

Students should be acquainted with Imaging Philosophies and current trends in medical imaging systems.

Course Topics

- Human Visual System
- Image formation
- Continuous and Discrete Images Sampling and Quantization
- Image Coding and Enhancement Methods
- Image Quality
- Conventional and Digital X-ray Imaging Systems
- Ultrasound
- Computed Tomography
- Positron Emission Tomography
- Magnetic Resonance Imaging

Prerequisites

BE 711: Introduction to Biomedical Engineering

References

- R.C Gonzalez and R.E Woods, "*Digital Image Processing*," Prentice Hall, 2001

- J.D. Bronzino, "*Biomedical Engineering Handbook*," CRC and IEEE press. 2000

Course Code : **BE 718**

Course Title : **Biomedical Signal Processing**

Credit Hours : **3**

Course Description

Origin and Dynamic Characteristics of Biomedical Signals, Signal Acquisition and Processing, Data Compression, Wavelet Analysis, Advanced Statistics. Neural Networks and Fractals.

Course Objectives

Students should be acquainted with advanced digital signal processing methods in biomedical engineering.

Course Topics

- Origin and Dynamic characteristics of biomedical signals
- signal acquisition and processing
- Data compression
- wavelet analysis
- Advanced statistics
- Neural networks and fractals

Prerequisites

BE 711: Introduction to Biomedical Engineering

References

- R. Weitkumat, "*Digital Biosignal Processing*," Elsevier, 1991.
- A. Cohen, "*Biomedical Signal Processing*," CRC Press, 1986

Course Code : **BE 719**

Course Title : **Statistics for Biomedical Engineering**

Credit Hours : **3**

Course Description

Two–Sample Comparisons, Analysis of Variance and Multiple Comparison Procedures, Linear Regression Model, Time Series Models, Tools for Multivariate Data.

Course Objectives

Students should be introduced to advanced statistical methods with applications to biomedical engineering.

Course Topics

- Two–sample Comparisons
- Analysis of Variance and Multiple Comparison Procedures
- Linear Regression Model
- Time Series Models
- Tools for Multivariate Data

Prerequisites

BE 718: Biomedical Signal Processing

References

- C.L. Nikias and A.P. Petropulu, "*Higher–Order Spectral Analysis: A Nonlinear Signal Processing Framework*," Prentice Hall, 1993

Course Code : **BE 720**

Course Title : **Magnetic Resonance Imaging**

Credit Hours : **3**

Course Description

Nuclear Magnetic Resonance with Applications to Medical Imaging Image Processing, Image Contrast, Image Artifact. Recent Trends in Magnetic Resonance Imaging (MRI).

Course Objectives

Students should be introduced to technical principles and medical applications of MRI systems.

Course Topics

- Nuclear Magnetic Resonance with Applications to Medical Imaging Image Processing
- Image Contrast
- Image Artifacts
- Recent Trends in Magnetic Resonance Imaging (MRI)

Prerequisites

BE 717: Medical Imaging

References

- Z.P. Liang and P.C. Lauterbur, "*Principles of Magnetic Resonance Imaging*," Wiley, 2000
- Jianming Jin. "*Electromagnetic Analysis and Design of Magnetic Resonance Imaging*," CRC Press, 1999

Course Code : **BE 721**

Course Title : **Biosensors**

Credit Hours : **3**

Course Description

Electrochemical Biopotentials, Membrane Electrodes, Double Layer Structures Mass Transport and Ion Migration, Hydrodynamic Electrodes, Cyclic Voltametryarid, Neuroscience Applications, Low-Current Measurements, Electrode-to–Tissue Interactions. Redox and Immobilized Enzymes. Optical Sensors.

Course Objectives

Students should be acquainted with advanced methods in biomedical sensors.

Course Topics

- Electrochemical Biopotentials
- Membrane Electrodes
- Double Layer Structures Mass Transport and Ion Migration
- Hydrodynamic Electrodes
- Cyclic Voltametryarid
- Neuroscience Applications
- Low-current Measurements
- Electrode-to–Tissue Interactions
- Redox and Immobilized Enzymes
- Optical Sensors

Prerequisites

BE 716: Biomedical Measurements

References

- J.G. Webster, "*Medical Instrumentation: Application and Design*," Houghton Mifflin, 1992
- J.D. Bronzino, " *Biomedical Engineering Handbook*" CRC and IEEE Press, 2000

Course Code : **BE 722**

Course Title : **Biomedical Seminar**

Credit Hours : **3**

Course Description

Special Topics Related to Advanced Biomedical Engineering. Analysis of Data Conclusions and Presentation Reports are advanced in details.

Course Objectives

Gain the ability to prepare and present talks on advanced topics in engineering.

Course Topics

- Special topics related to advanced biomedical engineering
- Analysis of data conclusions and presentation reports are advanced in details

Prerequisites

BE 711: Introduction to Biomedical Engineering

References

- J.D. Bronzino, " *Biomedical Engineering Handbook*" CRC and IEEE Press, 2000

Course Code : **BE 723**

Course Title : **Neural Networks**

Credit Hours : **3**

Course Description

Computing Methods Based on Structure and Operation of The Human Brain Physiological Principles and Neural Architectures, Interconnected Networks, Back – Propagation Learning, Medical Applications of Artificial Intelligence and Expert Systems.

Course Objectives

Students should be acquainted with principles of biomedical computing in signal processing.

Course Topics

- Computing Methods based on structure and operation of the Human Brain
- Physiological Principles and Neural Architectures
- Interconnected Networks
- Back–Propagation Learning
- Medical Applications of Artificial Intelligence and Expert Systems

Prerequisites

BE 718: Biomedical Signal Processing

References

- P.R. Lippman, J.E Moody, and D.S. Touretzky, "*Advances in Neural Information Processing Systems,*" Morgan Kauffman, 1991.

Course Code : **BE 724**

Course Title : **Advanced Patient Monitoring and Safety**

Credit Hours : **3**

Course Description

Physiological Transducers, Electrophysiological Signal Acquisition and Analysis, Cardiovascular System Models, Pediatric Monitoring, Ambulatory Monitoring, Intensive Care Units, Safety of Biomedical Measurements.

Course Objectives

Students should be introduced to advanced patient and monitoring systems.

Course Topics

- Physiological Transducers
- Electrophysiological Signal Acquisition and analysis
- cardiovascular system models
- pediatric monitoring
- ambulatory monitoring
- intensive care units
- Safety of Biomedical measurements

Prerequisites

PE 716: Biomedical Measurements

References

- R. Beckerman, R. Brouillette, and C. Hunt, "*Respiratory Control Disorders in Infants and Children*," Williams Wilkins, 1992.

Course Code : **BE 725**

Course Title : **Telemedicine Networks**

Credit Hours : **3**

Course Description

Communication and Computer Systems with Applications to Medicine, Telemetry and Telecommunication Networks, Medical Features and Parameters for Telemedicine.

Course Objectives

Students should be introduced to technical principles and applications of telemedicine.

Course Topics

- Communication and computer systems with applications to medicine, telemetry and telecommunication networks
- Medical features and parameters for telemedicine

Prerequisites

BE 718: Biomedical Signal Processing

References

- J. Proakis "*Digital Communications*," McGraw Hill, 2001.

Course Code : **BE 726**

Course Title : **Special Topics in Biomedical Engineering**

Credit Hours : **3**

Course Description

Selected Topics Dealing with Recent Advances and Developments in Biomedical Engineering.

Course Objectives

Students should be introduced to recent scientific research and development in Biomedical Engineering.

Course Topics

- Selected topics dealing with recent advances and developments in biomedical engineering

Prerequisites

BE 711: Introduction to Biomedical Engineering

References

- J.D Bronzino, "*Biomedical Engineering Handbook*," CRC and IEEE press, 2000

Faculty Members

(in alphabetical order)

- **AMR EL-HELW**
  Ph.D. (2008) Staffordshire University, UK
  Pattern Recognition Using Spread Spectrum

- **DARWISH ABDEL-AZIZ,** Head of Department
  Ph.D. (1988) Military Technical College, Egypt
  Antennas

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  Ph.D. (2002) Louisiana State University, USA
  Signal Processing for Wireless Communications

- **EHAB SABRY**
  Ph.D. (1983) University of McMaster, Canada
  Satellite Communications

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  Ph.D. (1997) Rostock University, Germany
  Communications Engineering

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  Ph.D. (2006) Waterloo University, Canada
  Pattern Analysis and Recognition

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  Ph.D. (2002) Alexandria University, Egypt
  Measurements and Instrumentation

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  Communications

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  Digital Signal Processing

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  Ph.D. (2001) University of Bradford, UK
  Communications Engineering

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  Ph.D. (2006) University of Mississippi, USA
  Electromagnetics and Antennas

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  Ph.D. (2004) University of Ottawa, Canada
  Wireless Communications

- **MOHAMED YOUSSEF OMAR**
  Ph.D. (2007) Alexandria University, Egypt
  Communications Engineering

- **MOUSTAFA HUSSEIN**
  Ph.D. (1987) Alexandria University, Egypt
  Optical Fibers

- **NADDER HAMDY**
  Ph.D. (1979) University of Erlangen-Nuremberg, Germany
  Electronics Signal Processing

- **ROSHDI ABU-ELAZAYEM**
  Ph.D. (1981) University of Houston, USA
  Electronic Devices and Circuits

- **SHARAF ELDIN EL-NAHAS**
  Ph.D. (1984) Washington University in St. Louis, USA
  Electronic Communications

ENGINEERING MANAGEMENT

M.ENG. PROGRAM

OVERVIEW

The Master of Engineering in Engineering Management program at the Arab Academy for Science, Technology and Maritime Transport (AASTMT) is designed to accommodate graduate students with different engineering backgrounds.

In addition, it is an extremely attractive program to working engineering professionals who are seeking to advance to positions of greater managerial and technical responsibility.

The program is based on an integrated approach to the management of product, process and information technology and provides the opportunity to develop expertise in these areas.

ENGINEERING MANAGEMENT

Engineering Management focuses on effective decision making in engineering and technological organizations. Addressing the needs of engineers and scientists moving into management positions, Engineering Management complements their technical backgrounds with the human aspects, organizational and financial issues, project considerations, resource allocation, and extended analytical tools required for effective decision making and program management.

This program is designed for technically qualified individuals who plan to assume a management role in project or program-oriented environments in industry or government. It provides the analytical, organizational, and managerial skills to bridge the gap between a technical specialty and technical management.

THE NEED FOR ENGINEERING MANAGEMENT EDUCATION

The emerging discipline of Engineering Management has experienced an explosive growth pattern during the past few decades. The reasons for this pattern can be identified at three levels.

The Individual Level

Engineers who move to management positions as a result of their technical success have become aware that their technical skills are not adequate in dealing with the complexities of their management responsibilities.

The Industry Level

The critical importance of engineering skill and knowledge is well recognized in the management of engineering systems.

The National Level

The scarcity of raw materials, declining productivity and increased competition have imposed challenges to technological leadership and shifted priorities toward the development of new technologies and the management of these systems.

M.Eng. in Engineering Management

A large portion of engineers assume some form of management role during their professional career performing management duties ranging from the indirect supervision of a small staff to the management of entire engineering organizations.

Although prepared for technical responsibilities, engineers have received little or no formal training for decisions beyond their specialties above those they had acquired as engineering specialists. These new capabilities are necessary to prepare them for decision-making roles in broad areas while maintaining identity in their technical background. It has become clear that success as an engineer is a necessary but insufficient condition to manage technical people, technical projects, technical organizations, technical resources and technical systems.

In response to engineers' need for a technically oriented management education, a number of universities are now offering Engineering Management Programs designed for engineers and scientists who are moving toward technical management positions, but not away from their technical backgrounds. These programs prepare engineers for much broader responsibilities in the technological system. The strong growth pattern observed in the Engineering Management Programs during the past decade is still continuing. Engineers now have an opportunity to prepare themselves for a smooth transition from technical specialties to leaders in technical management.

ADMISSION REQUIREMENTS

To join the program of M.Eng. in Engineering Management, the following minimum prerequisites are required:

- A Bachelor's degree (or higher) in an engineering area.
- A maximum of three Pre-Master's Courses: depending on each student's background (with backgrounds other than industrial engineering). The number of Pre-Master's courses required by each student is determined by the department's Graduate Program Coordinator (Academic advisor).

Program Detailed Structure

M.ENG. PROGRAM

M.Eng. in Engineering Management

Master's Courses

TEN COURSES ARE NECESSARY

Course Code	Course Title	Credit Hours
IM711	Materials Properties and Selection Criteria	3
IM712	Engineering Materials for New Applications	3
IM713	Manufacturing Systems Engineering	3
IM714	Non-Destructive Testing of Materials	3
IM715	Computer Integrated Manufacturing	3
IM721	Manufacturing Systems Management and Analysis	3
IM722	Applications of Artificial Intelligence in Industry	3
IM723	Advanced Operations Management	3
IM724	Industrial Ergonomics and Human Factors Engineering	3
IM726	Advanced Techniques of Operations Research	3
IM727	Special Topics in Industrial Engineering	3
IM728	Industrial Facilities Planning and Design	3
IM729	Discrete Systems Simulation	3
IM731	Health and Safety Management	3
IM732	Warehouse and Distribution Management	3
IM733	Supply Chain Management	3
IM734	Supply Chain Design	3
IM735	Strategic Management for Engineers	3
IM736	Advanced Maintenance Management	3
IM737	Human Resource Management	3
IM738	Advanced Project Management	3
IM739	Advanced Management of International Business	3
IM742	Design and Statistical Analysis of Experiments	3
IM743	Advanced Reliability Engineering	3
IM744	Productivity and Quality Improvement	3
IM745	Systems Engineering	3
IM746	Lean Six Sigma	3
IM747	Quality Management	3
IM751	Marketing Issues for Engineers	3
Total	**10 Courses * 3 Credit Hours**	**30**

M.Eng. in Engineering Management

Pre-Master's Courses (Non-Credited)

Course Code	Course Title	Credit Hours
IM341	Engineering Statistics	0
NE364	Engineering Economy	0
IM425	Operations Research	0
Total	**3 Courses * 0 Credit Hours**	**0**

Courses

Course Code : **IM 341**

Course Title : **Engineering Statistics**

Credit Hours : **0**

Course Description

Introduction to statistical sciences, descriptive statistics and inferential statistics. Methods of graphical presentation of data, histogram, box plot, position parameters, mean, median, quartiles. Dispersion parameters, variance. Fundamentals of probability distributions for discrete and continuous variables sampling distributions.

Course Objectives

- To enable students to use statistical tools to manipulate and present data.
- To build up student capability to construct and manipulate statistical and probability models in order to solve engineering and management problems.

Course Topics

- Introduction to statistics. Data and their role in engineering and management graphical presentation of data. Histograms
- Position parameters of data, mean, median, quartiles, percentiles, the box plot
- Dispersion parameters of data, range variance, coefficient of variation, interquartile range
- Applications of descriptive statistics
- Theory of probability, random experiments, sample space, events, probability of events. Frequency definition of probability, axiomatic definitions of probability, De Morgan laws and addition rules
- Conditional probability, multiplication rule, total probability
- Bayes' theorem and its applications
- Discrete random variable and mass functions, cumulative probability distributions, mean and variance and discrete random variables
- Well-known probability distribution of discrete random variables, uniform, binominal and geometric distribution their mean and variance
- Poisson’s probability distribution and its applications to event arrivals problems
- Continuous random variables, probability density functions, mean, and variance of continuous random variables. Uniform distribution
- Normal distribution and its applications in management and engineering
- Exponential distribution. Introduction to statistical estimation
- Sampling distribution, introduction

References

- D.C. Montgomery, G.G. Runger, *Applied Statistics and Probability for Engineers*, Wiley.

Course Code : **NE 364**

Course Title : **Engineering Economy**

Credit Hours : **0**

Course Description

A study of basic concepts emphasizing analysis of aggregate economy. Examination of the processes of price determination and calculation of optimum demand for maximum profit. Basic principles of money-time relationship. Methods of investment assessment and fundamental techniques of comparison of investment opportunities. Theories of depreciation of physical facilities and cost recovery systems.

Course Objectives

- Introduction basic cost concepts and economic environment.
- Familiarization of the principles of money time relations and basics of investments opportunities assessment and evaluation.

Course Topics

- Introduction and overview
- Cost concepts and the economic environment
- Principles of money – time relations, the concept of economic equivalence
- Cash flow diagrams: Interest formulas and uniform series
- Cash flow diagrams: Uniform gradient series and geometric sequence
- Nominal and effective interest rates, continuous compounding and continuous cash flows
- Applications and effective interest rates, continuous compounding and continuous cash flow
- Applications of engineering economy: Methods of investment assessment
- Comparing alternatives: Useful life is equal to the study period
- Comparing alternatives: Useful life is shorter than the study period
- Comparing alternatives: Useful life is longer than the study period
- Depreciation: Historical Methods
- Depreciation: Cost recovery systems

References

- E.L. Grant, W.G. Ireson, R.S. Leavenworth, *Principles of Engineering Economy*, 6th Edition, Wiley, New York
- Chan S. Park, *Contemporary Engineering Economics*, 2nd Ed., Addison Wesley.

