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Preface

The postgraduate studies in the faculty of engineering at Mataria, Helwan University have started since the seventies of the last century. Several upgrading processes have taken place since that time, while the governing rules and regulations were issued implicitly with the undergraduate faculty curriculum. The existing postgraduate studies curriculum was issued at 1987 and is still valid and applied. The present postgraduate curriculum follows the credit hour system.

The curriculum based on the credit hour system will allow, through it's application, to go along with the new and modern technologies as well as the fast development in all engineering fields.

I. Objectives and Main Frame

1- To originate programs of **Postgraduate Studies Diploma** in different engineering fields
2- To originate programs of postgraduate studies in the **Department of Physics and Engineering Mathematics**.
3- To originate **a** program of **Professional Studies Diploma** in the specific fields show in Table (1).
4- To originate a study program for the **Master of Engineering Degree** in addition to the existing M**aster of Science in Engineering Degree**.
5- To develop and upgrade the existing courses and course syllabus and introduce additional modern courses and new topics.
6- To overcome the constraints and difficulties that have appeared through practicing the former curriculum.
7- To improve the system of the comprehensive exam for doctorate candidates**,** to comply with the Excellency of this degree level .

Curriculum Main Frame

a) The proposed rules considered introducing different levels of study programs, to comply with the scientific background of the applicant and meet his needs for further knowledge in the engineering fields he applies for.

b) Helwan University awards the following postgraduate certificates according to the approval of the faculty council:

1. **Professional Studies Diploma**
2. **Postgraduate Studies Diploma**
3. **Master of Engineering Degree (M.Eng.)**
4. **Master of Science in Engineering Degree (M.Sc.Eng.)**
5. **Doctor of Philosophy Degree (Ph.D.)**

These certificates are awarded in the different specializations fields listed in Table (1).

c) The certificate will explicitly indicate the name of scientific department awarding the degree, the title of the thesis (in case of master of science and doctor of philosophy degrees) and the specialization field, according to Table (2).

Table (1) Scientific Department and Related Code

#	Department	Code
1	**Mechanical Power Engineering**	**MP**
2	**Automotive & Tractors Engineering**	**AT**
3	**Mechanical Design Engineering**	**MD**
4	**Architecture Engineering**	**AR**
5	**Civil Engineering (Structural, Water Resources, Public Works)**	**CVS, CVW, CVP**
6	**Physics and Engineering Mathematics**	**BS**

Coding System of the Courses

Each course will be indicated by a code number consisting of 2 or 3 characters indicating the scientific department; (MP/AT/MD/AR,CVS,.. etc), followed by study level (500 or 600 ,or 400 in the Department of Physics and Engineering Mathematics) and ends with the course list number within the syllabus of this program.

Ex. AR508 means:

Department	Level	List#
Architectural Eng.	**500**	**8**

Table 2. Post Graduate Fields of Specialization

	Scientific Department	Specialization Field
1	Mechanical Power Engineering	1. Thermal Power Generation
		2.Internal & Continuous Combustion Engineering.
		3. Refrigeration & Air Conditioning
		4. Engineering Turbo Machinery
		5. Pipelines & Pumping Networks
		6. New & Renewable Energy
		7. Pneumatic & Hydraulic Control
2	Automotive & Tractors Engineering	1. Control & Vehicle Dynamics Eng.
		2. Vehicle Design 1
		3. Vehicle Design 2
		4. Maintenance & Replacement Engineering
		5. Heavy Equipment Engineering
		6. Hybrid & Electric Vehicles Engineering
		7. Terra Mechanics Engineering
		8. Transportation Engineering
3	Mechanical Design Engineering	1. Mechanical Design
		2. Material Science
		3. Mechanical Systems
4	Architectural Engineering	1. Architectural Design
		2. Construction Technology
		3. Urban Design
		4. Housing
		5. Cities & Provinces' Planning
		6. Landscaping
5	Civil Engineering	1. Soil Mechanics & Foundation Engineering
		2. Reinforced Concrete Structures
		3. Project Management & Construction
		4. Sanitary Engineering
		5. Environmental Engineering
		6. Engineering Hydraulics
		7. Surveying & Information Systems Engineering
		8. Roadways & Airports Engineering
		9. Irrigation & Drainage Engineering
		10. Water Resources Management
		11. Engineering Geodesy
		12. Structures Repair & Reinforcement
		13. Maintenance of Structures
		14. Projects' Control & Quality Assurance
		15. Steel Structures
		16. Protection & Management of offshore Structures
6	Physics & Engineering Mathematics	1. Optimization in Engineering systems

Other specialization fields may be added upon request of the scientific departments' committees and approval of the faculty council

Definition of Scientific Degrees

1. **Professional Studies Diploma**: This degree aims to develop the professional capability and efficiency in branches of engineering, through the study of applied courses and practical training. This diploma also provides broad exposure to conjunctive engineering fields.

2. **Post Graduate Studies Diploma**: The goal of this degree is to enhance the scientific and academic efficiency in application disciplines and specializations of different engineering branches. The goal of this program is achieved by providing practical and advanced scientific courses and by participating in group work, to prepare and achieve practical projects.

3. **Master of Engineering Degree**: This degree aims to upgrade the scientific abilities and develop the practical skills of the candidate in the field of specialization he chooses. The goal of this degree is achieved by using new techniques and advanced scientific methodologies. This program is achieved through advanced academic courses and research applications.

4. **Master of Science in Engineering Degree**: This degree aims to develop the research capabilities and the scientific thinking ability of the candidates in the field of specialization he chooses, based on the research program of the college. The goal of this degree is achieved by applying modern scientific research fields and advanced technology. The candidate should finish a number of advanced academic courses and prepare a thesis, which provides training, to carry out academic as well as applied research.

5. **Doctor of Philosophy Degree**: This degree aims to develop the creativity, independent thinking and ability of the candidate. It also helps getting familiar with new technologies, in the area chosen by the candidate. In addition he has to follow the scientific and technical research methodologies, and deepening the research ability he has gained during the completion of his master thesis.

II. Internal Curriculum

Article 1

Study Discipline

The study is based on the credit hour system and allow the graduates of Egyptian faculties of engineering, or those who have scientific degrees from other universities that are accredited by the Supreme Council of Universities, to apply for admission. Also, graduates of scientific faculties can apply at the Professional Studies Diploma, after successfully passing the qualification program studies.

One credit hour equals one-hour lecture or two hours training sessions, laboratory sessions or workshop sessions. Each lecture duration should not be less than 45 minutes.

Article 2

Time Schedule and Admission

Each academic year is divided into 3 semesters as follows:

- 1st Semester: starts on the fourth Saturday of September, duration 15 weeks .
- 2nd Semester: starts on the second Saturday of February, duration 15 weeks .
- Summer Semester: starts on the first Saturday of July, duration 6 weeks .
- Candidates may apply for admission for any of these semesters within three weeks before the beginning of each semester. The admission is approved after fulfilling all admission requirements and paying the required fees according to the registration rules and regulations. It is prohibited for any applicant to apply for admission through anybody else but himself.
- For those who apply for the first time, applications are submitted in September or February of each year.
- Admission requirements for envoy candidates, in any postgraduate program, are determined by the university council based on the recommendation of the faculty council .

Article 3

Admission Requirements

- For the first and the second semesters, the candidate can be enrolled for a minimum of 12 credit hours; without full time requirement; after the approval of his academic advisor.
- The candidate is allowed to be enrolled for a maximum of 18 credit hours for the first and second semesters, after the approval of his academic advisor.
- At the summer semester, the candidate is allowed to register for a maximum of 6 credit hours, after the approval of his academic advisor.
- The candidate can drop and/or add some courses during the 1st two weeks of the enrolled semester, after the approval of his academic advisor (this is not applied for the summer semester).

- The candidate is able to withdraw one of the courses (tuition fees and cost of educational services cannot be refunded) during a period of maximum 6 weeks from the beginning of the 1st and 2nd semesters or 3 weeks from the beginning of the summer semester. This can be only achieved after the approval of his academic advisor.
- The student is able to re-register for any course that he did not pass and to re-apply for the course after paying the fees and the educational service costs, according to the rules and regulations.

Article 4

Evaluations and average weights

Grade	Grade Point	Marks %	Standing
A	4.00	100= A ≥95	Excellent
A^-	3.67	95> A^- ≥90	Excellent
B^+	3.33	90> B^+ ≥85	Very Good
B	3.00	85> B ≥80	Very Good
B^-	2.67	80> B^- ≥75	Very Good
C^+	2.33	75> C^+ ≥70	Good
C	2.00	70> C ≥65	Good
C^-	1.67	65> C^- ≥60	Good
D^+	1.33	60> D^+ ≥55	Pass
D	1.00	55> D ≥50	Pass
F	0.00	<50	Fail
FA	—	Absent	Fail
W	—		Withdrawn
I	—		Incomplete

Grade' distribution for each course is : 40% for the class works and 60% for the final exam . The faculty council will determine the general rules of class work for each course .

- The candidate has successfully passed the exam of any course if he has got a grade of C as a minimum.
- The candidate should achieve a minimum of accumulated weight of C in the courses of diploma , B^- in the courses of master , and B in the courses of doctor of philosophy.
- The weight of each course is the result of multiplication of it's credit hours by the weight of the grade point ,to the nearest one decimal .

- The estimation of the total weights that the candidate has achieved at any semester can be estimated as the summation of the weights of all the courses that the student has studied in that semester.
- The average of weights of any semester can be estimated as the division of the summation of the total weights that the candidate has achieved in a semester, by the number of credit hours of the courses he has studied in that semester ,to the nearest one decimal .
- The accumulation weight can be estimated as the division of the summation of the total weights that the candidate has achieved in all previous semesters, by the number of credit hours of the courses he has studied in all previous semesters ,to the nearest one decimal.
- If the candidate has failed several times in a course , one time fail is only considered when estimating his semester weight or his accumulation weight .
- A grade less than C in any course will be considered in the average of the grade points but will not be considered among the credit hours of the semester unless the candidate re-applied for the course and successfully passed the exam. Then, only the later grade point is concerned.
- The candidate can re-apply for not more than 9 credit hours during any postgraduate program in order to increase his accumulation weight . The maximum grade for any re-applied course is C . Then, only the later grade point for each re-applied course is considered when estimating the accumulation weight .

Article 5

Registration

1. **Registration Freezing:** The faculty council, based on a suggestion from the specialized department committee and approval of the committee of the post graduate studies and researches, may freeze the registration of the candidate upon his request for periods of duration not more than 24 months. Then, the candidate should pay the identified registration fees.
2. **Warning List:** The candidate is recorded on the warning list to cancel his registration, if he has failed to obtain the required accumulation weight of any study program, as illustrated in the curriculum in hand. The warning list is scheduled at the end of each semester not including the first admission semester.
3. **Canceling of registration:** The registration of a post graduate candidate is canceled according to the decision of the faculty council based on a recommendation from the concerned department committee upon the candidate request to cancel his registration, or if the candidate was recorded absent for two semesters without a written apology or excuse, or if the candidate was recorded on the warning list for two consecutive

semesters, or if the thesis is refused by the jury. This also should be done after approval of the concerned department committee and the committee of post graduate studies and researches, according to a report to be submitted by the principal supervisor.

4. **Re-registration:** If the registration of a candidate was canceled for any of the reasons of item number (3) then, the candidate must submit a request for re-registration according to the specified application schedules following article number(2) and the general registration rules of article number(3) and the rules for registration of each study program, as illustrated in the curriculum in hand. The faculty council may accept re-registration of the candidate according to a suggestion from the concerned department committee and approval of the committee of the postgraduate studies and researches. The courses that the candidate has successfully passed before may be accredited if this occurred in no more than 2 academic years.

Article 6

Attendance

The candidate fails if his attendance is less than 75% of the course lectures. This decision is initiated by a report presented by course lecturer supported by a recommendation of the concerned department. The department recommendation is presented to the post graduates and researches committee to be approved by the faculty council.

Article 7

Academic Fees

- The academic fees for postgraduate students are determined according to the executive curriculum for the law of universities regulation.

Article 8

Advisor and Academic Supervisor

- The department assigns academic advisor; for each candidate; from the department associates to guide him through course selection and approval of the study plan. The academic advisor continues with the candidate until he successfully completes his diploma or master of engineering degree. If he applies for Master of Science or Ph.D. degrees, the advisor shall be replaced by the academic supervisor among the professors or associate professors of the department.

Article 9

Study Phases

- The attached chart presents the phases of the study programs, the required credit hours for each study phase, it's level as well as the payments' deadlines for matriculation and defense fees. The study courses have levels of 500 and 600 to fully integrate with the course levels taught in the undergraduate stage (000 through 400 levels).
- The concerned scientific departments prepare course lists and contents along with their relevant credit hours and the discipline sector or scientific department responsible of teaching them. The postgraduate and researches committee and the faculty council approve these lists.
- The academic departments may propose and generate new courses depending on the nature of the study after approving it from the concerned department council, approval the postgraduate and researches committee, and the faculty council.

Following are the different study phases:

1- Qualifying Studies

- These programs are meant for graduates of scientific colleges who have the desire to upgrade and increase their professional skills and capabilities in one of the engineering disciplines listed in this curriculum. The study plan, course work and credit hours assigned for each candidate are based on their scientific background and professional expertise. The plan has to be approved by the college council according to the department recommendations. The study period ranges between one to two semesters.
- The courses are at the engineering undergraduate levels. The department may require the student to study some courses from the undergraduate level that he may not have studied before.
- For the Department of Physics and Engineering Mathematics, the student has to complete 30 credit hours (of level-400) from the qualifying courses according to the course lists in one of the department disciplines which are engineering mathematics, engineering physics, engineering mechanics and geometry. These courses prepare the candidate to study in one of the aforementioned department disciplines provided that he achieves a minimum grade point average of 3.0 in these courses.

2- Professional Studies Diploma

- These courses are meant for engineering graduates or graduates of scientific colleges who successfully pass the qualifying studies.
- In this stage, the student has to complete 18 credit hours courses of level-500.

- This stage is considered final and does not allow it's graduates to apply for any further advanced studies.

3- Prequalification Studies

- These courses are meant for engineering graduates from any Egyptian university or those approved by the Supreme Council of Universities in the specializations mentioned in Table (1).
- In this stage, the candidate registers 12 credit hours courses of level-500 offered according to the faculty internal curriculum from the offered course lists

4. Post Graduate Diploma

- The candidate who registers in this stage should have successfully completed 8 credit hours during the prequalification studies.
- During this stage, the student registers in 18 credit hours courses of level-500.
- The candidate obtains a Post Graduate Diploma in the area of specialization if he successfully completes the qualification studies and Post Graduate Diploma courses.

5.Registration for Master and Doctorate Degrees

- Applicant for the Master or Doctorate degree shall present to the relevant department a registration form - signed by the candidate - including the research title and the main supervisor's registration approval.
- The student shall present the proposed research plan including the research title in Arabic and in English and indicating the objective of the research, in addition to the equipment, laboratories and references requirements signed by the candidate and approved by the main supervisor.
- The candidate shall present certificate of passing the international TOEFL exam with a minimum grade of 500 or equivalent from an internationally accredited center or institute.
- The candidate shall present the proposed plan of his research in a seminar, which shall be announced in the relevant department indicating the research objective and methodology. Then, the main supervisor shall prepare a scientific report on the seminar to be presented to the department with the proposed research methodology.
- The research methodology and the supervisor report shall be presented to the relevant department for approval. Then, it should be presented to the post graduate committee who shall hand it over to the faculty council for approval on registration. The beginning

of the registration period is estimated starting from the date of the agreement of the university council.

6. Master Courses (Phase One)

- The candidate shall pursue his Master if he has completed his preliminary studies with a minimum grade point average (GPA) of 3.00. On the other hand, the student who is enrolled in the Post Graduate Diploma may transfer to the Master degree if he has successfully completed 12 credit hours with a minimum GPA of 3.0 in all completed courses or after receiving his Diploma with a minimum GPA of 3.0.
- In this stage, the candidate shall register 18 credit hours of the courses level-600 after the agreement of his academic supervisor.

7. Master Courses (Phase Two)

- The candidate shall successfully complete courses from the first stage equivalent to a minimum of 12 credit hours with a minimum GPA of 2.67 before starting his studies in this stage.
- The candidate shall study 12 credit hours of the courses level-600.

8. Master Research Completion with Courses

- Studying in this stage is according to the student's preference and do not have to be full time.
- The candidate shall successfully complete courses equivalent to a minimum of 8 credit hours from the second phase and with a minimum GPA of 2.67 before starting this phase.
- The candidate shall prepare an applied research based on 6 credit hours, which will be evaluated through a committee appointed by the department council. This committee shall determine in its evaluation the research grade to be added to the GPA.
- The candidate who does not get a minimum GPA of 2.67 shall submit his research once again and will be dealt with as a regular course concerning the GPA and the registration fees.
- The candidate shall get the degree of Master of Engineering after successfully completing all requirements of the different phases with a minimum GPA of 2.67.

9. Master Thesis Completion

- The candidate shall complete courses from the first stage equivalent to 12 credit hours with a minimum GPA of 2.67 before starting the thesis.

- The student will have to be a full time student for at least one semester (3 – 4 months).
- The candidate shall prepare a scientific thesis in English to be evaluated based on 18 credit hours.
- The candidate shall defend his thesis after successfully completing all courses with a minimum GPA of 2.67.

10. Comprehensive Exam of applying to Doctorate Degree

- In order to apply for this exam, the applicant shall have a Master degree from Egyptian Universities or an equivalent degree accredited from the Supreme Council of Universities in any of the Engineering specialization presented in this curriculum.
- The department council shall appoint the examination committee (five staff members) among the professors and associate professors of different specializations related to the general scope of research. The committee reporter shall be the most senior.
- The committee reporter shall invite the committee for a meeting to determine the examination subjects so it includes the major specialization related to the main scope and its requirements in a level appropriate for doctorate degree.
- The committee shall determine a date for the written exam, its allowed duration and then notify the candidate.
- After successfully passing the written exam, the committee shall appoint a date for an oral exam with the presence of all committee members. Then, at the end of the examination session, the committee shall declare the student has passed or failed in this examination with a minimum pass grade of 65%.
- The student may, after repaying the registration fee, re-apply for the comprehensive exam after a period of at least three months of declaring the previous exam grade.

11. Doctorate Degree

- To apply for this stage, the candidate shall have successfully passed the comprehensive exam.
- During this stage, the candidate registers in 18 credit hours courses of level-600.

12- Completion of Ph.D. Dissertation

- The student has to finish, at least, 12 credit hours with a minimum GPA of 30 before starting the dissertation.
- The student must be registered on full time basis for at least two semesters (6 to 8 months).

- The candidate should submit a technical dissertation, in English, which is considered as 30 credit hours.
- The student should not submit a proposal for the dissertation jury before successfully passing all the courses with minimum GPA of 3.0.

Article 10

Duration of Study Programs

- Maximum duration to cover all subjects related to the professional diploma is one year and a half- the study covers the courses of the professional diploma studies.
- Maximum duration of the postgraduate diploma is two years. This period covers the qualifications study discipline and the postgraduate diploma courses.
- Maximum duration of Master degree studies is 4 years from the date of registration for master courses. This duration covers the courses study period and the thesis completion.
- Maximum duration of the Ph.D. degree is 6 years from the date of passing the comprehensive exam. This duration covers the courses study period and the thesis completion.

Article 11

Supervision

- The supervisor of a master thesis or Ph.D. thesis shall be a full professor or associate professor. Equivalent external staff may participate in supervision. The principal supervisor is the most senior among the participating supervisors. Lecturers may assist in supervision.
- The vice dean for graduate studies and researches has to send the title and the thesis abstract written in Arabic and in English as well, to the concerned faculties in all Egyptian universities, Research Centers and Technical Research Academy. In addition, this data should be published on the internet home page of the university.
- The faculty council may assign an alternative committee member, based on the nomination of the department council, in case of absence of a committee member due to external technical mission or other reasons for more than a year. The new alternative member should replace the name of the absent member with preserving all his technical and ethical rights during his supervision period.
- If the committee member mentioned above was the only supervisor of the thesis, one or more alternative supervisor may be chosen to

replace this member based on the nomination of the department council and the approval of the faculty council.

- The main supervisor shall submit two reports every year during May and November. Each of these reports includes the situation of the research, the progress and the problems if any. These reports must be presented to the department council for information and copies of the reports should be kept in the file of the candidate.

Article 12

Preparation of Thesis

- The candidate must finish at least 12 credit hours for the Master degree and 12 credit hours for the Ph.D. degree with a minimum GPA of 2.67 for the M.Sc.Eng. degree and 3.0 for the PH.D. degree before starting the thesis.
- Concerning the dissertation, 18 credit hours are assigned for the Master degree and 30 credit hours are assigned for the Ph.D. degree.
- The candidate is not allowed to defend his thesis until passing successfully all the academic subjects required to fulfill the degree requirements.

Article 13

Judgment Committee

- After finishing, successfully, all the degree requirements and presenting the results of the research through a public seminar, the student must write the dissertation in English with an abstract in Arabic. The supervising committee, then, submits a report to the departments' council addressing the validity of the thesis.
- Based on the suggestion of department, the faculty council assigns a technical academic jury committee to attend and evaluate the defense. This committee consists of three members; one of them is the main supervisor. (Maximum two supervisors may participate in this committee with one vote). At least one of the committee members should be a staff member of another university. Moreover, for Ph.D. thesis, one of the committee members may be from other country. The principal member of this jury committee is chosen based on the seniority.
- A detailed single reports should be submitted to the main supervisor. Then, the main supervisor of the jury committee assigns the defense date. This date must be within 3 months after approval of the committee and must be announced two weeks before the day of jury.
- At the day of jury, the committee members meet at the faculty and their single reports are presented to the committee. The candidate makes a presentation of his work, followed by open discussion then, a final report

signed from all committee members is submitted addressing the level of the thesis and the decision of the committee. Both the single reports and the general committee report must be presented to the faculty council and then to the university council to decide upon awarding the degree.

- The committee has the right to return back the thesis to the candidate to complete his work if any, with a maximum time allowance of 6 months. All the committee members must approve this extension. If this time allowance exceeded 6 months, a new jury committee shall be assigned.
- For the Master degree to be awarded, at least one technical paper must be published in a specialized accredited journal or a specialized accredited conference. The contents of this paper should be extracted from the thesis. The candidate has to submit a verification of either presentation or acceptance of the paper.
- For the Ph.D. degree to be awarded, the research should present a technical addition in the field of specialization. The candidate must publish at least two technical papers in specialized accredited journals or specialized accredited conferences. The contents of these papers have to be extracted from the thesis. The candidate must submit a verification of either presentation or acceptance of these papers.
- Single and general reports should be assigned from the department committee to the faculty council then, to the university council for approval of degree awarding.

Article 14

Study Plan

The faculty council approves the plan of study of all stages of the postgraduate studies in the specialization previously announced, according to the article number (3) of the general rules.

Article 15

Conjunctive Studies

At the beginning of an academic year, the faculty council assigns scientific committee for the post graduate studies specializations of the conjunctive nature (i.e. specializations common among the scientific departments). The committee is composed of 7 members at least and the head of the committee is the Vice Dean for post graduate studies and researches. The committee has all the rights and authorities of the scientific department committees concerning any subjects related to disciplines of Diplomas of the post graduate studies and the degrees of M.Sc. and Ph.D. of the conjunctive specializations. The committee includes the heads of faculty scientific departments and few staff members who take part in teaching the courses.

Article 16

Accreditation of Courses

The faculty council, according to a suggestion from the specialized department committee and a recommendation from the committee of the post graduate studies and researches, is able to approve previously passed postgraduate courses with grade not less than 2.00 in the college or in any other college or institute accredited by the Supreme Council of Universities in a period of 5 years before the student registration with a maximum of 8 credit hours. This will be done based on equalization of the number of hours and the scientific course contents regarding the course description of the faculty curriculum. Also, the student is able to study through e-learning or distance learning disciplines with a maximum of 3 credit hours. This can be done in one of the registered universities inside and/or outside Egypt, upon a suggestion from the academic advisor and after the approval of the scientific committee of the program and the faculty council. In this case the examination must be held at the Faculty of Engineering, Mataria, Helwan University.

Article 17

Examinations system

Candidates that are registered for post graduate studies of all offered engineering specializations can attend the examinations in studied courses at the end of each semester according to the time schedule approved by the faculty council. The faculty council will determine the exam time for all courses .

Article 18

Transmission Rules

The present curriculum shall be applied on fresh-man students starting from the approval date of the Ministry decision in that concern, while the curriculum of 86/1987 and it's accompanying regulations shall be applied on students already being registered for postgraduate studies.

Postgraduate Courses for Mechanical Power Engineering

Mechanical Power Engineering Department

Postgraduate Courses (Diploma & Master, Level 500)

No	Code no.	Course title	Credit hours	Contact hours		Pre-requisite
				Lect.	Tutorial or lab	
1	MP501	Advanced heat transfer	3	3		
2	MP502	Advanced thermodynamic	3	3		
3	MP503	Advanced fluid mechanics	3	3		
4	MP504	Theory of turbo machinery	3	3		
5	MP505	Thermodynamic and combustion	3	3		
6	MP506	**Oil & Lubrication**	3	3		
7	MP507	Air pollution	3	3		
8	MP508	**Cooling and freezing systems**	4	4		
9	MP 509	Ventilation and air conditioning Systems	4	4		
10	MP510	Heat Exchangers	4	4		
11	MP511	Pumps & Compressors	3	3		
12	MP512	**Computer applications**	3	3		
13	MP513	Measurement and control equipments	3	3		
14	MP514	Steam boilers	6	6		
15	MP515	Gas dynamics	3	3		
16	MP516	Internal combustion engine	3	3		
17	MP517	Refrigeration and air conditioning equipments	3	3		
18	MP518	Solar energy	3	3		
19	MP519	Water turbines	3	3		
20	MP520	Compressors and pumps	3	3		
21	MP521	Liquids and gas pipe systems	3	3		
22	MP522	Economics of pipe systems	3	3		
23	MP523	New and renewable energy sources	3	3		
24	MP524	Thermal power station	3	3		
25	MP525	Economics and performance of power stations	3	3		
26	MP526	Nuclear engineering	3	3		
27	MP527	Gas and steam turbines	3	3		

N.B.

1) From the present table, the academic advisor assigns courses with total credit hours of 18 cr. hr. for students of Professional Diploma, 12 cr. hr for students of the pre-…. Of the Postgraduate Diploma, and 18 cr. hr. for students of the postgraduate Diploma.

2) The academic advisor may include among the student study program, courses from other specializations.
3) Other courses may be included according to the recommendation of the department committee and the agreement of the collage committee.

Mechanical Power Engineering Department
Postgraduate Courses (Diploma & Master, Level 500)

No	Code no.	Course title	Credit hours	Contact hours		Pre-requisite
				Lect.	Tutorial or lab	
28	MP528	Performance of internal combustion engines	4	4		
29	MP529	Supercharged engines	4	4		
30	MP530	Engines new trends	4	4		
31	MP531	Air conditioning applications	3	3		
32	MP532	Refrigeration and freezing applications	3	3		
33	MP533	Ventilation and air distribution systems	3	3		
34	MP534	Refrigeration and air-conditioning loads	3	3		
35	MP535	Control of turbo-machines	4	4		
36	MP536	Applications and performance of turbo-machines	4	4		
37	MP537	Flow control in pipe systems	4	4		
38	MP538	Subject 1	4	4		
39	MP539	Subject 2	4	4		
40	MP540	Wind energy	4	4		
41	MP541	Solar cells	4	4		
42	MP542	Bio-mass energy	4	4		
43	MP543	Project	-	6		
44	MP544	Hydraulic power plants	3	3		
45	MP545	Mp 545 operation and maintenance of thermal power plants	3	3		
46	MP546	**Dynamic machines and stress analysis**	3	3		
47	MP547	Gas turbine applications	3	3		
48	MP548	Economics in refrigeration and air-conditioning systems	3	3		
49	MP549	Control in refrigeration and air-conditioning equipments	3	3		
50	MP550	Operation, testing and maintenance of pumps	3	3		
51	MP551	Operation, testing and maintenance of turbo-machines	3	3		
52	MP552	Energy storage, conversion and economics	3	3		
53	MP553	Co-generation	3	3		

N.B.

1) From the present table, the academic advisor assigns courses with total credit hours of 18 cr. hr. for students of Professional Diploma, 12 cr. hr for students of the pre-…. Of the Postgraduate Diploma, and 18 cr. hr. for students of the postgraduate Diploma.
2) The academic advisor may include among the student study program, courses from other specializations.
3) Other courses may be included according to the recommendation of the department committee and the agreement of the collage committee.

Mechanical Power Engineering Department
Postgraduate Courses (Master & PhD, Level 600)

No	Code no.	Course title	Credit hours	Pre-requisite
1	MP601	Cooling and freezing Systems	3	
2	MP602	Performance and economy of refrigeration and air-conditioning systems	3	
3	MP603	Ventilation and air distribution systems	3	
4	MP604	Air conditioning systems	3	
5	MP605	Energy and environment	3	
6	MP606	Solar energy and its applications	3	
7	MP607	Wind energy and its applications	3	
8	MP608	Gas and steam turbines	3	
9	MP609	Compressors and pumps	3	
10	MP610	Foundations and vibrations of engines	3	
11	MP611	Steam power stations	3	
12	MP612	Gas turbine and diesel engine power plants	3	
13	MP613	Sea wave energy	3	
14	MP614	Bio-mass energy	3	
15	MP615	New and renewable energy sources	3	
16	MP616	Mechanical stresses in injection system	3	
17	MP617	Advanced turbo propeller units	3	
18	MP618	Gas dynamics	3	
19	MP619	Heat transfer by conduction	3	
20	MP620	Heat transfer by convection	3	
21	MP621	Heat transfer by radiation	3	
22	MP622	Oil and lubrication	3	
23	MP623	Supercharging engines	3	
24	MP624	Energy equipments	3	
25	MP625	Advanced fluid mechanics and	3	

		thermodynamics		

N.B.