Course Code : **IM 425**

Course Title : **Operation Research**

Credit Hours : **0**

Course Description

Basic concepts and fundamentals of management science, problems addressed by operations research problem formulations in linear programs, graphical solution of linear programs, simplex method, big M technique, two phase technique, sensitivity analysis, transportation model, network planning, critical path and PERT methods.

Course Objectives

- To promote the scientific approach to solve management problems.
- To build up capability to construct mathematical models of practical problems and solve them.
- To acknowledge the role of computer technology in solving problem of operations research.

Course Topics

- Introduction to operations research and its role in management
- Formulation of problems into linear programs with variables with single subscripts
- Formulation of problems into linear programs with variables with double and multiple subscripts
- Graphical solutions of linear programs
- The simplex method to solve problems with constraints (≤)
- The simplex method to solve problems with constraints (≥, =), Big M technique
- The two- phase technique
- Sensitivity analysis of optimal solution obtains by simplex method
- Transportation model, formulation and initial solutions
- Transportation model, optimization technique
- Network planning, deterministic technique
- Probabilistic approach, project evaluation and review technique (PERT)
- Applications of PERT

References

- Taha, H.; "*Operations Research*". Prentice Hall.

Course Code : **IM 711**

Course Title : **Materials Properties and Selection Criteria**

Credit Hours : **3**

Course Description

The use of different materials in designing a component or a particular application of materials is critical. The use of the suitable material involves providing the adequate properties and requirements in terms of mechanical, physical and environmental conditions. The selection process is a fairly complicated task; however, it can be made easy by using special techniques and charts which collate different properties and parameters influencing the selection.

Course Objectives

- To provide the students with the basic knowledge about structure and properties of different engineering materials.
- To introduce the students to the different classes of engineering materials in addition to new materials.
- To enable the students to understand the concept of designing with materials and the important criteria used in selecting materials for a particular application.

Course Topics

- Different types of engineering materials
- The effect of composition and processing on materials properties
- The concept of structure-property relationships
- How to select a suitable materials, property charts
- Other factors affecting the selection such as cost

References

- Ashby, M., Shercliff, H. and Cebon, D., "*Materials: engineering science, processing and design*", 1st ed., Butterworth-Heineman, 2007.
- Ashby, M.F., "*Materials Selection in Mechanical Design*", Pergamon Press, 2005.
- Budinski, K.G. and Budinski, M.K., "*Engineering Materials: Properties and selection*, 8th ed., Prentice Hall, 2005.

Course Code : **IM 712**

Course Title : **Engineering Materials for New Applications**

Credit Hours : **3**

Course Description

Designing of new engineering materials for a particular application is a complicated task. It involves a combined experimental and modelling approach with a thorough understanding of how structure can be affected by original chemical composition and processing of materials. New classes of materials are a result of much research work focusing on changing the composition and processing conditions and relating the obtained structure to final improved properties.

Course Objectives

- To provide the students with the basic knowledge about structure and properties of engineering materials.
- To introduce the students to the newly developed classes of materials and the concept of designing new materials.
- To enable the students to conceive the effect of microstructure and how to tailor it in order to achieve newly improved properties for engineering materials.

Course Topics

- Classical engineering materials
- The effect of composition and processing on materials properties
- The concept of structure-property relationships
- Modelling the behaviour of engineering materials
- Designing new materials
- New classes of engineering materials, comparison to traditional engineering materials

References

- Ashby, M., Shercliff, H. and Cebon, D., "*Materials: Engineering Science, Processing and Design*", 1st ed., Butterworth-Heineman, 2007.
- Jacobs, J.A. and Kilduff, T.F., "*Engineering Materials Technology: Structures, Processing, Properties, and Selection*", 5th ed., Prentice Hall, 2005.

Course Code : **IM 713**

Course Title : **Manufacturing Systems Engineering**

Credit Hours : **3**

Course Description

A manufacturing system is a collection or arrangement of operations and processes used to make desired product (s). The manufacturing system includes the actual equipment composing the processes and the arrangement of those processes. Control of a system applies to total control of the whole, not of the individual processes or equipment. All the users of the manufacturing system must understand how it works (behaves). The entire manufacturing system must be controlled in order to regulate levels of inventory, movement of material through the plant, production (output) rates, and product quality.

Course Objectives

- This course introduces the fundamental of design, planning and control of manufacturing system aided by computers. Integration and interfacing of computerized manufacturing systems, programmable logic controllers and sequential programming, sensor implementation strategies, automated fixturing, robotic work cell creation, performance modelling of automated manufacturing systems, group technology and flexible manufacturing systems, etc. will be addressed.

Course Topics

- Trends in manufacturing systems
- Evolution of manufacturing systems
- System defined and design
- Manufacturing and production systems
- Classification of manufacturing systems
- Automation
- Robotics

References

- Ronald Askin and Charles Stand ridge, "*Modelling and Analysis of Manufacturing Systems*". John Wiley.
- Katdundo Hitomi, "*Manufacturing System Engineering*". Taylor and Francis
- J. T. Black; "*The design of the factory with a future*". McGraw Hill.

Course Code : **IM 714**

Course Title : **Non-destructive Testing of Materials**

Credit Hours : **3**

Course Description

The student will be able to perform metal surface inspection. Knowing the theory behind different inspection techniques, detecting material flaws.

Course Objectives

- The NDT course is to provide theory lectures and practical training around understanding basic principles of NDT.
- Performing calibrations, measuring samples and performing non-destructive testing using different NDT techniques.

Course Topics

- Understanding principles of NDT Current.
- Inspection and measurement of samples.
- Calibrating instruments.
- Understanding manufacturing and welding discontinuities.
- Preliminary test using NDT techniques such as Ultrasonic, Dye penetrate, magnetic flux and Eddy Current.
- Preparing test report

References

- Mix, P. E.; "*Introduction to Non-destructive Testing: A Training Guide*". 2nd Ed., Wiley, 2005.
- McEvily, A. J.; "*Metal Failures: Mechanisms, Analysis, Prevention*", Wiley, 2001.
- Raj, R. and Jayakumar, T.; "*Practical Non-destructive Testing*", Woodhead publishing.

Course Code : **IM 715**

Course Title : **Computer Integrated Manufacturing**

Credit Hours : **3**

Course Description

This course will study the technology associated with computer integrated manufacturing (CIM). The course will include computer-aided design (CAD), product data management (PDM), computer-aided engineering (CAE), and integrated manufacturing systems.

Course Objectives

- The course aims to provide the most advanced, comprehensive, and balanced coverage of the subject of integrated manufacturing systems. Also, the module covers the different CAD tools and the means to their integration. The objective of the course are:
- Understanding the basic functional units of integrated manufacturing systems and its importance to the manufacturing enterprise.
- Identifying the different design elements and production engineering.
- Understanding the enabling processes and systems for modern manufacturing.
- Know the different issues in integration of manufacturing systems.

Course Topics

- The Manufacturing Enterprise.
- Design Automation: CAD and PDM.
- Application of CAD to Manufacturing Systems.
- Selecting CAD Software for an Enterprise.
- Product Data Management
- Design Automation: CAE.
- Design for Manufacturing and Assembly.
- CAE Analysis and Evaluation.
- Production Engineering Strategies.
- The role of artificial intelligence in manufacturing

References

- James A. Rehg and Henry W. Kraebber, "*Computer Integrated Manufacturing*", Prentice Hall.
- Mikell P. Groover, "*Automation, Production Systems, and Computer-Integrated Manufacturing*", Prentice Hall.

Course Code : **IM 721**

Course Title : **Manufacturing Systems Management and Analysis**

Credit Hours : **3**

Course Description

The analysis of manufacturing systems with an emphasis on factory operations. Interaction between the different performance measures of a manufacturing system. Management of manufacturing systems variability.

Course Objectives

- Providing the student with an ability of analysing and understanding the underlying behaviour of most manufacturing systems.
- To review the elementary concepts required for describing manufacturing systems.
- To enable the student to identify the points of leverage in a plant, evaluate the impacts of the proposed changes, and coordinate improvement efforts.
- To provide the student with the ability to bring together the disparate components of a system into an effective whole.

Course Topics

- The production system and role of inventory
- Multistage production systems and models
- Lean manufacturing and the Just-in-Time philosophy
- Science of manufacturing
- Basic factory dynamics
- Variability in manufacturing systems
- Analysing the influence of variability on manufacturing systems' performance
- Push and pull production systems
- The human element in operations management
- Supply chain management

References

- Hopp, W. J. and Spearman, M. L.; "*Factory Physics*". McGraw-Hill, 2001.
- Askin, R. G. and Goldberg, J. B.; "*Design and Analysis of Lean Production Systems*", Wiley, 2002.
- Nahmais, S.; "*Production and Operations Analysis*". 5th Ed., McGraw-Hill, 2005.

Course Code : **IM 722**

Course Title : **Applications of Artificial Intelligence in Industry**

Credit Hours : **3**

Course Description

Emphasis on model integration and using computational intelligent approaches to solve problems across many areas of an industrial firm. Models and computational intelligence tools and techniques applicable to different basic functional areas within any enterprise, ranging from design of parts and process planning to manufacturing systems design and production management. Examples and actual case studies based on actual industrial projects.

Course Objectives

- To gain basic knowledge of the different artificial intelligence techniques used industry.
- To present recent advances in modelling and applying computational intelligent methods to enterprises.
- To become familiar with a number of available AI packages and how to use these packages in addressing different issues in actual industries.

Course Topics

- Introduction to the different AI techniques
- Knowledge-based systems
- Setup reduction
- Production planning and scheduling
- Selection of manufacturing equipment
- Layout of machines, facilities, and warehouses
- Inventory space allocation
- Supplier evaluation
- Data mining

References

- Kusiak, A.; "*Computational Intelligence in Design and Manufacturing*", Wiley, 2000.
- Konar, A.; "*Artificial Intelligence and Soft Computing*". CRC Press, 2000.

Course Code : **IM 723**

Course Title : **Advanced Operations Management**

Credit Hours : **3**

Course Description

Capacity planning – Forecasting- Facility location – Aggregate planning – Inventory Management – Production systems – and facility layout – Materials management.

Course Objectives

- To get acquainted with advanced tools of planning of operations.
- To raise student's capability of using microcomputers for solving problem of operations management.

Course Topics

- Capacity planning and modification
- Forecasting
- Facility location
- Aggregate planning
- Inventory management systems
- Production systems and facility layout
- Material management

References

- Marks, J.G. "*Operation Management, Theory and Problems*". McGraw Hill.
- Weiss, H.J and Gershon, M.E., "*Production and Operations Management*". Allyan and Bacon, Inc.

Course Code : **IM 724**

Course Title : **Industrial Ergonomics and Human Factors Engineering**

Credit Hours : **3**

Course Description

Basic concepts of ergonomics and their application to design of human-machine systems and products. Consideration of human behavioural and biological capabilities and limitations in design for human efficiency, safety and comfort. Systems development cycle; human-machine function allocation; task and skill analysis; systems evaluation; anthropometry. Design of control and display systems, instrument panels, workplaces, seating and tools.

Course Objectives

- To enhance the ergonomic knowledge base of students.
- To become familiar with the different ergonomics design applications of ergonomics in industry.
- To be trained on the design and analysis of occupational systems and consumer products.

Course Topics

- Engineering Anthropometry and Workspace Design.
- Biomechanics at Work.
- Work Physiology.
- Stress and Workload.
- Safety, Accidents, and Human Error.
- Ergonomic Models, Methods, and Measurements.
- Designing to Fit the Moving Body.
- The Office (Computer) Workstation.
- Human-Computer Interaction.
- Selection, Design, and Arrangement of Controls and Displays.
- Designing for Special Populations.

References

- Lee, J., Liu, Y. D., and Gordon-Becker, S.; "**Intr***oduction to Human Factors Engineering*". 2nd Edition, Prentice Hall, 2004.
- K.H.E. Kroemer, H.B. Kroemer, and K.E. Kroemer-Elbert; "*Ergonomics: How to Design for Ease and Efficiency*". 2nd Edition, Prentice Hall, 2001.

Course Code : **IM 726**

Course Title : **Advanced Techniques of Operations Research**

Credit Hours : **3**

Course Description

Theory of games and its applications, stochastic inventory systems, probabilistic dynamic programming, and nonlinear programming. Stochastic programming, goal programming.

Course Objectives

- To provide students with mathematical model to solve managerial and technical problems.

Course Topics

- Theory of games and its application
- Probabilistic dynamic programming
- Stochastic inventory systems
- Nonlinear programming
- Stochastic programming
- Goal programming

References

- Hiller and Liberman; "*Operations Research*". McGraw-Hill.

Course Code : **IM 727**

Course Title : **Special Topics in Industrial Engineering**

Credit Hours : **3**

Course Description

Content may vary from semester to semester.

Course Objectives

- The main objective of this course is to cover current topics of research interest in industrial engineering.

Course Topics

- Content may vary from semester to semester

References

- Content may vary from semester to semester.

Course Code : **IM 728**

Course Title : **Industrial Facilities Planning and Design**

Credit Hours : **3**

Course Description

Principles and techniques for planning and designing production facilities and material handling systems. Design and analysis of models and algorithms for facility location, vehicle routing, and facility layout problems. Emphasis will be placed on both the use of computers and the theoretical analysis of models and algorithms.

Course Objectives

- To learn the different requirements and functions needed for facilities design.
- To know the different methods of developing alternative facility designs.
- To become familiar with the different facilities systems, specifically material handling equipment.
- To be trained on different quantitative approaches for facilities planning.
- To know how to prepare and present a facility.

Course Topics

- Strategic facilities planning and design
- Material handling equipment
- Material handling problem-solving procedure
- Office layout techniques and space requirements
- Algorithmic approaches to facility layout
- Location, allocation, and location-allocation models
- Use of computers and the theoretical analysis of models and algorithms
- Presenting a finalized facility plan

References

- Tompkins, J. A., White, J. A., Bozer, Y. A., and Tanchoco, J. M. A.; "*Facilities Planning*", Wiley
- Meyers, F. E. and Stephens, M. P.; "*Manufacturing Facilities Design and Material Handling*". 3rd Edition, Prentice Hall, 2005.

Course Code : **IM 729**

Course Title : **Discrete Systems Simulation**

Credit Hours : **3**

Course Description

Modern methods for simulating discrete event models of complex stochastic systems. Systems exhibiting randomness are modelled and statistically analyzed using a state-of-the-art simulation language. Applications include improvement of existing and design of new production and service systems.

Course Objectives

- To provide students the basic modelling and simulation concepts and tools for analysing and improving the performance of industrial systems.
- To learn how to use a simulation package and apply it in actual industries.
- To apply what you have learned to a specific problem (project).

Course Topics

- Overview of Modelling and Simulation
- Discrete-Event Modelling and Simulation Principles
- Queuing Models
- Input Modelling
- Verification and Validation of Simulation Models
- Output Analysis
- Modelling and Simulation of industrial Systems
- Available Commercial Simulation Packages
- Use of a Simulation package in Evaluation and Decision Making of existing Industrial Systems

References

- Banks, J. et al.; "*Discrete-Event System Simulation*", Prentice-Hall.
- Kelton, W. D., et al.; "*Simulation with Arena*", McGraw-Hill.
- Bennett, B. S. *Simulation Fundamentals*. Prentice-Hall.

Course Code : **IM 731**

Course Title : **Health and Safety Management**

Credit Hours : **3**

Course Description

Safety information system, safety utilities, Ergonomics, Health standards, Fire fighting, Evacuation plans.

Course Objectives

- To demonstrate the importance of the health and safety regulations in the organization.
- To define the resources needed for the health and safety program.
- To get familiarized with the classification process for the work place hazards.
- To be trained on the emergency and disaster preparedness.

Course Topics

- Safety versus health
- Safety roles in corporate structure
- Safety resources
- Accident analysis
- Hazard classification
- Process safety and disaster preparedness
- Construction safety.

References

- C. Ray Asfahl; "*Industrial Safety and Health Management*". Pearson Prentice Hall, 2003.

Course Code : **IM 732**

Course Title : **Warehouse and Distribution Management**

Credit Hours : **3**

Course Description

Warehouse Issues, Equipment and processes Warehouse layout and planning Cross-docking Measuring warehouse efficiency.

Course Objectives

- Introducing the students to the warehouse rationale, material flow and warehouse management system
- Provide in-depth analysis of operations and design of warehouses and distribution networks, measuring warehouse efficiency
- Illustrating the different modes of storage and the different concepts of warehousing
- Understanding the concepts underlying warehouse layout, storage and handling equipment, and order picking,

Course Topics

- Warehouse Rationale, material flow and warehouse operations
- Warehouse Management systems, storage and handling equipment
- Warehouse layout, pallets, design of a fast-pick area
- Pieces geometry and slotting
- Order picking, piece picking and pick-path
- Cross-docking
- Measuring warehouse efficiency, activity profiling, and benchmarking
- Introducing warehousing around the world

References

- Bartholdi III, J and Hackman S., T., "*Warehouse and Distribution Science*"; Supply Chain and Logistics Institute at the Georgia Institute of Technology, 2008.
- Emmett, S.; "*Excellence in Warehouse Management, how to minimize cost and maximize value*" Purchasing and Supply Chain Management", Wiley, England, 2005, ISBN: 978-0-470-01531-5

Course Code : **IM 733**

Course Title : **Supply Chain Management**

Credit Hours : **3**

Course Description

Supply chain definition and supply chain elements. Technological infrastructure that supports supply chains. Different types and operation methods of a supply chain. Supply chain mapping and analysis Supply chain performance measurement and control Logistics outsourcing, reverse logistics, and green supply chains.