1) From the present table, the academic supervisor assigns courses with total credit hours of 18 cr. hr. for students of First Stage of Master Degree., 12 cr. hr for students of M.Eng., 18 cr. hr. for students of Ph.D.
2) Supervisor may include among the student study program, courses from other specializations.
3) Other courses may be included according to the recommendation of the department committee and the agreement of the collage committee.

Mechanical Power Engineering Department
Postgraduate Courses (Master & PhD, Level 600)

No	Code no.	Course title	Credit hours	Pre-requisite
26	MP626	Combustion engineering	3	
27	MP627	Control and measurement equipments	3	
28	MP628	Control and safety equipment in air conditioning systems	3	
29	MP629	Control of turbo-machines	3	
30	MP630	Combustion in industrial furnaces and boilers	3	
31	MP631	Control and safety equipment in refrigeration systems	3	
32	MP632	Refrigeration and air-conditioning loads	3	
33	MP633	Heat transfer in industrial furnaces an3d boilers	3	
34	MP634	Advanced heat transfer	3	
35	MP635	Water treatment	3	
36	MP636	Nuclear power stations	3	
37	MP637	Theory and systems of fuel injection	3	
38	MP638	Fuel economy	3	
39	MP639	Multi-phase flow	3	
40	MP640	Unsteady flow of fluids	3	
41	MP641	Jet propulsion	3	
42	MP642	Turbulent flow	3	
43	MP643	Advanced thermodynamic	3	
44	MP644	Water desalination	3	
45	MP645	Boundary layer theory	3	
46	MP646	Advanced energy measurements	3	
47	MP647	Economics of power generation	3	
48	MP648	Storing energy	3	
49	MP649	Fire fighting	3	
50	MP650	Control of industrial processes	3	

N.B.

1) From the present table, the academic supervisor assigns courses with total credit hours of 18 cr. hr. for students of First Stage of Master Degree., 12 cr. hr for students of M.Eng., 18 cr. hr. for students of Ph.D.

2) Supervisor may include among the student study program, courses from other specializations.
3) Other courses may be included according to the recommendation of the department committee and the agreement of the collage committee.

Mechanical Power Engineering Department
Postgraduate Courses (Master & PhD, Level 600)

No	Code no.	Course title	Credit hours	Pre-requisite
51	MP651	Control in cooling and air-conditioning equipment	3	
52	MP652	Fluid control equipments	3	
53	MP653	Control in missiles and airplanes	3	
54	MP654	Automatic control in engines	3	
55	MP655	Performance of internal combustion engines	3	
56	MP656	Transient combustion	3	
57	MP657	New trends in combustion engines	3	
58	MP658	Heat transfer by boiling	3	
59	MP659	Heat transfer by condensing	3	
60	MP660	Transient heat transfer	3	
61	MP661	Program simulations for energy equipments	3	
62	MP662	Reverse engineering applications	3	
63	MP663	Mathematical methods in energy science	3	
64	MP664	Viscous Flow	3	
65	MP665	Numerical methods in heat transfer	3	
66	MP666	Mathematical methods in fluid dynamics	3	

N.B.

1) From the present table, the academic supervisor assigns courses with total credit hours of 18 cr. hr. for students of First Stage of Master Degree., 12 cr. hr for students of M.Eng., 18 cr. hr. for students of Ph.D.
2) Supervisor may include among the student study program, courses from other specializations.
3) Other courses may be included according to the recommendation of the department committee and the agreement of the collage committee.

Courses Syllabus

Postgraduate Courses Syllabus
for Mechanical Power Engineering Department
Level 500

MP502	**ADVANCED THERMODYNAMIC**
	Basics of thermodynamics — Isentropic flow waves — Adiabatic flow — Flow with friction—Thermodynamics of turbo-machines.
MP503	**ADVANCED FLUID MECHANICS**
	Kinematics of fluid motion — Flow of incompressible ideal fluids — Flow of compressible ideal fluids — Impulse momentum principle — Similitude and dimensional analysis — Fluid flow in pipes — Fluid flow around immersed bodes — Fluid flow measurements.
MP504	**THEORY OF TURBOMACHINERY**
	Introduction to turbomachinery- The essentials of turbomachinery performance - The essentials of turbomachinery durability - Centrifugal compressor and pump performance - Problem session: centrifugal compressor evaluation - Axial compressors and pumps - Axial turbines - Radial turbines - Fans & Blowers -Modeling turbomachinery flows- Stability and range limitations - The design process -Experimental techniques for machinery development.
MP507	**AIR POLLUTION**
	Nature and extent of problem — Nitrogen oxides formation — Carbon monoxide formation Unburned hydrocarbon emissions — Particulate emissions — Exhaust gas treatment.
MP508	**COOLING AND FREEZING SYSTEMS**
	Engineered refrigeration systems for industrial and commercial practices — Liquid overfeed systems — System practices for halo-carbon refrigerants — System practices for ammonia —System practices for secondary refrigerants — System practices for multistage applications — Moisture — lubricants —Contaminants control in refrigeration systems.
MP509	**VENTILATION AND AIR CONDITIONING SYSTEMS**
	Natural and forced ventilation methods — Hygienic aspects of ventilation Methods of ventilation — Design principles of ventilation systems — Special ventilation application — Industrial ventilation system — Local exhaust systems — System design. Air flow and distribution methods: (Air flow in ducts, Duct system design and noise attenuation). Basic air conditioning system design — Air system — Air and water systems — Unitary systems — Total energy systems — Forced air systems — Chilled and dual temperature water systems — Industrial exhaust systems.
MP512	**COMPUTER APPLICATIONS**
	Introduction to computer applications in the field of boilers — Efficiency calculations of boilers given fuel type, Temperature and composition of exhaust gases — Thermal design of boilers —Programs for design of$_1$ steam piping networks — Programs for control of boiler operation — Calculation of thermal losses from steam pipe lines and efficiency of thermal insulation.
MP514	**STEAM BOILERS**
	Steam equipment for boilers — Water feeding tanks for industrial boilers — Water pumps for boilers — Water and steam valves — Boiler blow down systems — Steam strainers — Steam traps — Pressure reducing

	valves — Air vents and vacuum breakers — Equipment to control steam flow rates — Methods to measure steam flow rates — Design of steam pipe lines —Thermal insulation of steam pipe lines — Types of steam pipes — Installation of steam pipe lines — Expansion in steam pipe lines — Methods of condensation recovery in steam pipe lines.
MP515	**GAS DYNAMICS**
	Steady flow energy equation Euler's equation — Speed of sound and mach number —Flow with friction — Equation of flow with friction — The area-velocity relationship —Flow at constant-area duct. The shock wave — The normal shock relation for the perfect gas Equation for flow with combined area change friction and heat transfer — Heat transfer with area change without friction — Heat transfer in a constant area duct without friction —The rayleigh curve.
MP518	**SOLAR ENERGY**
	General idea about the source of solar energy — Its intensity in the outer space and the motion of the earth with respect to the sun — The angles of solar rays on earth. Different models for calculating solar energy intensity and the fraction dispersed through the earth's atmosphere. Theory of solar collectors and equations defining the glass cover transitivity —Thermal losses and thermal efficiency — Solar collector performance and its effect on the phase of the fluid flowing through the collector.
MP519	**WATER TURBINES**
	Fundamental concepts of fluid mechanics — Water turbines: (Historical review — Unit characteristics — Specific speed — Classifications — Configurations). Impulse turbines: (Setting, Head balance, speed regulations, Design considerations, Energy conversion,Performance and testing). Reaction turbines: (Classifications inward/outward flow turbines Francis turbines — Deriaz turbines — Design considerations — Tailpipes — Energy conversion — Performance and testing). Power house: (Requirements and site selection, Layout, Number and size, Underground power house, Hydro-generators, Gates and valves, Electrical equipment and auxiliary equipment).
MP520	**COMPRESSORS AND PUMPS**
	Pumps: (Performance, Velocity diagrams, Losses, Specific speed, Cavitation, Water hammer and axial thrust). Design of radial type centrifugal pump: (Impeller design, Diffuser design, and casing design) — Compressors: Performance, Analysis of compressible fluids, Axial compressor, Velocity triangle, Thermodynamics of an axial compressor stage, Loading coefficient, Flow coefficient and degree of reaction — Design of an axial compressor stage: Theory of aerodynamic bodies and steps of axial compressor design — Testing of compressors.
MP523	**NEW AND RENEWABLE ENERGYSOURCES**
	Solar energy — Wind energy Wave energy — Bio-mass energy Tidal energy Solar ponds — Geothermal energy — Agricultural and organic waste energy.
MP524	**THERMAL POWER STATION**
	Classifications of power installation of construction machinery: (Prime and secondary movers). Characteristic and performance study of prime mover: (Steam engine and Internal combustion engine). Secondary mover components: (Hydraulic, pneumatic and electric motors) — Performance

	study of hydraulic and pneumatic motors — Control systems of power installation equipment.
MP525	**ECONOMICS AND PERFORMANCE OF POWER STATIONS**
	First and second laws analysis of thermal systems — Energy analysis of power cycles — The cost of electrical power generation — Selection of type of generation — Performance and operating characteristics of power plants — Load division among generators — Interest and depreciation — present worth — Annual fuel cost — Levelizing equations — Economic evaluation methods — Construction cost — Operation and maintenance costs — Generator mix — Economic scheduling principle — Load distribution — Variation of station cost with size of unit.
MP527	**GAS AND STEAM TURBINES**
	Gas turbines: (Gas turbine cycles, Radial flow turbines, Axial flow turbines and Component matching). Steam turbines: steam cycles, Basic types and elements of steam turbines, One dimensional flow through axial stages and theory of twisted blades.
MP531	**AIR CONDITIONING APPLICATIONS**
	Introduction — Residences — Retail facilities — Commercial and public buildings — Places of assembly — Domestic facilities — Health facilities — Surface transportation — Aircraft — Ships — Industrial air conditioning — Enclosed vehicular facilities — Laboratories —Engine test facilities — Printing plants — Textile processing — Photographic materials —Drying and storing farm crops — Air conditioning of wood and paper products facilities —Mine air conditioning and ventilation — Ventilation of the industrial environment.
MP532	**REFRIGERATION AND FREEZING APPLICATIONS**
	Refrigerated warehouse designs — Refrigerated warehouse applications — Freezing tunnels types — Design and application — Refrigeration applications in concrete dams —Subsurface soil — and foundations — Ice manufacture.
MP533	**VENTILATION AND AIR DISTRIBUTION SYSTEMS**
	Natural and forced ventilation methods — Hygienic aspects of ventilation — Methods of ventilation — Design principles of ventilation systems — Special ventilation application — Industrial ventilation system — Local exhaust systems — System design. Air flow and distribution methods: (Air flow in ducts, Duct system design and noise attenuation). Air flow and distribution methods: Air flow in ducts, Duct system design, Noise attenuation — Air diffusing equipment and air cleaning equipment. Fans: Types, Fan laws, Performance curves, Fan and system pressure relationships, Fan selection and fan installation.
MP534	**REFRIGERATION AND AIR-CONDITIONING LOADS**
	Inside and outside operating conditions — Design conditions — Heat transmission — Solar radiation — Wall heat load. Air change load — Additional loads: (electrical motors, Lighting, People, product load, Sensible, Respiration and equipment selection). Introduction to thermal storage — Thermal release — Thermal capacity of structure and enclosures — Sensible and latent loads — Weather data — Outside and inside design conditions — Heat transmission coefficients — Cooling load temperature difference (CLTD) External loads: (Conduction from walls, Roofs and floors, solar irradiation from fenestration). Internal loads: Occupants, Machinery and equipment, Electric motors, Appliances, Lighting, Ventilation and infiltration air cooling load. Phsychrometric

	processes — Cooling loads for residential buildings.
MP535	**CONTROL OF TURBO-MACHINES**
	Basic definitions of control systems — Mathematical representation of physical systems —Transient response of conirol systems — Laplace transformation — Application of mechanical and hydraulic governors in thermal systems — Types of controllers (Pneumatic Hydraulic). Frequency response methods in control systems: Bode plots, Polar plots and nicholas chart. System stability — Compensation techniques.
MP 536	**APPLICATIONS AND PERFORMANCE OF TURBO-MACHINES**
	Pump stations: (Classifications, Pump construction, Pump testing and Emergency problems) Compressor Stations: (Classifications, Compressor testing, Auxiliaries — Compressor construction, Compressor testing and emergency problems) — Gas turbine stations: (Classifications, Turbine testing and emergency problem).
MP540	**WIND ENERGY**
	An introduction to wind energy — Survey of wind energy Measuring instrumentation Theoretical study of wind energy Wind turbine blade Horizontal and vertical axis wind turbines control system Wind energy for pumping and electricity generation —Computer programs for calculating the turbine power — Wind measurements.
MP542	**BIO-MASS ENERGY**
	This course covers: Energy sources and their classifications — Conventional energy conversion — Power plants and vapor cycles — Methods of bio-mass conversion into energy Biological methods — Aerobic and anaerobic fermentation — Thermo-chemical methods Direct combustion — Gasification (Partial combustion) and pyrolysis — Practical applications of bio-mass conversion into energy The use of gaseous fuel in internal combustion engines.
MP543	**PROJECT**
	Independent work leading to writing an extensive article — Preparing a theoretical study or experimental work with complete analysis in topic relevant to the diploma field of study.
MP544	**HYDRAULIC POWER PLANTS**
	Study of flow data and water power estimates — Hydraulic turbines — Power plant construction — Waterways and pondstocks — Power house equipment — Plant accessories — Speed and pressure regulation — Water hammer: (Causes, effects and protection) — Cost and value of water power.
MP545	**OPERATION AND MAINTENANCE OF THERMAL POWER PLANTS**
	Starting and loading of power plant units — Stopping of units — Speed and load regulation — Parallel operation of units — Synchronization — Load sharing between units — Tests on boilers — Turbo-alternators — Condensers — Pumps... etc. Reliability tests — Acceptance tests. Guarantee figures — Performance characteristics tests. Alarm signals and remedy of its causes. Automatic tripping and causes: (Excessive vibrations, Over-speed, Failure of thrust, Diagnosis of faults and maintenance work).
MP548	**ECONOMICS IN REFRIGERATION AND AIR-CONDITIONING SYSTEMS**
	Energy analysis of thermal system — Engineering economy background — Cost equations —Subsystem analysis — Comparison between systems using cost equations — Optimization Methods Energy analysis of thermal

	system — Engineering economy background — Cost equations — Subsystem analysis — Comparison between systems using cost equations — Optimization methods.
MP549	**CONTROL IN REFRIGERATION AND AIR-CONDITIONING EQUIPMENTS**
	Control theory and terminology — Type of control devices: Pneumatic, Electric, Electronic and fluidic — Flow control devices — Elementary control system — Complete control system — Electric control system — Supervisory control systems — Special control systems.
MP550	**OPERATION, TESTING AND MAINTENANCE OF PUMPS**
	Pumps classification and range of application — Pumps sealing and the mechanical seals with the theory of operation — Types of impeller rotors — Pump materials used for the construction of different pump components and the standard specifications — Starting and stopping procedures for pumps with low specific speeds — Daily, semi annual, annual inspection and maintenance of different types of pumps — Pump troubles and ways of maintenance and repair — Pump testing, tabling of results and improving the performance.
MP551	**OPERATION, TESTING AND MAINTENANCE OF TURBO-MACHINES**
	Classification of turbo-machines and range of application for each — Pumps theory and performance — Pump sealing and the mechanical seals with the theory of operation — Pump shafts and its load calculations — Materials used in construction and the standard specifications — Daily, semiannual and annual inspection for different pump types —Starting and stopping procedures — Pump troubles and testing procedures — Theory of operation of fans, blowers and compressors. Optimum operation of fans, blowers and compressors — Methods for daily, semiannual and annual maintenance of fans, blowers and compressors — Testing of the compentents.
MP552	**ENERGY STORAGE, CONVERSION AND ECONOMICS**
	Need for storage — Types: (Biological — Chemical — Thermal — Electrical —Mechanical). Pumped storage: (Requirements, Working principle, Economic justification, Advantages of pumped storage, Site selection, Classification, Machinery, Lakes, Power house and typical plants).

Postgraduate Courses Syllabus
for Mechanical Power Engineering Department
Level 600

MP601	**COOLING AND FREEZING SYSTEMS**
	Engineered refrigeration systems for industrial and commercial practices — Liquid overfeed systems — System practices for halo-carbon refrigerants — System practices for ammonia —System practices for secondary refrigerants — System practices for multistage applications — Moisture — lubricants —Contaminants control in refrigeration systems.
MP602	**PERFORMANCE AND ECONOMY OF REFRIGERATION AND AIR-CONDITIONING SYSTEMS**
	Energy analysis of thermal system — Engineering economy background — Cost equations —Subsystem analysis — Comparison between systems using cost equations — Optimization Methods Energy analysis of thermal system — Engineering economy background — Cost equations — Subsystem analysis — Comparison between systems using cost equations — Optimization methods.
MP603	**VENTILATION AND AIR DISTRIBUTION SYSTEMS**
	Natural and forced ventilation methods — Hygienic aspects of ventilation — Methods of ventilation — Design principles of ventilation systems — Special ventilation application — Industrial ventilation system — Local exhaust systems — System design. Air flow and distribution methods: (Air flow in ducts, Duct system design and noise attenuation). Air flow and distribution methods: Air flow in ducts, Duct system design, Noise attenuation — Air diffusing equipment and air cleaning equipment. Fans: Types, Fan laws, Performance curves, Fan and system pressure relationships, Fan selection and fan installation.
MP604	**AIR CONDITIONING SYSTEMS**
	Basic air conditioning system design — Air system — Air and water systems — Unitary systems — Total energy systems — Forced air systems — Chilled and dual temperature water systems — Industrial exhaust systems.
MP605	**ENERGY AND ENVIRONMENT**
	Gaseous and solid pollutants — Formation mechanism of gaseous and solid pollutants during combustion processes within boilers — Industrial furnaces and gas turbines — Formation mechanism of pollutants in internal combustion engines — Control of pollutants formation in boilers, Industrial furnaces and gas turbines — Control of pollutants in internal combustion engines — Thermal pollution from cooling processes of power producing equipment
MP606	**SOLAR ENERGY AND ITS APPLICATIONS**
	General idea about the source of solar energy — Its intensity in the outer space and the motion of the earth with respect to the sun — The angles of solar rays on earth. Different models for calculating solar energy intensity and the fraction dispersed through the earth's atmosphere. Theory of solar collectors and equations defining the glass cover transitivity —Thermal losses and thermal efficiency — Solar collector performance and its effect on the phase of the fluid flowing through the collector. Solar heating — Solar dryers — Solar electricity generation: (Photovoltaic cells — Solar boilers) Solar desalination — Solar cookers — Solar refrigeration and air conditioning —Solar pumping.

MP607	**WIND ENERGY AND ITS APPLICATIONS**
	An introduction to wind energy — Survey of wind energy Measuring instrumentation Theoretical study of wind energy Wind turbine blade Horizontal and vertical axis wind turbines control system Wind energy for pumping and electricity generation —Computer programs for calculating the turbine power — Wind measurements. Wind electricity generation Wind pumps.
MP608	**GAS AND STEAM TURBINES**
	Gas turbines: (Gas turbine cycles, Radial flow turbines, Axial flow turbines and Component matching). Steam turbines: steam cycles, Basic types and elements of steam turbines, One dimensional flow through axial stages and theory of twisted blades.
MP609	**COMPRESSORS AND PUMPS**
	Pumps: (Performance, Velocity diagrams, Losses, Specific speed, Cavitation, Water hammer and axial thrust). Design of radial type centrifugal pump: (Impeller design, Diffuser design, and casing design) — Compressors: Performance, Analysis of compressible fluids, Axial compressor, Velocity triangle, Thermodynamics of an axial compressor stage, Loading coefficient, Flow coefficient and degree of reaction — Design of an axial compressor stage: Theory of aerodynamic bodies and steps of axial compressor design — Testing of compressors.
MP610	**FOUNDATIONS AND VIBRATIONS OF ENGINES**
	Calculation of the pressure variation during the engine cycle — Force analysis for the piston, Connecting rod and crank for a single cylinder — Force analysis for multi-cylinder engine —Torsional vibrations — Engine foundation — Dampers: (Types, Design) — Calculation of deflection of dampers and frequency of vibration of dampers — Resonance.
MP611	STEAM POWER STATIONS
	Conventional cycles — Combined cycles — Cogeneration — Power plant siting — Fuels and combustion — Fuel burning equipment — Draught systems — Water treatment — Steam piping.
MP612	**GAS TURBINE AND DIESEL ENGINE POWER PLANTS**
	Gas turbines: (Classifications Open and closed cycle, Thermal efficiency improvement arrangement of plant components, Combustion chambers, Performance) — Diesel power plants: (Main systems of the plant, Plant layout, Combustion chambers, Engine performance, Engine supercharging, Dual fuel engine and fuel injection systems).
MP613	**SEAWAVE ENERGY**
	Introduction — Sea wave characteristics Wave energy conversion to mechanical energy —Mechanical energy conversion into other usable forms — Tides — Tidal energy —Construction Moving devices — Environmental — Social and industrial considerations —Typical plants.
MP614	**BIO-MASS ENERGY**
	This course covers: Energy sources and their classifications — Conventional energy conversion — Power plants and vapor cycles — Methods of bio-mass conversion into energy Biological methods — Aerobic and anaerobic fermentation — Thermo-chemical methods Direct combustion — Gasification (Partial combustion) and pyrolysis Practical applications of bio-mass conversion into energy The use of gaseous fuel in internal combustion engines.
MP615	**NEW AND RENEWABLE ENERGYSOURCES**
	Solar energy — Wind energy Wave energy — Bio-mass energy Tidal energy Solar ponds — Geothermal energy — Agricultural and organic

	waste energy.
MP618	**GAS DYNAMICS**
	Steady flow energy equation Euler's equation — Speed of sound and mach number —Flow with friction — Equation of flow with friction — The area-velocity relationship —Flow at constant-area duct. The shock wave — The normal shock relation for the perfect gas Equation for flow with combined area change friction and heat transfer — Heat transfer with area change without friction — Heat transfer in a constant area duct without friction —The rayleigh curve.
MP619	**HEAT TRANSFER BY CONDUCTION**
	General heat conduction equation — Thermal conductivity — Steady one-dimensional conduction — Resistance concept — Extended surfaces — Steady two-and three dimensional conduction — Unsteady heat conduction and multidimensional systems — Time varying boundary conditions — Phase change with moving boundaries — Solution methods —Laplace transform — Fourier series — Bessel functions — Legender series and numerical methods.
MP620	**HEAT TRANSFER BY CONVECTION**
	Laminar boundary layer on a *flat* plate — Energy equation of the boundary layer — The thermal boundary layer — The relation between fluid friction and heat transfer in turbulent flow in tube — Heat transfer in high speed flow — Empirical relation for pipe and tube flow — Flow across cylinders and spheres — Flow across tube rows — Liquid metal heat transfer — Free convection heat transfer on vertical flat plate — Empirical relations for free convection — Free convection from vertical planes and cylinders — Free convection from horizontal cylinders and plates — Free convection from inclined surfaces — Non newtonian fluids — Simplified equation for air — Free convection from spheres — Free convection in enclosed spaces — Combined free and forced convection — Condensation heat transfer phenomena — Film congestion inside horizontal tubes boiling heat transfer — Simplified relations for boiling heat with water.
MP621	**HEAT TRANSFER BY RADIATION**
	This course covers: radiation from blackbody — Definitions and estimation of radiative properties of non black surfaces — Properties of real materials — Radiation exchange between black and gray surfaces — Thermal radiation between gases and enclosures —Combined convection and radiation heat transfer — Applications and numerical solutions.
MP625	**ADVANCED FLUID MECHANICS AND THERMODYNAMICS**
	Kinematics of fluid motion — Flow of incompressible ideal fluids — Flow of compressible ideal fluids Impulse momentum principle — Similitude and dimensional analysis — Fluid flow in pipes — Fluid flow around immersed bodies — Fluid measurements.
MP627	**CONTROL AND MEASUREMENT SYSTEMS**
	Introduction — Force measurement — Pressure measurement — Flow measurement —Temperature measurement — Signal conditioning — Indicating and recording devices —Measuring systems and their calibration — Testing of internal combustion engines — Control systems.
MP628	**CONTROL AND SAFETY EQUIPMENT IN AIR CONDITIONING SYSTEMS**
	Control theory and terminology — Types of control devices — Pneumatic — Electric —Electronic and fluidic — Flow control devices — Elementary control systems — Complete control systems — Electric control system — Supervisory control systems — Special control systems in air conditioning.

MP629	**CONTROL OF TURBO-MACHINES**
	Basic definitions of control systems — Mathematical representation design of physical systems — Transient response of control systems — Laplace transformation — Applications of mechanical and hydraulic governors in thermal systems — Types of controllers (Pneumatic — Hydraulic) — Frequency responses of control systems: (Bode plots — Polar plots —Nicholas chart) — System stability — Compensation techniques — Sensing and measuring elements — Constant speed control — Valves and valve elements — Control valves and components — Multiple orifices and types.
MP630	**COMBUSTION IN INDUSTRIAL FURNACES AND BOILERS**
	Combustion fundamentals — Fuel characteristics — Atomization of liquid fuel —Evaporation and combustion of fuel droplets — Characteristics of turbulent diffusion flames for liquid Gaseous and solid fuels — Characteristics of turbulent premixed frames —Mechanisms of pollutants formation during combustion — Flame and combustion requirements in industrial furnaces and boilers.
MP631	**CONTROL AND SAFETY EQUIPMENT IN REFRIGERATION SYSTEMS**
	Control theory and terminology — Type of control devices: Pneumatic, Electric, Electronic and fluidic — Flow control devices — Elementary control system — Complete control system — Electric control system — Supervisory control systems — Special control systems.
MP632	**REFRIGERATION AND AIR-CONDITIONING LOADS**
	Inside and outside operating conditions — Design conditions — Heat transmission — Solar radiation — Wall heat load. Air change load — Additional loads: (electrical motors, Lighting, People, product load, Sensible, Respiration and equipment selection). Introduction to thermal storage — Thermal release — Thermal capacity of structure and enclosures — Sensible and latent loads — Weather data — Outside and inside design conditions — Heat transmission coefficients — Cooling load temperature difference (CLTD) External loads: (Conduction from walls, Roofs and floors, solar irradiation from fenestration). Internal loads: Occupants, Machinery and equipment, Electric motors, Appliances, Lighting, Ventilation and infiltration air cooling load. Phsychrometric processes — Cooling loads for residential buildings.
MP633	**HEAT TRANSFER IN INDUSTRIAL FURNACES AND BOILERS**
	Fundamentals of heat transfer — Heat transfer from gaseous, Liquid and solid fuel flames —Heat transfer from flames in industrial furnaces — Heat transfer from flames and combustion products in fire tube and water tube boilers — Methods to control heat transfer rates —Thermal insulation of boilers and industrial furnaces.
MP635	**WATER TREATMENT**
	Chemical and physical composition of water — Methods to remove solid suspensions from water — Construction and performance of water filters — Requirements of boiler water —Methods to reduce dissolved solid salts in water — Control equipment for operation of water treatment plants — Internal treatment of boiler water — Selection of water treatment plants to suit type of boilers. Chemical and physical composition of water — Methods to remove solid suspensions from water — Construction and performance of water filters — Water storage — Water treatment pumps — Methods to reduce dissolved solid salts in water — Towers and gas extraction towers.
MP636	**NUCLEAR POWER STATIONS**
	Principles of nuclear energy — Nuclear fusion and fission — Radioactivity — Decay rate and half lives — Neutron flux and reaction rates — Pressurized water reactor power plant — The boiling water reactor power plant — The gas cooled reactor power plant — The high temperature gas cooled reactor power plant — The pebble bed reactors — The pressurized heavy water reactor the fast breeder reactors power plants — The liquid metal fast breeder reactors — Cladding and structural materials — Shielding materials — Disposal of nuclear waste.
MP637	**THEORY AND SYSTEMS OF FUEL INJECTION**
	Introduction — Classification — Methods of fuel injection — Requirements of the injection system — Theory and methods,of calculations of the injection system — Determination of the effect of the different parameters on the injection characteristics and fuel atomization —Methods of calculations of the main dimensions of the fuel injection system — Evaluation and development of the injection system- Reverse