Course Objectives

- Introducing the students to logistics and supply chain management problems, performance measures and operation methods
- Understanding the concepts underlying fleet management, vehicle routing, crew scheduling and related problems.
- Grasping the different qualitative issues in distribution network structuring, centralized versus decentralized network control, variability in the supply chain, strategic partnerships, and product design for logistics will be considered through discussions and cases.

Course Topics

- 21st century supply chains and lean logistics
- Market distribution, procurement, and manufacturing strategies
- Supply Chain main Key performance indicators (KPIs)
- Supplier evaluation, selection, and measurement
- Supply chain performance measurement and evaluation
- Organizational and relationship management

References

- Bowersox, D. J., Closs, D. J., and Cooper, M. B.; "*Supply Chain Logistics Management*". McGraw Hill, 2002.
- Monczka, R., Trent, R., and Handfield, R.; "*Purchasing and Supply Chain Management*". 2nd Edition, South-Western Thomson Learning, 2002.
- Lambert, D.M, (2005), *Supply Chain Management: Processes, Partnerships, Performance*, Supply Chain Management Institute, Sarasota, FL.
- Simchi-Levi, D., Kaminsky, P. and Simchi-Levi, E., (2004), *Managing the Supply Chain: the Definitive Guide for the Business Professional,* McGraw-Hill, New York, NY.

Course Code : **IM 734**

Course Title : **Supply Chain Design**

Credit Hours : **3**

Course Description

Supply chain configuration and design requirements Differentiating supply chain models according to different methods of manufacturing Supply Chain Network Optimization Supply Chain Ontology Developing a SCOR thread diagram for different types of supply chains.

Course Objectives

- Introducing the students to logistics and supply chain design and optimization, supply chain modelling, mapping and analysis with respect to cost reduction and maximum performance and utilization of the global supply chain components.
- Understanding the concepts underlying fleet management, vehicle routing, crew scheduling and related problems.
- Grasping the different qualitative issues in distribution network structuring, centralized versus decentralized network control, variability in the supply chain, strategic partnerships, and product design for logistics will be considered through discussions and cases.

Course Topics

- 21st century supply chains and lean logistics
- Enterprise resource planning and execution systems
- Planning and scheduling in supply chains
- Operational purchasing integration
- Supplier evaluation, selection, and measurement
- Supply chain network optimization
- Warehouse design, distribution and transportation models design

References

- Simchi-Levi, D., Kaminsky, P., and Simchi-Levi, E., "*Designing and Managing the Supply Chain*". 2nd Edition, McGraw Hill, International Edition, 2002.
- Monczka, R., Trent, R., and Handfield, R.; "*Purchasing and Supply Chain Management*". 2nd Edition, South-Western Thomson Learning, 2002.

Course Code : **IM 735**

Course Title : **Strategic Management for Engineers**

Credit Hours : **3**

Course Description

Study of all functional areas of an enterprise to provide strategic direction to an organization. Strategy for effective management in the new millennium. A developed framework for understanding the interrelation of accounting, finance, operations, engineering, human resources and marketing.

Course Objectives

- Exposes engineers to various functional areas of an enterprise and how each interrelates for success.
- Strategies are taught to enable students to recognize and overcome obstacles of today's global market.

Course Topics

- Strategic management, course overview, expectations, goals and objectives
- Overview of the business environment and globalization
- Defining the company's mission and social responsibility
- Evolution of the competitive marketplace, local, regional, national and international
- Marketing strategies, marketing industrial vs., consumer products
- Total quality management, ISO quest for quality or trade barrier
- Organizational structure, balance sheets, income statements, breakeven analysis and effective utilization of depreciation
- Financial strategies, balance sheets, income statements, break-even and effective utilization of depreciation
- Human resource assets, capitalism, compensation, performance review.
- Assembling a professional management team, compatibility vs. complimentary style/skill
- Differentiation in learning style

References

- Pearce and Robinson; "*Strategic Management Formulation, Implementation and control*". 7th Edition.

Course Code : **IM 736**

Course Title : **Advanced Maintenance Management**

Credit Hours : **3**

Course Description

The course introduces the advanced maintenance types and techniques. The course focuses on management of maintenance and its factors such as scheduling, planning, criticality, cost and techniques. Participants should be able to define, understand and discuss the following items: Various types of maintenance organizations – equipment life expecting – expecting failure rates – preventive and predictive (TPM) – introduction to computerized maintenance management system (CMMS) – case studies.

Course Objectives

- This course is designed to provide students with latest procedures associates with
- Organizing maintenance resource.
- Analyzing failures.
- Setting and conducting a maintenance plan
- Planning spare parts.
- Estimating and controlling maintenance costs
- Computerizing maintenance planning and measurement operations

Course Topics

- Introduction to maintenance management
- Types of maintenance organizations
- Statistical application related to maintenance study
- Preventive maintenance (PM): definition, routine, major criticality, planning, scheduling
- Predictive maintenance (PDM)
- Total productive maintenance (TPM) and its implementation
- Facility maintenance project planning and control
- Computerized maintenance management system (CMMS)

References

- Matthew P. Stephens, *Productivity and Reliability–Based Maintenance Management*, Pearson, Prentice Hall, 2004
- Frank Herbaty, *Handbook of maintenance management*, NOYES publications, 1990.
- Joseph D. Patton, Jr., *Preventive maintenance*, Instrument society of America, Prentice Hall, 1983.
- Anthony Kelly, *Maintenance strategy*, 1998.

Course Code : **IM 737**

Course Title : **Human Resource Management**

Credit Hours : **3**

Course Description

The strategic Role of Human Resource Management, planning for conducting job analysis, job description and specification, Personnel planning and recruitment, Employee testing and selection, Basic testing concepts including validity and reliability, Basic types of interviews- improve performance as an interviewer, Mid-term Exam, Training and developing employees., Perceivers used to determine pay rates for employees, pay for performance and financial incentives, Types of benefits provided by employers- both mandatory and optional, Manager careers and fair treatment, Appraising performance, Labour relations and collective bargaining.

Course Objectives

- The student undertaking this course should be able to:
- Discuss the importance of HR management and the basic methods of conducting job analysis.
- Discuss eight methods used for recruiting job candidate.
- Describe the overall selection and testing process and the basic types of interviews.
- Describe the basic training process.
- Determine pay rates for employees.

Course Topics

- The strategic role of HR management
- Job analysis
- Personnel planning and recruiting
- Employee testing
- Interviewing
- Orientation and training
- Developing managers
- Managing quality and productivity
- Appraising performance.
- Establishing pay plans
- Financial incentives
- Benefits and Services

References

- Dessler, G., "*Human Resource Management*". Prentice - Hall.

Course Code : **IM 738**

Course Title : **Advanced Project Management**

Credit Hours : **3**

Course Description

Study of the field of project management as applied to technology intensive, product development projects. Emphasis on the basics of project management success in a high risk technology environment.

Course Objectives

- Enables the student to:
- Recognize the project management culture.
- Apply and match techniques of project management to the needs of the organization.
- Establish basic organization policies to enable effective project management techniques.
- Apply appropriate project management leadership strategies.

Course Topics

- The project management body of knowledge
- The project management context, link to strategy
- Requirements planning and requirements management
- Project planning methodology model, project life cycle
- Project scheduling and use of work breakdown structure
- Project control and earned value analysis.
- Project management applied to business process re-engineering. The impact of culture
- Project leadership

References

- James P. Lewis, "*The project Manager Desk reference. A comprehensive guide planning, scheduling, evaluation, control and systems*". McGraw Hill, 1995.

Course Code : **IM 739**

Course Title : **Advanced Management of International Business**

Credit Hours : **3**

Course Description

This course introduces the strategic topic of international business and operations and the motives for companies to become international. It provides deep understanding of the current global economic, political and financial environment, which are the key elements for the management of Multinational enterprises. The course also presents the classical theories of international trade and the theory of economic integration together with the role of governments to control trade and economy under market philosophy.

Course Objectives

- Understand the basic international economic, political and financial terms and functions.
- Introduce the new waves of global environment and ways of managing an international company.
- Study current international issues and how it would affect local economic environments for example stock market, inflation, exchange rates, institutional agreements, GATT, Oil prices, etc.
- Provide hands-on experience on analyzing a country's current economic indicators and future course of action to overcome obstacles.
- Concentrate on real case studies from past experience of international companies.
- Encourage students to discuss and present case studies from readings, new clips, Internet, and magazine articles about lessons and experience they have throughout lectures.

Course Topics

- An overview of international operations
- The International Political Environment
- The International Economic Environment
- International Trade theory
- Government Influence on Trade
- Economic Integration
- Foreign Direct Investment
- The world Financial Environment
- The Impact of Multinational Enterprises

References

- Daniels, J. D., Radebaugh, L. H., and Sullivan, D. P.; "*International Business: Environments and Operations*". 10th Edition, Prentice-Hall, 2004.

Course Code : **IM 742**

Course Title : **Design and Statistical Analysis of Experiments**

Credit Hours : **3**

Course Description

Hypotheses Testing – Single Factor Experiments – Factorial design – Robust design – nonparametric statistics.

Course Objectives

- To enable student to apply the finding of statistical analysis and experimental design in his master's course projects.

Course Topics

- Tests of hypotheses
- Statistical significance
- Design of single factor experiments
- Factorial design
- Robust design
- Optimization Experiments
- Non-parametric statistics.

References

- D.C. Montgomery, Runger, *Applied Statistics and Probability for Engineers*, Wiley.
- D.C. Montgomery, *Design and Analysis of Experiments*.

Course Code : **IM 743**

Course Title : **Advanced Reliability Engineering**

Credit Hours : **3**

Course Description

Introduction, Depiction of fundamentals formulas of reliability and failure probability, failure probability distribution, systems reliability (series, parallel, complex) System redundancy (K- out of- N, standby) Failure tree analysis, Failure Mode Effect and Criticality, Reliability Testing. Warranty Analysis, Reliability centered maintenance.

Course Objectives

- To create awareness towards problems of system failures, reliability and safety.
- To model mathematically the failure probabilities for different types of systems.
- To apply methods of statistical analysis to data reliability tests.

Course Topics

- Failure time Distributions
- System Reliability
- Reliability Testing
- Reliability Improvement
- Reliability in Design
- FMECA and FTA

References

- El-Sayed A. El-Sayed, "*Reliability Engineering*", Addison Wisley.
- John P. Bentley, "*Introduction to Reliability and Quality Engineering*", Addison Wisley.

Course Code : **IM 744**

Course Title : **Productivity and Quality Improvement**

Credit Hours : **3**

Course Description

Introduction, project identification, Planning and separating, Performance measurements, problem analysis and selections, Inspection capability, Corrective and preventive action matrix, process control procedures, process control implementation, problem profanation, Defect accountability, Measurement of effectiveness.

Course Objectives

- To provide a systematic approach to statistical process control implementation for productivity and quality improvement.
- To provide an integrated action plan for improving quality, productivity and profits through emphasizing the statistical techniques, problem solving techniques, productivity and quality improvement attitude and quality planning.

Course Topics

- Introduction, project identification
- Planning and reporting, performance measurements
- Problem analysis and solution
- Inspection capability, process capability
- Corrective and preventive action matrix
- Process control procedure, process control implementation
- Problem prevention, Defect accountability, Measurements of effectiveness.

References

- John L. Hardesky, *Productivity and quality Improvement - A practical guide*, McGraw-hill international. Ed., Industrial Engineering Series, 1988
- Deming, W.D., *Quality, productivity and Competitive position*, Center for Advanced Engineering Study, Cambridge, Massachusetts, USA. 1982.
- Grant, E.L. and Richard Leavenworth, *Statistical Quality Control*, McGraw-Hill, New York, 1979.

Course Code : **IM 745**

Course Title : **Systems Engineering**

Credit Hours : **3**

Course Description

Definitions of a system, attributes, relationships, concurrent engineering, quality deployment in systems engineering, operational feasibility in systems engineering.

Course Objectives

- To introduce different techniques and tool in systems engineering and design.
- To enable students to undertake the tasks of concept design of system using different software packages.

Course Topics

- Definition of systems and their classification
- Concurrent engineering and its implementation in systems engineering
- Quality function deployment
- Operational feasibility of systems reliability, maintainability, man ability

References

- Blanchard, B. S. and Fabrycky, W. J.; "*Systems Engineering and Analysis*", 4/E, Prentice Hall, 2006.
- Sterman, J., "*Business Dynamics: Systems Thinking and Modeling for a Complex World*", 1st Edition, McGraw-Hill, 2000.
- Pidd, M.; "*Systems Modelling: Theory and Practice*", Wiley, 2004.

Course Code : **IM 746**

Course Title : **Lean Six Sigma**

Credit Hours : **3**

Course Description

Students of this course will develop a broad understanding of Lean/Six Sigma principles and practices, build capability to implement Lean/Six Sigma initiatives in manufacturing operations, and learn to operate with awareness of Lean/Six Sigma at the enterprise level.

Course Objectives

- Develop a broad understanding of Lean/Six Sigma principles and practices.
- Build capability to implement Lean/Six Sigma initiatives in manufacturing operations.
- Operate with awareness of Lean/Six Sigma at the enterprise level.

Course Topics

- Lean Thinking
- Six Sigma Principles and Systems Change Principles
- Reducing Defects with Six Sigma
- Transactional Six Sigma
- Reducing Variation with Six Sigma
- Sustaining Improvement.
- Laser-Focused Process Innovation.
- Making Lean Six Sigma Successful.
- Visualizing and Improving the Process
- Measurement System Analysis.
- Design for Lean Six Sigma.
- Statistical Tools for Lean Six Sigma
- Simulation-Based Lean Six-Sigma Application

References

- Bass, I.; "*Lean Six Sigma Using SigmaXL and Minitab*". McGraw-Hill, 2009.
- Martin, J.; "*Lean Six Sigma for Supply Chain Management*". McGraw-Hill, 2006.
- George, M., Rowlands, D. and Kastle, B.; "*What Is Lean Six Sigma?*" McGraw-Hill, 2003.
- El-Haik, B. and Al-Aomar, R.; "*Simulation-based Lean Six-Sigma and Design for Six-Sigma*", Wiley, 2006.

Course Code : **IM 747**

Course Title : **Quality Management**

Credit Hours : **3**

Course Description

Students of this course will develop a broad understanding of Quality Management and the recent developments in the field: Improvement Approaches, Six Sigma, and new challenges in Quality Management; the latest information on the ISO 9000 series of quality management system series standards; combined with up-to-date tools, techniques and quality systems.

Course Objectives

- To provide insight into diverse ways of understanding and applying total quality.
- To familiarize the student with the broad array of tools, techniques and philosophies regarding quality management.

Course Topics

- Philosophy and concepts of quality management
- Tools and techniques of quality management
- Implementing quality management
- Organizing for quality management
- Quality Management Systems
- Designing and assuring quality
- Continuous improvement of the quality system
- Six Sigma Management and Tools

References

- Summers, D. C. S.; "*Quality Management*". 2nd Edition, Prentice Hall, 2009.
- Goetsch, D. L. and Davis, S. B.; "*Quality Management*". 5th Edition, Prentice Hall, 2006.
- Foster, S. T.; "*Managing Quality: Integrating the Supply Chain*". 3rd Ed., Prentice Hall, 2007.
- Dale, B. G., van der Wiele, T., and van Iwaarden, J.; "*Managing Quality*", 5th Ed., Wiley, 2007.

Course Code : **IM 751**

Course Title : **Marketing Management**

Credit Hours : **3**

Course Description

Strategic marketing, types of market and buyer behaviour, product strategies, marketing decision (price, channel, advertising, sales force) market research and international marketing.

Course Objectives

- To demonstrate the role of marketing in the company.
- To explore the relationship of marketing and other functions.
- To help the student in making marketing decisions in the context of general management.
- Focuses on concepts of demand, environment, consumer behaviour and marketing mix including product design, pricing, promotion and distribution.

Course Topics

- Introduction to marketing
- Marketing mix and marketing strategy
- Market segmentation
- Product analysis
- Pricing
- Promotional mix
- Distribution.

References

- Philip Kotter; "*Marketing Management, Analysis, Planning, Implementation, and Control*". Prentice Hall, 1990.