	method of calculation of the fuel system.
MP638	**FUEL ECONO MY**
	Basic requirements for fuel — Basic components of vehicle fuel consumption — Effect of engine design — Transmission ratio — External resistance forces on the fuel consumption —Methods of reducing fuel consumption engine specific fuel consumption maps — Impact of the driving behavior on fuel consumption — Vehicle economical speed. Driver's alarming systems for economical fuel driving.
MP639	**MULTI-PHASE FLOW**
	Fundamentals of phase equilibrium of single materials and mixtures. Basics of dynamic equilibrium and equations for bubble growth dynamics — Momentum and viscosity effects. Two phase flow regimes (gas-liquid) — Models for void fraction and pressure drop calculations. Boiling modes.
MP640	**UNSTEADY FLOW OF FLUIDS**
	Incompressible fluids: (Pipe networks, Water, Method of characteristics, Mathematical solution, Other methods of solution, Water hammer in pumping stations, Resource in pumps — Water hammer in turbines, Reciprocating pumps, Column separation and interrupted air, Methods of controlling transients, Oil pipeline transients, Computer programming aids). Compressible fluids: (Fundamental mathematics, Solution by patterns, Flow in steady cross-section channels and other applications).
MP641	**JET PROPULSION**
	Introduction and classification — Basic gas turbine cycles — Actual gas turbine cycles —Performance of air compressors — Performance of turbines — Matching between compressors, Turbines and combustion chamber — Combustion and chemical equilibrium —Flow in nozzles — Liquid and solid propellants — Jet propulsion units — Performance of liquid and solid propellant rockets.
MP642	**TURBULENT FLOW**
	The nature of turbulence — Methods of analysis — Diffusivity of turbulence — Length scales in turbulent flows — Measurement of turbulence — The hot wire anemometer — The laser doppler anemometer — The equations of motion — Time averaging of the conservation equations — Turbulent shear stress models of turbulence.
MP643	**ADVANCED THERMODYNAMIC**
	Basics of thermodynamics — Isentropic flow waves — Adiabatic flow — Flow with friction—Thermodynamics of turbo-machines.
MP644	**WATER DESALINATION**
	Need to desalination — Properties of water and aqueous solutions — Engineering and economic considerations — Methods of desalination — Problems common to distillation —Multiple effect distillation — Multiple stage flash distillation — Vapor compression distillation — Combined distillation plants — Distillation with non-fuel energy sources —Ion exchange — Electro-dialysis — Reverse osmosis — Design of desalination plants.
MP645	**BOUNDARY LAYER THEORY**
	Fundamental laws of motion for a viscous fluid — The boundary layer concept — Derivation of Navier-Stokes equations — Very slow motion — Laminar boundary layers — Exact solutions of the steady state boundary layer equations — Approximate methods for the solution — Thermal boundary layers in laminar flows — Laminar boundary in compressible flows — Turbulent boundary layers
MP646	**ADVANCED ENERGY MEASUREMENTS**
	Basic concepts of measurements — Problem analysis — Basic characteristics of measuring devices — Calibration sensors and transducers — Basic requirements of transducers —Performance characteristics of instrumentation system — Zero order system — First

	order system — Second order system — Specifications and testing of dynamic response — Prisms measurements and calibration — Flow measurements and calibration temperature measurements and calibration — Data acquisition and conversion — Input and output devices and displays. Laser applications for measurements of fluid flow velocity — Concentration of combustion products — Temperature and soot concentration — Chromatographic chemical analysis of gaseous mixtures — Measurements of flow velocity with hot wire anemometer — Data acquisition systems — High speed cameras.
MP650	**CONTROL OF INDUSTRIAL PROCESSES**
	Introduction and basic definition — Advanced process dynamics — Industrial controllers (Design — tuning — Maintenance) — Optimum controllers and tuning — Final control elements: (Servo-motors — Valves — Design — Choice and maintenance) — Identification of control systems and processes in open loop and closed loop — Introduction to nonlinear control systems (Relay control systems — Harmonic linear) — Introduction to stochastic control.
MP651	**CONTROL IN COOLING AND AIR-CONDITIONING EQUIPMENT**
	Introduction to microcomputers — Basic language — Numerical analysis and programming Applications in refrigeration and freezing: (Heat load calculation, Refrigeration and freezing systems in cooling and freezing and air conditioning equipment).
MP653	**CONTROL IN MISSILES AND AIRPLANES**
	Introduction and definition — Different types of coordinate systems needed in deriving equations of motion — Equations of motion of flying bodies (rigid and flexible) — Types of gyroscopic systems as sensing elements and their mathematical models — Auto-pilots in ballistic missiles and airplanes — Trajectory calculations in control system dynamics and its relation to the earth navigation stations — The digital control systems in ballistic missiles and airplanes — Data acquisition — Monitoring and control equipment in flying objects.
MP654	**AUTOMATIC CONTROL IN ENGINES**
	Automatic control systems — Classification of control systems — Block diagram — Engine steady state conditions — Engine unsteady state conditions — Engine differential equations — Engine as a plant controlled in crankshaft rotational speed — Engine as a plant controlled in cooling water (air) temperature — Selection of control method — Direct acting governors Indirect governors — Electronic governors — Dynamic proporties of governors and their components — Stability of automatic control systems.
MP655	**PERFORMANCE OF INTERNAL COMBUSTION ENGINES**
	Introduction to supercharging — Supercharger types and efficiency — Matching superchargers (mechanically driven, Utilization of exhaust gas energy, Matching turbochargers, Pulse converters, Two stage — Elementary methods — Quasi steady methods — The gas exchange process turbo-charging — Pressure exchangers) —Turbo-charging of petrol engine — Analytical matching and performance prediction method — Filling and emptying method — transient response models.
MP656	**TRANSIENT COMBUSTION**
	Mathematical models of droplet vaporization — Fuel atomizers — The simple chemically reacting system model (SCRS) — Droplet combustion — Survey of kinetically Influenced phenomena Introduction to chemical kinetics — Reaction rate formula — Spontaneous ignition model — Laminar flame propagation — Mathematical model for spark ignition.
MP660	**TRANSIENT HEAT TRANSFER**
	Differential equation of heat conduction — Steady state heat conduction in two and three dimensions: (Analytical and numerical methods). Fins with variable cross section. Transient heat conduction in one and multi

	dimensions for sudden change of surface temperature or surrounding heat transfer in fluid — Solution by analytical and heisler charts methods — Systems of negligible thermal resistance — Thermal radiation: (Properties, Shape factor, Radiation exchange among nonblock surfaces, Radiation from flan~es and gases, Radiation exchange with transmitting, Reflecting and absorbing media, Radiation heat transfer coefficient).
MP662	**REVERSE ENGINEERING APPLICATIONS**
	Methods of product inspection — History of product in operation — Deduction of the product function — Determination of control dimensions, Functional, Usage, Mounting and c.e. —Testing of materials according to standard techniques and materials standards Preparation of design documents in view of available capabilities testing — Techniques for the final products.

Postgraduate Courses for Automotive and Tractors Engineering

Department: Automotive & Tractors Engineering
Master Degree Courses (Level 500)

Specialization:

No	Code no.	Course title	Credit hours	Pre-requisite
1	AT500	Theory of Automobiles (1)	3	-
2	AT501	Automotive fault diagnosis	3	-
3	AT502	Service station planning	3	-
4	AT503	Friction, lubrication and wear	3	-
5	AT504	Sensors and Data Acquisitions	3	-
6	AT505	Brake Systems	3	-
7	AT506	Vehicle Dynamic (1)	3	-
8	AT507	Vehicle Design(1)	3	-
9	AT508	Industrial safety	3	-
10	AT509	Traction and soil mechanics	3	-
11	AT510	Vehicle Assistance Systems	3	-
12	AT511	Fuel injection theory	3	-
13	AT512	Cutting and grading soil equipment	3	AT509
14	AT513	Operations research methods and	3	-
15	AT514	Breaker (crusher) and mixing	3	-
16	AT515	Tests and calibrations	3	AT504
17	AT516	Engineering Economy	3	-
18	AT517	Operation cost analysis	3	-
19	AT518	Project (1)	3	-
20	AT519	Injection system diagnosis	3	AT511
21	AT520	Electrical vehicles theories	3	-
22	AT521	Productivity and operating	3	-
23	AT522	Engineering management for	3	AT517
24	AT523	Pneumatic and Hydraulic Systems	3	-
25	AT524	Heavy equipment engineering	3	AT509-AT523

N.B.

3) From the present table, the academic supervisor assigns courses with total credit hours of 12 cr. Hr.
4) Supervisor may include among the student study program, courses from other specializations.
3) Other courses may be included according to the recommendation of the department committee and the agreement of the collage committee.

Department: Automotive & Tractors Engineering
Master Degree & Ph.D. Supplementary Courses (Level 600)

Specialization:

No	Code no.	Course title	Credit hours	Pre-requisite
1	AT625	Theory of Automobiles(2)	3	AT500
2	AT626	Vehicle Control	3	-
3	AT627	General quality	3	-
4	AT628	Maintenance and replacement	3	-
5	AT629	Vehicle Aerodynamics	3	AT500
6	AT630	Pneumatic and Hydraulic Control	3	AT523
7	AT631	Service station planning	3	-
8	AT632	Lifting and handling equipment	3	AT523
9	AT633	Suspension systems	3	-
10	AT634	Loading and unloading equipment	3	AT523
11	AT635	Transportation engineering	3	-
12	AT636	Mechatronics	3	AT626
13	AT637		3	AT517
14	AT638	Self Driving and Assist System	3	-
15	AT639	Organization and management of	3	-
16	AT640	Design of composite material	3	AT508
17	AT641	Vehicle with Air Bags	3	AT500
18	AT642	Composite material manufacturing	3	AT640
19	AT643	Agricultural tractors engineering	3	AT509
20	AT644	Performance and productivity of	3	AT509
21	AT645	Failure Analysis	3	AT503-AT506
22	AT646	Hybrid vehicle performance	3	AT520
23	AT647	Transimision Systems	3	-
24	AT648	Control of the vehicle pneumatic	3	AT630
25	AT649	Technical specification and offers	3	AT516

N.B.

1) From the present table, the academic supervisor assigns courses with total credit hours of 18 cr. hr. for students of First Stage of Master Degree., 12 cr. hr for students of M.Eng., 18 cr. hr. for students of Ph.D.
2) Supervisor may include among the student study program, courses from other specializations.
3) Other courses may be included according to the recommendation of the department committee and the agreement of the collage committee.

Department: Automotive & Tractors Engineering
Master Degree & Ph.D. Supplementary Courses (Level 600)

Specialization:

No	Code no.	Course title	Credit hours	Pre-requisite
26	AT650	Project (2)	3	AT518
27	AT651	Stability and steerability of vehicle	3	AT500
28	AT652	Advanced engineering maintenance	3	AT628
29	AT653	researshes discussion (oral)	3	-
30	AT654	Advanced transportation engineering	3	AT635
31	AT655	Computer Applications in Transportation	3	AT635
32	AT656	Measurements and advances measurements system	3	AT504
33	AT657	Experimental design	3	-
34	AT658	Maintenance management	3	AT628
35	AT659	Non linear system	3	-
36	AT660	Vehicle and Community Pollution	3	-
37	AT661	Vehicle dynamic (2)	3	AT506
38	AT662	Traffic control, comfortable and safety devices	3	AT626
39	AT663	Vehicle Design (2)	3	AT507
40	AT664	Electronic circuits at vehicles	3	-
41	AT665	Computers applications	3	AT503-AT506
42	AT666	Computerized Maintenance	3	AT628
43	AT667	Application of the Reverse Engineering	3	AT508

N.B.

1) From the present table, the academic supervisor assigns courses with total credit hours of 18 cr. hr. for students of First Stage of Master Degree., 12 cr. hr for students of M.Eng., 18 cr. hr. for students of Ph.D.
2) Supervisor may include among the student study program, courses from other specializations.
3) Other courses may be included according to the recommendation of the department committee and the agreement of the collage committee.

Courses Syllabus

Postgraduate Courses Syllabus
for Automotive & Tractors Engineering Department
Level 500

AT500	**Theory of Automobiles (1)**
	Mechanics of pneumatic tires; parameters affecting rolling resistance, parameters affecting tractive effort of tires, longitudinal and lateral tire slip. Performance of curved motion vehicle. Handling characteristics of road vehicles; steering theory, steady-state handling.
AT501	**Automotive diagnosis**
	Introduction of diagnosis strategies-automotive diagnosis system-equipment & devices of automotive diagnosis- diagnosis systems- data base systems- design of diagnosis maps- diagnosis system programming.
AT502	**Service station planning**
	Productivity and human behavior-job orders design-analysis of work methods-work measurements- organization steps-price planning- station planning- analysis and evaluation of workshops.
AT503	**Friction, lubrication and wear**
	Friction types- Betrouf law- hydrodynamic lubricating theory-bearing design consideration- performance of positive lubrication bearing- the friction of internal combustion engines parts- requirements of lubrication oils-lubrication systems at engines-greases seals.
AT504	**Sensors and Data Acquisitions**
	Variable resistance sensors-carbon resistance strain wire isolation sensors-variable inductive sensors-differential inductive sensors-differentials transformer sensors- variable capacity sensors-piezo electric sensors-electromagnetic sensors-light intensity sensors- variable light connectivity sensors- variable light resistance sensors- variable current due to light sensors-thermostat sensors- variable connection state due to heat sensors-thermo coupling-ion sensors-another sensors-inductive sensors-surrounding sensors-ultra sound wave sensors- Data Acquisitions.
AT505	**Brake Systems**
	Introduction to brake systems – Effect of vehicle brake systems on vehicle stability and safety during braking- Electronically controlled brakes systems – Using controllable brake systems to increase the vehicle stability and safety during driving – Modeling of vehicle dynamics using conventional and electronically controlled brake systems.
AT506	**Vehicle Dynamic (1)**
	Introduction – Human comfort standard regarding to vertical and horizontal vibration levels–Types of conventional and electronically controlled suspension systems – Modeling of vehicle ride dynamics based on two degrees of freedom vibration model – Modeling of road surface and any vibration source in vehicles – Modeling of vehicle driveline torsional vibration.
AT507	**Vehicle Design(1)**
	The power unit - the power unit environment- electric propulsion- vehicle suspension and ride- vehicle steering/handling- wheel, brake and trailer design- drive axles and drive line- transmission gearbox- off-road propulsion.

AT508	**Industrial safety**
	Introduction- protection working laws- industrial environment-health dangerous and protection methods- industrial light-industrial vibration-industrial noise- exhibit electrical accidents-pressure vessel safety-safety requirements of equipments and industrial process- protection against fire-health requirements in industrial builds.
AT509	**Traction and soil mechanics**
	Introduction to terra-mechanics – characterization of soils – basic soil behavior– kinematics of wheel and track– stress distribution in the terrain under tyre and track loads– performance of tyre and track on terrain– vehicles mobility parameters– prediction methods of the off-road vehicles– evaluation of the off-road vehicles.
AT510	**Vehicle Assistance Systems**
	Hydraulic steering systems-electrical steering system-hydraulic brake system-air brake systems.
AT511	**Fuel injection theory**
	Introduction– fuel systems classification– fuel injection methods– fuel injection systems requirements– theory and calculation method of fuel systems– hydrodynamic method – injection systems with and without delivery tube– the most important parameters affecting injection system performance and fuel atomization– calculation methods for fuel injection system dimensions– opposite method to calculate fuel injection system.
AT512	**Cutting and grading soil equipment**
	The tyre and track contact with soil- equilibrium and equations of motion of earthmoving equipment- equipment performance curves- cutting and soil moving theory- performance and productivity of different cutting and compacting soil equipment (bulldozer-scraper-grader).
AT513	**Operations research methods and decision support**
	Linear program formulation and solutions- duality and sensitivity analysis– transportation model– networks– integer program – dynamic program.
ATA614	**Breaker (crusher) and mixing equipment**
	Crushers types – work methods – ability and productivity – the effective force at breaker system – productivity performance of surface and decentralized sieves – washer equipment productivity – performance and productivity of mixers with knifes, millers, cylindrical flipping equipments and notable blades.
AT515	**Tests and calibrations**
	Measurement's error- error treatment- operation and calibration of (chassis dynamometers- engine dynamometers- brake testers- exhaust gas analyzer) – Measurements of pressure,

	temperature, flow rate, displacement, velocity, acceleration, strain, force, torque- calibration.
AT516	**Engineering Economy**
	Principles of engineering economy- cost estimation of automotive projects; cost terminology, balance sheet, profits and loss, applications on petrol stations, applications on automotive work shops- application of money; time relationships, present value, internal rate of return, external rate of return, payback period- depreciation method- replacement analysis-economy studies of engineering projects.
AT517	**Operation cost analysis**
	Operation vehicle cost: background –theory– cost elements – fuel and oil cost– fuel consumption model– fuel consumption rate for pass anger, light track, buses and trucks– tyre cost – tyre cost data– tyre cost rate– tyre consumption for passenger, light trucks, buses and trucks – maintenance cost – data collection – statistically– analysis– spare parts cost– total vehicle cost – transportation cost.
AT518	**Project (1)**
	Separate study for each student to write dense article – theoretical and or experimental analysis in related topics.
AT519	**Injection system diagnosis**
	Introduction- different parts wear-up- abnormal increase temperature- leakage- no-pass clearance between different parts- hydraulic properties of different parts- evaluation of piston and injectors performance- technical service- trouble diagnosis and equipment- repair and adjustment methods- tests and measurements.
AT520	**Electrical vehicles theories**
	Introduction- advantages disadvantages of electrical vehicles- types of electrical vehicles- electrical vehicles motors- alternator & direct current motor- electrical vehicles speed control- types of batteries- safety & protection of electric impact- electrical vehicles using.
AT521	**Productivity and operating management**
	Work environment– vehicle productivity and work analysis – operations planning– performance development– expected transportation.
AT522	**Engineering management for industrial projects**
	Concept of management for industrial projects- elements of management; production strategy, marketing study, strategy of products price- planning; planning responsibility, planning

	parameters, long planning strategy, short planning strategy, application and practical cases- leadership; definition, leadership theory, practical application- supervision; definition, supervision requirement, requirement for efficient supervision, practical application-decision making; definition and types of decisions, decision steps, argent decision, practical application.
AT523	**Pneumatic and Hydraulic Systems**
	Fixed and variable displacement pumps– pumps control systems– hydraulic motors– hydrostatic transmission– components of pneumatic systems– types and performance of compressors– design of pneumatic system in vehicles and machines– performance of pneumatic motors.
AT524	**Heavy equipment engineering**
	Engines for heavy mobile equipment– terrain materials and characteristics– types of heavy equipment– soil cutting forces – soil resistance of heavy equipment motion– operating cycle of heavy mobile equipment– hydraulic systems of heavy equipment– heavy equipment control.
AT525	**Theory of Automobiles (2)**
	Stable braking performance of vehicle; front wheels slip, rear wheels slip, middle axle wheels slip for three axle vehicle, antilock braking system, traction control system; two axle vehicles, tractor semi-trailer, Ride characteristics of vehicles; human response to vibration, tow-degree of freedom models, active and semi-active suspensions.

Postgraduate Courses Syllabus
for Automotive & Tractors Engineering Department
Level 600

AT626	**Vehicle Control**
	Introduction to automatic control theories – Electronic fuel injection for petrol and diesel engines - electronic ignition systems - valve train electronic control - engine cooling temperature control – vehicle driveline control - traction control (using engine control – driveline control) - electronic control of vehicle steering systems.
AT627	**General quality**
	introduction – aim – purpose – using – registration of system quality – product quality planning – ISO 9000 – main requirements – specially requirements for production type – continuous development – manufacturing possibility – examples as specially requirements for consumer – design and development method – production and actualization method – feed back correction method – control methods of plan.
AT628	**Maintenance and replacement**
	maintenance problems – maintenance control – mathematical model – statistical principles – immediately values – replacement decisions – overhaul and repair decisions – organization structural decision – planning decisions.
AT629	**Vehicle Aerodynamics**
	Forces and moments due to aerodynamics –vehicle shape designs to reduce the aerodynamic effects – effect of aerodynamic forces and moments on the vehicle stability and safety – advanced designs to enhance the vehicle stability and safety against aerodynamics.
AT630	**Pneumatic and Hydraulic Control (1)**
	Introduction to pneumatic and hydraulic control– Pneumatic and hydraulic control units (pumps– compressors– motors – pressure and flow valves – directional control valves– accumulators) – principles of pneumatic control– design and analysis of pneumatic control systems– vehicles and tractors applications.
AT631	**Service station planning**
	Productivity and people behaviors– job orders– work methods analysis– work rate– organization steps –capacity planning – place planning– analysis and evaluation of work shop.
ATA632	**Lifting and handling equipment**

	Types of static lifters and dynamic lifters– the force acting upon equipment and it's components– preparation stability of lifter during working at location– productivity of belts and buckets.
ATA633	**Suspension systems**
	Introduction (vibration isolation vibration absorption classification of suspension system) Concepts of semi-active suspension systems- control design methodology- properties of semi- active suspension (Performance indexes)- Examples of practical applications (Passenger cars – road friendly trucks – trains – airplanes).
AT634	**Loading and unloading equipment**
	Pull and transportation of liquids– pull equipment – productivity – performance and types of tippers and loaders– loading equipment – belts and buckets.
AT635	**Transportation engineering**
	Relation between transportation and national economic – Lieontief table (input-output analysis)– transport matrices– trip characteristics and generation- commercial engineering planning for transportation– factors affecting methods to choose different types of transportation. – transportation cost– public.
AT636	**Mechatronics**
	Active suspension systems- Anti-lock braking systems- Traction control- Four-wheel steering control- Electronic stability systems.
AT637	**Replacement models**
	Introduction– replacement of items that deteriorate with time – replacement of items that fail suddenly and completely– application of network analysis in replacement problems– replacement and maintenance.
AT638	**Self Driving and Assist System**
	Vehicle ideal driving performance– modeling of self driving and assist systems – automatic driving work at vehicles – sensing devices – self driving devices.
AT639	**Organization and management of storage**
	Storage type – constant order system – constant period system – speed fixation models – storage planning – storage planning – material management – purchase.
AT640	**Design of composite material**
	properties of material at one and two dimension – strain and stress – maximum strain theory – change relation between diff

	properties micro mechanics – similar slices – strain and bending relations – failure theory – some components – channels – long cylindrical tubes – columns – thermal stress – determine dimension due to stiffness methods.
AT641	**Vehicle with Air Bags**
	introduction – supply air bags – different theory – basic component to air bags – different applications for air bags – transportation exterior runways – evaluation of vehicles with airbags – body building – lift system – push system and control system – performance of trucks with air bags – security and safety.
ATA642	**Composite material manufacturing**
	Methods of composite material manufacturing– manual methods – average quantity method– big quantity method– continuous method– default during manufacturing.
ATA643	**Agricultural tractors engineering**
	Engines for agricultural tractors– terrain materials and characteristics – types of agricultural tractors– kinematics' of wheel and track – stress distribution in the terrain under tyre and track loads – performance of tyre and track on terrain – stability of agricultural tractors – hydraulic systems of agricultural tractors – performance tests of agricultural tractors.
AT644	**Performance and productivity of heavy equipment**
	Engines for heavy mobile equipment– terrain materials and characteristics– types of heavy equipment– soil cutting forces – soil resistance of heavy equipment motion– operating cycle of heavy mobile equipment– hydraulic systems of heavy equipment.
AT645	**Failure Analysis**
	Operational failures – Tribological failures – Thermal failure — Rust and corrosion -Fatigue and creep - Design against failure – Failure diagnoses.
AT646	**Hybrid vehicle performance**
	Hybrid vehicles definitions-difference between hybrid vehicles and electrical vehicles-types of hybrid vehicle- parallel hybrid vehicle-series hybrid vehicle- hybrid vehicle engines (internal combustion engines [petrol & diesel] electrical motor[alternator and direct current])- hybrid vehicle control- hybrid vehicle and pollution.
AT647	**Transmissions Systems**
	Gears Design and Calculations:(types of gears, gearing geometry, design and stress analysis)- Design and Performance Parameters of Hydraulic Types (internal gear pumps, operating line pressure, control valves, pressure regulating

	valves, solenoid valves, shifting hydraulic circuits)- Design and Performance Parameters of Torque Converters- Electronic and Steptronic Transmission Types (hydraulic sensors, electronic sensors, actuators, control units, system failure analysis).
AT648	**Control of the vehicle pneumatic and hydraulic systems**
	Elements of hydraulic and pneumatic circuits - hydraulic steering and braking systems - pneumatic braking systems – hydraulic clutch – hydraulic left and crane – hydraulic and pneumatic pumps, motors (actuators) and valves - prognostic and control systems of hydraulic and pneumatic circuits' performance.
AT649	**Technical specification and offers evaluation**
	Introduction– general vehicle specification– vehicle using and cost strategies– cost of vehicle life time– specification of passenger, light trucks and heavy duty– specification field to improving diesel engines– performance of clutches and fans with viscous rotation.
ATA650	**Project (2)**
	Separate study for each student to write dense article – theoretical and or experimental analysis in related topics
ATA651	**Stability and steerability of vehicle**
	Vehicle lateral stability characteristics – Vehicle body lateral rolling – Effect of operating factors on vehicle lateral stability – Longitudinal stability – Vehicle steerability characteristics – Rolling of the steerable vehicle wheels without slipping – Wheel lateral slip and ability of a vehicle to turn – Relation between angles of turn of steerable vehicle wheels – Stabilization of the vehicle steerable wheels.
ATA652	**Advanced engineering maintenance**
	Engine, transmission and brake, etc… predictive maintenance programs under desired condition– repair programs– maintenance planning.
AT653	**researches discussion (oral)**
	Discussions of published research work in a certain related topic.
AT654	**Advanced transportation engineering**
	Definition of the transportation models– application on transportation models– solution of transportation problems – the assignment model– the transshipment model– network minimization – shortest route problem– maximal flow problem – linear program representation of networks.
AT655	**Computer Applications in Transportation**
	Advanced programming –Design of computer programs to solve conventional and advanced transportation problems – transportation computer packages.
AT656	**Measurements and advances measurements system**
	Linear measurement by using laser – measurement of shapes by lasers – system and stress measurement by laser –measurement computer by pictures inspection automatic.
AT657	**Experimental design**

	Basic definitions – variable parameters and determining values – accuracy of results – results statistically analysis – accuracy of measured values – the non correct values. Basic experimental – select method by random selection – calculation of the most parameter and the interference between them – design of selection plan – reduction of number of main experimental – analysis of laboratory experimental results – evaluation of deviation to experimental after determine the mathematical relations – determine the suitable values to requirement parameters – evaluation of experimental after determine values of variable parameter – discussion the results.
AT658	**Maintenance management**
	Right decision and failure analysis statistical – maintenance planning – organize maintenance supplied – quantity method to maintenance organization – spare parts storage – grid analysis for planning and control maintenance – condition maintenance – management method at maintenance.
AT659	**Non linear system**
	Different nonlinear models – exactly methods analysis nonlinear methods – harmonic method to convert into linear relations – random method - system with variable construct – perform and stability of nonlinear system.
AT660	**Vehicle and Community Pollution**
	Vehicle exhaust – Nitrogen oxide formation – Nitric oxide formation – Nitrogen dioxide in both SI and pressure engines – Carbon monoxide formation – Unburned hydrocarbon formation in both SI and pressure engines – Fine material formation in SI engine – Particles distribution in engine cylinder – Carbon layers and oxidation formation - Evaporation - Exhaust gases treatment – Noise – Exterior and Interior noises produced from vehicle elements (parts) – Vehicle noise treatment and control – Community noise pollution .
AT661	**Vehicle dynamic (2)**
	Characteristics of pneumatic tire stricture – The control and stability of two axle vehicle – The articulated semi-trailer vehicle – Vehicle suspension mechanics – The control and stability of a vehicle with freedom to roll – Simulation – Simulation of some vehicle model – Further vehicle models – Trailer train dynamic characteristics – Vehicle handling characteristics.
AT662	**Traffic control, comfortable and safety devices**
	Schedule and control systems – traffic systems – study the waiting and queues theory – control devices at traffic control sealed of traffic – optimal control at big traffic systems – automatic suspension system.
AT663	**Vehicle Design (2)**
	Vehicle configuration- vehicle interior design- aerodynamics vehicle-body trim and fittings- electrical/electronic controls- body-electronic-truck engineering. - structure design.
AT664	**Electronic circuits at vehicles**
	Introduction – description of components – analysis method of electronic circuit – digital circuits – logic transistor gates – mosfet logic gate –logic

	gate – follower logic gate – simulation of circuit by computer – similar circuits – amplifier for small signals – amplifier for big signals – feed back amplifier – digital and similar converter – power supply – power electronic circuits.
AT665	**Computers applications**
	MATLAB Program – Applications of Using MATLAB in simulating dynamic Systems (passive suspension systems, steering systems, brakes, engine mounts)- Applications of Using MATLAB in designing control laws of controlled systems (passive suspension systems, steering systems, brakes, engine mounts) - Programming with Simulink.
AT666	**Computerized Maintenance**
	Maintenance Software – Application on (Maintenance planning & Scheduling – Stock Control)- Reports Generation
AT667	**Application of the Reverse Engineering**
	Concepts of the reverse engineering processes-Two and three dimensional measuring devices -Component dimensioning and geometrical tolerances-Material analysis and selection-Heat treatment of components -Testing of automotive components including static and -dynamic fatigue tests-evaluation of components modifications if necessary -Two and three components-Evaluation of the mechanical dimensional drawing of vehicle characteristics and performance of the modified parts using the available software.