Faculty Members

(in alphabetical order)

- **ABDEL-RAZEK KANDEIL**
  Ph.D. (1979) Carleton University, Canada
  Materials and Manufacturing Engineering

- **AHMED FAROUK**
  Ph.D. (1970) Soviet Union
  Mechanical Engineering

- **AZIZ EZZAT ELSAYED**
  Ph.D. (1983) Alexandria University, Egypt
  Industrial Planning

- **ESSAM ROUSHDY**
  Ph.D. (1979) Purdue University, USA
  Industrial Engineering

- **KHALED EL-KILANY,** Head of Department
  Ph.D. (2004) Dublin City University, Ireland
  Systems Modelling and Analysis

- **M. WAGIH BADAWI**
  Ph.D. (1964) Victoria University of Manchester, UK
  Industrial Engineering

- **MOHAMED KHAMIS**
  Ph.D. (2004) University of Akron, USA
  Quality Engineering and Material Science

- **MOUSTAFA HELALY**
  Ph.D. (1981) Alexandria University, Egypt
  Machines Operation and Maintenance

- **OMAR GAAFAR**
  Ph.D. (1982) University of Strathclyde, UK
  Production Management

- **OSSAMA RASHED**
  Ph.D. (1983) Birmingham University, UK
  Measurements and Quality Engineering

- **YEHIA YOUSSEF**
  Ph.D. (2003) Imperial College, UK
  Material Science and Engineering

MARINE ENGINEERING

M.ENG. PROGRAM

M.Eng. in Marine Engineering

OVERVIEW

Marine and offshore engineers play a major role in ship design, operation, inspection and maintenance as well as offshore oil and gas platform design, operation, inspection and maintenance.

The department qualifies the students in areas such as drilling technology, oil and gas production, offshore oil and gas pipelines, underwater technology, safety and reliability of ships and offshore structures.

Graduates of the department often find careers in the shipping and offshore petroleum industries either as designer inspectors or operating engineers.

Many marine engineers pursue positions in management, while others prefer a career along technical and professional lines.

Program Detailed Structure

M.ENG. PROGRAM

M.Eng. in Marine Engineering

Core Courses:

Course Code	Course Title	Credit Hours
ME 755	Advanced Computational Methods	3
MM 740	Advanced Structural Analysis	3
MM 744	Advanced Marine Hydrodynamics 1	3
Subtotal	**3 Courses * 3 Credit Hours**	**9**

Elective Courses:

Course Code	Course Title	Credit Hours
MM 711	Vibration and Noise Control	3
MM 713	Advanced Marine Engineering	3
MM 721	Marine Propulsion Systems	3
MM 723	Marine Renewable Energy	3
MM 741	Ship Outfitting	3
MM 745	Ship Maintenance and Repair	3
MM 746	Ship Production Technology	3
MM 750	Dynamics of Marine Vehicles	3
MM 751	Advanced Marine Hydrodynamics 2	3
MM 752	Advanced Marine Materials	3
MM 753	Advanced Marine Vehicles	3
MM 754	Advanced Underwater Technology	3
MM 755	Marine Pollution: Prevention and Control	3
MM 756	Marine Statutory Regulations	3
MM 757	Production of Offshore Structures	3
MM 771	Hydromechanics of Offshore Structures	3
MM 772	Structural Design of Offshore Structures	3
MM 773	Offshore Drilling Technology	3

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Course Code	Course Title	Credit Hours
MM 774	Maintenance of Offshore Structures	3
MM 775	Subsea Pipelines	3
MM 776	Oil and Gas Production Technology	3
MM 777	Marine and Offshore Safety	3
MM 778	Marine Operations	3
Subtotal	**7 Courses * 3 Credit Hours**	**21**

Total	**30**

Courses

Course Code : **ME 755**

Course Title : **Advanced Computational Methods**

Credit Hours : **3**

Course Description

Error analysis. Solution of non-linear algebraic equations. Curve fitting. Numerical integration. Numerical solution of ordinary differential equations (odes) for the initial value problem. Solution of systems of odes. The stiff odes. The solution of the boundary value problem using the linear shooting, finite difference, and non-linear shooting methods. Applications to Mechanical, and Marine system design. The finite difference approximation. Numerical solution of partial differential equations (PDEs) using the finite difference method. Applications on elliptic, parabolic, and hyperbolic PDEs. Direct and iterative methods of solution. Solution of PDEs using the finite element method. Applications to problems in fluid mechanics, elastic deformation of solid elements, and stress analysis. Case studies using the MATLAB programming and available software and modules.

Course Objectives

The student should be able to master the approximation techniques used in numerical solutions and types of errors and achieve hands on experience to successfully implement numerical methods in engineering.

Course Topics

- Error analysis
- Solution of non-linear algebraic equations
- Curve fitting
- Numerical integration - Numerical solution of ODE's
- The solution of the boundary value problem using the linear shooting, finite difference, and non-linear shooting methods
- Applications to Mechanical, and Marine system design
- The finite difference approximation
- Direct and iterative methods of solution

References

- Anderson J. D. "*Computational Fluid Dynamics: The Basics with Applications*", McGraw Hill, 1995
- Nakamura S. "*Numerical Analysis and Graphic Visualization with MATLAB*", Prentice Hall, 1996
- Burden F. "*Numerical Methods*", PWS Pub. Co., 1997
- Ferziger J. H., "*Numerical Methods for Engineering Applications*", John Wiley
- Coombes K. R., "*Differential Equations with MATLAB*", John Wiley, 2000

Course Code : **MM 711**

Course Title : **Vibration and Noise Control**

Credit Hours : **3**

Course Description

Introduction. Free vibration of single-degree of freedom systems. Harmonic excitation of single degree of freedom systems. Response of non harmonic excitation. Continuous systems. Multi-degree of freedom systems. Applications to ships and marine structures. Typical vibration problems and remedies. Vibration control. Acoustic concepts. Noise control. Machinery noise.

Course Objectives

The student should be able to:

- Present a comprehensive coverage of the fundamental principles of vibration theory, with emphasis on the application of these principles to practical engineering problems
- Develop the ability of the student to estimate the frequencies of marine structures using advanced and approximate methods and to study means of noise control
- Facilitate the comparison of theoretical and experimental results and to help carrying out further studies to control noise and vibration

Course Topics

- Introduction
- Free vibration of single-degree of freedom systems
- Harmonic excitation of single degree of freedom systems
- Response of non harmonic excitation
- Continuous systems
- Multi-degree of freedom systems
- Applications to ships and marine structures
- Typical vibration problems and remedies
- Vibration control
- Acoustic concepts
- Noise control

References

- Singiresu S. Rao, "*Mechanical Vibrations*", Addison Wesley, 1995.
- William T. Thomson, "*Theory of Vibration with Applications*", Prentice Hall, 1993.
- Eric Tupper, "*Introduction to Naval Architecture*", Butterworth, Heinemann.
- "*Ship Design and Construction*", Published by SNAME, 1980.
- "*Principles of Naval Architecture*" SNAME

Course Code : **MM 713**

Course Title : **Advanced Marine Engineering**

Credit Hours : **3**

Course Description

Advanced technology for construction, operation and surveying of equipment and systems onboard ships. International regulations for Marine Engineering. Marine environment. Pollution. Ballast water, management, sea trials.

Course Objectives

The student should become acquainted with:

- Advanced technology of Marine Engineering equipment and engine room systems

Course Topics

- Advanced technology for construction, operation and surveying of equipment and systems onboard ships
- International regulations for Marine Engineering
- Marine environment
- Pollution
- Ballast water, management, sea trials

References

- Marine Institute publications.
- IMO regulations and publications.

Course Code : **MM 721**

Course Title : **Marine Propulsion Systems**

Credit Hours : **3**

Course Description

Early development of the screw propeller. Modern propulsion systems, The propeller environment, The wake field. Propeller performance characteristics. Theoretical methods. Propeller theory. Cavitations. Propeller noise. Propeller – ship interaction. Thrust augmentation devices. Transverse and azimuthing thrusters. Water jet propulsion. Propeller design. Operational problems.

Course Objectives

The student should become acquainted with:

- Different marine propulsion systems
- Modern propulsions
- Propulsion of advanced marine vehicles
- Use of thrusters in dynamic positioning systems

Course Topics

- Early development of the screw propeller
- Modern propulsion systems, The propeller environment, The wake field
- Propeller performance characteristics
- Theoretical methods
- Propeller theory
- Cavitations
- Propeller noise
- Propeller – ship interaction
- Thrust augmentation devices
- Transverse and azimuthing thrusters
- Water jet propulsion
- Operational problems

References

- J. S. Carlton, "*Marine propellers and Propulsion*", Butter worth- Heinmann Ltd 1994
- Taggart, "*Marine Propulsion: Principles and Evolution*", Gulf Publishing Company 1969
- *Principles of Naval Architecture*, SNAME

Course Code : **MM 723**

Course Title : **Marine Renewable Energy**

Credit Hours : **3**

Course Description

New wind, wave and tidal technology, renewable energy systems, offshore wind characteristics, wind turbines types and performance predictions, offshore wind energy farms, wave energy systems, marine spatial planning, environmental protection, sustainable development, project management and integration, economics and viability, installation, maintenance and subsea operations, transport / lift vessels and associated support infrastructure, regulations, licensing and future directions for development.

Course Objectives

The student should be able to:

- Have appreciation for offshore renewable sources
- Have better understanding for environment energy related issues and the associated increasing global awareness
- Become exposed to some existing worldwide offshore renewable energy projects
- Design and study the performance of offshore energy project

Course Topics

- New wind, wave and tidal technology
- Renewable energy systems
- Offshore wind characteristics
- Wind turbines types and performance predictions
- Offshore wind energy farms
- Wave energy systems
- Marine spatial planning
- Environmental protection, sustainable development
- Project management and integration
- Economics and viability
- Installation, maintenance and subsea operations
- Regulations, licensing and future directions for development

References

- Lecture Notes

Course Code : **MM 740**

Course Title : **Advanced Structural Analysis**

Credit Hours : **3**

Course Description

Rationally based structural design. Basic aspects of structural design. Structural safety. Probabilistic design methods. Loads. Response. Limit states. Optimization techniques. Statistical and dynamic aspects of wave. Loads. Matrix stiffness analysis. Application to frames and grillages. Basic aspects of the finite element method. Plate bending. Small deflection theory. Large deflection theory. Buckling and ultimate strength of columns. Buckling and ultimate strength of plates. Applications using commercial software packages.

Course Objectives

The student should be able to:

- Cover the calculations of various loads acting on a ship during service as well as to calculate the stresses induced in ship's structure
- Design and calculate the scantlings of different structural elements in ship's structure to check its structural safety

Course Topics

- Rationally based structural design
- Basic aspects of structural design - Structural safety
- Probabilistic design methods
- Loads, Response, Limit states
- Optimization techniques
- Statistical and dynamic aspects of wave loads
- Matrix stiffness analysis
- Application to frames and grillages
- Basic aspects of the finite element method
- Plate bending
- Large deflection theory
- Buckling and ultimate strength of columns
- Buckling and ultimate strength of plates
- Applications using commercial software packages

References

- *Ship Structural Design – Rationally–based Approach*
- *Principle of Naval Architecture* (SNAME)
- Paik, J. K, Thayamballi, A. K. "*Ultimate Limit State Design of Steel-Plated Structure*".
- Offshore Technology Conference, *Proceedings*
- Lecture Notes

Course Code : **MM 741**

Course Title : **Ship Outfitting**

Credit Hours : **3**

Course Description

Outfitting systems. Shipboard piping systems. Mooring systems. Anchoring systems. Cargo- handling equipment. Steering systems. Accommodation. Pollution prevention. Classification societies requirements.

Course Objectives

The student should be able to:

- Explain the different outfitting systems onboard a ship and their functions
- Cover the design, construction and testing of such systems
- Choose, design and test different outfitting systems for a particular ship

Course Topics

- Outfitting systems
- Shipboard piping systems
- Mooring systems
- Anchoring systems
- Cargo- handling equipment
- Steering systems
- Accommodation
- Pollution prevention
- Classification societies requirements

References

- Jackson L. and Morton T.D., "*General Knowledge for Marine Engineers*"
- Taylor D.A., "*Introduction to Marine Engineers*"
- SNAME, "*Principles and Naval Architecture*", vol. III published.
- Eyres, D.J., "*Ship Construction, Heinemann Professional Publishing*", Ltd, 1988.

Course Code : **MM 744**

Course Title : **Advanced Marine Hydrodynamics 1**

Credit Hours : **3**

Course Description

Review of vector algebra. Derivations of basic flow equations. Potential flow. Viscous flows. Laminar and turbulent flows. Laminar and turbulent boundary layer theory. Marine Applications.

Course Objectives

The student should be able to:

- Apply basic flow governing equations to model and or solve problems pertaining to flow past floating and immersed bodies
- Use modern techniques and models to predict some real flow aspects

Course Topics

- Review of vector algebra
- Derivations of basic flow equations
- Potential flow
- Viscous flows
- Laminar and turbulent flows
- Laminar and turbulent boundary layer theory
- Marine applications

References

- Hermann Schlichting, "*Boundary Layer Theory*", 8th Edition, Springer Verlag, Berlin
- Frank M. White, "*Viscous Fluid Flow*", 3rd Edition, McGraw Hill, Science/ Engineering / Math, 2005
- J.A. Schetz, "*Boundary Layer Analysis*", Prentice Hall

Course Code : **MM 745**

Course Title : **Ship Maintenance and Repair**

Credit Hours : **3**

Course Description

Ship docking and types of docks. Repair of metal hulls. Repair of ships: methods, structure and machinery parts. Types of maintenance. Ship's surveys. Classification societies. Quality assurance. Strength after Repair.

Course Objectives

The student should be able to:

- Schedule and assess the maintenance planning programs of ships
- Meet the standards of Classification Societies
- Be aware of quality assurance concepts

Course Topics

- Ship docking and types of docks
- Repair of metal hulls
- Repair of ships: methods, structure and machinery parts
- Types of maintenance
- Ship's surveys
- Classification societies
- Quality assurance
- Strength after repair

References

- S. Shields, "*Ship Maintenance: A Quantitative Approach*".
- Oleg Leizerson, "*Ship Repair Practice*", Mir Publishers.
- *Safety and Health in Shipbuilding and Ship Repairing*, International Labor Office Geneva.
- Jackson, L. and T.D. Morton "*General Knowledge for Marine Engineers*".
- Thomas Walton, "*Steel Ships, their Construction and Maintenance*".

Course Code : **MM 746**

Course Title : **Ship Production Technology**

Credit Hours : **3**

Course Description

Ship's order. Ship building processes. Advanced welding techniques. Berth. Dry and floating docks. Operation systems. Quay and sea trials. Ship delivery. Classification Societies. Quality assurance in shipbuilding. Ship's Building Contract. Shipyard Site and arrangement.

Course Objectives

The student should become acquainted with:

- Various shipbuilding processes and the new trends
- Production and operation techniques
- Standards of Classification Societies
- Quality assurance concepts

Course Topics

- Ship's order
- Ship building processes
- Advanced welding techniques
- Berth
- Dry and floating docks
- Operation systems
- Quay and sea trials
- Ship delivery
- Classification societies
- Quality assurance in shipbuilding
- Ship's Building Contract

References

- Eyres, D.J. "*Ship Construction*" Heinemann Professional Publishing. 1988.
- Walton, T. "*Steel Ships*", Griffin, London.
- "*Merchant Ship Design*".

Course Code : **MM 750**

Course Title : **Dynamics of Marine Vehicles**

Credit Hours : **3**

Course Description

Introduction, simple harmonic motion, sinusoidal water waves, uncoupled heaving, pitching, and rolling motions, irregular seaway, motions in irregular seaway, Dynamic effects, motions in three dimensional irregular seaway, coupled heaving, and pitching motions, nonlinear rolling motions (uncoupled), powering in a seaway, loads due to motion, wave loads, motion stabilization, model tests, full scale trials, and scale effects, sea keeping considerations in design, sea keeping of advanced marine vehicles

Course Objectives

The student should become acquainted with:

- Different ship motions and the associated couplings
- Ship motion in regular and irregular seaway
- Sea keeping qualities of marine vehicles

Course Topics

- Introduction
- Simple harmonic motion
- Sinusoidal water waves
- Uncoupled heaving, pitching, and rolling motions
- Irregular seaway, motions in irregular seaway
- Dynamic effects
- Motions in three dimensional irregular seaway
- Coupled heaving and pitching motions
- Nonlinear rolling motions (uncoupled)
- Powering in a seaway
- Loads due to motion
- Model tests, full scale trials, and scale effects
- Sea keeping considerations in design
- Sea keeping of advanced marine vehicles

References

- A. Lloyd "*Seakeeping, Ship Behavior in Rough Weather*"
- R. Bhattacharyya "*Dynamics of Marine Vehicles*".
- "*Principles of Naval Architecture*", SNAME, vol. III

Course Code : **MM 751**

Course Title : **Advanced Marine Hydrodynamics 2**

Credit Hours : **3**

Course Description

Ship resistance. Dimensional analysis. Frictional resistance. Residuary resistance, Wave making resistance, Form resistance, Two and three dimensional resistance formulations. Methodical Series of data. Shallow water effects. Relation of hull form to resistance, Advanced Marine vehicles. Theory of aerofoil sections. Powering of ships, Theory of propeller action. Law of similitude for propellers, Interaction between hull and propeller. Geometry of screw propellers. Cavitation. Propeller design

Course Objectives

The student should be able to:

- Perform resistance and powering calculations for different types of ships
- Carry out calculations for the design of propellers

Course Topics

- Ship resistance
- Dimensional analysis
- Frictional resistance
- Residuary resistance, Wave making resistance, Form resistance, Two and three dimensional resistance formulations
- Methodical Series of data
- Shallow water effects
- Relation of hull form to resistance, Advanced Marine vehicles
- Theory of aerofoil sections
- Powering of ships, Theory of propeller action
- Law of similitude for propellers, Interaction between hull and propeller
- Geometry of screw propellers
- Propeller design

References

- "*Principles of Naval Architecture*", SNAME, vol. III
- J.S. Carlton Butter Worth, "*Marine Propellers and Propulsion*", Heinemann, Lid,19
- K.J. Rowsan and E.C. Tupper, "*Basic Ship Theory*".
- G. Kuiper, "*The Wageningen Propeller Series*", Marine Publication 1992

Course Code : **MM 752**

Course Title : **Advanced Marine Materials**

Credit Hours : **3**

Course Description

Introduction to materials. Ferrous materials. Phase diagrams. Carbon steels. Alloy steels. Nonferrous alloys. Properties of Marine materials: Mechanicals, chemical, thermal, electrical and magnetic. Toughness. Creep. Corrosion. Fatigue. Marine Materials selection and substitution. Future trends in marine materials usage. Environmental issues. Fracture, weld ability and the influence of welding on mechanical properties. Crystal structure, a review. Diffusion in metals. Solidification of metals. Equilibrium diagrams. Heat treatment alloys. Defects on materials. Strengthening of materials. Corrosion resistant materials. Cathodic Protection. Marine coating. Material inspection.

Course Objectives

The student should be able to:

- Develop and enhance the knowledge and skill of the student in order to select the most suitable materials for marine structures applications
- Provide the students with the latest developments in material technology and applications of new advanced materials
- Relate fracture, corrosion and welding behavior to particular alloy specifications

Course Topics

- Introduction to materials
- Ferrous materials
- Phase diagrams - Alloys
- Properties of Marine materials:
- Marine Materials selection and substitution –
- Future trends in marine materials usage - Environmental issues
- Fracture, weld ability and the influence of welding on mechanical properties
- Crystal structure, Diffusion in metals, Solidification of metals and Equilibrium diagrams
- Heat treatment alloys, Defects on materials
- Corrosion resistant materials, Cathodic Protection, Marine coating
- Material inspection

References

- William F. Smith, "Foundation of Materials Science and Engineering".
- Flinn and Trojan, "Engineering Materials and Their Applications"
- F. Shackelford, "Introduction to Materials and Their Applications"
- M. Farag. "Materials Selection for Engineering Design"
- SNAME and RINA Publications

Course Code : **MM 753**

Course Title : **Advanced Marine Vehicles**

Credit Hours : **3**

Course Description

Hydrodynamics of small high-speed craft including planning hulls, air cushion vehicles, surface effect ships, and Wing in Ground Effect. Theoretical and empirical methods for resistance propulsion and attitude prediction. Nonlinear dynamics and stability of high-speed marine vehicles. Effect of hull form on resistance and dynamic performance. Structural design considerations including bottom plating strength and frame loading. Discussion of various types of framing. Material choices.

Course Objectives

The student should be able to:

- Understand the differences between conventional and advanced marine vehicles geometrical, hydrodynamic, and structural aspects
- Apply new codes pertaining to high speed and advanced marine vehicles

Course Topics

- Hydrodynamics of small high-speed craft including planning hulls
- Air cushion vehicles
- Surface effect ships, and Wing in Ground Effect
- Theoretical and empirical methods for resistance propulsion and attitude prediction
- Nonlinear dynamics and stability of high-speed marine vehicles
- Effect of hull form on resistance and dynamic performance
- Structural design considerations including bottom plating strength and frame loading
- Discussion of various types of framing
- Material choices

References

- Odd M. Faltinsen, “Hydrodynamics of High-Speed Marine Vehicles”, Cambridge University Press, NY, 2005
- B. R. Clayton, “Mechanics of Marine Vehicles”, Gulf Pub Co 1982
- Lecture Notes

Course Code : **MM 754**

Course Title : **Advance Underwater Technology**

Credit Hours : **3**

Course Description

Underwater equipment. Underwater cutting. Underwater welding. Underwater inspection. Underwater repair operations.

Course Objectives

The student should become acquainted with:

- Different methodologies and techniques for under water operations as related to marine structures

Course Topics

- Underwater equipment
- Underwater cutting
- Underwater welding
- Underwater inspection
- Underwater repair operations

References

- Handouts and Lecture Notes

Course Code : **MM 755**

Course Title : **Marine Pollution: Prevention and Control**

Credit Hours : **3**

Course Description

Sources of marine pollution. Hazards of marine pollution. Statutory regulations and international conventions to prevent marine pollution. Methods and measures of controlling marine pollution. Ballast water management.

Course Objectives

The student should be able to:

- Identify sources of marine pollution
- Assess the conformity of marine system with local and international environmental regulations
- Assess environmental impacts of marine system operations

Course Topics

- Sources of marine pollution
- Hazards of marine pollution
- Statutory regulations and international conventions to prevent marine pollution
- Methods and measures of controlling marine pollution
- Ballast water management

References

- Lecture Notes

Course Code : **MM 756**

Course Title : **Marine Statutory Regulations**

Credit Hours : **3**

Course Description

Government administration. International Maritime Organization (IMO). SOLAS. Surveys and certification. Subdivision and stability. Machinery and electric installations. Fire protection. Fire detection and fire extinction. Life saving appliances. Radiotelegraphy and radiotelephony. Safety of navigation. Carriage of grain. Carriage of dangerous goods. Nuclear ships, port State Control.

Course Objectives

The student should become:

- Aware of recent marine regulations
- Knowledgeable of national and international conventions in the marine fields
- Familiar with recommendations and guidelines of marine and offshore bodies

Course Topics

- Government administration
- International Maritime Organization (IMO)
- SOLAS
- Surveys and certification
- Subdivision and stability
- Machinery and electric installations
- Fire protection
- Fire detection and fire extinction
- Life saving appliances
- Radiotelegraphy and radiotelephony
- Safety of navigation
- Carriage of dangerous goods
- Nuclear ships, port State Control

References

- Lecture Notes

Course Code : **MM 757**

Course Title : **Production of Offshore Structures**

Credit Hours : **3**

Course Description

Material in the ocean. Construction of ocean structures. Impact of the ocean environment on structural design. Structural assembly. Outfitting. Preservation of ocean structures. Cost and contracts.

Course Objectives

The student should be able to:

- Identify the ocean characteristics and their impacts on the offshore structure
- Assess the building and assembly approaches to offshore structures
- Study different protection and preservation methods of ocean structures -

Course Topics

- Material in the ocean
- Construction of ocean structures
- Impact of the ocean environment on structural design
- Structural assembly
- Outfitting
- Preservation of ocean structures
- Cost and contracts

References

- Handouts and Lecture Notes

Course Code : **MM 771**

Course Title : **Hydromechanics of Offshore Structures**

Credit Hours : **3**

Course Description

Hydromechanics of offshore structures, Features of offshore structures, Selected basics of hydromechanics (Continuity, Laplace, Euler, Bernoulli, Navier-Stokes Equations), Non Dimensional Characteristic numbers, 2D potential flow of incompressible fluids, 3D potential flow of incompressible fluids, Wave theories (Linear wave theory, Stokes finite amplitude theory), Hydrostatic analysis (Pressure and buoyancy, Stability of floating offshore structures, stability of compliant offshore structures), Hydrodynamic analysis (Wave forces on hydrodynamically transparent structures, Motion of hydrodynamically transparent structures in a seaway, Forces and motions of hydrodynamically compact structures in a seaway, wave drift forces

Course Objectives

The student should be able to:

- Estimate the fluid loading accurately in order to perform the structural design of offshore platforms

Course Topics

- Hydromechanics of offshore structures
- Features of offshore structures
- Selected basics of hydromechanics (continuity, Laplace, Euler, Bernoulli, Navier-Stokes equations)
- Non-dimensional characteristic numbers
- 2D and 3D potential flow of incompressible fluids
- Wave theories (linear wave theory, Stokes finite amplitude theory)
- Hydrostatic analysis
- Hydrodynamic analysis
- Forces and motions of hydrodynamically compact structures in a seaway
- Wave drift forces

References

- Barltrop, N. P., Mitchell, G. M. and Atkins J.B. “Fluid Loading on Fixed Offshore Structure”.
- Gunther Clauss, Eike Lehmann, and Carsten Ostergaard, “Offshore structures Vol. I Conceptual Design and Hydromechanics”, Springler Verlag
- Offshore Technology Conference Proceedings
- Sarpkaya, T. and Isaacson M., “Mechanics of Wave Forces on Offshore Structures”.
- Lecture Notes

Course Code : **MM 772**

Course Title : **Structural Design of Offshore Structures**

Credit Hours : **3**

Course Description

General design procedure. Design loads and forces. Jacket structural design. Tubular joint design. Fatigue analysis. Design codes. Topside structures. Layout and design considerations. Design of plates. Design of beams and girders. Pile foundations. Axial and lateral pile capacities. Soil-pile interaction. Pile design. Dynamic analysis of jacket platforms. Time domain and frequency domain approaches.

Course Objectives

The student should be able to:

- Perform detailed design calculations for offshore jacket platforms

Course Topics

- General design procedure
- Design loads and forces
- Jacket structural design
- Tubular joint design
- Fatigue analysis
- Design codes
- Topside structures
- Layout and design considerations
- Design of plates
- Design of beams and girders
- Pile foundations
- Soil-pile interaction
- Pile design
- Dynamic analysis of jacket platforms
- Time domain and frequency domain approaches

References

- Barltrop and Adams “Dynamics of Fixed Marine Structure”
- Offshore Technology Conference - Proceedings.
- Lecture Notes

Course Code : **MM 773**

Course Title : **Offshore Drilling Technology**

Credit Hours : **3**

Course Description

Petroleum geology. Types of rocks. Oil and gas traps. Well types. Offshore exploration methods. Offshore drilling platforms. Drilling equipment. Drilling derrick. Rotary system. Draw works. B.O.P. and well control equipment. Mud system. Mud classification. Mud testing. Mud pumps. Drilling and completion operations. Directional drilling. Drilling problems. Well design.

Course Objectives

The student should be able to:

- Enhance and develop the knowledge and experience of students in the field of marine drilling for oil and gas

Course Topics

- Petroleum geology
- Types of rocks
- Oil and gas traps
- Well types
- Offshore exploration methods
- Offshore drilling platforms
- Drilling equipment
- Drilling derrick
- Rotary system
- Draw works
- B.O.P. and well control equipment
- Drilling and completion operations
- Directional drilling
- Drilling problems
- Well design

References

- McLachlan, M. “An Introduction to Marine Drilling”.
- Applied Drilling Engineering (SPE)
- Offshore Technology Conference - Proceedings.
- Lecture Notes

Course Code : **MM 774**

Course Title : **Maintenance of Offshore Structures**

Credit Hours : **3**

Course Description

Offshore structures. Fixed and floating structures. Subsea systems. Pipelines. Deterioration of offshore structures. Fabrication and installation stages. In-service stage. Maintenance strategies and types. Underwater work systems. Tools. Instruments. Divers. Underwater vehicles. Maintenance of jacket structures. Cleaning. Inspection. Maintenance of the topside structures. Steel structures. Topside facilities and equipment. Maintenance of subsea systems and pipelines. Reporting and documentation.

Course Objectives

The student should learn:

- Planning, performing and supervising maintenance programs for offshore structures and subsea systems

Course Topics

- Offshore structures
- Fixed and floating structures
- Subsea systems and Pipelines
- Deterioration of offshore structures
- Fabrication and installation stages
- In-service stage
- Maintenance strategies and types
- Underwater work systems
- Tools, Instruments, Divers - Underwater vehicles
- Maintenance of jacket structures
- Cleaning, Inspection
- Steel structures
- Topside facilities and equipment
- Maintenance of subsea systems and pipelines
- Reporting and documentation

References

- An Introduction to Offshore Maintenance (OPL)
- M. Bayliss “Underwater Inspection”
- Offshore Technology Conference Proceedings.
- Lecture Notes

Course Code : **MM 775**

Course Title : **Subsea Pipelines**

Credit Hours : **3**

Course Description

Types of pipelines. Design of offshore pipelines. Forces and motions of offshore pipeline in seaway. Special design considerations. Stress analysis of offshore pipelines. Installation and laying of pipelines. Methods. Laying barges. Towing. Inspection and survey of pipelines. Inspection techniques. Classification Societies requirements. Maintenance and repair of pipelines.

Course Objectives

The student should be able to:

- Design and evaluate offshore pipeline with consideration to the production technology, environmental conditions, route characteristics, safety requirements and economical aspects

Course Topics

- Types of pipelines
- Design of offshore pipelines
- Forces and motions of offshore pipeline in seaway
- Special design considerations
- Stress analysis of offshore pipelines
- Installation and laying of pipelines
- Methods
- Laying barges
- Towing
- Inspection and survey of pipelines
- Inspection techniques
- Maintenance and repair of pipelines

References

- Subsea and Pipeline Engineering – Bentham Press
- Rules for Submarine Pipeline Systems – Det Norske Veritas
- Offshore Technology Conference Proceedings
- Lecture Notes

Course Code : **MM 776**

Course Title : **Oil and Gas Production Technology**

Credit Hours : **3**

Course Description

Well completion. Bottom hole completion techniques. Types of production systems. Fixed platforms. Floating and compliant production systems. Subsea systems. Offshore pipelines. Oil and gas separation. Mechanisms of small particle collection. Piping systems. Pressure vessels. Layout and design of process plant. Gas production. Oil production. Oily water processing. Separation facilities and processing equipment. Oil drive mechanism. Enhanced oil recovery systems. Maintenance and safety aspects.

Course Objectives

The student should be able to:

- Evaluate and chose the proper production system for a given offshore field
- Evaluate, prepare the layout and design of oil and gas production trains
- Determine the main specifications of the required processing equipment

Course Topics

- Well completion
- Bottom hole completion techniques
- Types of production systems
- Fixed platforms
- Floating and compliant production systems
- Subsea systems and Offshore pipelines
- Oil and gas separation
- Mechanisms of small particle collection
- Piping systems, Pressure vessels
- Layout and design of process plant
- Gas production, Oil production
- Separation facilities and processing equipment
- Oil drive mechanism
- Enhanced oil recovery systems
- Maintenance and safety aspects

References

- Offshore Technology Conference Proceedings
- Production Facilities (SPE)
- Offshore Oil and Gas Process Engineering – Benthan Press
- Lecture Notes

Course Code : **MM 777**

Course Title : **Marine and Offshore Safety**

Credit Hours : **3**

Course Description

Main risks. Classification and survey regulations. Safety case approach. Goal setting. Verification schemes. The Safety Management System. Offshore risk assessment. Quantitative risk assessment. Safety of topside structure. Safety considerations of topside facilities and equipment. Personnel safety considerations. Fire-fighting equipment. Active fire protection. Passive fire protection. Life-saving appliances. Emergency systems. Safety aspects of underwater structure and systems. Design stage. In-serve stage.

Course Objectives

The student should be able to:

- Identify and specify the main risks affecting marine and offshore structures and systems for both the underwater structure and topside facilities
- Perform safety assessment using modern techniques and tools

Course Topics

- Main risks
- Classification and survey regulations
- Safety case approach
- Goal setting and Verification schemes
- The Safety Management System
- Offshore risk assessment
- Quantitative risk assessment
- Safety of topside structure
- Safety considerations of topside facilities and equipment
- Personnel safety considerations
- Fire-fighting equipment
- Life-saving appliances
- Emergency systems
- Safety aspects of underwater structure and systems
- Design stage and in-serve stage

References

- Offshore Technology Conference Proceedings
- Inspection, Assessment and Recertification of Offshore Platforms – Bentham Press
- Preparation and Evaluation of Safety Case – Bentham Press
- Lecture Notes

Course Code : **MM 778**

Course Title : **Marine Operations**

Credit Hours : **3**

Course Description

Review of basic ship definitions. Stability of floating units. Stability criteria. Ballasting and free surfaces. Trim. Resistance and powering estimation. Types of propulsion systems. Propellers. Types of propellers. Rig - moves. Towage. Approaching the location. Anchor types. Anchor handing. Dynamic positioning systems.