Postgraduate Courses for Mechanical Design Engineering

Department :Mechanical Design
Postgraduate Diploma & Master Degree Courses (Level 500)

Specialization:

No	Code no.	Course title	Credit hours	Contact hours		Pre-requisite
				Lect.	Tutorial or lab	
1	MD501	Technical language	3	2	2	
2	MD502	Numerical Methods	3	3	—	
3	MD503	Analytical Methods in Mechanical Engineering	3	3	—	
4	MD504	Calculus Methods	3	3	—	
5	MD505	Advanced Mechanics	3	3	—	
6	MD506	Analysis of Mechanisms and Design	3	3	—	
7	MD507	Mechanical Vibrations	3	2	2	MD518
8	MD508	System Dynamics	3	3	—	MD522
9	MD509	Rotor Dynamics	4	4	—	MD518
10	MD510	Advanced Machines Dynamics	3	3	—	MD518
11	MD511	Non-Linear Vibrations	4	4	—	MD518
12	MD512	Signal Analysis	4	3	2	MD502
13	MD513	Fault Diagnosis	4	3	2	MD527- MD522
14	MD514	Robotics	3	3	—	MD523
15	MD515	Control Technology	3	3	—	
16	MD516	Automatic Control	3	3	—	MD530
17	MD517	Design and Applications of Control Systems	3	3	—	
18	MD518	Applications of Mechanisms and Manipulators	3	3	—	
19	MD519	Theory of Measurements	4	3	2	
20	MD520	Finite Element Method	4	4	—	
21	MD521	Finite Elements Analysis	3	3	—	MD505
22	MD522	Engineering Drawing	3	3	—	
23	MD523	Computer Aided Graphics	3	3	—	MD507
24	MD524	Manufacture Technology	3	3	—	
25	MD525	Material Science	3	2	2	

N.B.

5) From the present table, the academic supervisor assigns courses with total credit hours of 12 cr. Hr.
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3) Other courses may be included according to the recommendation of the department committee and the agreement of the collage committee.

Department :Mechanical Design
Postgraduate Diploma & Master Degree Courses (Level 500)

Specialization:

No	Code no.	Course title	Credit hours	Contact hours		Pre-requisite
				Lect.	Tutorial or lab	
26	MD526	Stress Analysis	3	2	2	
27	MD527	Computer Dimension Measurements	4	4	—	
28	MD528	Mechanical Design	3	3	—	
29	MD529	Tribology	3	3	—	
30	MD530	Computer Aided Design CAD	3	3	—	MD536
31	MD531	Design of Internal Combustion Engine Elements	3	3	—	MD516
32	MD532	Pressure Vessels Design	4	4	—	
33	MD533	Optimal Design	4	4	—	MD536
34	MD534	Quality Control	4	4	—	
35	MD535	Ferrous and Non-Ferrous Metals	3	3	—	MD525
36	MD536	Composite Materials	4	4	—	MD525
37	MD537	Testing and Mechanical Properties of Material	3	2	2	MD525
38	MD538	Non destructive Testing	4	3	2	
39	MD539	Testing and Applications of Engineering Materials	4	4	—	MD525 – MD537
40	MD540	Elasticity and Plasticity	3	3	—	MD516 – MD513
41	MD541	Fracture Mechanics	3	3	—	MD525 – MD513
42	MD542	Mechanical Failure Analysis	4	4	—	MD513 – MD516
43	MD543	Project	4	—	8	MD501

N.B.

1) From the present table, the academic supervisor assigns courses with total credit hours of 12 cr. Hr.
2) Supervisor may include among the student study program, courses from other specializations.
3) Other courses may be included according to the recommendation of the department committee and the agreement of the collage committee.

Department: Mechanical Design
Master Degree & Ph.D. Supplementary Courses (Level 600)

No	Code no.	Course title	Credit hours	Pre-requisite
1	MD601	Advanced System Dynamics	3	MD602
2	MD602	Mechanical Vibrations & Applications	3	MD610
3	MD603	Analytical Methods in Mechanical Engineering	3	MD605
4	MD604	Engineering Tribology	3	MD607
5	MD605	Numerical Analysis	3	
6	MD606	Finite Element Method	3	
7	MD607	Material Science & Engineering	3	
8	MD608	Experimental & Numerical Analysis of Stress	3	MD605
9	MD609	Testing & Mechanical Properties of Engineering Materials	3	MD607
10	MD610	Advanced Dynamics of Machines	3	MD602
11	MD611	Advanced Mechanical Design	3	
12	MD612	Fracture Mechanics	3	MD609
13	MD613	Mechanics of Composite Materials	3	MD 607
14	MD614	Advanced Engineering Materials	3	MD 607
15	MD615	Applied Elasticity & Plasticity	3	
16	MD616	Design of Pressure Vessels & Piping	3	MD 611
17	MD617	Design of Internal Combustion Engines	3	MD 611
18	MD618	Selection & Applications of Engineering Materials	3	MD609, MD614
19	MD619	Signal analysis	3	
20	MD620	Quality Management	3	
21	MD621	Engineering Measurements	3	
22	MD622	Non Destructive Testing of Materials	3	MD607
23	MD623	Vibration of Non Linear Systems	3	MD602
24	MD624	Mechanisms & Manipulators Synthesis	3	
25	MD625	Robot Technology	3	MD610
26	MD626	Optimal Mechanical Design	3	MD611
27	MD627	Mechanical Failures Analysis	3	MD607, MD609
28	MD628	Fault Diagnosis	3	MD602, MD619
29	MD629	Automatic Control	3	MD601
30	MD630	Rotor Dynamics	3	MD610
31	MD631	Technical Language & Report Writing	3	
32	MD632	Project	3	MD631

N.B.

1) From the present table, the academic supervisor assigns courses with total credit hours of 18 cr. hr. for students of First Stage of Master Degree., 12 cr. hr for students of M.Eng., 18 cr. hr. for students of Ph.D.
2) Supervisor may include among the student study program, courses from other specializations.

3) Other courses may be included according to the recommendation of the department committee and the agreement of the collage committee.

Courses Syllabus

Postgraduate Courses Syllabus
for Mechanical Design Department
Level 500

MD501	**Technical Language**
	Language capability. Importance of reports. Types and requisites of technical reports. Report writing. Report writing using computer.
MD502	**Numerical Methods**
	Finite differences. Initial and boundary value problems with applications in mechanical engineering. Numerical integration and differentiation. Curve fitting. Solution of simultaneous differential equations. State space method.
MD503	**Analytical Methods in Mechanical Engineering**
	Linear algebra. Laplace transforms and applications to problems in mechanics and vibrations. Fourier analysis and boundary value problems with applications in vibration and solid mechanics.
MD504	**Calculations Methods**
	Computing techniques using computers for mechanical engineers. Roots of equations, simultaneous equations, differential, integration, regression analysis, interpolation and differential equations.
MD505	**Advanced Mechanics**
	Equilibrium and stability of rigid bodies. Rigid body motion using Newton"s laws and energy methods. Kinetics of mechanisms.
MD506	**Mechanisms Analysis and Design**
	Analysis of plane motion mechanisms, numerical and analytical solutions for some of the basic mechanisms, methods of calculating rolling and sliding velocities, and accelerations of contacting bodies, cams, and gear.
MD507	**Mechanical Vibrations**
	Multi-mass linear systems. Eigen value problem. Modal analysis. Beam vibration with classical boundary conditions. Applications to axial, lateral and torsional vibration of rods and shafts. Impedance data.
MD508	**System Dynamics**
	Modeling of mechanical, electrical, fluidic and thermal systems. Transfer function. Free and forced responses in time domain. Frequency domain analysis. Introduction to modern control. State space method. Stability criteria.
MD509	**Rotor Dynamics**
	Rotor balancing. Rigidity of bearings. Gyroscopic effects. Shaft vibrations and mode shapes.
MD510	**Advanced Machine Dynamics**
	Kinematics and kinetic analysis of closed loop linkages using vector and complex number methods. Design of cams. Analysis of dynamic loads. Rotor dynamics. Spatial mechanisms.
MD511	**Non-Linear Vibrations**
	Non-linear and random vibrations. Fourier transforms and frequency response functions. Use of software packages for computational techniques.
MD512	**Signal Analysis**
	Data acquisition and signal types. Fourier analysis. Random signals. Fast Fourier Transforms. Instruments characteristics.

MD513	**Fault Diagnosis**
	Types of faults. Instrumentation for fault detection an d monitoring. Methods of analyses and restoration. Performance efficiency and product service life.
MD514	**Robotics**
	Structure and specifications of robot manipulators. Homogeneous transformations. Spatial kinematics and kinetic equations and motion trajectories. Dynamic models of robotic manipulators; position and force control. Use of robots in industrial applications.
MD515	**Control Technology**
	Analysis and synthesis of feedback systems; functional description of dynamic systems; basic controllers; sensitivity, stability and error analysis; transient and steady-state response using computational techniques, state-space analysis systems.
MD516	**Automatic Control**
	Control systems. Basic elements in control systems. Responses in time domain. Vibration isolation.
MD517	**Design and Applications of Control Systems**
	Analysis, computer-aided design and implementation of practical control systems; introduction to state-space and digital control, data acquisition, system identification, analog-computing .
MD518	**Applications of Machines and Manipulators**
	Synthesis of planar and spatial mechanisms for function generation and rigid body guidance. Optimization based methods of synthesis. Manipulator joint layout synthesis for spatial positioning and orientation. Application to serial, parallel and hybrid configurations.
MD519	**Theory of Measurements**
	Performance characteristics of measuring instruments. Force and vibration measurements. Manipulation of measuring errors. Signal analysis. Constant and variable errors.
MD520	**Finite Element Method**
	Basics of finite element analysis. Development of discrete equations for planar and three-dimensional problems. Applications in structural analysis, stress analysis, vibrations, heat transfer and fluid flow. Use of FE software packages.
MD521	**Finite Element Analysis**
	Concepts of finite-element method, method of weighted residuals, interpolation functions, numerical implementation with software, applications to engineering problems.
MD522	**Engineering Drawing**
	Basics engineering drawing, including geometrical construction, orthographic projection, sectional views using AUTOCAD software.
MD523	**Computer Aided Graphics**
	Use of commercial drafting software packages for editing professional mechanical drawings. Codes and standards, fits and tolerances, surface finish symbols, and material specifications.
MD524	**Industrial Technology**
	Engineering technology disciplines, operations and processes. Metal cutting machines and tools. Metal work. Casting and forging.

MD525	**Material Science**
	Structure of metals, physical and mechanical properties. Ceramics and polymers, Phase diagrams. Heat treatments, alloying, diffusion, microstructure studies, environmental effects. Corrosion and wear.
MD526	**Stress Analysis**
	Stress and strain tensors. Failure theories. Curved beams. Buckling. Plates and shells. Dynamic stresses. Impact loads. Visco-elastic materials. Functionally graded materials.
MD527	**Computer Dimension Measurements**
	Accuracy in fits and tolerances. Specifications of dimensions. Technology and software for drafting and specifications of a product.
MD528	**Mechanical Design**
	Design of mechanical elements such as screws, fasteners, welded joints, shafts, couplings and springs. Design of spur, helical, worm, and bevel gears. Antifriction bearings, lubrication and journal bearings.
MD529	**Tribology**
	Surface quality and characterization. Friction and wear mechanisms. Hertzian analysis. Theory of hydrodynamic lubrication. Boundary and mixed lubrication modes. Hydrostatic bearings. Elasto-hydrodynamic lubrication. Lubricants and additives.
MD530	**Computer Aided Design CAD**
	Basic elements of CAD and relevance to current industrial practice. 3-D models geometry. Methods for curve and surface fitting. Input and output devices for computer graphics. Graphical programming languages. Development of interactive 3-D computer graphics.
MD531	**Design of Internal Combustion Engine Elements**
	Types and characteristics of internal combustion engines. Dynamic and thermal loads on engine elements. Dynamics of crank shaft. Balancing of reciprocating elements. Fits and tolerances of different assemblies. Cooling and lubrication systems.
MD532	**Pressure Vessels Design**
	Stresses in thin and thick wall cylinders and tanks. Thermal stresses. Plates and shells. Welding techniques, specifications and codes. Flow in pipes. Valve designs. Flow and pressure control and measurement devices.
MD533	**Optimal Design**
	One dimensional optimization techniques. Polynomial approximation, and multiple variable optimization techniques. Constrained optimization. Introduction to linear programming. Applications in mechanical design.
MD534	**Quality Control**
	Technical evaluation of products. Control of material types for accurate fits. Tolerances. Surface finish. Production defects.
MD535	**Metals and Non-Metals**
	Materials Classifications. Phase diagrams. The iron-carbon phase diagrams. Nucleation and growth of micro structural constituents. Time-temperature-transformation (TTT) curves. Effect of heat treatments on properties. Structural, high strength and specialty steels.
MD536	**Composite Materials**
	Constituents and interfacial bonding. Manufacturing techniques.

	Microstructure and micro-mechanics. Theory of anisotropy. Classical laminate theory. Material characterization, failure and damage. Composite structure design and applications.
MD537	**Testing and Mechanical Properties of Material**
	Standard testing. Mechanical and electrical properties of materials. Methods for improvement of metals and polymers properties. Recent materials.
MD538	**Non destructive Testing**
	Type of material testing. Instruments for testing and calibration. Nondestructive test types and requirements. Accuracy of instruments.
MD539	**Testing and Applications of Engineering Materials**
	Physical and mechanical properties of materials. Standard specifications of materials. Prevention of oxidation and corrosion. Environmental effects.
MD540	**Elasticity and Plasticity**
	Elastic constitutive relations for isotropic and anisotropic materials. Application to torsion, flexure, and generalized plane stress problems. Solution of two and three-dimensional problems in terms of displacement potentials and stress functions. Theories of plasticity: Elastic-plastic work-hardening.
MD541	**Fracture Mechanics**
	Linear elastic and elasto-plastic fracture mechanics. Classical fatigue analysis. Crack propagation. Reliability, durability and damage tolerance analysis. Industrial significant applications.
MD542	**Mechanical Failure Analysis**
	Modes and theories of failure in mechanical components. Buckling. Deflection of beams, plates and shells under static and dynamic loads. Non-destructive evaluation. Legal and economic aspects of materials failure.
MD543	**Project**

Postgraduate Courses Syllabus
for Mechanical Design Department
Level 600

MD601	***Advanced System Dynamics***
	Modeling of mechanical, electrical, fluidic and thermal systems. Transfer function. Solution of initial value problems using Laplace transforms and numerical methods. Free and forced responses in time domain. Frequency domain analysis. Introduction to modern control.
MD602	**Mechanical Vibrations and Applications**
	Multi-mass linear systems. Eigen value problem. Modal analysis. Continuous systems. Beam vibrations with classical boundary conditions. Transfer matrix method for lumped parameter systems. Applications to axial, lateral and torsional vibrations of rods and shafts. Impedance data. Signal analysis.
MD603	**Analytical Methods in Mechanical Engineering**
	Linear algebra. Multi-valued complex functions. Laplace transformations and applications to problems in mechanics and vibrations. Fourier analysis and boundary value problems with applications in vibrations and solid mechanics. Introduction to calculus of variations.
MD604	**Engineering Tribology**
	Surface quality and characterization. Wear resisting materials. Fiction materials. Surface coating. Lubricants. Applications on tribological components.
MD605	**Numerical analysis**
	Finite differences. Initial and boundary value problems with applications in structures, vibrations, hydrodynamic bearings, steady and transient heat transfer. Numerical integration and differentiation. Curve fitting. Solution of simultaneous differential equations.
MD606	**Finite Element Method**
	Basics of finite element analysis. Development of discrete equations for planar and three-dimensional problems. Applications in structure analysis, stress analysis and vibrations. Use of FEM software package.
MD607	**Material Science and Engineering**
	Microscopic structure of materials. Properties of materials. Relation between structure and properties and behavior of materials. Effect of environmental conditions on properties of materials. Examples of some engineering materials (metals, polymers, ceramics, composites and other advanced materials).
MD608	**Experimental and Numerical Stress Analysis**
	Stress and strain tensors. Basics of elasticity and plasticity. Experimental methods for stresses and strains measurements. Introduction to finite elements method. Engineering applications.

MD609	**Testing and Mechanical Properties of Engineering Materials**
	Types of mechanical testing (destructive and non-destructive). Standard specifications of material properties and testing. Material properties of different materials (metals, polymers, ceramics, composites, ...etc). Method of improving the properties of metals.
MD610	**Advanced Dynamics of Machines**
	Linkage synthesis. Kinematics and kinetic analysis of closed loop linkage using vector and complex number methods. Follower motion synthesis of cams. Gyroscopic action analysis of dynamic loads. Spatial mechanisms.
MD611	**Advanced Mechanical Design**
	Basic elements of CAD. Use of commercial drafting software package in machines components design. Engineering applications (shafts, gears, springs, ... etc).
MD612	**Fracture Mechanics**
	Basics of linear elastic and elasto-plastic fracture mechanics. Crack propagation. Classification of types of failure. Method of determination of fracture toughness. Safe design against failure.
MD613	**Mechanics of Composite Materials**
	Constituents and interfacial bonding. Manufacturing techniques. Material characterization. Design with composite materials. Engineering applications.
MD614	**Advanced Engineering Materials**
	Metallic materials, ferrous and non-ferrous alloys (composition, properties, heat treatment). Polymeric materials. Ceramic materials. Composite materials. Intelligent materials. Engineering applications.
MD615	**Applied Elasticity and Plasticity**
	States of stress and strain. Elastic constitutive relations. Stress function. Theory of plasticity. Yield, flow and elastic-plastic work-hardening rules. Engineering applications.
MD616	**Pressure Vessels and Piping Design**
	Stresses in thin and thick walled cylinders and tanks. Thermal stress. Plates and shells. Welding techniques, specifications and codes. Flow in pipes. Valve designs. Flow and pressure control and measurement devices.
MD617	**Design of Internal Combustion Engine**
	Types and characteristics of internal combustion engines. Dynamic and thermal loads on engine elements. Dynamics of crankshafts. Balancing of reciprocating elements. Fits and tolerances of different assemblies. Cooling and lubricating systems.
MD618	**Selection and Applications of Engineering Materials**
	Types and properties of engineering materials. Standard and specifications of materials. Criteria affecting the selection. Methods of materials selection for engineering applications.

MD619	**Signal Analysis**
	Collection of data. Types of signals. Fourier analysis. Random signals. Measuring equipments.
MD620	**Quality Management**
	Technical inspection of product. Standardization and interchangeability. Quality control and dimensional accuracy.
MD621	**Engineering Measurements**
	Characteristics and functions of measuring equipments. Measurement of vibrations and forces. Correction of measuring errors. Stable and varying errors. Signals analysis.
MD622	**Non-Destructive Testing of Materials**
	Types of engineering tests. non-Destructive testing of materials (ultrasonic waves, X-rays, □-rays, magnetic methods, photo-elasticity,...etc).
MD623	**Vibration of Non-Linear Systems**
	Non-linear vibrations. Random vibrations. Fourier transformations and frequency response functions. Limit cycles. Use of software packages for computational techniques.
MB624	**Mechanisms and Manipulators Synthesis**
	Synthesis of planar and spatial mechanisms for function generation and rigid body guidance. Analytical optimization. Methods of synthesis. Manipulator joint layout synthesis for spatial positioning and orientation. Application to serial, parallel and hybrid configurations.
MD625	**Robotics Technology**
	Specifications and applications of robot. General structure and function of robotic systems. Measurement systems. Systems of control and programming of robots. Introduction to robotic modeling.
MD626	**Optimal Mechanical Design**
	One-dimensional optimization techniques. Polynomial approximation and derivations. Multiple variable optimizations. Introduction to linear programming. Applications of optimization in mechanical design.
MD627	**Mechanical Failures Analysis**
	Modes of failures. Theories of failure. Methods of failures control. Mechanical failure analysis. Failures cases of study.
MD628	**Fault Diagnosis**
	Types of faults. Fault measuring equipments. Methods of analysis. Management efficiency and life of product.
MD629	**Automatic Control**
	Classification of control systems. Basic components of control systems. Response of mechanical systems in time domain. Isolation of mechanical vibrations.
MD630	**Rotor Dynamics**
	Equilibrium of rotors. Rigidity of bearings. Gyroscopic action. Vibrations of rods and shafts.

MD631	**Technical Language and Report Writing**
	Importance of reports. Types and requirements of technical reports. Report

	writing. Skill requirement in technical language. Methods of reports arrangement. Use of computer in report writing.
MD632	**Project**

Postgraduate Courses for Archtecture Engineering

Department of Architecture
Courses for Higher Studies Diploma and Master Degree (level 500)

No	Code no.	Course title	Credit hours	Contact hours		Pre-requisite
				Lect.	Tutorial or lab	
1	AR 501	Architectural Design Principles	3	3		
2	AR 502	Architectural Movements and Schools of Thought	3	3		
3	AR 503	Form and Composition in Architectural Design	3	3		
4	AR 504	Architectural Research	3	3		
5	AR 505	Computer Applications	3	3		
6	AR 506	Contemporary Egyptian Architecture	3	3		
7	AR 507	Architectural Projects	3	3		
8	AR 508	History and Theory of Architectural Philosophy	3	3		
9	AR 509	Theory and Philosophy of Aesthetics	3	3		
10	AR 510	Local and Regional Architecture	3	3		
11	AR 511	Architectural Programming	3	3		
12	AR 512	Building Laws	3	3		
13	AR 513	Architectural Criticism	3	3		
14	AR 514	Project Management and Development	3	3		
15	AR 515	Introduction to Interior Design	3	3		
16	AR 516	Science of Building Technology	3	3		
17	AR 517	Modern Building Materials	3	3		
18	AR 518	Economic Building Standards	3	3		
19	AR 519	Research Applications in the Science of Building Technology	3	3		
20	AR 520	Improving Performance and Constructional Equipment	3	3		
21	AR 521	Technical Installations	3	3		
22	AR 522	Systems and Methods of Construction	3	3		
23	AR 523	Project Management and Construction	3	3		
24	AR 524	Evaluations and Analyses of Projects	3	3		
25	AR 525	Building Maintenance and Preservation	3	3		

N.B.
1) From the present table, the academic advisor assigns courses with total credit hours of 18 cr. hr. for students of Professional Diploma, 12 cr. hr for students of the pre-…. Of the Postgraduate Diploma, and 18 cr. hr. for students of the postgraduate Diploma.

2) The academic advisor may include among the student study program, courses from other specializations.
3) Other courses may be included according to the recommendation of the department committee and the agreement of the collage committee.

Department of Architecture

Courses for Higher Studies Diploma and Master Degree (level 500)

No	Code no.	Course title	Credit hours	Contact hours		Pre-requisite
				Lect.	Tutorial or lab	
26	AR 526	Prefabricated Buildings	3	3		
27	AR 527	Projects in the Science of Building Technology	3	3		
28	AR 528	Theory of Urban Design	3	3		
29	AR 529	Improvement and Urban Renewal	3	3		
30	AR 530	Conservation of Historic Areas	3	3		
31	AR 531	Visual Perception	3	3		
32	AR 532	Management and Development of Urban Environment	3	3		
33	AR 533	Population Studies and Urban sociology	3	3		
34	AR 534	Urban Design of Housing Projects	3	3		
35	AR 535	Urban Design and Environmental Behavior.	3	3		
36	AR 536	Sociological and Social Factors in Architecture	3	3		
37	AR 537	Urban Design in Slum Areas	3	3		
38	AR 538	Acoustic and lighting in Architecture	3	3		
39	AR 539	Research in Urban Design	3	3		
40	AR 540	Urban design in Areas of a Special Nature	3	3		
41	AR 541	Landscape in Urban Environments	3	3		
42	AR 542	Studies in Urban Character	3	3		
43	AR 543	Projects in Urban Design	3	3		
44	AR 544	Methods and Procedures of Housing Projects	3	3		
45	AR 545	Public Participation in Housing Projects	3	3		
46	AR 546	Housing Policies for Low Income Groups	3	3		
47	AR 547	Urban Public Transportation	3	3		
48	AR 548	Housing Policies in Egypt	3	3		
49	AR 549	Design and Development of Urban communities	3	3		
50	AR 550	Environmental Impact Assessment of Urban Projects	3	3		

N.B.
1) From the present table, the academic advisor assigns courses with total credit hours of 18 cr. hr. for students of Professional Diploma, 12 cr. hr for students of the pre-…. Of the Postgraduate Diploma, and 18 cr. hr. for students of the postgraduate Diploma.
2) The academic advisor may include among the student study program, courses from other specializations.
3) Other courses may be included according to the recommendation of the department committee and the agreement of the collage committee.

Department of Architecture

Courses for Higher Studies Diploma and Master Degree (level 500)

No	Code no.	Course title	Credit hours	Contact hours		Pre-requisite
				Lect.	Tutorial or lab	
51	AR 551	Housing Projects	3	3		
52	AR 552	Housing types in Slum Areas	3	3		
53	AR 553	Urbanization Policies	3	3		
54	AR 554	Research in Housing	3	3		
55	AR 555	Methods and Skills of urban planning	3	3		
56	AR 556	Planning of Coastal Cities	3	3		
57	AR 557	Studies in Regional Planning	3	3		
58	AR 558	Projects in Planning	3	3		
59	AR 559	Town Planning and Planning of New Urban Communities.	3	3		
60	AR 560	Research of Regional and Urban Planning.	3	3		
61	AR 561	History of Gardens and Parks (1)	3	3		
62	AR 562	History of Gardens and Parks (2)	3	3		AR 561
63	AR 563	Landscape Elements (1)	3	3		
64	AR 564	Landscape Elements (2)	3	3		AR 563
65	AR 565	Plants (1):	3	3		
66	AR 566	Plants (2):	3	3		
67	AR 567	Free Drawing and Presentation in Landscape:	3	3		
68	AR 568	Working Drawings for Landscape Using Computer Programs:	3	3		
69	AR 569	Irrigation, Drainage, Nutrition and Lighting Techniques for Landscape:	3	3		
70	AR 571	Landscape Research:	3	3		
71	AR 572	Landscape Projects:	3	3		

N.B.
1) From the present table, the academic advisor assigns courses with total credit hours of 18 cr. hr. for students of Professional Diploma, 12 cr. hr for students of the pre-…. Of the Postgraduate Diploma, and 18 cr. hr. for students of the postgraduate Diploma.

2) The academic advisor may include among the student study program, courses from other specializations.
3) Other courses may be included according to the recommendation of the department committee and the agreement of the collage committee.

Department of Architecture
Postgraduate Courses (Master & PhD, Level 600)

No	Code no.	Course title	Credit hours	Pre-requisite
1	AR 601	Architectural Movements and Schools of Thought	3	
2	AR 602	Form and Composition in Architectural Design	3	
3	AR 603	Local and Regional Architecture	3	
4	AR 604	History and Theory of Architectural Philosophy	3	
5	AR 605	Culture and Urbanism	3	
6	AR 606	Urban Design	3	
7	AR 607	Project Management and Development	3	
8	AR 608	Architectural Projects	3	
9	AR 609	Theory and Philosophy of Aesthetics	3	
10	AR 610	Architectural Criticism	3	
11	AR 611	Scientific Research Methods	3	
12	AR 612	Building Laws	3	
13	AR 613	Local and Regional Architecture.	3	
14	AR 614	Modern Building Materials	3	
15	AR 615	Improving Performance and Constructional Equipment	3	
16	AR 616	Science of Building Technology	3	
17	AR 617	Evaluations and Analyses of Projects	3	
18	AR 618	Building Maintenance and Preservation	3	
19	AR 619	Projects in the Science of Building Technology	3	
20	AR 620	Construction Economics	3	
21	AR 621	Studies into Prefabricated Buildings	3	
22	AR 622	Research into Building Construction	3	
23	AR 623	Construction Systems	3	
24	AR 624	Theory of Urban Design	3	
25	AR 625	Visual Perception	3	

N.B.

7) From the present table, the academic supervisor assigns courses with total credit hours of 18 cr. hr. for students of First Stage of Master Degree., 12 cr. hr for students of M.Eng., 18 cr. hr. for students of Ph.D.
8) Supervisor may include among the student study program, courses from other specializations.
3) Other courses may be included according to the recommendation of the department committee and the agreement of the collage committee.

Department of Architecture
Postgraduate Courses (Master & PhD, Level 600)

No	Code no.	Course title	Credit hours	Pre-requisite
26	AR 626	Design and Development of Urban Communities	3	
27	AR 627	Environmental Impact Assessment of Urban Projects	3	
28	AR 628	Computer Applications	3	
29	AR 629	Urban Design of Housing Projects	3	
30	AR 630	Developing Rural Environments	3	
31	AR 631	Improvement and Urban Renewal	3	
32	AR 632	Landscape in Urban Environments	3	
33	AR 633	Solar Architecture	3	
34	AR 634	Urban Form in Desert Settlements	3	
35	AR 635	Urban Design in Slum Areas	3	
36	AR 636	Population Studies and Urban Sociology	3	
37	AR 637	Urban Design in Hot Climates	3	
38	AR 638	Urban design in New Developments	3	
39	AR 639	Special Topic in Urban Design	3	
40	AR 640	Special Topic in Urban Design	3	
41	AR 641	Urban Design Project	3	
42	AR 642	Infrastructure and Services	3	
43	AR 643	Land Use Planning	3	
44	AR 644	Housing types in Slum Areas	3	
45	AR 645	Rural Housing	3	
46	AR 646	Urban Public Transportation	3	
47	AR 647	Housing in Desert Areas	3	
48	AR 648	Housing policies in developing countries.	3	

49	AR 649	Introduction to Sustainable Development	3	
50	AR 650	Conservation of Historic Areas	3	

N.B.

1) From the present table, the academic supervisor assigns courses with total credit hours of 18 cr. hr. for students of First Stage of Master Degree., 12 cr. hr for students of M.Eng., 18 cr. hr. for students of Ph.D.
2) Supervisor may include among the student study program, courses from other specializations.
3) Other courses may be included according to the recommendation of the department committee and the agreement of the collage committee.