Course Objectives

The student should be able to:

- Perform the various calculations needed during jacket and topside structure transportation including stability evaluation
- Determine the power and specifications of the tug boots used for towing operations

Course Topics

- Review of basic ship definitions
- Stability of floating units
- Stability criteria
- Ballasting and free surfaces
- Trim resistance and powering estimation
- Types of propulsion systems
- Propellers
- Types of propellers
- Rig - moves
- Towage
- Approaching the location
- Anchor handing
- Dynamic positioning systems

References

- Offshore Technology Conference Proceedings
- Muckle, W. “Muckle’s Naval Architecture”.
- Rawson. K.J., Tupper, E.C., “Basic Ship Theory”
- Carlton, J. S., “Marine Propellers and Propulsion”
- Lecture Notes

Faculty Members

(in alphabetical order)

- **AMR ALI HASSAN**, Head of Department
  Ph.D. (2002) University of Nottingham, UK
  Computational Fluid Dynamics, Heat Transfer

- **EL-SAYED HEGAZY**
  Ph.D. (1973) University of Alexandria, Egypt
  Structural Ship Design

- **MOHAMED ABBAS KOTB**
  Ph.D. (1985) Virginia Polytechnic Institute and State Univ., USA
  Ship hydrodynamics, Ship Propulsion, Energy Systems

- **MOHAMED EL-NOUR ABDEL-RADI**
  Ph.D. (1984) University of Glasgow, UK
  Offshore Engineering

- **MOHAMED FAHMY SHEHADA**
  Ph.D. (2006) University of Heriot-Watt, UK
  Material Engineering

- **TAREK AHMED ELSAYED**
  Ph.D. (1998) University of California, Berkeley, USA
  Naval Architecture and Offshore Engineering

MECHANICAL ENGINEERING

M.ENG. PROGRAM

OVERVIEW

Mechanical Engineering is concerned with the development and use of new technologies and the design of new processes and products, which mainly involve 'things that move', such as motor vehicles, aircraft systems, engines, pumps, gas turbines, industrial plants, air conditioning/ refrigeration systems, manufacturing processes, building services, oil and gas industries and even space stations.

The Master of Engineering program in Mechanical Engineering offers high quality education that prepares students for advanced academic, research and professional careers in one of the following specializations: Power and Energy, Refrigeration and Air Conditioning, Automotive and Mechatronics.

Design is the backbone of the program. Within the program, graduates will obtain the knowledge of design, engineering science courses, thermodynamics, fluid mechanics, machine dynamics, mechatronics, and materials.

The objectives of the Master of Engineering Degree in Mechanical Engineering are to provide the graduates of the program with:

- A broad knowledge of modern computational and experimental methods in engineering.
- Extensive knowledge in one of the following specializations: Power and Energy, Refrigeration and Air Conditioning, Automotive, and Mechatronics.
- Deep understanding of the research techniques and data analysis in the area of specialization.
- Ability to solve unstructured engineering problems, think critically, function well in a team, and communicate effectively.
- A high standard of written and oral communication on technical matters.

Program Detailed Structure

M.ENG. PROGRAM

M.Eng. in Mechanical Engineering

DIVISION (A): MECHANICAL ENGINEERING

Master's Courses

CORE COURSES:

Course Code	Course Title	Credit Hours
ME 711	Research Methods in Mechanical Engineering	3
ME 731	Advanced Heat and Mass Transfer	3
ME 753	Advanced Computational Methods	3
ME 761	Advanced Fluid Mechanics	3
Subtotal	**4 Courses * 3 Credit Hours**	**12**

ELECTIVE COURSES:

Course Code	Course Title	Credit Hours
ME 721	Theory of Combustion	3
ME 722	Thermal Power Plants	3
ME 723	Renewable Energy	3
ME 732	Advanced Air Conditioning and Refrigeration	3
ME 751	Vibrations and Noise Control	3
ME 752	Robotics and Applications	3
ME 754	Simulation and Modeling of Mechanical Systems	3
ME 762	Piping Systems	3
ME 763	Engineering Experimentations and Measurements	3
ME 771	Advanced Engineering Materials	3
ME 781	Advanced Automotive Technology	3
ME 785	Automotive Maintenance	3
ME 791	Advanced Mechatronics Systems	3
ME 795	Embedded Control of Manufacturing Processes	3
ME 796	Design for Manufacturability	3
Subtotal	**6 Courses * 3 Credit Hours**	**18**

Total	**30**

M.Eng. in Mechanical Engineering

DIVISION (B): MECHATRONICS ENGINEERING

MECHANICAL ENGINEERING COURSES:

Course Code	Course Title	Credit Hours
ME 791	Advanced Mechatronics Systems	3
ME 793	Condition Monitoring and Diagnostic Expert Systems	3
ME 794	Robots Design and Applications	3
ME 795	Embedded Control of Manufacturing Processes	3
ME 796	Design for Manufacturability	3
Subtotal	**3 Courses * 3 Credit Hours**	**9**

ELECTRONICS AND COMMUNICATIONS ENGINEERING COURSES:

Course Code	Course Title	Credit Hours
EC 731-M	Principles of Digital Signal Processing	3
EC 732-M	Advanced Electronic Measurements	3
EC 738-M	Advanced Electronic Systems	3
Subtotal	**2 Courses * 3 Credit Hours**	**6**

COMPUTER ENGINEERING COURSES:

Course Code	Course Title	Credit Hours
CC 715	Advanced Programming Applications	3
CC 724	Computer Architecture and Embedded Systems	3
CC 734	Computer Communications	3
CC 744	Data Acquisition Systems	3
CC 751	Applications of Artificial Neural Networks	3
Subtotal	**2 Courses * 3 Credit Hours**	**6**

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ELECTRICAL AND CONTROL ENGINEERING COURSES:

Course Code	Course Title	Credit Hours
EE 713	Digital Control Systems	3
EE 715	Optimal Control	3
EE 751	Power Electronic Devices and their Applications	3
EE 752	Automated Industrial Systems	3
Subtotal	**3 Courses * 3 Credit Hours**	**9**

Total	**30**

Courses

Course Code : **ME 711**

Course Title : **Research Methods in Mechanical Engineering**

Credit Hours : **3**

Course Description

The course provides graduate students with an overall understanding of the nature of academic research. Research design, qualitative and quantitative research, sources of data. Data collection procedures, measurement strategies and results analysis. Evaluating and writing research report. Error analysis. Presentation skills.

Course Objectives

To provide an understanding of the main research methods used in Mechanical engineering and develop the necessary knowledge and skills for pursuing research projects, theses or dissertations.

Course Topics

- Nature of Mechanical Engineering Research
- Formulation of research problem
- Literature review and technical writing
- Research methods and research design
- Statistical analysis: parametric and non-parametric techniques, regression and factor analysis.
- Advanced statistical topics
- Modeling techniques, optimization, simulation, and IT applications in research
- Research validation
- Error Analysis
- Presentation skills

References

- Tan, W. "*Practical Research Methods*" Pearson Prentice Hall, New York, 2004.
- Cramer, D. "*Advanced Quantitative Data Analysis*" Open University Press, McGraw-Hill Education, 2003.
- Bryman, A. and Cramer, D. "Qu*antitative Data Analysis with SPSS Release 12.0*", Routledge, London, 2004.
- Sree Ramulu, U. S. "*Thesis Writing*" – Oxford and IBH Publishing, New Delhi, India. 1988.
- John R. Taylor, *An Introduction to Error Analysis- The study of uncertainties in physical Measurements*", USA, 1982.

Course Code : **ME 721**

Course Title : **Theory of Combustion**

Credit Hours : **3**

Course Description

Broad survey and principle to fuels and combustion technology. Also, combustion systems as applied to engineering, selection and design of combustion systems. Delineate the fundamentals of combustion engines emission and their control. Case study projects and laboratory activities.

Course Objectives

The student should be able to:

- Understand the fundamentals and applications of combustion technology
- Understand the problem of energy conservation and improvement of combustion efficiency
- Understand the selection and design of a specified combustion system
- Understand the combustion safety and air pollution problem
- Understand the special combustion challenges for aeronautical and space development

Course Topics

- Principle to fuels and combustion technology
- Combustion system as applied to engineering
- Selection and design of combustion systems
- Case study projects and laboratory activities

References

- S. P Sharma, C. Mohan, "*Fuels and Combustion*," McGraw Hill, 1982
- D. B. Spalding, "*Combustion and Mass Transfer*," Pergamon Press, Oxford, 1983
- N. A. Chigier, "*Progress in Energy and Combustion Science*", Pergamon Press, Oxford, 1986
- A. M. Kanury, "*Introduction to Combustion Phenomena*", Gordon and Breach Science Publishers, New York, 1979
- T. M. Williams, "*Combustion Theory*", Addision-Wasley, 1973
- D. J. Patterson, N. A. Henein, "*Emission from Combustion Engines and their Control*", Butterworth Group, Michigan, 1982
- C. R. Croswell, "*Notes on Air Pollution Control*", H.K. Kowis, London, 1978

Course Code : **ME 722**

Course Title : **Thermal Power Plants**

Credit Hours : **3**

Course Description

Steam generators design. Cold startup. Efficient generation of steam. Failure analysis. Maintenance and preventive maintenance. Water treatment. Advanced technology. Pollution control. Steam turbines. Steam turbine components. Turbine losses. Turbine efficiencies. Turbine performance at varying loads. Operating turbines. Turbine maintenance. Upgrade opportunities for system turbines. Bearing and seals. Governors. Gas turbines: start up procedures. Advances in material technology. Cooling techniques. Gas turbine stall. Advanced gas turbine design. Combined cycles: different kinds of combined cycles. Design of waste heat recovery boilers. Advanced combined cycles. Combined cycles retrofit. Comparison of power producing technologies.

Course Objectives

The student should acquire the state of the art of thermal power plants and power

plants strategies.

Course Topics

- Steam generators design. Cold startup
- Efficient generation of steam. Failure analysis
- Maintenance and preventive maintenance
- Water treatment. Advanced technology. Pollution control
- Steam turbines. Steam turbine components
- Turbine losses. Turbine efficiencies
- Turbine performance at varying loads
- Operating turbines. Turbine maintenance
- Upgrade opportunities for system turbines. Bearing and seals
- Governors. Gas turbines. start up procedures
- Advances in material technology
- Cooling techniques. Gas turbine stall
- Advanced gas turbine design. Combined cycles
- Different kinds of combined cycles
- Design of waste heat recovery boilers. Advanced combined cycles
- Combined cycles retrofit. Comparison of power producing technologies

References

- *Modern Power Station Practice* (8 volumes).
- *Central Electricity Generating Board* - Pergamon Press LTD.
- The NALCO guide to bailer failure analysis.

Course Code : **ME 723**

Course Title : **Renewable Energy**

Credit Hours : **3**

Course Description

Alternative energy sources and sustainable energy sources. Cost-benefit analysis on each form of alternative energy in order to determine what is practical on a large scale, as well as on the scale of the individual homeowner. The efficiency of each alternative energy source as well as what limitations exist in terms of extracting useable energy. The solar energy, wind, tides, hydroelectric, ocean currents, and geothermal.

Course Objectives

The student should be able to:

- Gain an understanding of the cost-benefit ratio of various alternative energy sources to see what is feasible on the large scale and what is not.
- Understand some of the various obstacles associated with actual implementation of production line alternative energy facilities.
- Do simple calculations regarding the cost of energy usage and the required infrastructure to deliver a certain amount of power.

Course Topics

- Alternative energy sources and sustainable energy sources.
- Cost-benefit analysis on each form of alternative energy in order to determine what is practical on a large scale, as well as on the scale of the individual homeowner
- The efficiency of each alternative energy source as well as what limitations exist in terms of extracting useable energy
- The solar energy, wind, tides, hydroelectric, ocean currents, and geothermal Convection

References

- Sorensen, Bent, *Renewable Energy: Its Physics, Engineering, Use, Environmental Impacts, Economy And Planning Aspect*.
- Boyle, Godfrey, *Renewable Energy: Power For A Sustainable Future*
- Lecture Notes
- Internet Sources.

Course Code : **ME 731**

Course Title : **Advanced Heat and Mass Transfer**

Credit Hours : **3**

Course Description

Three dimensional time-dependent heat transfer. Graphical method. Finite difference method. Finite difference solution. Convection. Radiation heat transfer. Mass transfer. Diffusion in liquids, solids and gases. Mass transfer coefficients. Magneto fluid dynamics systems. Low density heat transfer. Heat pipe. Special topics assigned to students.

Course Objectives

The student should be able to deal with any advanced thermodynamics problem.

Course Topics

- Three dimensional time - dependent heat transfer
- Graphical method
- Finite difference method
- Finite difference solution
- Convection
- Convection
- Radiation heat transfer
- Mass transfer
- Mass transfer
- Diffusion in liquids, solids and gases
- Mass transfer coefficients
- Magneto fluid dynamics systems
- Low density heat transfer
- Heat pipe
- Special topics assigned to students
- Special topics assigned to students

References

- Mills, A.F. "*Heat and Mass Transfer,*" Irwin, Chicago. 1995
- Incropera, Frank P. "*Fundamentals of Heat and Mass Transfer*," Wiley, New York, 1990
- Holman, J.P. "*Heat Transfer*," McGraw Hill, New York.
- Eastop. "*Applied Thermodynamics*," Longman, Singapore. 1993
- Balhr, Hans Dieter "*Heat and Mass Transfer*"

Course Code : **ME 732**

Course Title : **Advanced Air Conditioning and Refrigeration**

Credit Hours : **3**

Course Description

Introduction, Non vapor compression systems, Cryogenics, Building management systems, Industrial air ventilation, Duct design, balancing and control, Hourly load estimation, Hourly based cooling load calculation. HVAC and Refrigeration software applications. Solving variable cooling load problems and system design.

Course Objectives

The student should be able to:

- Apply the advanced principles of refrigeration and air conditioning
- Design any refrigeration and air conditioning system

Course Topics

- Absorption refrigeration systems
- Absorption refrigeration systems
- Absorption refrigeration systems
- Thermoelectric refrigeration systems
- Thermoelectric refrigeration systems
- Thermoelectric refrigeration systems
- Cryogenics. Indoor air quality
- Cryogenics. Indoor air quality
- Cryogenics. Indoor air quality
- Cryogenics. Indoor air quality
- Space air diffusion
- Space air diffusion
- Space air diffusion
- Building air distribution
- Building air distribution
- Building air distribution

References

- ASHRAE, Applications
- ASHRAE, Fundamentals
- Stocker W. F. "*Refrigeration and Air Conditioning*"

Course Code : **ME 751**

Course Title : **Vibration and Noise Control**

Credit Hours : **3**

Course Description

Introduction. Response of nonharmonic excitation. Continuous systems. Multidegree of freedom systems. Vibration control. Vibration measurements. Typical vibration problems. Acoustic concepts. Noise control. Machinery noise. Design of mufflers and barriers.

Course Objectives

The student should be able to:

- Present comprehensive coverage of the fundamental principles of vibration theory, with emphasis on the application of these principles to practical engineering problems.
- Help the students understand how the vibrations are of great importance to various engineering systems and gain experience in their design and development.
- Facilitate comparison of theoretical and experimental results and to help carrying out further studies to control noise and vibrations.

Course Topics

- Introduction
- Response of nonharmonic excitation
- Response of nonharmonic excitation
- Continuous systems
- Continuous systems
- Multidegree of freedom systems
- Multidegree of freedom systems
- Vibration control
- Vibration measurements.
- Vibration measurements.
- Typical vibration problems.
- Acoustic concepts
- Noise control
- Machinery noise
- Design of mufflers and barriers
- Design of mufflers and barriers

References

- Singiresu S. Rao, "*Mechanical Vibrations*", Addison Wesley, 1995.
- M.L. JAMES, G.M. SMITH, J.C. WOLFORD and P.W. WHALEY, "*Vibration of Mechanical and Structural Systems*", Harper and Row, Publishers, New York, 1989.
- William T. Thomson, "*Theory of Vibration with Applications*", Prentice Hall, 1993.

Course Code : **ME 752**

Course Title : **Robotics and Applications**

Credit Hours : **3**

Course Description

Differential relationships. Manipulator dynamics. Inverse dynamics. Static forces. Compliant motion. Manipulator control. Programming.

Course Objectives

The student should be able to:

- Apply the kinematics, dynamics and control of manipulators from both theoretical and practical points of view.
- Design and analyze systems involving manipulators in various engineering applications.

Course Topics

- Differential relationships.
- Manipulator dynamics.
- Inverse dynamics.
- Static forces.
- Compliant motion.
- Manipulator control.
- Programming.

References

- Yoshikawa T. *Advanced robotics, Analysis and control*, Cambridge MIT Press
- Koren Y. "*Robotics for Engineering*", McGraw-Hill.
- Nakamura Y. "*Advanced Robotic Redundancy and Optimization*", Addison, Wesley.
- Craigs, "*Introduction to Robotics*", Addison, Wesley.
- Asada H. and Toumi, K. "*Direct Drive Robotic*", Cambridge University, Press.

Course Code : **ME 753**

Course Title : **Advanced Computational Methods**

Credit Hours : **3**

Course Description

Error analysis. Solution of non-linear algebraic equations. Numerical integration. Numerical solution of ordinary differential equations (ODEs) for the initial value problem. Solution of systems of ODEs. The stiff ODEs. The solution of the boundary value problem using the linear shooting, finite difference, and non-linear shooting methods. Applications to Mechanical, hydraulic, and thermal system design. The finite difference approximation. Numerical solution of partial differential equations (PDEs) using the finite difference method. Applications on elliptic, parabolic, and hyperbolic PDEs. Direct and iterative methods of solution. Solution of PDEs using the finite volume method. Solution of PDEs using the finite element method. Applications to problems in fluid mechanics, steady and transient conduction heat transfer, elastic deformation of solid elements, and stress analysis. Case studies using the MATLAB programming and available software and modules.