Department of Architecture
Postgraduate Courses (Master & PhD, Level 600)

No	Code no.	Course title	Credit hours	Pre-requisite
51	AR 651	Housing Policies in New Towns:	3	
52	AR 652	Maintenance of Residential Buildings.	3	
53	AR 653	Land Subdivision:	3	
54	AR 654	Analyzing bids for housing projects.	3	
55	AR 655	Urban Design of Housing Projects:	3	
56	AR 656	Topics in Housing	3	
57	AR 657	Housing Projects	3	
58	AR 658	Planning of Slum Areas	3	
59	AR 659	Theories of Regional Planning	3	
60	AR 660	Geographic Information Systems.	3	
61	AR661	Improvement and Development of Rural Environment (2).	3	
62	AR 662	Urban development in Historic Cities and Areas	3	AR 630
63	AR 663	Site Planning and design	3	
64	AR 664	Project Management and Construction	3	
65	AR 665	Town Planning and Planning of New Urban Communities.	3	
66	AR 666	Urban Economics.	3	
67	AR 667	Urban Sociology	3	
68	AR 668	Selected topics of urban planning	3	
69	AR 671	Plants and Types of Gardens:	3	
70	AR 672	Basic Designs for different spaces in Landscape:	3	
71	AR 673	The Influence of Landscape on Individual behaviour:	3	
72	AR 674	Landscape in Historical Areas:	3	
73	AR 675	Plants in Egyptian Environment	3	
74	AR 676	Landscape in Desert Environment	3	
75	AR 677	Cities and Landscape.	3	
76	AR 678	External Lighting	3	

N.B.

1) From the present table, the academic supervisor assigns courses with total credit hours of 18 cr. hr. for students of First Stage of Master Degree., 12 cr. hr for students of M.Eng., 18 cr. hr. for students of Ph.D.

2) Supervisor may include among the student study program, courses from other specializations.
3) Other courses may be included according to the recommendation of the department committee and the agreement of the collage committee.

Department of Architecture
Postgraduate Courses (Master & PhD, Level 600)

No	Code no.	Course title	Credit hours	Pre-requisite
77	AR 679	Irrigation, Drainage, and Nutrition in Landscape.	3	
78	AR 680	Sustainable Landscape	3	
79	AR 681	Readings in Landscape	3	
80	AR 682	Applications and Analysis of Landscape	3	
81	AR 683	Research in Landscape	3	

N.B.

1) From the present table, the academic supervisor assigns courses with total credit hours of 18 cr. hr. for students of First Stage of Master Degree., 12 cr. hr for students of M.Eng., 18 cr. hr. for students of Ph.D.
2) Supervisor may include among the student study program, courses from other specializations.
3) Other courses may be included according to the recommendation of the department committee and the agreement of the collage committee.

Courses Syllabus

Postgraduate Courses Syllabus
for Architectural Engineering Department
Level 500

AR 501	**Architectural Design Principles**
	The course deals with design constraints and defines the goals of the design process. Students are subjected to political, economic, cultural and social problems as well as environmental issues and resources. The course is an evaluation and analysis of the design process.
AR 502	**Architectural Movements and Schools of Thought**
AR 601	This course projects the different approaches to architectural design on an international and local scale exposing regional and local approaches to design. The analysis and evaluation of these movements and their philosophies, artistic and architectural orientations are presented.
AR 503	**Form and Composition in Architectural Design**
AR 602	This course links between the principles of form creation in design and its effect upon functional, structural, cultural and aesthetic architectural dimensions. The relationship between form creation and architectural and urban aesthetics are also presented.
AR 504	**Architectural Research**
	This course introduces models of research and its development and application in the field of architecture. It involves an understanding of research methods and their performance using data derived from students' individual and group research in workshops.
AR 505	**Computer Applications**
AR 628	Computer applications that help in design drawing and virtual applications that help students in visualizing and final presentation of design projects.
AR 506	**Contemporary Egyptian Architecture**
	A subjective study and analysis for evaluating contemporary Egyptian architecture. The course aims to evaluate the success and failure of architecture by examining local approaches to design. The aim is to expose local trends and link it to the local heritage.
AR 507	**Architectural Projects**
AR 608	Searching for different methods of architectural expression and representation using local examples. By examining the design constraints various design alternatives are created and evaluated using environmental, cultural, visual and economic criteria.
AR 508	**History and Theory of Architectural Philosophy**
AR 604	A close look at the literature on the history of buildings and settlements architectural projects with an overall look at society. The interrelationships between the various schools of architecture and its product and the literature on thought and architectural criticism.

AR 509	**Theory and Philosophy of Aesthetics**
AR 609	The course explains the theoretical viewpoints and principles of aesthetics in

	relation to human biological and cultural differences from a historical perspective. The course links perception to individuals and the different cultural and social backgrounds.
AR 510	**Local and Regional Architecture**
AR 603	An understanding of local and regional architecture is the subject area of this course. The main objective is to determine the socio-cultural, economic, political, managerial and environmental constraints that affect the urban fabric. Traditional and vernacular architecture is studied with language formulation and how it is represented in architecture and urbanism.
AR 511	**Architectural Programming**
	The creation and evaluation of building programs through architectural practice on a local and international level. The role of users and social groups in the creation of the architectural design programs are included.
AR 512	**Building Laws**
AR 612	Architectural practice, building management and local constraints are introduced in this course. Architectural and urban laws for building order are also covered.
AR 513	**Architectural Criticism**
AR 610	The purpose is to develop architectural criticism through a greater understanding of the arts and humanities, architectural philosophy and public culture.
AR 514	**Project Management and Development**
AR 607	This course manages all aspects of the site and building as a process for development. The issues covered relate to topography, soil, table water, land use distribution, building density, residential density, infrastructure, landscape, detailed costs, investment, building maintenance and management.
AR 515	**Introduction to Interior Design**
	This course covers all aspects of interior design including furniture, colours, textures, installations and functional requirements and how they shape interior space.
AR 516	**Science of Building Technology**
	This course covers the history of building science, technology and theory of construction.
AR 517	**Modern Building Materials**
AR 614	The course examines the principles for choosing and evaluating new materials including their function, efficiency, cost and appearance of materials.
AR 518	**Economic Building Standards**
	Contract specifications with building contractors. Transport and storage of materials and methods for reducing building costs. Calculating all stages of the construction and the financial arrangements within contracts.
AR 519	**Research Applications in the Science of Building Technology**
	Theory of building technology and building research including materials and methods.
AR 520	**Improving Performance and Constructional Equipment**
AR 615	Developing the use of on-site construction equipment and machinery in construction. The course determines the basis of choice of equipment for raising the level of efficiency and to reduce costs. Local construction equipment in the Egyptian market are also covered.
AR 521	**Technical Installations**

	This course covers pipelines and piping, insulation, elevators, air-conditioning systems including air-handling units.
AR 522	**Systems and Methods of Construction**
	This course deals with the development of construction systems in Egypt for low-cost residential units. This includes prefabricated units and new systems for construction and their qualities and deficiencies.
AR 523	**Project Management and Construction**
	The purpose of this course is to determine the principles for setting a plan for on-site construction. Time and cost are the main dimensions for choosing the construction plan. How to take decisions and an examination of the project's stages along the construction time schedule for construction is also covered.
AR 524	**Evaluations and Analyses of Projects**
AR 617	The goal is to determine the objectives of projects and the principles for evaluation with regards to technology, structure and economics. The chosen projects for evaluation are that of large investment companies.
AR 525	**Building Maintenance and Preservation**
AR 618	Maintaining the buildings by examining the factors that affect the longevity of buildings. These factors include and are not limited to piping, electric, mechanical, and structural systems and materials. The course includes methods for preserving historical buildings.
AR 526	**Prefabricated Buildings**
	An understanding of the methods for constructing prefabricated concrete parts and how they are designed and connected.
AR 527	**Projects in the Science of Building Technology**
AR 619	Plans for implementing structural projects within time schedules. This includes setting the criteria for quality assurance and building efficiency. This course deals with document filing, standardization and money flow arrangements for the purpose of implementing projects.
AR 528	**Theory of Urban Design**
AR 624	A study of the theory of urban design and its development until today. This is implemented by determining the urban design levels at the scale of the city and neighborhood.
AR 529	**Improvement and Urban Renewal**
	The concept and importance of urban renewal. Types of urban renewal: clearance, re-development, restoration, conservation, rehabilitation. Economic theory in redevelopment: historical, political, social, administrative and technical aspects. Methods and stages of renewal in different countries. The role of: government, investors, owners, civil society, and local administration in urban renewal.
AR 530	**Conservation of Historic Areas**
AR 650	Description of historic area liable to conservation. International and national examples of historic areas
AR 531	**AR 531 Visual Perception**
AR 625	Bases and theories of visual perception –Identification of aesthetical aspects in urban form. Visual perception of spatial forms, visual solutions in urban forms and elements of design.
AR 532	**Management and Development of Urban Environment**
AR 664	Policies and stages of urban management and planning on a local – regional level. Structural organization and levels of decision making, distribution of

	work and personnel management, coordination of governmental planning programs at different levels. Preparation and implementation of development plans. Planning, public relations and citizens' participation in planning.
AR 533	**Population Studies and Urban sociology**
AR 636	The importance of human sciences and social factors in housing projects (existing and new projects). The historical evolution of cities and residential areas, social theory and social structure of urban and rural areas. Rural/urban migration known as urbanization, identification of slum areas. Social consideration of urban upgrading.
AR 534	**Urban Design of Housing Projects**
AR 629	The role of urban design in residential areas. Applying elements of urban design in buildings and urban spaces. Urban architectural character of residential areas.
AR 535	**Urban Design and Environmental Behavior.**
	The relationship between urban design and environmental behavior. The study of effects of urbanization on environmental aspects.
AR 536	**Sociological and Social Factors in Architecture**
	Basic information about concepts and concerns related to the social and sociological reactions of design and forms of human environment.
AR 537	**Urban Design in Slum Areas**
AR 635	Study of existing conditions in slum areas. Methods of improvement, development and upgrading in slum area. The role of urban design. National and international experiences.
AR 538	**Acoustic and lighting in Architecture**
	1st part: study of sound in the surrounding environment. 2nd part: Lighting in architecture, natural and artificial lighting.
AR 539	**Research in Urban Design**
	The department of architecture chooses a special topic in urban design each semester and depending upon course availability. Students are expected to participate in research and develop new ideas which are supervised by faculty members.
AR 540	**Urban design in Areas of a Special Nature**
	Problems of special areas (historic-coastal areas). Conservation of architectural values of such areas
AR 541	**Landscape in Urban Environments**
AR 632	**The concept of landscape**
AR 542	**Studies in Urban Character**
	Study of problems of deterioration of architecture and urban character in Egypt. Approaches to control of character.
AR 543	**Projects in Urban Design**
	Analysis of urban design problems at the local and international level.
AR 544	**Methods and Procedures of Housing Projects**
	Searching for different methods of architectural expression and representation in housing projects
AR 545	**Public Participation in Housing Projects**
	Concepts, principals, and methods of public participation in housing projects. The role of inhabitants, the civil society, and non governmental organizations in upgrading projects.
AR 546	**Housing Policies for Low Income Groups**

AR 646	Defining housing types for low income groups, nationally and internationally. Case study. The role of the state and public in the provision of shelter for low income groups.
AR 547	**Urban Public Transportation**
AR 646	The historic evolution of modes of transportations and their role in national, regional and local planning. Norms and specification and classification of roads. Modes of circulation in residential, commercial, industrial, agricultural areas and city centers.
AR 548	**Housing Policies in Egypt**
	Introducing different housing types in Egypt and their… to socio-economic conditions of different groups.
AR 549	**Design and Development of Urban communities**
AR 626	History and contemporary evolution of communities. Policies, planning and development. Development programs: objectives - stages- strategies- norms. Principles of land subdivisions and building systems. Factors affecting building systems (natural - social- cultural - economic- aesthetic..). Examples in traditional and modern environments. Preplanning of traditional and modern communities.
AR 550	**Environmental Impact Assessment of Urban Projects**
AR 627	Objective, nature and elements of environmental impact in urban projects. Effect of development on socio-economic, pollution, and traffic circulation aspects. Technique for measuring environment impact.
AR 551	**Housing Projects**
AR 657	The study of a residential area. (data collection – analysis of primary and secondary data). Identification of problems, constraints, objectives, analysis and programs – alternatives using plans, pictures, tables, charts, Planning and design of a city centre for a medium sized city or slum area. Effect of internal and surrounding constraints in directing and developing the projects. Identify: objectives, problems, strategy and stages of development. Survey and analysis of land use, circulation, commercial element, urban constraints and spatial structure.
AR 552	**Housing types in Slum Areas**
AR 644	Understanding and analyzing problems of housing in slum areas. Upgrading projects. Characteristics of slum areas, the mechanism of growth (internal and external) Constraints effecting housing types in slum areas.
AR 553	**Urbanization Policies**
	Historic, social, cultural, and economic aspects of urbanization. Population growth and migration development in the Third World. Urban/ rural change urbanization, ruralization, dissertation, industrialization, modernization, and economic development. Urbanization problems and issues. Poverty in slum areas. Relation between urbanization and economic development and quality of the environment in its national and regional context.
AR 554	**Research in Housing**
	Comprehensive studies in workshop -design of private units (social, cultural, economic and urban constraints). Traditional and non-traditional housing projects and models. Detached attached housing. Planning and design of housing sites.
AR 555	**Methods and Skills of urban planning**
	The development of skills in planning through exercises including: surveys-

	data collection- landuse –circulation- visual study – land condition- arial and satellite pictures. Preservation of data : tables –plans – charts.
AR 556	**Planning of Coastal Cities**
	Land use planning- urban form and comprehensive urban development – environmental planning – sustainable development.
AR 557	**Studies in Regional Planning**
	Strategies of development and regional balance. Kinds and levels of regions. Delineation and classification of regions. Theories and principals of regional planning. Effect of regional development on urban planning. Study of consultants and governmental reports on regional planning
AR 558	**Projects in Planning**
	Study and analysis of regional and urban planning projects to attain needed skills to deal with different planning problems and methods of solution. The effect of different inputs (economic- population- social..) on the planning decision on both the regional and local level.
AR 559	**Town Planning and Planning of New Urban Communities**
AR 665	Factors and policies effecting the choice of a New town . The location of a new town. Survey and analysis of different aspects of planning (economic –social-geographic-topographic- geological –climatical – natural – circulation) Preparation of planning program. Preparation of proposed comprehensive plan.
AR 560	**Research of Regional and Urban Planning**
	Readings in different sources of data and information in the internet to enlarge the students' perception to the concept of planning studies. Analysis and explanation of international experiences and its effect on local community study of drawbacks and positive and negative aspects.
AR 561	**History of Gardens and Parks (1)**
AR 670	The syllabus deals with the main lines of landscape through different historical ages from Pharaohs till Renaissance concerning its influence on architecture, customs and traditions, and different culture.
AR 562	**History of Gardens and Parks (2)**
AR 670	Deals with the main lines of landscape after Renaissance till the Twenty One century concerning its effect on architecture, customs and traditions, and different culture
AR 563	**Landscape Elements (1)**
	Highlights the study of plants and water as landscape elements concerning its different characteristics, basic designs, its functions in sites.
AR 564	**Landscape Elements (2)**
	Demonstrates tiles, topography, and furniture as landscape elements concerning their different characteristics, basic designs, and their functions in sites
AR 565	**Plants (1)**
	It is divided into two parts: the first is concerned with defining plants, its categories, its botanical parts, and different factors impact its growing.
AR 566	**Plants (2)**
	The second part focuses upon studies of decorative plants, their types in Egypt, and the effects of soil in selecting plants.
AR 567	**Free Drawing and Presentation in Landscape**
	In this part postgraduates learn different presentation techniques using pencil, ink, and oil colours through different sketches for landscape. Moreover, they

	learn the correct method to present any landscape project to different companies.
AR 568	**Working Drawings for Landscape Using Computer Programs**
	The postgraduates learn working drawing methods through a landscape project using computer programs.
AR 569	**Irrigation, Drainage, Nutrition and Lighting Techniques for Landscape**
	The syllabus deals with irrigation techniques and equipments, drainage techniques for gardens and open spaces, nutrition and mechanical techniques of swimming pools and lakes. It also includes different types of lighting for landscape.
AR 572	**Landscape Projects:**
AR 669	Each student redesigns a garden, park, or a small part inside a town through a landscape project. 1. Examining different circumstances of the site concerning the topography, environment, and nature. 2. Proposing a former project and improve it. 3. Drawing sketches, sections, and elevations for some parts of the project. 4. Presenting a final coloured design for the project.
AR 571	**Landscape Research**
AR 683	It includes various studies and researches in the field of landscape, in addition to a variety of readings or reviews for new issues in this field.

Postgraduate Courses Syllabus
for Architectural Engineering Department
Level 600

AR 605	**Culture and Urbanism**
	This course covers the culture of people and the interrelationship that connects the urban environment with the behavior of people witin a cultural perspective. The course is set within the human social sciences and an understanding of culture and history by drawing comparisons between different cultures.
AR 606	**Urban Design**
	This course covers how to design urban spaces in different environmental contexts. Students are subjected to local and international examples to gain a greater understanding the constraints witnessed in Egyptian urban contexts.
AR 611	**Scientific Research Methods**
	This course covers both qualitative and quantitative research methods and their applications within different research approaches. How to structure research and set its objectives and hypothesis. The course also trains on hypothesis writing and testing and questionnaire design.
AR 613	**Local and Regional Architecture.**
	This course is linked to the structure and components of regional and local architecture. The course is backed by research and group work and discussions.
AR 620	**Construction Economics**
	Principles of economic analysis in construction.
AR 621	**Studies into Prefabricated Buildings**
	This course is an examination of methods to develop prefabricated structural elements in order to determine new applications in building construction.
AR 622	**Research into Building Construction**
	Construction methods and elements of construction and a study of on-site work jobs using construction machinery.
AR 623	**Construction Systems**
	Project management and division of projects into stages using time sheets. The course projects the managerial structure within projects and how decisions are serially made both horizontally and vertically.
AR 630	**Developing Rural Environments**
	This course examines built environments in rural contexts. How traditional forms are created and modernized and their relationship to urbanity.
AR 633	**Solar Architecture**
	An examination of sunlight and how much light falls on horizontal, vertical and curved surfaces set in all directions. How natural light levels can be controlled by using different architectural elements, examining site constraints, solar movement, orientation and spatial design in plan and cross section.
AR 634	**Urban Form in Desert Settlements**
	This course examines how urban form is created in desert environments. The objective is to determine design principles for desert settlements and derive basic planning principles for building in desert environments.

AR 637	**Urban Design in Hot Climates**
	This course covers urban planning in hot climates by examining urban design projects and their success and failure to adapt to the hot climatic zones. The

	course analyses both local and international examples having similar climatic circumstances with Egypt.
AR 638	**Urban design in New Developments**
	This course examines new planning projects within cities or new towns and aim to compare between these projects. Projects within Egypt are critically examined against the circumstances in which they appear.
AR 639	**Special Topic in Urban Design**
AR 640	The department of architecture chooses a special topic in urban design each semester and depending upon course availability. Students are expected to participate in research and develop new ideas which are supervised by faculty members.
AR 641	**Urban Design Project**
	A comparison between problem solving methods in urban design at the local and global level. Students participate in studies and analyze methods for improving urban environments.
AR 642	**Infrastructure and Services**
	Systems, kinds, and elements of infra-structure and its effects on planning and housing. It includes water, electric, sanitary drainage, telephones, and road networks. Types and systems of infrastructures and its relation with the urban fabric: health, educational, religion, cultural, recreational and commercial services. International and national norms and methods of planning and design. Implementation and maintenance of infrastructure and services and its role in forming an urban program. Quantitative and qualitative determination of services and infrastructure for urban projects.
AR 643	**Land Use Planning**
	The role of land use in urban planning. Classification of land use according to distribution, relation , percentage and quantity. Structure of land use and its relation to circulation systems. Factors of change in land use, and their social, economic and environmental effects. Basic land uses including residential commercial, industrial and central areas. Calculation of land areas, population growth, and norms for facilities and service distribution. Social and economic factors that identify types needed of land use.
AR 645	**Rural Housing**
	Strategies, policies and problems of housing in rural areas. The evolution of rural housing according to social and economic changes since mid 20^{th} century until now. The effects of legislations on the growth of Egyptian village. The development of the design of rural houses.
AR 647	**Housing in Desert Areas**
	Identification of housing needs in desert areas within an environmental context. The effect of the environment on the design of individual houses, housing groups and housing areas.
AR 648	**Housing policies in developing countries.**
	Housing policies in developing countries especially to lower income groups. The role of states, governmental and non governmental efforts.
AR 649	**Introduction to Sustainable Development**
	Definition of human sustainable development concentrating on the provision of suitable housing for everyone and equal provision of basic services as a main axis of sustainable urban development. Confronting urban poverty. Urban

	management policies.
AR 651	**Housing Policies in New Towns:**
	Factors and influences of housing policies in new towns. Comparing a number of housing policies and the choice of suitable housing policies for new towns. Survey and analysis of social, economic, geographic, topographic, geological, climatical and natural aspects influencing housing policies. Preparation of housing types program for a new town and factors affecting it.
AR 652	**Maintenance of Residential Buildings.**
	Regular, emergency and main maintenance of residential buildings, Maintenance against heat, rain and earthquakes. Renewing sanitary and electrical works in residential buildings. Public and private roles in maintenance of residential projects.
AR 653	**Land Subdivision:**
	Types, objectives and problems of land subdivision (residential, commercial industrial, agricultural and educational) Models and application of plans of subdivision: new direction and procedure. Analysis of contemporary methods of subdivision: elements and regulations guiding the distribution of areas and uses. Overview of economic, administrative, social and environmental problems, problems evolving from the methods and laws applied in subdivision, and their effects on planning, housing and urban design.
AR 654	**Analyzing bids for housing projects.**
	Methods of analyzing and evaluation of bids and monitoring.
AR 655	**Urban Design of Housing Projects:**
	Study of different types of housing projects. Theories of rehabilitation of residential areas. Identification of approaches of development of existing housing areas through urban design. International and national examples.
AR 656	**Topics in Housing**
	A topic is chosen by the department each semester in order to encourage develop and enhance the students knowledge through research and readings under the supervision of staff members.
AR 658	**Planning of Slum Areas**
	Discuss and analysis of the problems of slum areas. Model standard upgrading projects. The concept and general characteristics of slum areas, their growth (interval and external mechanism of their growth. Constraints effecting upgrading projects. A study of the phenomena in its Egyptian context.
AR 659	**Theories of Regional Planning**
	Bases and theories of regional planning. Analysis of regional inter-relations. Introduction of economic theory and immigration, industrial location, regional structures.
AR 660	**Geographic Information Systems.**
	Introduction of the use of GIS in urban planning including basics and steps of data collection, analysis and output
AR661	**Improvement and Development of Rural Environment (2).**
	Study of built areas in rural areas identifying different threats in infrastructure and services leading to pollution and deterioration in the built environment.
AR 662	**Urban development in Historic Cities and Areas**
	Historic cities are national treasures with its contents of monument areas considered as an important part of the urban structure of the city. Urban change

	and development of historical cities could lead to the neglection of monumental areas. The problem evolves in the attainment of balance between urban development that might cause damage to such areas and the conservation of monuments. The study of the future of these cities is a must. Analyzing the relationship between urban development and conservation in the most important time of urban change and growth in a number of historical cities in Europe and Egypt helps in verifying the effect of urban improvement and change of historic cities and monumental areas within it.
AR 663	**Site Planning and design**
	The concept and framework of site planning and design. Comprehensive stages including elements internal and external to the site (topography, soil, wind, humidity, sunlight, sanitary drainages, circulation and views. Analyzing site potentials and constraints, identification of problems and solutions of different sites. Land survey, preparation and implementation stages. Design of recreational facilities, children playgrounds and pedestrian paths.
AR 666	**Urban Economics.**
	The study of the elements of urban economics and economic systems and their impact on the build the strategy of development of new regions. Finance for development and infrastructure. National urban development strategy.
AR 668	**Selected topics of urban planning**
	During every semester a topic would be chosen by the department. The curriculum thus enhances encourage and developing of the knowledge of student through research and readings and application under the supervision of staff members.
AR 671	**Plants and Types of Gardens**
	This part is specialized in studying different kinds of gardens according to their historical importance or special characteristics depending upon the type of plant such as aromatic gardens or gardens of warm colours.
AR 672	**Basic Designs for different spaces in Landscape**
	This part deals with a historical study of different urban spaces besides an analysis of some international models, along with a study of these spaces and connecting them with the factors of landscape. Moreover, this part focuses upon studying the basic designs of these spaces and explaining the modern international trends in this field.
AR 673	**The Influence of Landscape on Individual behaviour**
	This part pinpoints the importance of relating psychology and sociology to design in general and landscape in particular. In addition, it analyzes the influence of landscape on the behaviour of space users through presenting different scientific examples
AR 674	**Landscape in Historical Areas**
AR 570	It describes in details historical areas and presents organized international doctrines in dealing with these areas and the conditions for intervention and preservation through historical landscape by including different international examples.
AR 675	**Plants in Egyptian Environment**
	It comprises the following aspects: a definition of plants and their different divisions, a study of decorative plants and productive plants, a study of different environments and testing the plants in each environment, a detailed study of plants in different Egyptian environments and an analysis of each

	plant concerning its shape-colour-size- and texture.
AR 676	**Landscape in Desert Environment**
	It defines the desert environment and studies urban planning for these areas to determine the design trends for landscape elements in the desert environment through providing practical local and international examples.
AR 677	**Cities and Landscape**
	It includes the following points: definition of a city, a historical background concerning the development of the city in relation to landscape, a study of various scale for gardens and green areas in the city after the industrial revolution till the present, and the importance of these varieties by presenting different local and international examples, a study of the problems of landscape in Egyptian cities and the proposed solutions.
AR 678	**External Lighting**
	It deals with the following points: a background and definition of the development and kinds of artificial lighting, a study focusing upon the importance of interior and exterior lighting, a definition of different types and levels of external lighting, a study of the employment of lighting in elevations and elements of landscape, an analysis of a real project in an Egyptian city that serve the development of the concept of lighting.
AR 679	**Irrigation, Drainage, and Nutrition in Landscape**
	This syllabus deals with the study of the methods of irrigation and the equipments used, in addition to the system of drainage for gardens and various open spaces , besides the system of nutrition and different Mechanical tactics in constructing swimming pools, lakes and water floating bodies.
AR 680	**Sustainable Landscape**
	It deals with the following points: a definition of the concept of sustainability, a study of the relation between sustainability and landscape, a study of possible policies that can be applied to develop the sustainability through landscape as a whole and through its different elements.
AR 681	**Readings in Landscape**
	The Department, in each term, determines a certain topic for this subject that coordinates with other trends presented in the department. This syllabus aims to encouraging, developing and providing the student with information through research and supervised readings by the professors committee in the department. Practical applications are to be included if necessary.
AR 682	**Applications and Analysis of Landscape**
	The Department, in each term, determines a certain topic for this subject that coordinates with other trends presented in the department. This syllabus aims to encouraging, developing and providing the student with information through research and supervised readings by the professors committee in the department. Practical applications are to be included if necessary.

Postgraduate Courses for Civil Engineering

Department: Civil Engineering
Postgraduate Diploma & Master Degree Courses (Level 500)
Specialization: Structural Engineering

No	Code no.	Course title	Credit hours	Contact hours		Pre-requisite
				Lect.	Tutorial or lab	
1	CVS501	Theory of Elasticity	3	2	2	
2	CVS502	Theory of Plasticity	3	2	2	
3	CVS503	Fracture of concrete	3	3	—	
4	CVS504	Dynamic Analysis	3	3	—	
5	CVS505	Plastic Analysis and Design of steel structures	3	3	—	
6	CVS506	Prestressed concrete structures	3	3	—	
7	CVS507	Mathematical Modeling	3	3	—	
8	CVS508	Earthquakes Engineering	3	3	—	
9	CVS509	High Rise Buildings	3	3	—	
10	CVS510	Properties & strength of New and Composite Materials	3	2	2	
11	CVS511	Inspection and Repair of RC Structures	3	2	2	
12	CVS512	Special Types of Concrete	3	3	—	
13	CVS513	Reinforced Concrete Bridges	3	3	—	
14	CVS514	Advanced Mathematics	3	3	—	
15	CVS515	Surveying Observation of Structures Movements	3	3	—	
16	CVS516	Analysis and Design of special Structures	3	3	—	
17	CVS517	Mechanics of Reinforced Concrete	3	3	—	
18	CVS518	Design of RC Structures Based on Advanced Codes	3	3	—	
19	CVS519	Structural Analysis using Finite Element Method	3	3	—	
20	CVS520	Numerical Analysis	3	3	—	
21	CVS521	Concrete Technology	3	3	—	
22	CVS522	Evaluation of Structures	3	3	—	
23	CVS523	Technical Reports	3	3	—	
24	CVS524	Fire Protection of Structures	3	3	—	
25	CVS525	Management of Structures Maintenance	3	3	—	
26	CVS526	Chemical and Materials used in Repair and Rehabilitation	3	3	—	

N.B.

1) From the present table, the academic advisor assigns courses with total credit hours of 18 cr. hr. for students of Professional Diploma, 12 cr. hr for students of the pre-…. Of the Postgraduate Diploma, and 18 cr. hr. for students of the postgraduate Diploma.
2) The academic advisor may include among the student study program, courses from other specializations.
3) Other courses may be included according to the recommendation of the department committee and the agreement of the collage committee.

Department: Civil Engineering
Postgraduate Diploma & Master Degree Courses (Level 500)
Specialization: Structural Engineering

No	Code no.	Course title	Credit hours	Contact hours		Pre-requisite
				Lect.	Tutorial or lab	
27	CVS527	Fracture Mechanics for Structures	3	3	—	
28	CVS528	Behavior of Brick Buildings	3	3	—	
29	CVS529	Non Destructive Testing and Stress Analysis	3	3	—	
30	CVS530	Computer Applications for Quality Assurance	3	3	—	
31	CVS531	Construction Technology	3	3	—	
32	CVS532	Durability of Concrete	3	3	—	
33	CVS533	Special Studies in Steel Structures	3	3	—	
34	CVS534	Systems for Halls and Factories	3	3	—	
35	CVS535	Computer Applications for Steel Structures	3	3	—	
36	CVS536	Plastic Analysis and Design of Steel Structures	3	3	—	
37	CVS537	Shell Steel Structures	3	3	—	
38	CVS538	Suspended Structures	3	3	—	
39	CVS539	Specifications and Quantities of Steel Structures	3	3	—	
40	CVS540	Diploma Project	3	3	—	
41	CVS541	Engineering geology	3	3	—	
42	CVS542	Soil Mechanics	3	3	—	
43	CVS543	Laboratory testing of soils / rocks	3	2	2	
44	CVS544	In-Situ Testing	3	3	—	
45	CVS545	Foundation System	3	3	—	
46	CVS546	Soil Improvement	3	3	—	
47	CVS547	Retaining Structures	3	3	—	
48	CVS548	Soil / Rock Hydrology	3	3	—	
49	CVS549	Tunneling	3	3	—	
50	CVS550	Geosynthetics in geotechnical engineering	3	3	—	

51	CVS551	Numerical methods in geotechnical engineering	3	3	—	
52	CVS552	Computer applications in geotechnical engineering	3	3	—	

N.B.

1) From the present table, the academic advisor assigns courses with total credit hours of 18 cr. hr. for students of Professional Diploma, 12 cr. hr for students of the pre-…. Of the Postgraduate Diploma, and 18 cr. hr. for students of the postgraduate Diploma.

2) The academic advisor may include among the student study program, courses from other specializations.

3) Other courses may be included according to the recommendation of the department committee and the agreement of the collage committee.

Department: Civil Engineering
Master Degree & Ph.D. Supplementary Courses (Level 600)
Specialization: Structural Engineering

No	Code no.	Course title	Credit hours	Pre-requisite
1	CVS601	Advanced Properties of Materials	3	
2	CVS602	Theory of Elasticity	3	
3	CVS603	Design of Brick Bearing Walls	3	
4	CVS604	Structural Fracture Mechanics	3	
5	CVS605	Non Destructive Testing	3	
6	CVS606	Concrete Technology	3	
7	CVS607	Repair and Strengthening of RC Structures	3	
8	CVS608	Durability of Concrete	3	
9	CVS609	Special Types of Concrete	3	
10	CVS610	Evaluation of Structures	3	
11	CVS611	Finite Element Analysis of Structures	3	
12	CVS612	Design of Repair Works for RC Structures	3	CVS 607 or CVS511
13	CVS613	Computer Applications for RC Structures	3	
14	CVS614	High Rise RC Structures	3	
15	CVS615	Non linear Analysis of RC. Structures	3	
16	CVS616	Special RC Structures	3	
17	CVS617	Prestressed and precast Concrete Structures	3	
18	CVS618	Improving of fire resistance for RC structures	3	
19	CVS619	Advanced Reinforced Concrete	3	
20	CVS620	Plastic Analysis of Steel Structures	3	
21	CVS621	Analysis and Design of Cold Formed Elements	3	
22	CVS622	Advanced Design of Steel Connections	3	
23	CVS623	High Rise Steel Structures	3	
24	CVS624	Bridge Engineering	3	
25	CVS625	Foundation Engineering	3	
26	CVS626	In-Situ Testing and site characterization	3	

27	CVS627	Rock Mechanics	3	
28	CVS628	Soil Dynamics	3	
29	CVS629	Soil – Structure Interaction	3	
30	CVS630	Constitutive Modelling of geomaterials	3	
31	CVS631	Earth structures	3	
32	CVS632	Problematic soils	3	
33	CVS633	Probabilistic methods in geotechnical engineering	3	

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Department: Civil Engineering
Postgraduate Diploma & Master Degree Courses (Level 500)
Specialization: Water Resources

No	Code no.	Course title	Credit hours	Contact hours		Pre-requisite
				Lect.	Tutorial or lab	
1	CVW501	Engineering Systems & Statistics				
2	CVW502	Irrigation & Drainage Systems				
3	CVW503	Water Structures 1				
4	CVW504	Water Management				
5	CVW505	Surface Water Hydrology 1				
6	CVW506	Groundwater Hydrology 1				
7	CVW507	Water Quality Control				CVW504
8	CVW508	Management & Conjunctive Use of Water Resources				CVW505
9	CVW509	Hydrological Measurements				CVW505
10	CVW510	Water Management Operations				CVW506,CVW505, CVW504
11	CVW511	Methods of Analysis & Water Treatment				
12	CVW512	Water Laws				
13	CVW513	River Engineering				
14	CVW514	Planning & Management of Water & Environmental Systems				CVW505, CVW506
15	CVW515	Water Reuse				CVW504, CVW505
16	CVW516	Well Design				CVW506

17	CVW517	Numerical Modeling				
18	CVW518	Flood Protection				CVW505
19	CVW519	Seminar				
20	CVW520	Irrigation Engineering				CVW502
21	CVW521	Engineering Mathematics	3	2	2	
22	CVW522	Computational Hydraulics	3	2	2	Hydraulics 2
23	CVW523	Measuring instruments	3	2	2	Hydraulics 1,2
24	CVW524	Advanced Hydraulics	3	2	2	Hydraulics 1,2
25	CVW525	Sediment Transport Hydraulics	3	2	2	Hydraulics 2
26	CVW526	Hydraulics Machine	3	2	2	Hydraulics 2

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3) Other courses may be included according to the recommendation of the department committee and the agreement of the collage committee.

Department: Civil Engineering
Master Degree & Ph.D. Supplementary Courses (Level 600)
Specialization: Water Resources

No	Code no.	Course title	Credit hours	Pre-requisite
1	CVW601	Hydropower Stations		
2	CVW602	Water Structures 2		
3	CVW603	Environmental Hydrology		
4	CVW604	Surface Water Hydrology 2		CVW505
5	CVW605	Groundwater Hydrology 2		CVW506
6	CVW606	Assessment of Environmental Impact		
7	CVW607	Modeling & Simulation of Flow & Contaminant Transport		CVW507
8	CVW608	Water Resources Management		
9	CVW609	Statistical Methods for Water Management		CVW505,CVW508
10	CVW610	Economics of Water Resources		
11	CVW611	Engineering Analysis for Risk in Water Resources & Irrigation		
12	CVW612	Seminar		
13	CVW613	Information Systems in Irrigation		CVW502,CVW520
14	CVW614	Dams Engineering		CVW505
15	CVW615	Educational Research		

16	CVW616	Hydraulic Models		
17	CVW617	Turbulence and its Measurement		Hydraulics 1,2
18	CVW618	Applied Hydraulics (1)		CVW526
19	CVW619	Stable Channel Design		CVW525
20	CVW620	Applied Hydraulics (2)		CVW618
21	CVW621	Transport of Sediment by Wave		CVW525
21	CVW622	Hydrodynamics		Hydraulics 1,2

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Department: Civil Engineering
Postgraduate Diploma & Master Degree Courses (Level 500)
Specialization: Public Work

No	Code no.	Course title	Credit hours	Contact hours		Pre-requisite
				Lect.	Tutorial or lab	
1	CVP501	Engineering Mathematics and Statistics	3	2	2	-
2	CVP502	Theory of Errors and Adjustment Computations	3	2	2	CVP501
3	CVP503	Adjustment Computations in surveying	3	2	2	CVP502
4	CVP504	Advanced Geodetic surveying (1)	3	2	2	CVP503
5	CVP505	Satellite Geodesy	3	2	2	CVP504
6	CVP506	Global Positioning Systems (1)	3	2	2	CVP505
7	CVP507	**Physical Geodesy**	2	1	2	CVP505
8	CVP508	Aerial photogrammetry	2	1	2	CVP503
9	CVP509	Map Projections and Numbering	2	1	2	CVP508
10	CVP510	Advanced Geodetic surveying (2)	3	2	2	CVP509
11	CVP511	**Global Positioning Systems (2)**	3	2	2	CVP510
12	CVP512	**Planning and Management Surveying Projects**	2	1	2	CVP503
13	CVP513	**Applied Astronomy**	2	1	2	CVP503
14	CVP514	**Gyroscopic Systems in Surveying**	2	1	2	CVP503
15	CVP515	**Computer Applications in Geodesy**	2	1	2	CVP514
16	CVP516	Close Rang photogrammetry	3	2	2	CVP508

17	CVP517	**Photogrammetry and Digital Map**	3	2	2	CVP508
18	CVP518	Remote Sensing	2	1	2	CVP501
19	CVP519	**Photo Interpretation**	2	1	2	CVP501
20	CVP520	**Geographic Information System (GIS)**	3	2	2	CVP517
21	CVP521	Surveying Applications in Remote Sensing	2	1	2	CVP520
22	CVP522	**Underground Surveying**	2	1	2	CVP502
23	CVP523	**Cartography**	2	1	2	CVP502
24	CVP524	Map Projections and Numbering	2	1	2	CVP502
25	CVP525	**Diploma Project**	6	4	4	CVP502

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Department: Civil Engineering
Postgraduate Diploma& Master Degree Courses (Level 500)
Specialization: Public Work

No	Code no.	Course title	Credit hours	Contact hours		Pre-requisite
				Lect.	Tutorial or lab	
26	CVP526	Transportation and Traffic Engineering	3	2	2	-
27	CVP527	Applied Statistics	3	2	2	-
28	CVP528	Geometric Design of Highways	3	2	2	CVP526
29	CVP529	Construction and Pavement of Highways	3	2	2	CVP528
30	CVP530	Soil Stabilization and Improvement	3	2	2	CVP529
31	CVP531	Materials and Testing of Highways Construction and Pavement	3	2	2	CVP529
32	CVP532	**Structural Design of Highways**	3	2	2	CVP528
33	CVP533	Preparing and Writing of Technical Reports	2	1	2	-
34	CVP534	Maintenance and Repairing of Highways and Airports	3	2	2	CVP528
35	CVP535	Application of **G I S** in Highways and Transportation Management	3	2	2	CVP528
36	CVP536	**Planning and Design of Airports**	3	2	2	CVP532
37	CVP537	**Structural Design of Airports**	3	2	2	CVP532
38	CVP538	**Environmental Impacts of Highways and Traffic**	2	1	2	CVP526

39	CVP539	**Alignment of Highways Centerlines**	3	2	2	CVP528
40	CVP540	**Applications of Computer Software in Highways and Airports**	2	1	2	CVP536
41	CVP541	**Applied Research**	2	1	2	CVP539
42	CVP542	Master plan of wastewater projects	3	2	—	—
43	CVP543	Water works and treatment	3	2	2	—
44	CVP544	Soil characteristics for design and construction of infrastructure projects	3	2	2	—
45	CVP545	Infrastructures projects managements	3	2	2	CVP526
46	CVP546	Water microbiology	3	2	2	—
47	CVP547	Sanitary chemistry	3	2	2	—
48	CVP548	Gravity sewers and wastewater treatment plants design	3	2	2	CVP530, CVP531
49	CVP549	Construction supervision of utilities projects	3	2	2	CVP527
50	CVP550	English language & Technical Report Writing	3	2	2	—

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Department: Civil Engineering
Postgraduate Diploma & Master Degree Courses (Level 500)
Specialization: Public Work

No	Code no.	Course title	Credit hours	Contact hours		Pre-requisite
				Lect.	Tutorial or lab	
51	CVP551	Environmental quality	3	3		
52	CVP552	Public Health Engineering	3	3		
53	CVP553	Microbiology I	3	2	1	
54	CVP554	Chemistry I	3	2	1	
55	CVP555	Statistics I	3	3		
56	CVP556	Integrated urban water management	3	3		
57	CVP557	Water and wastewater transport	3	3		
58	CVP558	Water treatment I	3	3		CVP554 ,CVP553
59	CVP559	Wastewater treatment I	3	3		CVP554 ,CVP553
60	CVP560	Solid waste engineering and management I	3	3		CVP554 ,CVP553
61	CVP561	Environmental process technology	3	3		CVP554

						,CVP553
62	CVP562	Environmental monitoring	3	3		CVP551
63	CVP563	Environmental Impact assessment	3	3		
64	CVP564	Project cycle and management	2	2		
65	CVP565	Financial management of utilities	3	3		CVP564
66	CVP566	seminar I	2	2		
67	CVP567	Programming language I	4	2	1	
68	CVP568	Diploma project	4	2	1	

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Department: Civil Engineering
Master Degree & Ph.D. Supplementary Courses (Level 600)
Specialization: Public Work

No	Code no.	Course title	Credit hours	Pre-requisite
1	CVP601	***Engineering Mathematics***	3	_—
2	CVP602	Applied Statistics	3	CVP601
3	CVP603	Theory of Errors and Adjustment Computations	3	CVP602
4	CVP604	Geodetic surveying	3	CVP603
5	CVP605	Satellite Geodesy	3	CVP604
6	CVP606	Global Positioning Systems	3	CVP605
7	CVP607	**Surveying with Mobile Mapping**	2	CVP605
8	CVP608	Aerial photogrammetry	3	CVP603
9	CVP609	Close Rang photogrammetry	3	CVP608
10	CVP610	**Photogrammetry and Digital**	3	CVP609
11	CVP611	**Remote Sensing**	2	CVP610
12	CVP612	**Photo Interpretation**	2	CVP610
13	CVP613	**Geographic Information System**	3	CVP603
14	CVP614	**Underground Surveying**	3	CVP603
15	CVP615	**Cartography**	2	CVP603
16	CVP616	**Map Projections**	2	CVP614
17	CVP617	**Marine Surveying**	2	CVP603
18	CVP618	**Applied Astronomy**	3	CVP604
19	CVP619	**Computer Applications in Surveying**	3	CVP603

20	CVP620	Surveying Applications in Remote	2	CVP611
21	CVP621	Dynamic Geodesy	3	CVP605
22	CVP622	Planning and Management Surveying	3	CVP603
23	CVP623	Construction Surveying	2	CVP603
24	CVP624	Gyroscopic Systems in surveying	2	CVP603
25	CVP625	Traffic Engineering	3	—

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Department: Civil Engineering
Master Degree & Ph.D. Supplementary Courses (Level 600)
Specialization: Public Work

No	Code no.	Course title	Credit hours	Pre-requisite
26	CVP626	Geometric Design of Highways	3	-
27	CVP627	Transportation Economy	3	CVP625
28	CVP628	Soil Stabilization and Improvement	3	CVP626
29	CVP629	Safety and Traffic Accidents on Highways	3	CVP625
30	CVP630	Structural Design of Highways	3	CVP626
31	CVP631	Applications of Computer Software in Highways Design	3	CVP630
32	CVP632	**Applications of Computer Software in Transportation and Traffic**	2	CVP625
33	CVP633	Geometric and Structural Design of Highways	3	CVP630
34	CVP634	Technology of Construction and Pavement of Highways	3	CVP633
35	CVP635	**Analysis of Traffic Systems**	3	CVP625
36	CVP636	**Management and Construction of Highways Projects**	3	CVP634
37	CVP637	**Planning of Urban Transportation**	3	-
38	CVP638	**Statistics Applications of Traffic Operation**	2	CVP625
39	CVP639	**Surveying Planning of Highways**	3	CVP626
40	CVP640	**Maintenance and Repair of Highways and Airports**	3	CVP634
41	CVP641	Hydraulic applications in water and wastewater treatment plants	3	

42	CVP642	Advanced wastewater treatment processes	3	
43	CVP643	Sludge treatment and management	3	
44	CVP644	Solid wastes collection and treatment	3	
45	CVP645	Modeling of aerobic and anaerobic treatment processes	3	
46	CVP646	Computer programs for water and wastewater networks designs	3	
47	CVP647	Building capabilities of scientific researching	3	
48	CVP647	MicrobiologyII	3	CVP553
49	CVP648	Chemistry II	3	CVP554
50	CVP649	Statistics II	3	CVP555

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Department: Civil Engineering
Master Degree & Ph.D. Supplementary Courses (Level 600)
Specialization: Public Work

No	Code no.	Course title	Credit hours	Pre-requisite
51	CVP650	Water treatment II	3	CVP558
52	CVP651	Wastewater treatment II	3	CVP559
53	CVP652	Solid waste engineering and management II	3	CVP560
54	CVP653	aerobic treatment mathematical modeling	3	CVP650, CVP652, CVP660 CVP561
55	CVP654	anaerobic treatment mathematical modeling	4	CVP650, CVP652, CVP660 CVP561
56	CVP655	Environmental planning	4	
57	CVP656	Environmental Management system ISO14001	4	CVP657
58	CVP657	Cleaner production	4	
59	CVP658	Research and management skills	3	CVP649
60	CVP659	seminar II	3	
61	CVP660	Programming language II	2	CVP567
62	CVP662	Experimental lab and measurements	3	CVP658
63	CVP663	Thesis preparation	2	CVP662

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Courses Syllabus

Postgraduate Courses Syllabus
for Civil Engineering (Structure Engineering)
Level 500

CVS501	**Theory of Elasticity**
	Relation between stress and strain, Hook's law, stress and strain components in plane, in two plains, and in three planes, stress and strain variables, plane strain and plane stress, Mohr's circle, equilibrium differential equations, plane problems with Cartesian and angular coordinates.
CVS502	**Theory of plasticity**
	Bending of symmetric and non symmetric sections, failure of single span beams, analysis and design using equilibrium and mechanisms, theory of plastic failure, formation of plastic joints, partial and total failure, upper limit analysis, methods of plastic analysis, calculation of bending moments and shearing force in failure mechanisms, plastic moments under shear and axial loads.
CVS503	**Fracture of Concrete**
	Condition for cracking & propagation, cracks in plastic bodies , non linear models for mechanics of failure, size effects on structures, dynamic case in mechanics of failure.
CVS504	**Dynamic Analysis**
	Comparison between static's and dynamics, single degree of freedoms systems, basic equations of motion, free under repetitive loads, strain under instantaneous loads, strain under general coordinates and Riley's method.
CVS505	**Plastic analysis & design for steel structures**
	Basics of plastic analysis, formation of plastic joints, analysis of plastic failure models, beam model, compound model, analysis and design of beams and frames and connections.
CVS506	**Pre-stressed Concrete Structures**
	Introduction to pre-stressing of concrete, materials, types of pre-stressing, Code requirements, Structural analysis of pre-stressed concrete beams, design of sections, stress distribution, cable profiles, limit state design. Losses of pre-stressing force, end blocks, pre-stressed slabs, construction details.
CVS507	**Earthquake Engineering**
	Tendency of earthquakes, propagation of earthquake effects, effects of earthquakes on elastic and plastic systems, Forier spectrum, estimation of earthquake risks, effects, of local geology and soil types on properties of earthquake motion, structural response to ground motion using response spectrums. Solution methods using constants axial force, architectural requirements, earthquake resistant design: reinforced concrete, structural steel, bearing walls, structures with base isolation.
CVS508	**Mathematical Modeling**
	Basics of mathematical models, material models, partial models, complete system model under gravity and lateral loads, models for foundation, columns, beams slabs, frames, trusses, shear walls, models for connections between shear walls and frames, evaluation of computer output, dynamic models of structures.
CVS 509	**High Rise RC Structures**
	Historical development, different structural systems for high rise buildings, shear walls with openings, equivalent frame method, design of walls and

	connecting beams, behavior of pipe framed structures, shear for pipe frames, silos analysis and design, suspended systems, temperature effects.
CVS510	**Properties of Modern and Composite Materials**
	Introduction – bricks as a compound material – fibers and resins as compound materials. Properties of advanced concrete – concrete creep and durability.
CVS511	**Inspection and Repair of Concrete Structures:**
	Types and causes of defects in structures, deteriorating actions, checking and evaluation, selection of repair materials, methods of shoring and repair, methods for strengthening and repair of different concrete elements such as foundation and columns and beams and slabs.
CVS512	**Special Types of Concrete:**
	Light weight concrete, heavy concrete, fiber reinforced concrete, polymer concrete, high performance concrete, self compacting concrete.
CVS513	**Concrete Bridges**
	Types of pre-stressed concrete bridges, box brides, tilted bridges, methods of construction, suspended bridges, composite bridges.
CVS514	**Advanced Mathematics**
	Solution of differential equations, lap lace transformation, Forier series, Dual energy, Riley Retenz method, numerical integration methods, methods for plotting cures, methods for solving systems of linear and nonlinear equations.
CVS515	rvey of Structural Motion
	Role of survey in engineering projects – Total Station applications in building coordinates and axes – transfer of plane axes between different floors – transfer of levels between floors – methods for measuring cracks and deformations of buildings in 3 dimensions – methods for measuring settlement and vertical motion in buildings.
CVS516	**Design and Analysis of Special Structures**
	Different structural systems for halls and space structures, shells, folded plates, Tunnels, Structural analysis, Design and detailing.
CVS517	**Mechanics of Reinforced Concrete**
	Material properties, linear models, material non similarities in 2 or more directions, non linear models, introduction to limit state design, elastic models, failure hypothesis, analysis using compression and tension elements.
CVS518	**Design of RC Structures Based on Advanced Codes**
	Introduction to mechanical behavior of concrete components, Material and load factors of safety for different codes, types of cracks and failures under different loads, ultimate states design, section under torsion, sections under eccentric forces, design of sections exposed to shear, punching shear, sections under bending, service limit state, control of cracking in R.C. control of deformations in skeleton structures.
CVS519	**Finite Element Analysis of RC Structure**
	Introduction Mathematical modeling and structural analysis using stiffness and finite element for Concrete structures – Formation of the stiffness matrix for elements of trusses, beams, and frames – two dimensional finite elements like plane stress and plane strain elements, three dimensional elements, plate and shell elements, modeling of supports & loads, calculation steps.
CVS520	**Numerical Analysis**
	Solution of linear & non linear equations finite element solution of differential equations, numerical integration and differentiation.

CVS521	**Concrete Technology**
	Introduction – special types of concrete – introduction to high strength concrete – hot weather concrete.
CVS522	**Evaluation of Structures**
	Introduction – Methods for evaluating structures – non destructive testing – analysis of test results – preparation of reports.
CVS523	**Technical Reports**
	Introduction – methods for writing reports – methods for presenting reports – case study.
CVS524	**Fire Protection of Structures**
	Introduction – sources of fire in structures – effects of fire on concrete performance – effects of fire on reinforcements.
CVS525	**Management of Structures Maintenance**
	Introduction – daily evaluation of structures – crack types – routine reports – …when to repair a structure.
CVS526	**Chemical and Materials used in Repair and Rehabilitation**
	Introduction – material used in repair – repair methods – special mixers – materials used in surface repair.
CVS527	**Structural Fracture Mechanics**
	Introduction – Basics of linear elastic fracture mechanics – coefficient of stress concentration.
CVS528	**Behavior of Brick Buildings**
	Introduction – history of using bricks in bearing walls – properties of materials used in brick walls – methods for designing brick walls.
CVS548	**Earthquake Engineering**
	Introduction – dynamic loads – structural behavior under earthquake loads – modes of failure – methods for structure strengthening for Earthquakes.
CVS529	**Non Destructive Testing and Stress Analysis**
	Introduction ultra sound tests – rebound test – properties of advanced concrete
CVS530	**Computer Applications in quality control**
CVS531	**Construction technology**
CVS532	**Durability of Concrete**
	Introduction – Concrete toughness – fatigue load creep in concrete
CVS533	**Systems for Halls and Factories**
CVS534	**Computer Applications for Steel Structures**
CVS535	**Plastic Analysis of Steel Structures**
CVS536	**Shell Steel Structures**
CVS537	**Suspended Structures**
CVS 538	**Specifications and Quantities of Steel Structures**
CVS 539	**Diploma Project**
	Scientific content: The student prepares a practical paper in structural engineering using a computer. The paper subject and content is agreed upon

	with the supervisor from members of the faculty teaching the diploma. The paper is submitted of 3 copies directly to the department chairman after the exams of the second term of the second years, to be discussed in the scientific convention, item 23 oh the curriculum.

Postgraduate Courses Syllabus
for Civil Engineering (Structure Engineering)
Level 600

CVS601	**Advanced Properties of Materials**
	Basic Properties of materials - modern materials – test basics - type of tests - Definition – categories of composite materials – behavior – uses – estimation of properties based on raw materials – composite layered materials – theory of layered materials – stress calculation at edges – use of composite materials foe repair and strengthening.
CVS602	**Theory of Elasticity**
	Introduction – Resolving strains and stresses in 3 planes, general theories (equilibrium equations, deflection compatibility, theory of superposition, strain energy, virtual work, castigations theories), torsional stresses, beam and plate bending, non symmetric problems, temperature stresses.
CVS603	**Design of Brick Bearing Walls**
	Types & properties of different building units – different types of mortars properties of materials – injection materials under horizontal loads on walls - design of walls under vertical loads. Design of un-reinforced brick walls under vertical & horizontal loads in plane and out of plane – Earthquake requirements for brick buildings- units – different types of mortars - properties of different types of mortars.
CVS604	**Structural Fracture Mechanics**
	Introduction – Reasons for cracking and different crack shapes – stress calculation for different cracks – calculations for failure mode due to cracks.
CVS605	**Non Destructive Testing**
	Studies of new methods and revising conventional non destructive tests – vibrations - electromagnetic and X-ray, etc – sound, ultra sound, die and ether advanced methods.
CVS606	**Concrete Technology**
	Studies of components for optimizing concrete production – Concrete production Stages for producing better grade concrete – how o use concrete before hardening with improving properties (united of getting rid of it) for environmental reasons.
CVS607	**Repair and strengthening of Structures**
	Introduction deterioration factors for concrete structures and reinforcement, common mistakes in design and their effect on performance and safety of structures, routine maintenance for structures, analysis and type of cracks and deterioration symptoms in RC structures, shoring methods for structures exposed to failure, methods for repairing design and construction defect in slash, beams, columns, and foundations, methods for repairing defects link steel and concrete corrosion in different structural elements, precautions during design & construction to protect structures exposed to deterioration factors**.**
CVS608	**Durability of Concrete**
	Concrete formation effect on strength with time factors causing concrete damage – carbonation – reinforcement corrosion Alkaline effect – Sulfates — chlorides – desalinated water – acids – organic materials – water flow – erosion – freeze thaw cycles methods for improving concrete resistance with time.
CVS609	**Special Types of concrete**

	Introduction – special type of concrete – high strength concrete – hot weather concrete.
CVS610	**Evaluation of Structures**
	Types and reasons for structural defects – visual checking – evaluation based on calculations – evaluation based of field and lab – tests – non destruction – preparation of evaluation reports including results and recommendations.
CVS611	**Structural Analysis using the Finite Element Method**
	Introduction to finite element method, basics: virtual work, plain stress and strain, and strain, Isoperimetric relations, modeling of rigid bodies, antis symmetric bodies, plates and shells. Mathematical modeling and structural analysis using stiffness and finite element for Concrete structures – Formation of the stiffness matrix for elements of trusses, beams, and frames – two dimensional finite elements like plane stress and plane strain elements, these dimensions ional element, plate and shell elements, modeling of support & loads.
CVS612	**Design of repair works for RC Structures**
	Introduction - Different methods for connecting old and new concrete and calculation of shear strength on the separating surface - effect of shoring on stress distribution between old elements and additions related to shoring and strengthening - calculations of stress and strain developments in composite sections of old and new reinforcement and concrete under different construction situations – methods for repair and strengthening of columns and beams and foundation and slabs structural analysis of slab works.
CVS613	**Computer Applications for RC structures**
	Introduction - The use of computers in the analysis of RC structures - computer analysis of solid slobs, flat slabs hollow slabs – analysis of frame and special structures - space analysis - soil structure interaction – common mistakes in modeling RC elements on computer soft-wares and its effect on design adequacy - plotting structural drawings using computer drawing software.
CVS614	**High Rise RC Structures**
	Introduction – planning high rise building – computing wind and E.Q. loads on high rise buildings – structural systems for high rise buildings (frames – shear wall – combined frames & shear walls)- structural analysis of the various systems of high rise buildings under E.Q. and wind loads – structural design for the various systems – structural details for E.Q resistant buildings.
CVS615	**Non linear Analysis of RC. Structures**
	Introduction – Concrete behavior under one, two and three dimensional stress – Theory of plasticity in reinforced concrete and different behavior and failure models for concrete & steel using finite elements – Methods of non liner analysis under permanent loads effects on behavior and safety of structures – drying shrinkage and its effect on RC elements using computers.
CVS616	**Special Studies Reinforced Concrete Structures**
	Introduction – punching shear in flat slabs – design a cording to different codes – factors affecting punching shear in column – slab connection reinforcement methods and details shear and appropriate design methods – slab strengthening of RC structures using glass and carbon fibers – repair methods – behavior of repaired elements under loads – comparison with use of wire mesh concrete paste in construction and strengthening of RC structures.
CVS 617	**Pre-stressed and Pre-cast RC Structures:**