Course Objectives

The student should be able to:

- Develop ability to use personal computers to solve advanced problems in mechanical engineering.
- Write and/or use computer software to numerically solve a variety of problems.

Course Topics

- Error analysis
- Solution of non-linear algebraic equations
- Numerical integration
- Numerical solution of ordinary differential equations (odes) for the initial value problem
- Solution of systems of odes
- The stiff odes
- The solution of the boundary value problem using the linear shooting, finite difference, and non-linear shooting methods
- Applications to Mechanical, hydraulic, and thermal system design
- The finite difference approximation
- Numerical solution of partial differential equations (PDEs) using the finite difference method
- Applications on elliptic, parabolic, and hyperbolic PDEs
- Direct and iterative methods of solution
- Solution of PDEs using the finite volume method. Solution of PDEs using the finite element method
- Applications to problems in fluid mechanics, steady and transient conduction heat transfer, elastic deformation of solid elements, and stress analysis
- Case studies using the MATLAB programming and available software and modules

References

- Smith W. "*Numerical Solution of Partial Differential Equations*", Oxford Univ. Press, 1990
- Versteeg H. and Malalasekera W. "*An Introduction to Computational Fluid Dynamics*" The finite volume method, Longman Scientific and Technical, 1995
- Anderson J. D. "*Computational Fluid Dynamics: The Basics with Applications*", McGraw Hill, 1995
- Nakamura S. "*Numerical Analysis and Graphic Visualization with MATLAB*", Prentice Hall, 1996
- Burden F. "*Numerical methods*", PWS Pub. Co., 1997
- Coombes K. R. "*Differential Equations with MATLAB*", John Wiley, 2000

Course Code : **ME 754**

Course Title : **Simulation and Modeling of Mechanical systems**

Credit Hours : **3**

Course Description

Introduction to system concepts. Complex analysis, differential equations and Laplace transform. System model representation. Modeling of lumped mechanical systems. Electrical, Electronic and Electromechanical systems. Fluid and thermal systems. System response. High order Systems in closed form. State variables. Dynamic system simulation for MATLAB, SIMULINK, (Modeling, Simulation and Implementation).

Course Objectives

To help students gain knowledge about model trends to combine modeling,

theoretical analysis, and computer simulation.

Course Topics

- Introduction to system concepts
- Complex analysis, differential equations and Laplace transform
- Solution of PDEs using the finite element method
- System model representation
- System model representation
- Modeling of lumped mechanical systems
- Modeling of lumped mechanical systems
- Electrical, Electronic and Electromechanical systems
- Electrical, Electronic and Electromechanical systems
- Fluid and thermal systems
- System response
- High order Systems in closed form
- High order Systems in closed form
- State variables
- Dynamic system simulation for MATLAB, SIMULINK, (Modeling, Simulation and Implementation)
- Dynamic system simulation for MATLAB, SIMULINK, (Modeling, Simulation and Implementation)

References

- Cochin and W. Cadwallender, "*Analysis and Design of Dynamic Systems*", Addison Wesley, 1997.
- Hung V. Vu and Ramin S. Esfandiari, "D*ynamic Systems, Modeling and Analysis*", McGraw-Hill, 1998.
- *Dynamic System Simulation for MATLAB*, Prentice-Hall, 1998.

Course Code : **ME 761**

Course Title : **Advanced Fluid Mechanics**

Credit Hours : **3**

Course Description

General equations of motion of viscous fluid. Exact solutions of the Navier Stokes equations. Flow at small Reynolds number. The laminar boundary layer theory. Non-steady boundary layers. Boundary layer control. Transition and turbulent boundary layers. Analysis of theoretical and experimental data. Case studies and design problems encountered in various fluid flows and related fields.

Course Objectives

The student should be able to:

- Acquire good understanding and deep insight into the different types of fluid flows.
- Design, analyze and solve any problem in the field of fluid flows and related topics.

Course Topics

- General equations of motion of viscous fluid
- Exact solutions of the Navier Stokes equations
- Flow at small Reynolds number
- The laminar boundary layer theory
- Non-steady boundary layers
- Boundary layer control
- Transition and turbulent boundary layers
- Analysis of theoretical and experimental data
- Case studies and design problems encountered in various fluid flows and related fields

References

- H. Shlichting. *Boundary Layer Theory*. McGraw Hill
- L. Rosenhead. *Laminar Boundary Layers*. Oxford at Clarendon Press.
- H. Versteeg and W. Malalasekera. *An Introduction to Computational Fluid Dynamics*.
- *The Finite Volume Method*. Longman Scientific and Technical.

Course Code : ME 762

Course Title : Piping Systems

Credit Hours : 3

Course Description

Introduction and background to Fluid Power. Types of control valves and their applications including the servo and proportional valves. Hydraulic systems design and operation including the hydraulic accumulators and intensifiers. Hydraulic systems maintenance and troubleshooting.

Course Objectives

- To provide an in-depth background in the field of hydraulic systems, covering design, analysis, operation and maintenance.
- To acquire a thorough knowledge of the characteristics of all hydraulic components, especially the different types of control valves.
- To completely understand the functions and operation of the components of hydraulic systems to be designed and then will be able to design and analyze the hydraulic system.

Course Topics

- Introduction and background to Fluid Power
- Types of control valves and their applications including the servo and proportional valves
- Hydraulic systems design and operation including the hydraulic accumulators and intensifiers
- Hydraulic systems maintenance and troubleshooting

References

- Michael J. Pinches and John G. Ashby, "*Power Hydraulics*", Prentice Hall, 1989.
- Hugh Martin, "*The Design of Hydraulic Components and Systems*", Ellis Horwood, Ltd., 1995.
- Anthony Esposito, "*Fluid Power with Application*", Prentice-Hall, 6th ed., 2002.
- Richard J. Michell and John J. Pippenger, "*Fluid Power Maintenance Basics and Troubleshooting*", Marcel Dekker, Inc., 1997.

Course Code : **ME 763**

Course Title : **Engineering Experimentations and Measurements**

Credit Hours : **3**

Course Description

Basic principles of measurements. Uncertainty analysis. Differential pressure meters. Rotating mechanical flow meters. Volumetric flow meters. Volumetric flow meters. Choosing the right flow meters. Fluid velocity measuring instruments. Pressure devices and measurements.

Course Objectives

- To provide an in-depth background in the basic measurements techniques and uncertainty analysis.
- Acquire a thorough knowledge of the characteristics of flow meters, velocity meters and pressure measuring devices.
- Understand the functions and operation of the flow meters, velocity meters as well as pressure measuring devices.
- Gain a solid understanding of the uncertainty analysis as well as experience of applying the analysis to various sets of data.

Course Topics

- Introduction and background to Fluid Power
- Types of control valves and their applications including the servo and proportional valves
- Hydraulic systems design and operation including the hydraulic accumulators and intensifiers
- Hydraulic systems maintenance and troubleshooting

References

- Thomas G. Beckwith, Roy D. Marangoni and John H. Lienhard V, "*Mechanical Measurements*", Addison-Wesley, Inc., 1993.

Course Code : **ME 771**

Course Title : **Advanced Engineering Materials**

Credit Hours : **3**

Course Description

Crystal structure, a review. Diffusion in metals. Solidification of metals. Equilibrium diagrams. Heat treatment of metal alloys. Defects in materials. Strengthening of materials. Advanced materials, properties and applications (ceramics, polymers, composites). Materials selection.

Course Objectives

To cover the main topics of modifying materials structure and properties, and to provide the students with the latest developments in material technology and applications of new advanced materials.

Course Topics

- Crystal structure
- Diffusion in metals
- Solidification of metals
- Equilibrium diagrams
- Heat treatment of metal alloys
- Defects in materials.
- Strengthening of materials
- Advanced materials
- Properties and applications (ceramics, polymers, composites)
- Materials selection

References

- William D. Callister, "*Materials Science and Engineering – An Introduction*"
- James F. Shakelford, "*Introduction to Materials Science for Engineers*"
- William F. Smith, "*Foundations of Materials Science and Engineering*".
- Flinn and Trojan, "*Engineering Materials and Their Applications*"
- Mahmoud M. Farag, "*Materials Selection for Engineering Design*"

Course Code : **ME 781**

Course Title : **Advanced Automotive Technology**

Credit Hours : **3**

Course Description

An overview of the automotive industry and technology. Basic electronics and electricity, engine performance, diagnosis and service of the systems that directly affect the drivability of a vehicle. Sensing system and diagnosis devices theory and practice. Sensor errors and functions. Engine performance also include up-to-date and through discussion on OBDII and alternative fuels. Passenger comfort and Safety, laws governing the use of refrigeration system in vehicles. The theory of heating and air conditioning systems in a vehicle. Engine testing equipments, vacuum gauge test, cylinder power balance, cylinder compression test, ignition timing, exhaust gas CO and HC analyzer, oscilloscope engine and analyzer.

Course Objectives

The student should be able to:

- Understand the basics and advanced principles of engine performance.
- Use modern diagnosis devices
- Analyze the electrical and electronic systems in vehicles.
- Become familiar with the engine test and equipments.

Course Topics

- Basic overview of the automotive industry and technology
- Basic electronics and electricity
- Engine performance, diagnosis and service of the systems that directly affect the drivability of a vehicle
- Sensing system and diagnosis devices theory and practice
- The theory of heating and air conditioning systems in a vehicle

References

- Robert Bosch GMbH, *Automotive Electrics; Automotive Electronics*, 4th ed., Automotive Technology, Germany, 2004
- Heisler, H, *Advanced Engine Technology*, Butterworth-Heinemann, UK, 2001
- Heisler, H, *Advanced Vehicle Technology*, 2nd ed., Butterworth-Heinemann, UK, 2001
- Robert Bosch GMbH, *Diesel-Engine Management*, Automotive Technology, Germany, 2004.
- Robert Bosch GMbH, *Gasoline-Engine Management*, Automotive Technology, Germany, 2004.
- Stone, R and Ball, J, K, *Automotive Engineering Fundamentals*, SAE, USA, 2004
- Erjavec, J, *Automotive technology*, 3rd Ed., Delmar Thomson, USA, 2000.
- Robert Bosch GMbH, *Automotive handbook*, 6th edition, Germany, 2004.

Course Code : **ME 785**

Course Title : **Automotive Maintenance**

Credit Hours : **3**

Course Description

Overview of automotive technology, careers, tools, diagnostic equipments, and basic automotive systems. Predictive and protective maintenance, reliability maintenance. Comprehensive guide to the service and repair of contemporary automobiles. Engine subsystems diagnostic and service procedure, wheel alignments, air conditioning, steering systems, brake systems and engine sensors and actuators. Electronic service system and spare parts. Flat rate system and job card cycle.

Course Objectives

The student should be able to:

- Understanding the principle of the predictive and protective maintenance
- Dealing with engine main subsystem in servicing and repairing
- Dealing with the sensors and actuators in the vehicles.
- Dealing with the electronic software to management the vehicle maintenance
- Understating the job card cycle and the flat rate systems.

Course Topics

- Overview of automotive technology, careers, tools, diagnostic equipments, and basic automotive systems.
- Predictive and protective maintenance, reliability maintenance
- Comprehensive guide to the service and repair of contemporary automobiles
- Engine subsystems diagnostic and service procedure, wheel alignments, air conditioning, steering systems, brake systems and engine sensors and actuators
- Electronic service system and spare parts. Flat rate system and job card cycle

References

- Robert Bosch GMbH, *Automotive Electrics; Automotive Electronics*, 4th edition, Automotive Technology, Germany, 2004
- Heisler, H, *Advanced Engine Technology*, Butterworth-Heinemann, UK, 2001
- Heisler, H, *Advanced Vehicle Technology*, 2nd edition, Butterworth-Heinemann, UK, 2001
- Robert Bosch GMbH, *Gasoline-Engine Management*, Automotive Technology, Germany, 2004
- Erjavec, J, *Automotive Technology*, 3rd Edition, Delmar Thomson Learning, USA, 2000
- Robert Bosch GMbH, *Automotive Handbook*, 6th edition, Germany, 2004

Course Code : **ME 791**

Course Title : **Advanced Mechatronics Systems**

Credit Hours : **3**

Course Description

Foundational concepts in Mechatronics and Mechatronics Systems including analog and digital electronics. Basic electronic circuits, logic gates, encoders/decoders, DC and stepper motors, A/D and D/A conversion, sensors, actuators, microprocessors, and microprocessor interfacing to electromechanical systems. Combining hardware and software into integrated mechatronic systems. Hands-on laboratory experiments with components and measurement equipment used in-the design of mechatronic products.

Course Objectives

The student should be able to:

- Understand the basic principles of Mechatronics.
- Analyze Mechatronic Systems and combine hardware and software into integrated typical Mechatronic Systems.
- Develop hands-on laboratory experience with components and measurement equipment.

Course Topics

- Foundational concepts in Mechatronics and Mechatronics Systems including analog and digital electronics
- Basic electronic circuits
- Logic gates
- Encoders/decoders
- DC and stepper motors
- A/D and D/A conversion
- Sensors – Actuators - Microprocessors
- Microprocessor interfacing to electromechanical systems
- Combining hardware and software into integrated mechatronic systems
- Hands-on laboratory experiments with components and measurement equipment used in-the design of mechatronic products

References

- Alciator, David G., "*Introduction to Mechatronics and Measurement Systems*", McGraw-Hill. London.
- Bolton, W., "*Mechatronics Electronic Control Systems in Mechanical and Electrical Engineering*", Pearson Education, Harlow, England.
- Mahalik, Nitaigour Premchand, "*Mechatronics: Principles, Concepts and Applications*", Tata McGraw–Hill.
- Necsulescu, Dan, "*Mechatronics*", Prentice-Hall.
- Lyshevski, Sergey E., "*Electromechanical Systems, Electric Machines, and Applies Mechatronics*", CRC Pr.

Course Code : **ME 793**

Course Title : **Condition Monitoring and Diagnostic Expert Systems**

Credit Hours : **3**

Course Description

Condition monitoring definition and overview. Equipment and system failures. Techniques of predicting failures. Vibration measurement and analysis. Infrared thermography. Oil analysis and tribology. Ultrasonics. Motor current analysis. Equipment and component reliability. Equipment optimization. Engineering Expert Systems. The architecture and characteristics of expert systems. Applications of engineering expert systems. Classic and contemporary examples. Case studies. Laboratory activities.

Course Objectives

The student should be able to:

- Understand the main concepts of condition monitoring techniques.
- Understand the components and functions of engineering expert systems.
- Use available expert system for condition monitoring

Course Topics

- Condition monitoring definition and overview.
- Equipment and system failures
- Techniques of predicting failures
- Vibration measurement and analysis
- Infrared thermography
- Oil analysis and tribology
- Ultrasonics
- Motor current analysis
- Equipment and component reliability
- Equipment optimization
- Engineering Expert Systems
- The architecture and characteristics of expert systems
- Applications of engineering expert systems
- Classic and contemporary examples
- Laboratory activities

References

- J. H. Williams, Alan Davies and Peter R. Drake, "C*ondition–Based Maintenance and Machine Diagnostics*", Amazon.
- Trevor M. Hunt, "*Condition Monitoring of Mechanical and Hydraulic Plant*", Amazon.
- Trevor Hunt, "*Level Leakage and Flow*"
- Alan Davies, "*Handbook of Condition Monitoring- Techniques and Methodology*"
- "*Acoustic Emission and Ultrasonic Monitoring Handbook*"
- "*Noise and Acoustics Monitoring Handbook*"

Course Code : **ME 794**

Course Title : **Robots Design and Applications**

Credit Hours : **3**

Course Description

Introduction and basic concepts in robotics. Components and subsystems. Robots applications. Homogeneous transformations. Kinematics' equations: Manipulator position and manipulator motion. Differential relationships. Motion trajectories. Dynamics. Mobile robots. Sensors, measurements and perception. Control. Programming.

Course Objectives

The student should be able to:

- Apply the kinematics dynamics and control of manipulators from both theoretical and practical points of view.
- Apply control processes and algorithms to the design of manipulators and robots.
- Use robots to solve problems in various engineering applications.

Course Topics

- Introduction and basic concepts in robotics
- Components and subsystems
- Robots applications
- Homogeneous transformations.
- Kinematics' equations
- Manipulator position and manipulator motion
- Differential relationships
- Motion trajectories.
- Dynamics.
- Mobile robots.
- Sensors, measurements and perception
- Control
- Programming

References

- Yoshikawa T. *Advanced robotics, Analysis and Control*, Cambridge MIT Press
- Koren Y. "*Robotics for Engineering*", McGraw-Hill.
- Nakamura Y. "*Advanced Robotic Redundancy and Optimization*", Addison, Wesley.
- Craigs, "*Introduction to Robotics*", Addison, Wesley.
- Asada H. and Toumi, K. "*Direct Drive Robot*", Cambridge University, Press.

Course Code : **ME 795**

Course Title : **Embedded Control of Manufacturing Processes**

Credit Hours : **3**

Course Description

Development of general concepts for control of the manufacturing processes. Introduction to the concepts of and tools for process modeling, process optimization, and process control. Presentation of an integrated approach combining statistical process control (SPC) and traditional automatic process control (APC) theory.

Course Objectives

The student should be able to:

- Understand the concepts of the control of manufacturing processes.
- Apply process control techniques to typical problems and case studies.

Course Topics

- Development of general concepts for control of the manufacturing processes
- Introduction to the concepts of and tools for process modeling, process optimization, and process control
- Presentation of an integrated approach combining statistical process control (SPC) and traditional automatic process control (APC) theory

References

- Groover, M.P., "*Automation, Production Systems and Computer-Integrated Manufacturing*", Prentice Hall, 2001
- James A. Rehg, Henry W. Kraebber, "*Computer-Integrated Manufacturing*", Pearson Education, Inc., 2005.
- Vollmann, T. E., W. L. Berry, and D.C. Whybark, "*Manufacturing Planning and Control Systems*", Homewood, 1997
- Graham, G. A., "*Automation Encyclopedia*", Society of Manufacturing Engineers, 1988
- Foston, A. L., C. L. Smith, and T. Au., "*Fundamentals of Computer-Integrated Manufacturing*," Prentice Hall. 1991.
- Hall, R. W. "*Attaining Manufacturing Excellence*", Dow Jones- Irwin, 1987
- Srikanth, M. L., and M.M. Unble. "*Synchronous Manufacturing Principles for World Class Excellence*", Southwestern Purplish Company, 1990
- Goestsch, D. L., "*Modern Manufacturing Processes*", New York: Delmars Publishers, 1991
- Rehg, J.A., "*Introduction to Robotics in CIM Systems*", Prentice Hall, 2003
- Luggen, W. W., "*Flexible Manufacturing Cells and Systems*", Prentice Hall, 1991.

Course Code : **ME 796**

Course Title : **Design for Manufacturability**

Credit Hours : **3**

Course Description

Principles and practice of design and manufacturability with emphasis on Mechatronics, design parameters, manufacturing techniques, reliability, design for quality, assembly and environmental considerations, case study projects and laboratory activities.

Course Objectives

The student should be able to deal with advanced manufacturing techniques.

Course Topics

- Development of general concepts for control of the manufacturing processes
- Introduction to the concepts of and tools for process modeling, process optimization, and process control
- Presentation of an integrated approach combining statistical process control (SPC) and traditional automatic process control (APC) theory

References

- Groover, M.P., "*Automation, Production Systems and Computer - Integrated Manufacturing*", Prentice Hall, 2001
- James A. Rehg, Henry W. Kraebber, "*Computer-Integrated Manufacturing*", Pearson Education, Inc., 2005.
- Hill, T., "*Manufacturing Strategy*" Homewood, IL: Richard D. Irwin, 1989.
- Vollmann, T. E., W. L. Berry, and D.C. Whybark, "*Manufacturing Planning and Control Systems*", Homewood, 1997
- Boothroyb, G., and P. Dewhurst., "Pro*duct Design for Manufacture and Assembly*," Manufacturing Engineering, April 1988.
- Foston, A. L., C. L. Smith, and T. Au., "*Fundamentals of Computer-Integrated Manufacturing*," Prentice Hall, 1991.
- Rehg, J.A., "*Introduction to Robotics in CIM Systems*", Prentice Hall, 2003
- Lochner, R.H., "*Designing for Quality*", Statpower Associates, 1991.

Course Code : **CC 715**

Course Title : **Advanced Programming Applications**

Credit Hours : **3**

Course Description

Semantics of programming languages. Data types. Control structures. Object-oriented methodology. Programming. Methods and techniques. C-Programming language. File processing: text files, random access files, file application projects, recursion. Sorting. Searching. Sorting and searching.

Course Objectives

The student should be able to:

- Understand the main features of the C- programming language.
- Design and write computer programs for complex systems.
- Develop software skills in the design and analysis employing the C- programming language.

Course Topics

- Semantics of programming languages.
- Data types.
- Control structures.
- Object-oriented methodology.
- Programming.
- Methods and techniques.
- C-Programming language.
- File processing:
- Text files.
- Random access files,
- File application projects
- Recursion.
- Sorting and searching.
- Applications using graphics.
- Applications using graphics.

References

- Kenneth Louden, "*Programming Languages: Principles and Practice*", 2nd ed., 2002.
- Raphael A. Finkel, "*Advanced Programming Languages Design*", Addison Wesley, 1995.
- Ravi Sethi, "*Programming Languages, Concepts and Constructs*", Addison Wesley, 2000.
- IEEE Transactions on Software Engineering
- R. C. Martine, *Agile Software Development, Principles, Patterns, and Practices*, Prentice Hall 2002.
- R. Sebesta, *Concepts of Programming Languages*, Addison Wesley, 2003.
- Peters Van Ray, Seif Haridi, *Concepts, Techniques, and Models of Computer Programming*, MIT Press, 2004.

Course Code : **CC 734**

Course Title : **Computer Communications**

Credit Hours : **3**

Course Description

Introduction to computer communication networks. Fundamental Concepts of data communication. Layered network architecture and network protocols, integrated service networks and quality of service. The internet protocol and the asynchronous transfer mode. Fundamental concepts of wireless networks and network security.

Course Objectives

The student should be able to acquire a unified overview of the broad field of data and computer communications. The course emphasizes the basic principles and topics of fundamental importance concerning the technology and architecture of this field and provides a detailed discussion

Course Topics

- Introduction to computer communication networks.
- Fundamental Concepts of data communication.
- Layered network architecture and network protocols.
- Integrated service networks and quality of service.
- The internet protocol and the asynchronous transfer mode.
- Fundamental concepts of wireless networks and network security.

References

- Garcia, *Communication Networks: Fundamental Concepts and Key Architectures* 2nd ed., McGraw-Hill, 2003.

Course Code : **CC 724**

Course Title : **Computer Architecture and Embedded Systems**

Credit Hours : **3**

Course Description

Problems in hardware, firmware (micro-program), and software. Computer architecture for resource sharing, real-time applications, parallelism, micro-programming, and fault tolerance. Micro-operations, instruction sets, CPU design, memory and input/ output organizations. Various architectures based on cost performance, area and timing constraints.

Course Objectives

The course introduces the students to the design principles associated with non Von Neumann architectures. Moreover, the students are introduced to special-purpose machine design.

Course Topics

- Problems in hardware.
- Firmware (micro-program); and software
- Computer architecture for resource sharing
- Real-time applications
- Parallelism
- Micro-programming, and fault tolerance
- Micro-operations, instruction sets, CPU design, memory and input/ output organizations. Fundamental concepts of wireless networks and network security.
- Various architectures based on cost performance, area and timing constraints

References

- J. Henkel and S. Parameswaran, *Designing Embedded Processors: A Low Power Perspective*. 2007
- Deszso Sima et al., *Advanced Computer Architectures*, Addison Wesley, 1997
- Herman Kopetz, *Real-Time systems: Design Principles for Distributed Embedded Applications*, Springer, 1997

Course Code : **CC 744**

Course Title : **Data Acquisition Systems**

Credit Hours : **3**

Course Description

Data Acquisition, Definitions and Applications. Data Acquisition channel structure components. Sensors and transducers: types, applications, structural classifications. Signal conditioning. Amplifications, reshaping and filtration. Data conversion, principles, devices and limitations. Introduction to data analysis and elementary control. Case studies. Student projects.

Course Objectives

To develop microprocessor ROM applications with the PC, create portable applications for field data acquisition, and program interfaces to instruments, experiments and processes.

Course Topics

- Data Acquisition, Definitions and Applications.
- Sensors and transducers: types, applications, structural classifications
- Signal conditioning.
- Amplifications, reshaping and filtration. Data conversion, principles, devices and limitations.
- Introduction to data analysis and elementary control.
- Case studies.
- Student projects.

References

- Arnold, H. and Van Doren, *Data Acquisition Systems*, Reston Publishing Co., 1982.
- R. Pallas and J. G. Webster, *Sensors and Signal Conditioning*.
- Steven Grengo, *Interfacing: A Lab Approach*, Prentice Hall.
- Omega Instrumentation, Reference Year Book, V. 127.

Course Code : **CC 751**

Course Title : **Applications of Artificial Neural Networks**

Credit Hours : **3**

Course Description

This course allows the introduction of material relating to current artificial neural networks (ANN) research topics, and current advances in ANN technology. Topics include: network architectures, learning rules, linear transformations, Hebian learning, performance optimization, Widro-Hoff learning, back-propagation, competitive networks, Hopfield networks, stability, and, Adaptive resonance theory, and hardware implementation of ANN.

Course Objectives

To understand the simple abstractions of biological neurons, realized as elements in a program or perhaps a circuit made of silicon, the concepts of mathematical background and their applications in various areas

Course Topics

- This course allows the introduction of material relating to current artificial neural networks (ANN) research topics, and current advances in ANN technology
- Topics include: network architectures, learning rules, linear transformations
- Hebian learning, performance optimization.
- Widro-Hoff learning, back-propagation, competitive networks, Hopfield networks, stability
- Adaptive resonance theory and hardware implementation of ANN.

References

- R. Beale and T. Jackson, "*Neural computing: An Introduction*", Institute of Physics Publishing, 1990.
- J. Hertz, A Krogh and R.G. Palmer, "*Introduction to the Theory of Neural Computation*", Addison Wesley, Redwood City, CA 1992.

Course Code : **EC 731-M**

Course Title : **Principles of Digital Signal Processing**

Credit Hours : **3**

Course Description

Introduction. Definition of signals, sources of signal, signal conditioning, applications of DSP. Analog signal processing, amplification, filtering, clipping and clamping. Data converters, sampling of signals, DAC's, ADC's. Frequency transformations, DFT, FFT. Digital filtering, Recursive Df, Non-recursive Df.

Course Objectives

To be acquainted with signal processing techniques at large with special emphasis on digital processing of signals. Getting familiar with the tools and practical applications of DSP.

Course Topics

- Introduction.
- Definition of signals, sources of signal, signal conditioning, applications of DSP
- Analog signal processing, amplification, filtering, clipping and clamping.
- Fundamental Concepts of data communication.
- Analog signal processing, amplification, filtering, clipping and clamping.
- Data converters, sampling of signals, DAC's, ADC's.
- Frequency transformations, DFT, FFT.
- Digital filtering, Recursive Df, Non-recursive Df.

References

- E. C. Ifeachor and B. W. Jervis, "Dig*ital Signal Processing: A Practical Approach*," Prentice Hall, 2002.
- Steven W. Smith, "T*he Scientist and Engineer's Guide to Digital Signal Processing*"
- Saeed V. Vaseghi, "*Advanced Digital Signal Processing and Noise Reduction*," 3rd Ed., Wiley, 2006

Course Code : **EC 732-M**

Course Title : **Advanced Electronic Measurements**

Credit Hours : **3**

Course Description

Introduction. Transducers. Sensors. Data Acquisition Systems. Telemetry

Course Objectives

To be acquainted with industrial electronic measurement systems, their components, and construction. Typical systems like data acquisition systems and telemetry are then given with examples on nuclear reactors, intensive care units and telemetry.

Course Topics

- Introduction.
- Transducers.
- Sensors.
- Data Acquisition Systems.
- Telemetry

References

- John P. Bently, "*Principles of Measurement Systems*," 1995, Longman Group Limited, UK.
- David E. Johnson and John L. Hilburn, "*Rapid practical Designs of Active Filters*," John Wiley, New York, 1989.

Course Code : **EC 738-M**

Course Title : **Advanced Electronic Systems**

Credit Hours : **3**

Course Description

Introduction. Power supply systems, basic power supply system, voltage regulators, stabilized power supplies, uninterrupted power supply systems. Photovoltaic power systems. Basics of telecommunication systems, telephony, radio and TV broadcasting systems, TV cameras and monitors, microphones and loudspeakers. Micro Electro-Mechanical Systems (MEMS), principle, types, applications.

Course Objectives

To become familiar with some key electronic systems such as conventional power

supplies, UPS and non conventional power sources like solar cells units.

Course Topics

- Introduction.
- Power supply systems:
  - basic power supply system,
  - voltage regulators,
  - stabilized power supplies,
  - uninterrupted power supply systems.
- Photovoltaic power systems.
- Basics of telecommunication systems, telephony, radio and TV broadcasting systems, TV cameras and monitors, microphones and loudspeakers.
- Micro Electro-Mechanical Systems (MEMS):
  - principle,
  - types,
  - applications.

References

- S. M. Sze, "*Semiconductor Devices: Physics and Technology*," Wiley, 1988.
- "*Handbook of Advanced Electronic and Photonic Materials and Devices*."

Course Code : **EE 713**

Course Title : **Digital Control Systems**

Credit Hours : **3**

Course Description

Review to systems analysis using the z-transform. Discrete system modeling. State space representation. Controllability and observability. Digital controllers. Observers. Introduction to optimal control.

Course Objectives

The student should be able to:

- Define the digital system and its performance.
- Use a digital controller and design a digital one.
- Differentiate between digital and analog controllers.

Course Topics

- Review to systems analysis using the z-transform.
- Discrete system modeling.
- State space representation.
- Controllability and observability.
- Digital controllers.
- Observers.
- Introduction to optimal control.

References

- F. Halsall and P.F. Lister, "*Microprocessor Fundamentals*," UCL press 1993.
- A. P. Godse, "*Advanced Microprocessor and Microcontroller*," Technical Publications Pune, 2004.

Course Code : **EE 715**

Course Title : **Optimal Control**

Credit Hours : **3**

Course Description

Review of unconstrained optimal control problems. Constrained mathematical programming. Variation problems. Maximum principle. Computer methods in optimal control. Geometric optimization.

Course Objectives

The student should be able to:

- Learn the graduate optimization techniques and its application in control systems
- Apply optimization techniques in control systems and to use computer to optimize the controller

Course Topics

- Review of unconstrained optimal control problems.
- Constrained mathematical programming.
- Variation problems.
- Maximum principle.
- Computer methods in optimal control.
- Geometric optimization.

References

- G. F. Lawler, "*Optimal Control Theory for Applications*", Springer-Verlag, N.Y., 2003.
- J. B. Burl, "*Linear Optimal Control: H_2 and H-∞ Methods*," Addison Wesley, California, 1999.

Course Code : **EE 751**

Course Title : **Power Electronic Devices and their Applications**

Credit Hours : **3**

Course Description

Characteristics of Power diodes, Power MOSFETs, Thyristors and IGBTs. Gate drive signal generation. Signal coupling through pulse transformers and opto-couplers. Gating. Applications. Selection of power electronic devices suitable for machine rating. DC and AC drive. ADC and DAC applications in drive circuits. Construction of logic circuits based on position sensing. Current limiting circuits.

Course Objectives

The student should be able to:

- Choose the power electronic device suitable for the nature of the application.
- Understand the control circuitry associated with power electronic devices.

Course Topics

- Characteristics of Power diodes, Power MOSFETs, Thyristors and IGBTs.
- Gate drive signal generation.
- Signal coupling through pulse transformers and opto-couplers.
- Gating.
- Applications
- Selection of power electronic devices suitable for machine rating.
- DC and AC drive.
- ADC and DAC applications in drive circuits.
- Construction of logic circuits based on position sensing

References

- M. H. Rashid, "*Power Electronics Circuits, Devices and Applications*," Prentice Hall, 2004.
- N. Mohan, T. Undeland and W. Robbins, "*Power Electronic Converters: Applications and Design*", Wiley, 2003.
- F.L. Luo, H. Ye and M. Rashid, "*Digital Power Electronics and Applications*", Elsevier, 2005.

Course Code : **EE 752**

Course Title : **Automated Industrial Systems**

Credit Hours : **3**

Course Description

Automation hierarchical levels and components. Detecting sensors and actuating elements. Introduction to PLCs. Types of PLCs and construction. Hardware configuration and descriptions. Programming and testing basic functions. Programming and testing advanced functions. Industrial Applications using PLCs.

Course Objectives

The student should be able to:

- Investigate the different topics of structures of automated systems
- Provide the basics of programmable logic controllers
- Study behavior of PLC in industrial applications

Course Topics

- Automation hierarchical levels and components.
- Detecting sensors and actuating elements.
- Introduction to PLCs. types of PLCs and construction.
- Hardware configuration and descriptions
- Programming and testing basic functions
- Fundamental concepts of wireless networks and network security.
- Industrial Applications using PLCs.

References

- C. B. Gray, "*Electrical Machines and Drive Systems*", Longman, 1990.
- V. Subrahmanyam, "*Thyristor Control of Electric Drives*", Tata McGraw Hill, New Delhi, 1988.
- S. B. Dewan, G. R. Slemon and A. Sraughen, "*Power Semiconductor Drives*", Wiley, 1987

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