	Introduction – RC pre-stressing concept – Materials used and its mechanical properties and code equations – methods of pre-stressing analysis of pre-stressed beams design of pre-stressed RC sections distribution and profile of tendons in beams - stress distribution in beams - shear design - ultimate limit state – pre-stressing loss - end block design - structural analysis of continuous pre-stressed beams - analysis of pre-stressed slabs - special requirements of pre-stressed structures structural details.
CVS618	**Improvement of fire resistance for RC structures:**
	Introduction - fire types - Concrete resistance for fire behavior and failure of RC structures under fire – fire fighting methods and its effects on RC behavior during and after fire extinguishing - structural elements after fire and extinguishing protection requirements for RC elements to minimize fire effect securing structures against fire.
CVS619	**Advanced Reinforced Concrete**
	Introduction – design of slabs under concentrated loads – analysis and design of shell structures (sheds, folded plates, waffle slabs), spiral stairs, free standing stairs, strut and tie design of RC elements – effect of openings on beams and slabs. Analysis of concrete cracks and deformations.
CVS 620	**Plastic Analysis of Steel Structures**
	Introduction – Elastic and plastic analysis – maximum resistance – different design philosophies – plastic bending of beams – ultimate state analysis theories – plastic analysis of frame structures – factors affecting plastic bending capacity – plastic design of continuous beams – plastic design of multistory frames.
CVS621	**Analysis and Design of Cold Formed Elements**
	Introduction – advantages of cold formed sections – types – methods of production – different factors considered in design – properties of sections – limits for tension and compression elements – beams and welded connections – bolted connections.
CVS622	**Advanced Design of Steel Connections**
	Introduction – elastic connections – rigid connections – semi rigid connections – beam and beam column connections – steel column footings.
CVS623	**High Rise Steel Structures**
	Introduction – Loads affecting high rise buildings – different lateral load resisting systems – different methods for structural analysis - deign of high rise buildings.
CVS624	**Bridge Engineering**

Postgraduate Courses Syllabus
for Civil Engineering (Water Resources)
Level 500

CVW501	**Engineering Systems & Statistics**
	Development of concepts and techniques commonly associated with systems engineering which are applicable to design and operation of systems that concern civil engineers. Design and planning process; problem formulation, optimization concepts, linear programming, decision analysis; system simulation; network planning and project scheduling; computer applications. The techniques developed are used to solve problems in transportation, water resources, structures, and construction management.
CVW502	**Irrigation & Drainage Systems**
	Introduction to Irrigation and Drainage Engineering – soil – Water interaction – Water Duties – When Irrigation is needed – Agriculture and Irrigation cycles – Irrigation Systems and their Area in Egypt – Irrigation Methods – New Irrigation Systems – Sprinkler Irrigation – Drip Irrigation Drainage – Drainage Systems - Alignment and Design of Irrigation Projects.
CVW503	**Water Structures 1**
	Introduction- classification and types of water structures – intakes- dams and reservoirs- escapes- control and flow structures- culverts- siphons- aqueducts- river navigation locks
CVW504	**Water Resources Management**
	Definition of water resources, it's statistics and water budget in Egypt Arab and Middle East Countries- different scopes of water use- general policies of water management- supply & requirements management- qualitative management of water- economic, social, legal political and organizational aspects that should be considered with water management- definition of integrated management of water resources- water management on international level, watershed level, city level and farm level
CVW505	**Surface Water Hydrology 1**
	Surface runoff operations- time distribution of flow- drainage curves analysis- unit hydrographs- principal modules for determination of runoff curves- runoff measurements- determination of maximum runoff values- runoff characteristics- determination of design values of levels, discharges, volumes and flood period and their relation to storage – storage
CVW506	**Groundwater Hydrology 1**
	Introduction to groundwater flow principles, including steady and transient flow through porous media, numerical analysis, pumping tests, groundwater geology, contaminant transport, and design of waste containment systems.
CVW507	**Water Quality Control**
	Overview of approaches used by engineers to preserve or improve water quality at the watershed scale. Characterization and modeling of nutrients, metals and organic contaminants in watersheds. Application of ecosystem modification and pollutant trading to enhance water quality. The course emphasizes recent case studies and interdisciplinary approaches for solving water quality problems.
CVW508	**Management & Conjunctive Use of Water Resources**
	Geohydrology & Hydraulic measurements - Principles of stratified flow Dynamics - Sediment transport mechanics -

	Flow in pressure conduits - credible Open channels, lakes, reservoirs and ground water systems - Design and Construction aspects of structures for water resources projects - Structures for Storage - water supply/distribution - irrigation/drainage - hydroelectric power Generation - flood damage mitigation - Planning of water resources projects - introduction to water quality management - Field trips to Water Resources Projects.
CVW509	**Hydrological Measurements**
CVW510	**Water Management Operations**
	Characterizations of quality (serviceability, durability, safety, compatibility) in the life-cycle of engineered systems. Reliability and probability methods. Engineering guidelines. Evaluation of demands and capacities. Human and organizational factors. Recognition and management of reliability constraints (physical, psychological, social, economic). Assessments of impacts and consequences. Historic, economic, and standard-of-practice methods to determine acceptable or desirable reliabilities.
CVW511	**Methods of Analysis & Water Treatment**
	Unit operations and processes for water and wastewater treatment. Lectures and laboratories on tracers, filtration, aeration, adsorption chemical treatment of wastewater, biological filters, activated sludge, and anaerobic digestion.
CVW512	**Water Laws**
	General rules for water use- right of river-shoring countries in using a continental river- rule of fair use- rule of innocent use- international cooperation in the field of continental rivers- legal protection of river environment and pollution prevention- solution of problems related to continental rivers – applications on the River Nile
CVW513	**River Engineering**
	Analysis of steady and unsteady open-channel flow and application to rivers and streams. Examination of mixing and transport in rivers and streams. Effects of channel complexity. Floodplain dynamics and flow routing. Interaction of vegetation and fluid flows. Freshwater and tidal marshes. Sediment transport in rivers, streams, and wetlands. Implications for freshwater ecosystem function.
CVW514	**Planning & Management of Water & Environmental Systems**
	Fundamental and practical issues of environmental and water planning and management. Quantitative overview of the engineering, economic, and policy aspects of water and environmental systems. Topics in water and environmental planning and management include benefit cost analysis, contingency evaluation, inflation, pricing, marketing, transfers, uncertainty and decision analysis, and system analysis and their applications.
CVW515	**Water Reuse**
	Determination of changes in water resources & future requirements & reliability - methods of facing the problem of increasing water demands –

	requirements for management, workability and maintenance- Management by objectives & results- development of seasonal and annual plans and long term strategic planning- protection of water resources- types of water- water reuse- types of water reuse- environmental conditions for water reuse- follow-up, evaluation- methods of measurement and control of water- environment law in water reuse – examples
CVW516	**Well Design**
CVW517	**Numerical Modeling**
	A theoretical framework for modeling and applications in the area of ecology, drainage and irrigation, and contaminant transport. Hands-on applications using numerical modeling and analysis of real life problems and field experiments will be emphasized. flood and drought, and issues related to advanced hydrological modeling. Students will address practical problems and will learn how to use the current operational hydrologic forecasting model, and build hydrological models Numerical solution of linear systems – numerical solution of nonlinear equations – curve fitting-optimization-numerical solution of ordinary and partial differential equation.
CVW518	**Flood Protection**
	Flood expectation and prediction- reservoir and storage design- escapes design- protection works- design of protection works- design criteria- analysis of floods and storms return periods- design of flood control reservoirs- design of storm drains- rainfall prediction
CVW519	**Seminar**
	Selected topic for each student is selected by the course lecturer
CVW520	**Irrigation Engineering**
	Determination of water requirements- Selection of adequate crop pattern- Estimation of water budget-Distribution of available resources- Water quality & it's impacts on different crops-Salination problems & impact on agriculture-Reclamations of saline and alkaline lands-Follow-up & evaluation of irrigation projects
CVW521	**Engineering Mathematics**
	Solution of non-liner equations – solving sets of equations – interpolating polynomials – Numerical differentiation and numerical integration – numerical solution of ordinary differential equations .
CVW522	**Computational Hydraulics**
	Mathematical behavior of partial differential equations – Flow in pipes networks – Non steady flow and water hammer .
CVW523	**Measuring Instruments**
CVW524	**Advanced Hydraulics**
CVW525	**Sediment Transport Hydraulics**
	Sediment properties – Theroshold of particle movement . Geometry of

	fluvial channels – channel roughness – bed load transport – suspended sediment transport – total sediment transport rate .
CVW526	**Hydraulics Machine**
	Hydraulics turbines – types of turbines – properties of turbines – similarity in turbines – turbines performance – selection of turbines – non steady flow in pipes and water hammer – basic equation of water hammer – pressure wave in a conduit due to sudden closure of valve - Slow closing of a wave – surge tanks – pumping machinery – types of pumps – properties of pumps – limits of suction life - Pumps in series – pumps in parallel - performance curves of a pump.

Postgraduate Courses Syllabus
for Civil Engineering (Water Resources)
Level 600

CVW601	**Hydropower Stations**
	Introduction-historical background-classification of energy resources-efficiency of hydropower stations- …….- capacity of hydropower stations- planning of hydropower stations- water requirements for hydropower stations – elements of hydropower stations- determination of available …… on a river without storage- determination of available …… on a river with different storage types - applications
CVW602	**Water Structures 2**
	Pumping & elevation stations: classification & design- Dams: earth dams-concrete gravity dams- reinforced concrete dams- arch dams- Buttress dams – design elements- seepage analysis- filter design- effects of earthquakes- fundamentals of construction- methods of flood determination – determination of design capacity of reservoirs
CVW603	**Environmental Hydrology**
	Hydrologic cycle-hydrology & environment- importance of hydrology-hydro-metrology- filtration- surface runoff:: prediction of maximum runoff capacity-storm hydrograph- unit hydrograph- reasons for scour & sedimentation-drought, dryness & desertification- protection structures against flooding- diversion & storage structures- crossing structures-sediment traps- storm water drainage systems- interaction between soil & water- water quality & contaminant control: contamination sources-mechanics of contaminant transport in surface & subsurface water – protection of water resources from contamination
CVW604	**Surface Water Hydrology 2**
	Application of fluid mechanics principles to problems of pollutant transport and mixing in the water environment. Concepts of hydrological diffusion and transport; turbulent mixing; mixing in rivers, reservoirs, and estuaries; effects of stratification on mixing; theory of jets and plumes, and introduction to intakes and outfalls.
CVW605	**Groundwater Hydrology 2**
	Methods of groundwater investigation-groundwater quality and contamination: contamination sources- mechanics of pollutant transport in porous media- fresh- & salt-water intrusion-intrusion of sea water in groundwater reservoirs-contamination control & methods of treatment-groundwater simulation: mathematical physical & numerical models-simulation of groundwater flow in porous media- simulation of contaminant transport in porous media- management of groundwater systems- introduction for application of remote sensing & GIS in groundwater studies

CVW606	**Environmental Impact Assessment**
	Environmental ethics. Prediction and estimation of impact on air, water, soil quality, and biological, socio-economic, cultural environments. Water and air pollution laws, solid and hazardous waste laws. Environmental inventories, assessment preparation, and review. Federal and provincial laws and regulations on environmental assessment. Strategies for environmental compliance, resolution of environmental conflicts. Case studies.
CVW607	**Modeling & Simulation of Flow & Contaminant Transport**
	Introduction to the philosophy and practice of numerical modeling of environmental flow processes. structured computer modeling assignments on a single topic in environmental flow modeling, supported by focused lectures and discussions on the physical processes and on the associated numerical analysis. Topics such as contaminant transport, flood and tide propagation in channels and data analysis of climate, air and water quality observations. Fate of contaminants in the environment controlled by transport processes within a single media and between media. Similarities in contaminant dispersion within air, surface water, and groundwater are emphasized.
CVW608	**Water Resources Management**
	Modern methods for data preparation- use & application of GIS in the field of eater resources-programs & models applied in data analysis-Systems for decision making in management and analysis of water resources systems- Applications-Examples
CVW609	**Statistical Methods for Water Management**
	Topics in analysis and modeling of spatial heterogeneity, estimation in the earth sciences, and flow and transport processes in environments. Course emphasizes modeling of flow and transport under conditions of spatial heterogeneity of the hydro-geologic parameters. Fundamentals of the stochastic approach to spatial variability analysis, known as geo-statistics, and fundamental, as well as practical aspects of flow and transport in heterogeneous formations.
CVW610	**Economics of Water Resources**
	Urban demand for water; water supply and economic growth; water utility economics; irrigation demand; large water projects; economic impacts of surface water law and institutions; economics of salinity and drainage; economics of groundwater management.

CVW611	**Engineering Analysis for Risk in Water Resources & Irrigation**
	Applications of probability theory and statistics in planning, analysis, and design of civil engineering systems. Development of probabilistic models for risk and reliability evaluation. Occurrence models; extreme value distributions. Analysis of uncertainties. Introduction to Bayesian statistical decision theory and its application in engineering decision-making. Characterizations of quality (serviceability, durability, safety, compatibility) in the life-cycle of engineered systems. Reliability and probability methods. Evaluation of demands and capacities. Human and organizational factors. Recognition and management of reliability constraints (physical, psychological, social, economic). Assessments of impacts and consequences
CVW612	**Seminar**
	Topic is chosen for each student by the course lecturer
CVW613	**Information Systems in Irrigation**
	Importance of irrigation systems in water resources management- methods of data preparation- Irrigation systems- drainage systems- application of some programs for data entry, classification and preparation- information prediction from data- formation of mathematical or engineering problem concept and determination of objectives, solutions, alternatives- methods of presentation and data analysis- data base- GIS- application of information systems in decision making of irrigation projects- applications
CVW614	**Dams Engineering**
	Reservoir planning: selection of storage location- storage capacity- sedimentation in reservoirs- multi-purpose reservoirs- earth and gravity dams: classification of earth dams- fundamentals of design- leakage- filter design- causes of earth dams failure- gravity dams: forces affecting a gravity dam- safety and equilibrium requirements- theoretical and practical dam profile-effects of earthquakes- design height of gravity dams- design methods- Arch dams: classification- types- forces affecting dams- design methods- escapes- tranquil ling basins: types & design

CVW615	**Educational Research**
	Introduction – preparation and evaluation of a research plan – selection of a sample – selection of measuring instruments – research methods and procedures – data analysis and interpretation – preparation of a research report .
CVW616	**Hydraulic Models**
	Principles of the theory of similarity – flows without free surface – Reynolds models – flows through porous media – filtrations models – unidirectional flows with free surface – river and open channel models – similarity in sediment transport.
CVW617	**Turbulence and its measurements**
	The physics of turbulence measurable quantities and its physical significance – examples of turbulent flows – measurement techniques – hot wire anemometer – analysis of fluctuating signals – temperature and concentrations measurements.
CVW618	**Applied Hydraulics (1)**
	Basic equations of mass oscillation in simple surge tank – dynamic equations – equation of continuity – solution neglecting tunnel frictions – calcution of water – level osculation including tunnel friction – direct integration – step by step integration – surge shafts with expansion chamber – trotted and other surge – tanks problems – stability of single and multiple surge tanks – graphical methods of analysis .
CVW619	**Stable Channel Design**
	The empirical stable channel design – tractive force method of stable channel design – drag distribution and resistance to motion – design values for boundary shear – the minimum stable cross section – design by tractive force method.
CVW620	**Applied Hydraulics (2)**
	General theory – theory of water hammer in pipe–lines with surge tanks – air vessels – theory of periodic motion and resonance in pipe–lines governing of turbines – graphical method of Schnyder and Bengeron.
CVW621	**Transport of Sediment by wave**
	Transport outside the breaker action – transport within the surf zone – beach profile and shape – analytical profile models – beach profile and shape.
CVW622	**Hydrodynamics**
	Equations of motions – irrigational motion – motion of a liquid in two dimensions – irrotational motion in three dimensions – motion of solids through a liquid – dynamical theory – vortex motion – tidal waves – surface waves of expansion – viscosity and rotating masses of liquid .

Postgraduate Courses Syllabus
for Civil Engineering (Public Work)
Level 500

CVP501	**Engineering Mathematics and Statistics**
	Introduction – simultaneous linear equations matrices – linear programming - Eigen -Value problems - Algebraic and transcendental Equations –Numerical differentiation and integration – probability theory and its applications – additional tests – Lambert network.
CVP502	**Theory of Errors and Adjustment Computations**
	Introductions – definitions of measurements – concepts of errors and accuracy – Error propagations and indirect observations – theory of least squares – Adjustment with least squares - Adjustment by condition equations - Adjustment by parametric equations – applications of least squares.
CVP503	**Adjustment Computations in surveying**
	Least squares with additional conditions - General solution in Least squares – Variance covariance matrix – non linear solutions – filtering and smoothing – prediction in mathematical models – numerical applications and some software
CVP504	**Advanced Geodetic surveying (1)**
	Study of the earth figure – Geodetic computations on the earth – (Spherical triangles – Coordinates – Distances) – Reference Systems - Geodetic computations on the Reference Systems - Constructing the horizontal control points – (observation and computation) Types of horizontal control networks – constructing the vertical control points (observations and computations) – Trigonometric Geodetic Leveling .
CVP505	**Satellite Geodesy**
	Principals of satellite surveying – Satellite orbits and coordinates - observation techniques in satellite surveying – Lunar laser ranging – types and sources in satellite surveying.
CVP506	**Global Positioning Systems (1)**
	Introduction – figure of the earth – elements of satellite surveying – Global positioning system techniques GPS – GPS observation equations carrier phase and pseudo range observation equations – Types and Sources of GPS errors – Adjustment computations and accuracy evaluations.
CVP507	**Physical Geodesy**
	Introduction – gravity observations – computation on the reference systems – geoid determinations – astronomic methods – gravity observation techniques – satellite observations – height systems (orthometric –dynamic) – gravity effects in geodetic computations – Gravity corrections in geodetic computations – gravity prediction methods.
CVP508	**Aerial photogrammetry**
	Introduction – types of aerial cameras – Camera calibration – Principals of aerial photos –stereoscopy and parallax – theory of orientation – measurements in aerial surveying – relief displacement – aerial triangulation – ground control points – Flight planning – independent models techniques.

CVP509	Map Projections and Numbering
	Introductions – types and methods in map projections – Types of Map projections –conical projection – cylindrical projection – surveying projections – coordinates computations from projections – special projections – map projections and geographic information systems - Compilation systems of map numbering .
CVP510	**Advanced Geodetic surveying (2)**
	Introduction – Geodetic computations on the earth – first degree reference system – projections of the geodetic computations on the reference system – Spatial Geodesy coordinate computation and coordinate transformation.
CVP511	**Global Positioning Systems (2)**
	Introduction – Global positioning system observations – Ambiguity resolution and cycle slip detection – Types and Sources of GPS errors – Adjustment computations and accuracy evaluations – GPS applications and software study and analysis – preparing surveying programs for some applications.
CVP512	**Planning and Management Surveying Projects**
	Introduction – main elements in surveying project – human requirements for the project – instruments and tools for the project – system of observation management – project time table – control detection for the project plan – project economy – study some computer software in surveying management.
CVP513	**Applied Astronomy**
	Basic concepts – celestial sphere and celestial coordinate system – Transformation amongst celestial coordinates – Special star positions – the concept of time systems - Variations in the celestial coordinates – Determination of latitudes, longitudes and azimuth .
CVP514	**Gyroscopic Systems in Surveying**
	Introduction – the gyroscope – types of gyroscope – the gyroscopic theodolite – inertial systems in surveying – gyroscopic compass – mobile mapping systems – some engineering applications.
CVP515	**Computer Applications in Geodesy**
	Introduction – types of surveying information – Data collection techniques – surveying multimedia data (satellite images – aerial photos) – Data processing - studying some geodetic software – preparing some surveying programs in geodesy.
CVP516	**Close Rang photogrammetry**
	Methods in close rage photogrammetry - close rage photogrammetry instruments – accuracy in close rage photogrammetry – coordinates determination techniques in close rage photogrammetry - digital photographs - close rage photogrammetry Application .
CVP517	**Photogrammetry and Digital Maps**
	Introduction – reference systems in surveying and maps – map scale and contour interval – evaluation of topographic maps – Digital maps – Digital elevation model – Data sorting and management – Geographic information systems GIS - symbols in maps - Mapping - quality measure in mapping .

CVP518	Remote Sensing
	Introductions – principals of remote sensing – Electromagnetic radiations and fields – Sources of remote sensing data – catachrestic of aerial photo - multi-

	spectral images – satellite images – radar images - photo interpretations - instruments in remote sensing – remote sensing applications.
CVP519	**Photo Interpretation**
	Introductions – principals of photo interpretations – geological planning – agricultural models - aerial color and color infrared photography – index of photo interpretations – elements of index - satellite images – remote sensing applications.
CVP520	**Geographic Information System (GIS)**
	Introduction – data systems – data recording data classification - data transfer –surveying data sources – Data inputs and Data outputs – recording techniques – Data managements – Filing systems – information system design - geographic information system software – GIS applications .
CVP521	**Surveying Applications in Remote Sensing**
	Introduction – space photography – factors affecting the quality of space photographs – satellite images information – map production from space photos – photo preparation for GIS systems – Remote sensing application in land use and pollution – computer applications in satellite images.
CVP522	**Underground Surveying**
	Underground surveying terminology – instruments and equipments in underground surveying - underground orientation – vertical control survey method and equipments – underground leveling - applications in mining and tunnels
CVP523	**Cartography**
	The art and science of cartography – Map classification – Compilation systems of map numbering – Maps and map projections – surveying maps (topographic and detailed maps) – Cartography in terms of map products – coordinates in cartography – cartography in terms of information – introduction in map projections.
CVP524	**Map Projections and Numbering**
	Introductions – types and methods in map projections – plane projections – conical projection – cylindrical projection – surveying projections – map coordinates in conical and cylindrical projections
CVP525	**Diploma Project**
	The student should prepare applied search in engineering geodesy using computer- the title of the search should accepted from the teaching staff with the supervisor – the Project should introduced to the head of the department after the second exam in the second year for discussion in seminar .

Postgraduate Courses Syllabus
for Civil Engineering (Public Work)
Level 600

CVP601	***Engineering Mathematics***
	LAPLAS Transformation – Differential equation – Special function – complex numbers – real integration – linear differential equations – vector analysis – Furrier integrations and its applications in ordinary and partial differential equations.
CVP602	**Applied Statistics**
	Introduction – Data collection and analysis – Random variables and its distribution – Moments and moments functions – Conditional probability – correlation and regression – Data representation – Detailed probability models – simple and complex linear models – Quality control statistics – statistics assumptions tests.
CVP603	**Theory of Errors and Adjustment Computations**
	Introductions – definitions of measurements – concepts of errors and accuracy – Error propagations and indirect observations – theory of least squares – Adjustment with least squares - Adjustment by condition equations - Adjustment by parametric equations – applications of least squares.
CVP604	**Geodetic surveying**
	Study of the earth figure – Geodetic computations on the earth – (Spherical triangles – Coordinates – Distances) - Constructing the horizontal control points – (observation and computation) Types of horizontal control networks – constructing the vertical control points (observations and computations – Types and methods of first order ropers networks .
CVP605	**Satellite Geodesy**
	Principals of satellite surveying – Satellite orbits and coordinates - observation techniques in satellite surveying – Lunar laser ranging – types and sources in satellite surveying.
CVP606	**Global Positioning Systems**
	Introduction – figure of the earth – elements of satellite surveying – Global positioning system techniques GPS – GPS observation equations carrier phase and pseudo range observation equations – Types and Sources of GPS errors – Adjustment computations and accuracy evaluations – GPS applications and software.
CVP607	Surveying with Mobile Mapping
	Introduction – elements of mobile mapping system – control module and GIS system – The positioning Module – Stereoscopic system module and close range photogrammetry – Video module – Control module and positioning solutions – Field calibration for the mobile mapping system .
CVP608	Aerial photogrammetry
	Introduction – types of remote sensing instruments aerial cameras – Principals of aerial photos –stereoscopy and parallax – theory of orientation – measurements in aerial surveying – relief displacement – tilted displacement.

CVP609	**Close Rang photogrammetry**
	Methods in close rage photogrammetry - close rage photogrammetry instruments – accuracy in close rage photogrammetry – coordinates determination techniques in close rage photogrammetry - digital photographs - close rage photogrammetry Application.
CVP610	**Photogrammetry and Digital Maps**
	Introduction – reference systems in surveying and maps – map scale and contour interval – evaluation of topographic maps – Digital maps – Digital elevation model – Data sorting and management – Geographic information systems GIS - symbols in maps - Mapping - quality measure in mapping .
CVP611	**Remote Sensing**
	Introduction – principals of remote sensing – Electromagnetic radiations and fields – Sources of remote sensing data – catachrestic of aerial photo - multi-spectral images – satellite images – radar images - photo interpretations - instruments in remote sensing – remote sensing applications.
CVP612	**Photo Interpretation**
	Introduction – principals of photo interpretations – geological planning – agricultural models - aerial color and color infrared photography – index of photo interpretations – elements of index - satellite images – remote sensing applications.
CVP613	**Geographic Information System (GIS)**
	Introduction – data systems – data recording data classification - data transfer –surveying data sources – Data inputs and Data outputs – recording techniques – Data managements – Filing systems – information system design - geographic information system software – GIS applications .
CVP614	**Underground Surveying**
	Underground surveying terminology – instruments and equipments in underground surveying - underground orientation – vertical control survey method and equipments – underground leveling - applications in mining and tunnels.
CVP615	**Cartography**
	The art and science of cartography – Map classification – Compilation systems of map numbering – Maps and map projections – surveying maps (topographic and detailed maps) – Cartography in terms of map products – coordinates in cartography – cartography in terms of information – introduction in map projections.
CVP616	**Map Projections**
	Introductions – types and methods in map projections – plane projections – conical projection – cylindrical projection – surveying projections – map coordinates in conical and cylindrical projections.
CVP617	**Marine Surveying**
	Introductions – instruments used in marine surveying – principals in marine surveying – projections and map types used in marine surveying - natural factors affect marine surveying – mapping techniques - coordinates systems in marine surveying – planning marine surveying projects – applications .
CVP618	Applied Astronomy
	Basic concepts – celestial sphere and celestial coordinate system – Transformation amongst celestial coordinates – Special star positions – the

	concept of time systems - Variations in the celestial coordinates – Determination of latitudes, longitudes and azimuth .
CVP619	Computer Applications in Surveying
	Introduction – computation and adjustment of closed traverse – adjustment of trilateration networks –Adjustment by least squares - adjustment of leveling nets – methods of area and volume computation – coordinates computations using intersection and resection techniques – coordinates transformations – girding of leveling networks.
CVP620	**Surveying Applications in Remote Sensing**
	Introduction – space photography – factors affecting the quality of space photographs – satellite images information – map production from space photos – photo preparation for GIS systems – Remote sensing application in land use and pollution – computer applications in satellite images.
CVP621	**Dynamic Geodesy**
	Introduction – earth dynamics – earth rotation – north pole motion – tide in cadastral motion - tectonic motion satellite dynamics – dynamic analysis of the orbits – inertial systems in surveying – inertial system application in surveying and geodesy .
CV622	**Planning and Management Surveying Projects**
	Introduction – main elements in surveying project – human requirements for the project – instruments and tools for the project – system of observation management – project time table – control detection for the project plan – project economy – study some computer software in surveying management.
CVP623	**Construction Surveying**
	Introduction - Used tools and equipment- Surveying operations for eng. Projects - Site surveying for electric works - surveying for irrigation projects – surveying for Harbors projects .
CVP624	**Gyroscopic Systems in surveying**
	Introduction – the gyroscope – types of gyroscope – the gyroscopic theodolite – inertial systems in surveying – gyroscopic compass – mobile mapping systems – some engineering applications.

Postgraduate Courses Syllabus
for Civil Engineering (Transportation Engineering)
Level 500

CVP526	**Transportation and Traffic Engineering**
	Introduction – Methods of Studying Transportation and Traffic Systems – Methods of Planning Transportation and Traffic Systems - Site Studies and Transportation Networks – Local and International Transportation Networks – Methods of Estimation of Traffic Volumes – International Methods and Systems of Transportation and Traffic - Methods and Systems of Transportation and Traffic in Egypt – Environmental Evaluation of Transportation and Traffic Systems – Principals of Evaluation of Transportation and Traffic Networks.
CVP527	**Applied Statistics**
	Introduction –Types and Distributions of Variables- Moments and Functions – Conditional Probability – Theory of Estimation - Data Collection and Analysis – Graphical Representation of Data – Probability Models - Simple and Complex Linear Models - Quality Control statistics – Analysis of Correlation and Deviation - Statistics Tests - Correlation Functions.
CVP528	**Geometric Design of Highways**
	Introduction – Highways Classification – Characteristics of Traffic – Elements of Geometric Design – Horizontal and Vertical Alignment – Planning and Design of Surface and Free Intersections – Traffic Control Devices – Using of Computer Software in Design.
CVP529	**Construction and Pavement of Highways**
	Introduction – Properties of Soil for Highways Construction – Classification of Construction and Pavement Materials – Base Coarse Materials – Asphaltic Materials – Asphaltic Mixtures – Concrete Mixtures – Chemicals for Construction and Pavement of Highways.
CVP530	**Soil Stabilization and Improvement**
	Introduction – Study of Soil Stabilization Methods and Techniques – Compaction – Types of Compaction – Hydraulics Methods – Additives and Binders – Reinforcement and Confining of Soil – Soil Injection – Study of Special Cases in Soil Stabilization – Using of Computer Software in Studying of Soil Types and Stabilization.
CVP531	**Materials and Testing of Highways Construction and Pavement**
	Introduction – Materials of Highways Construction and Pavement - Types – Composition – Properties – Laboratory Tests – Elements of Testing - Testing Apparatuses – Testing of Base and Sub-base Layers- Composite Construction Materials and composition – Asphaltic and Concrete Mixtures and Testing– Compressive Strength for Concrete Slabs – Construction and Pavement Technology – Quality Assurance.
CVP532	**Structural Design of Highways**
	Introduction – Studies of Traffic Loads and Uses of Highways – Vehicle Characteristics – Stress Analysis on the Highways – Stages of Structural Design – Elements of Structural Design of Highways – Factors and Variables affect the Design.
CVP533	**Preparing and Writing of Technical Reports**
	Introduction – Basic Elements of Technical Report – Technical Specification

	for Highways Construction – Conditions of Contract – Billing Quantity – Bases of Calculations – Executive Documentations.
CVP534	**Maintenance and Repairing of Highways and Airports**
	Introduction – Pavement of Highways – Pavement Materials - Properties of Pavement Materials – Failure of Pavement Construction – Methods of Evaluation of Pavement Conditions – Methods and Procedures of Pavement Maintenance – Drainage Systems – Systems of Maintenance Management – Periodic Maintenance for Pavement and Time Tables – Materials of Maintenance and Repair – Methods of Pavement Repair.
CVP535	**Application of G I S in Highways and Transportation Management**
	Introduction – Definition of Geographic Information Systems – Composition of Systems – Computers and Software – Multimedia – Using of Information Systems Software in Transportation Management and Highways Operation – Control of Trips on Transportation Networks – Planning of Transportation bathes – Control of Time Tables for Vehicles and Trucks Trips on Highways Networks.
CVP536	**Planning and Design of Airports**
	Introduction – Components of Airport - Runways of Airplanes – Main and Secondary Terminals - Types and Characteristics of Airplanes – General Layout of Airports – Geometric Design of Runways – Structural Design of Terminals – Parking Areas - Land Side Marking – Navigation Signs and Lightning.
CVP537	**Structural Design of Airports**
	Introduction – Loads on Airport Terminal and Runways – Geometric Design Criteria – Structural Design Criteria- Factors affect the Structural Design – Examples on the Structural Design of Airports Using Computers.
CVP538	**Environmental Impacts of Highways and Traffic**
	Introduction – Environmental Importance of Transportation Projects – Environmental Studies Demands – Stages of Environmental Evaluation – Reports of Environmental Evaluation – Air Pollution – Sources of Pollution – Mathematical Models of Pollution Measurements – Traffic Noise – Measurement of Traffic Noise and Models of Prediction the Increase in Traffic Volume
CVP539	**Alignment of Highways Centerlines**
	Introduction – Design of Highway Centerline on Topographic Maps – Site Investigation – Setting out of the Proposed Centerline- Methods of Using the Traditional Surveying Devices – Alignment Using the Electronic Surveying Devices – Alignment of the Straight and Curved Portions - Surveying Devices and Tools Using in Alignment.
CVP540	**Applications of Computer Software in Highways and Airports**
	Introduction – Study and Operation of Software in Design and Management of Networks and Statistics Analysis.
CVP541	**Applied Research**
	The Student Prepares an Applied Research (Dissertation) in Highways and Airports Using Computer Software – The Title and Content is Prepared with the Aid of a Supervisor who is one of the Staff Members who are Involved in Teaching the Diploma Courses – The Dissertation is Directly Submitted to the Head of Department after Finishing the Second

Postgraduate Courses Syllabus
for Civil Engineering (Transportation Engineering)
Level 600

CVP625	**Traffic Engineering**
	Introduction – Definition of Traffic Engineering – Traffic Problems – Elements of Traffic Engineering (Vehicles – Roads – Vehicle Drivers- Walkers) – Characteristics of Traffic Flow – Traffic Control Techniques – Traffic Control Devices and Operation Methods – Control of Sections – Bicycle Movements – Light Signs – Parking – Accidents and Safety on the Road……
CVP626	**Geometric Design of Highways**
	Introduction – Advanced Studies in Highways Classification – Characteristics of Traffic – Criteria of Geometric Design of Highways – Horizontal and Vertical Alignment – Planning and Design of Surface and Free Intersections – Free Intersections and U Terns.
CVP627	**Transportation Economy**
	Annual Model of Cost – Expenditures of Vehicle Operation – Economic Analysis for Expenditures – Economic Theories for Global Transportation System – Transportation of Passengers and Goods between and inside Cities - Studies of Production Cost Determination – Determination of Demand Function – Design of Public Transportation Policy - Economic Boundaries – Infra- Structures Investments – Benefit – Effects on National Economy .
CVP628	**Soil Stabilization and Improvement**
	Introduction – Study of Soil Stabilization Methods and Techniques - Types of Compaction – Hydraulics Methods – Soil Injection –Chemical Binders – Sand and Stone Piles - Soil Reinforcement –Design of Reinforced Slopes – Geo-textiles Materials and Types.
CVP629	**Safety and Traffic Accident on Highways**
	Introduction- Types of accidents – Definition of Danger Zones – Human Factors – Behavior of Vehicle Drivers – Methods of Data Collection – Methods of Data Registration – Accident Reports – Using of Computer – Accidents Statistics – Accident Rates – Statistics Analysis for Traffic Data – Models of Accident Prediction – Site Analysis – Safety Entrance on highways – Modern Methods for Safety studies.
CVP630	**Structural Design of Highways**
	Introduction – Advanced Studies in Traffic Loads – Vehicle Characteristics– Stress Analysis on Highways – Elements of Structural Design – Methods and types of Pavement.
CVP631	**Applications of Computer Software in Highways Design**
	Introduction – Principals and Methodology of Highways Construction Management – Development and Operation of Computer Software in Highways Construction Management Projects – Applications for Construction Management Projects Using Computer Software – Applications of Computer software in Highways Evaluation and Design of Management, Maintenance and Repairs Programs.
CVP632	**Applications of Computer Software in Transportation and Traffic**
	Introduction – Methods of analysis and Modeling of Mathematical Models – Design of Transportation Modeling – Methods of Modeling the Random Numbers – Design and Analysis of the Similarity and Results- Experimental Mathematical Models for Sections using light Signs – Modeling of Free Networks – Design and Operation of Computer software.
CVP633	**Geometric and Structural Design of Highways**

	Introduction – Materials of Highways Construction – Soil Properties for Highways Construction- Base Course Applications – Materials of Sub-base Pavement - Asphalt Mixtures – Concrete Mixtures – Modern Materials of Pavement Construction.
CVP634	**Technology of Highways Construction and Pavement:**
	Introduction – Stages of Construction and Pavement – Elements of Highways Construction – Elements of Pavement – Equipments of Pavement Construction- Superintended of Construction and Pavement Stages – Devices and Methods using in Construction Superintended.
CVP635	**Analysis of Traffic Systems**
	Introduction – Nature of Traffic Data Demand – Analysis of Data and Modeling – Introduction in Sample Theory – Vehicle Bathes – Statistics Testing – Vehicle Speed – Origin Waves – Vehicle Impact – Traffic Generation Waves – Parking – Traffic Accidents – Environmental Impact of Traffic – Modern Methods for Data Collection and analysis.
CVP636	**Management and Construction of Highway Projects**
	Introduction – Elements of Highways – Management of Pavement Operation – Management and Evaluation – Design Alternatives and Analysis – Adoption of Management Programs- Applications and Field examples.
CVP637	**Planning of Urban Transportation**
	Introduction – Study of Transportation Demand and Balance – Calibration of Gravity Models - Direct Models of Transportation Demand – Models of Modal Split – Global Networks Planning and Traffic Assignment - Transportation Demand between Cities – Transportation of Goods.
CVP638	**Statistics Applications for Traffic Operation:**
	Introduction – Study of Statistics Distribution – Method of Sample Selection and the Required Volume – Statistics Distribution for Speeds – Statistics Distribution for Vehicles on the Urban and rural Highways – Statistics Distribution for Time Intervals – Statistics Evaluation for Traffic improvement Operation – Method of Registration of Statistics Analysis for Accident data.
CVP639	Planning Surveying for Highways
	Introduction – Coordinates points – Setting out of Highways Centerlines by Connection to Coordinates points - Planning Surveying for Highways centerlines (Straight and Curved Portions) – Alignment of Horizontal Curves – Study of Levels and Leveling Works – Determination of Levels on Highways Centerlines (Longitudinal and Cross sections) – Alignment of vertical Curves- Surveying Works for Construction Works
CVP640	**Maintenance and Repair of Highways and Airports**
	Introduction – Advanced Studies in Pavement Failure – Methods of Construction Evaluation – Methods of Pavement Maintenance and Highway Curves - Drainages Systems – Reusing of Pavement Materials – Systems of Maintenance Management.

Postgraduate Courses for Physics and Engineering Mathematics

Engineering Mathematics :

Code No.	Course title	Credit hours	Pre-req.	Code No	Course title	Credit hours	Pre-requ.
1st					2nd Semester		
BS 400	Abstract Algebra	2		BS409	Linear Algebra	2	
BS 401	Real Analysis	2		BS410	Ordinary Differential Equations1	2	
BS 402	Complex Analysis	2		BS411	Numerical Analysis	2	
BS 403	Functional Analysis	2		BS407	Computer Sciences	2	
BS 404	Introduction to Geometry	3		BS412	Experimental Physics	3	
Elective	Choice between BS405 BS403 ،BS407، BS408	4		Elective	Choice between BS413 BS414 ،BS415 ،BS408	4	
Contact Hours		15		Contact Hours		15	

2- Engineering Physics :

Code No.	Course title	Credit hours	Pre-requ.	Code No	Course title	Credit hours	Pre-requ.
First Term					Second Term		
BS 416	Quantum Mechanics	2		BS413	Solid State Physics	2	
BS 417	Statistical Mechanics	2		BS406	Atomic Physics	2	
BS 405	Mathematical Physics	2		BS407	Nuclear Physics	2	
BS 418	Classical Mechanics	2		BS415	Electrodynamics	2	
BS 419	General Engineering Mathematics (1)	3		BS404	Introduction to Geometry	3	
Elective	Choice between BS405 ، BS420 ،BS421 ،BS411	4		Elective	Choice between BS422 ، BS423 ،BS424 ،BS406	4	
Contact Hours		15		Contact Hours		15	

3- Engineering Mechanics :

Code No.	Course title	Credit hours	Pre-requ.	Code No	Course title	Credit hours	Pre-requ.
First Term					Second Term		
BS 411	Numerical Analysis	2		BS 407	Nuclear Physics	2	
BS 425	Fluid Mechanics	2		BS 415	Electrodynamics	2	
BS 426	Applied Mathematics	2		BS 429	Analytical Mechanics	2	
BS 427	Continuum Mechanics	2		BS 430	Thermodynamics	2	
BS 420	General Engineering Mathematics 1	3		BS 404	Introduction to Geometry	3	
Elective	Choice between BS416 ، BS417 ،BS407 ،BS428	4		Elective	Choice Between BS409 ، BS410 ،BS406 ،BS407	4	
Contact Hours		15		Contact Hours		15	

4- Geometry :

Code No.	Course title	Credit hours	Pre-requ.	Code No	Course title	Credit hours	Pre-requ.
First Term					Second Term		
BS 431	Projective Geometry 1	2		BS 436	Differential Geometry 1	2	
BS 404	Introduction to Geometry	3		BS 437	Advanced Descriptive Geometry 2	3	
BS 432	Advanced Descriptive Geometry 1	3		BS 438	Geometry of Algebraic Curves	2	
BS 419	General Engineering Mathematics1	3		BS 439	Computer Graphics 1	2	
Elective	Choice between BS433 BS411 ،BS434 ،BS435	4		BS 440	General Engineering Mathematics 2	2	

				Elective	Choice between BS409، BS407 ،BS441 ،BS442	4	
Contact Hours		15		Contact Hours		15	

Department : Physics and Engineering Mathematics
Courses for Higher Studies Diploma and Master Degree (level 400)

No	Code no.	Course title	Credit hours	Contact hours		Pre-requisite
				Lect.	Tutorial or lab	
1	BS400	Abstract Algebra	2			
2	BS401	Real Analysis and Topology (1)	2			
3	BS402	Functions of Complex Variable (1)	2			
4	BS403	Functional Analysis	2			
5	BS404	Introduction to Geometry	3			
6	BS405	Computational Physics	2			
7	BS406	Probability and Statistics (1)	2			
8	BS407	Computer Science (1)	2			
9	BS408	Fluid Mechanics	2			
10	BS409	Linear Algebra (1)	2			
11	BS410	Differential Equations (1)	2			
12	BS411	Numerical Analysis (1)	2			
13	BS412	Experimental Physics	3			
14	BS413	Partial Differential Equations (1)	2			
15	BS414	Operation Research (1)	2			
16	BS415	Analytical Mechanics (1)	2			
17	BS416	Quantum Mechanics	2			
18	BS417	Statistical Mechanics	2			
19	BS418	Classical Mechanics	2			
20	BS419	General Engineering Mathematics (1)	3			
21	BS420	Material Science (1)	2			
22	BS421	Dielectric Physics	2			
23	BS422	Semiconductor Physics	2			
24	BS423	Plasma Physics (1)	2			
25	BS424	Physics and Technology of Semiconductor Devices	2			

N.B.

1) From the present table, the academic advisor assigns courses with total credit hours of 30 cr. hr. divided on two terms as shown in the attached tables .
2) Other courses may be included according to the recommendation of the department committee and the agreement of the collage committee.

Department : Physics and Engineering Mathematics
Courses for Higher Studies Diploma and Master Degree (level 400)

No	Code no.	Course title	Credit hours	Contact hours		Pre-requisite
				Lect.	Tutorial or lab	
26	BS426	Applied Mathematics	2			
27	BS427	Continuum Mechanics	2			
28	BS428	Elasticity and Plasticity	2			
29	BS430	Thermo Dynamics	2			
30	BS431	Projective Geometry (1)	2			
31	BS432	Advanced Descriptive Geometry (1)	3			
32	BS434	Kinematics Geometry (1)	2			
33	BS435	Curve Fitting	2			
34	BS436	Differential Geometry (1)	2			
35	BS437	Advanced Descriptive Geometry (2)	3			BS 432
36	BS438	Geometry of Algebraic Curves (1)	2			
37	BS439	Computer Graphics (1)	2			
38	BS440	General Engineering Mathematics (2)	2			BS 419
39	BS441	N-Dimensional Geometry (1)	2			
40	BS442	Finite Geometry (1)	2			
41	BS443	Solid State Physics	2			

N.B.
1) From the present table, the academic advisor assigns courses with total credit hours of 30 cr. hr. divided on two terms as shown in the attached tables .
2) Other courses may be included according to the recommendation of the department committee and the agreement of the collage committee.

Department : Physics and Engineering Mathematics
Courses for Higher Studies Diploma and Master Degree (level 500)

No	Code no.	Course title	Credit hours	Contact hours		Pre-requisite
				Lect.	Tutorial or lab	
1	BS500	Solid State Physics	3	3		
2	BS501	Semiconductor Physics	3	3		
3	BS502	Atomic Physics (1)	3	3		
4	BS503	Nuclear Physics(1)	3	3		
5	BS504	Quantum Mechanics	3	3		
6	BS505	Statistical Mechanics	3	3		
7	BS506	Computational Physics	3	3		
8	BS507	Material Science (1)	3	3		
9	BS508	Electrodynamics (1)	3	3		
10	BS509	Dielectric Physics	3	3		
11	BS510	Plasma Physics (1)	3	3		
12	BS511	Physics and Technology of Semiconductor Devices	3	3		
13	BS512	Solid State Physics	3	3		
14	BS513	Experimental Physics	3	3		
15	BS514	Classical Mechanics	3	3		
16	BS515	Linear Algebra (1)	3	3		
17	BS516	Abstract Algebra (1)	3	3		
18	BS517	Real Analysis and Topology (1)	3	3		
19	BS518	Functions of Complex Variable (1)	3	3		
20	BS519	Ordinary Differential Equations (1)	3	3		
21	BS520	Partial Differential Equations (1)	3	3		
22	BS521	Numerical Analysis (1)	3	3		
23	BS522	Probability and Statistics (1)	3	3		
24	BS523	Computer Science (1)	3	3		
25	BS524	Operation Research (1)	3	3		

N.B.

1) From the present table, the academic advisor assigns courses with total credit hours of 18 cr. hr. for students of Professional Diploma, 12 cr. hr for students of the pre-…. Of the Postgraduate Diploma, and 18 cr. hr. for students of the postgraduate Diploma.

2) The academic advisor may include among the student study program, courses from other specializations.
3) Other courses may be included according to the recommendation of the department committee and the agreement of the collage committee.

Department : Physics and Engineering Mathematics
Courses for Higher Studies Diploma and Master Degree (level 500)

No	Code no.	Course title	Credit hours	Contact hours		Pre-requisite
				Lect.	Tutorial or lab	
26	BS525	Functional Analysis	3	3		
27	BS526	Differential Geometry (1)	3	3		
28	BS527	Projective Geometry (1)	3	3		
29	BS528	Analytic Mechanics (1)	3	3		
30	BS529	Fluid Mechanics	3	3		
31	BS530	Elasticity and Plasticity	3	3		
32	BS531	Applied Mathematics	3	3		
33	BS532	Continuum Mechanics	3	3		
34	BS533	Thermodynamics	3	3		
35	BS534	Introduction to Geometry	3	3		
36	BS535	Advanced Descriptive Geometry (1)	3	3		
37	BS536	Advanced Descriptive Geometry (2)	3	3		
38	BS537	Geometry of Algebraic Curves (1)	3	3		
39	BS538	Computer Graphics (1)	3	3		
40	BS539	Kinematics Geometry (1)	3	3		
41	BS540	Curve Fitting	3	3		
42	BS541	N^{th} Dimension Geometry (1)	3	3		
43	BS542	Finite Geometry (1)	3	3		
44	BS543	General Engineering Mathematics (1)	3	3		
45	BS544	General Engineering Mathematics (2)	3	3		
46	BS545	General Engineering Mathematics (3)	3	3		
47	BS546	Engineering Statistics	3	3		
48	BS547	General Engineering Physics	3	3		
49	BS548	General Engineering Chemistry	3	3		
50	BS549	Ceramic	3	3		
51	BS550	Polymer Science and Engineering	3	3		

N.B.3

1) From the present table, the academic advisor assigns courses with total credit hours of 18 cr. hr. for students of Professional Diploma, 12 cr. hr for students of the pre-…. Of the Postgraduate Diploma, and 18 cr. hr. for students of the postgraduate Diploma.
2) The academic advisor may include among the student study program, courses from other specializations.
3) Other courses may be included according to the recommendation of the department committee and the agreement of the collage committee.

Department : Physics and Engineering Mathematics
Courses for Higher Studies Diploma and Master Degree (level 500)

No	Code no.	Course title	Credit hours	Contact hours		Pre-requisite
				Lect.	Tutorial or lab	
52	BS551	Mathematical Analysis	3	3		
53	BS552	Introduction to Operation Research	3	3		
54	BS553	Modeling of Linear Systems	3	3		
55	BS554	Theories of Engineering Systems	3	3		
56	BS555	Network Modeling Systems	3	3		
57	BS556	Computer Applications in Eng. Systems	3	3		
58	BS557	Decision Making in Eng. Systems	3	3		
59	BS558	Modeling of Dynamic Systems	3	3		
60	BS559	Simulation of Engineering Systems	3	3		
61	BS560	Optimization of Nonlinear Systems	3	3		
62	BS561	Queuing Models in Eng. Systems	3	3		
63	BS562	Project	3	3		

N.B.

1) From the present table, the academic advisor assigns courses with total credit hours of 18 cr. hr. for students of Professional Diploma, 12 cr. hr for students of the pre-…. Of the Postgraduate Diploma, and 18 cr. hr. for students of the postgraduate Diploma.
2) The academic advisor may include among the student study program, courses from other specializations.
3) Other courses may be included according to the recommendation of the department committee and the agreement of the collage committee.

Department: Physics and Engineering Mathematics
Master Degree & Ph.D. Supplementary Courses (Level 600)

Specialization:

No	Code no.	Course title	Credit hours	Pre-requisite
1	BS600	Advanced Solid State Physics	3	
2	BS601	Advanced Quantum Mechanics	3	
3	BS602	Solid State Electronics	3	
4	BS603	Solid State Devices	3	
5	BS604	Thin Film Technology	3	
6	BS605	Physical Properties of Thin Films	3	
7	BS606	Introduction to Lasers and Electro-	3	
8	BS607	Opto-Electronic Devices	3	
9	BS608	Nuclear Physics (2)	3	
10	BS609	Atomic Physics (2)	3	
11	BS610	Material Science (2)	3	
12	BS611	Quantum Optics	3	
13	BS612	Advanced Semiconductor Device	3	
14	BS613	Optical Properties of	3	
15	BS614	Solar Cells	3	
16	BS615	Microwave Devices	3	
17	BS616	Semiconductor Device Processes	3	
18	BS617	Simulation and Modeling of	3	
19	BS618	Selected Topics in Advanced	3	
20	BS619	Thin Film Devices and Sensors	3	
21	BS620	Surface Properties of Solids	3	
22	BS621	Advanced Laser Physics	3	
23	BS622	Semiconductor Diode Laser Physics	3	
24	BS623	Photo-Electromechanical Properties	3	
25	BS624	Group Theory	3	

N.B.

1) From the present table, the academic supervisor assigns courses with total credit hours of 18 cr. hr. for students of First Stage of Master Degree., 12 cr. hr for students of M.Eng., 18 cr. hr. for students of Ph.D.
2) Supervisor may include among the student study program, courses from other specializations.
3) Other courses may be included according to the recommendation of the department committee and the agreement of the collage committee.

Department: Physics and Engineering Mathematics
Master Degree & Ph.D. Supplementary Courses (Level 600)

Specialization:

No	Code no.	Course title	Credit hours	Pre-requisite
52	BS651	Abstract Algebra (2)	3	
53	BS652	Real Analysis (2)	3	
54	BS653	Functional Analysis	3	
55	BS654	Partial Differential Equations (2)	3	
56	BS655	Numerical Analysis (2)	3	
57	BS656	Projective Geometry (2)	3	
58	BS657	Differential Geometry (2)	3	
59	BS658	Four Dimensional Descriptive	3	
60	BS659	Advanced Descriptive Geometry	3	
61	BS660	Central Projection	3	
62	BS661	The Geographical Maps	3	
63	BS662	Geometrical Principles of	3	
64	BS663	Kinematics Geometry	3	
45	BS664	Non-Euclidean Geometry	3	
66	BS665	Computer Graphics (2)	3	
67	BS666	Analytical Mechanics (2)	3	
68	BS667	Statistical Mechanics	3	
69	BS668	Vibration Mechanics	3	
70	BS669	Theory of Angular Momentum	3	
71	BS670	Advanced Engineering	3	
72	BS671	Advanced Engineering	3	
73	BS672	Engineering Numerical Analysis	3	
74	BS673	Engineering Probability and	3	
75	BS674	Special Topics in Mathematics	3	
76	BS675	Geometry of Algebraic Curves (2)	3	
77	BS676	Kinematic Geometry (2)	3	
78	BS677	N-Dimensional Geometry (2)	3	

N.B.

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2) Supervisor may include among the student study program, courses from other specializations.
3) Other courses may be included according to the recommendation of the department committee and the agreement of the collage committee.

Department: Physics and Engineering Mathematics
Master Degree & Ph.D. Supplementary Courses (Level 600)

Specialization:

No	Code no.	Course title	Credit hours	Pre-requisite
79	BS678	Finite Geometry (2)	3	
80	BS679	Higher Geometry	3	
81	BS680	Geometry of Algebraic Surfaces	3	
82	BS681	Robotics Geometry	3	
83	BS682	Computational Geometry	3	
84	BS683	Mechanisms Geometry	3	
85	BS684	Algebraic Geometry	3	
86	BS685	Affine Geometry	3	

N.B.

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2) Supervisor may include among the student study program, courses from other specializations.
3) Other courses may be included according to the recommendation of the department committee and the agreement of the collage committee.

Courses Syllabus

Postgraduate Courses Syllabus
for Physics and Mathematics Engineering Department
Level (400+500)

BS443	**SOLIDSTATE PHYSICS**
BS500	Periodic structures - Translation symmetry Periodic functions - Properties of reciprocal lattice - Fundamentals of the band theory - Schrodinger equation for the crystal - Brillouin zones - Concepts of metal semiconductor and dielectric.
BS422	**SEMICONDUCTOR PHYSICS**
BS501	Crystalline structures - Electronic states - Carrier statistics Transport in semiconductors Recombination process.
BS406	**ATOMIC PHYSICS (1)**
BS502	Radiation theory - Photon particle scattering - Models of hydrogen atom - Optical spectrum of the atom - Magnetic quantum numbers and electron distribution in the atom.
BS407	**NUCLEAR PHYSICS (1)**
BS503	Fundamental properties of the atomic nucleus - Different types of nuclear reactions - Detection methods of nuclear particle (electronic and visual) - Nuclear accelerator - Production of radioisotopes and their every day uses - Simple quantum mechanical example of nuclear sculpturing treatment Different models of nuclear structure.
BS416	**QUANTUM MECHANICS**
BS504	Old quantum theory - Physical basis of quantum mechanics - Properties of operators - Applications on schrodinger wave equation - Quantum mechanical treatment of hydrogen atom Time independent perturbation theory.
BS417	**STATISTICAL MECHANICS**
BS505	Complete review of Maxwell's thermodynamic relations - Disorder - Entropy - Information and equilibrium distribution - Equilibrium of energy and Maxwell boltzmann distribution •function - Statistical mechanics of a photon gas and Plank's law and BoseEinstein function - Statistical mechanics of an electron gas and fermi dirac function - Electron motion inside a non-metallic crystal (pure or doped) Magnetic cooling.
BS405	**COMPUTATIONAL PHYSICS**
BS506	A Monte-Carlo importance sampling method - Approximate models of random fields - Solving boundary value problems by the Monte-Carlo method - Stochastic processes and markovian chains Eigen-values of a sparse matrix and the Monte-Carlo technique.
BS420	**MATERIAL SCIENCE (1)**
BS507	Type of materials according to their structure - Different techniques used to identify the structure of materials - Bulk and surface properties of materials - Preparation of polycrystalline and single crystals - Composite materials and their structure.
BS415	**ELECTRODYNAMICS (1)**
BS508	Maxwell's equations - Scalar and vector potentials - Power density and pointing theorem - Radiation from a current element - The wave equation

	and its solution - Special theory of relativity.
BS421	**DIELECTRIC PHYSICS**
BS509	Dielectric polarization - Type of polarization - Permittivity and conductivity - Cramerkronig relations - Representation of dielectric functions: Impedance and permittivity, Equivalent circuits and representation of temperature dependence - Models of dielectric polarization: The harmonic oscillator, Free charge carriers and dipole floating - Dielectric phenomena in semiconductors: P-N junction, Schottky barrier and diffusive transport.
BS423	**PLASMA PHYSICS (1)**
BS510	Partial ionization of a gas and its statistics and radiation aspects - Scattering and capture interactions and their relations to fundamental plasma properties - Laws governing transport of plasma consistence inside it - Physical properties of a plasma under the action of external fields - Radiation phenomena resulting from the waves and interactions inside a plasma Study of plasma phenomenon in higher atmospheric layers in the sun and in fusion reactions.
BS424	**PHYSICS AND TECHNOLOGY OF SEMICONDUCTOR DEVICES**
BS511	An introduction course encompassing the principles of device operation - Review of the fundamentals of the electronic properties of semiconductors - Contact phenomena - P-N junctions - Schottky diodes - Photo-diodes - Bipolar - Transistors - Field effect transistors - Crystal growth - Oxidation - Diffusion and ion implantation.
	SOLID PHYSICS
BS512	Crystal structure-Electron diffraction – Crystal bond – Elastic properties – Thermodynamic properties – Fermi electron gas – Lattice vibrations and phonans – Band theory in solid state – Paramagnetism and diamagnetism.
BS412	**EXPERMENTAL PHYSICE**
BS513	Lab experimental on light – atomic physics –nuclear physics solid state – x – ray physics – physics of lazer.
BS418	**CLASSICAL MECHANICS**
BS514	Lagrang and Hamiltonian equations and their applications – Least action principle – Poissons's brackets – permanency laws – Introduction to relative mechanics.
BS409	**LINEAR ALGEBRA (1)**
BS515	Vector spaces - Matrices and determinants - Linear transformations - Sets of linear equations - Convex sets and N-Dimensional geometry - Characteristic value problems and quadratic forms.
BS400	**ABSTRACT ALGEBRA (1)**
BS516	Binary operations - Groups - Subgroups - Homomorphisms - Cosets - Lagrange’s theorem - Permutation groups - The general linear group - Rings - Polynomial ring – Euclidean rings.
BS401	**REAL ANALYSIS AND TOPOLOGY (1)**
BS517	Construction of the real numbers - Introduction to general metric spaces and their basic properties - Detailed study of continuous functions.
BS402	**FUNCTIONS OF COMPLEX VARIABLES (1)**
BS518	Basic concepts Analytic functions - Infinite series Integral theorems - Calculus of residues Conformal mappings and applications.
BS410	**ORDINARY DIFFERENTIAL EQUATIONS (1)**

BS519	First-order differential equations - General theory of linear differential equations - Systems of linear equations.
BS413	**PARTIAL DIFFERENTIAL EQUATIONS (1)**
BS520	Basic concepts Classification of second-order linear equations - Cauchy problem for wave equation and its solution Fourier series Separation of variables for equations of mathematical physics.
BS411	**NUMERICAL ANALYSIS (1)**
BS521	Iterative methods in matrix algebra – Eigen-values Nonlinear equations Numerical differentiation and integration - Initial-value problems for ordinary differential equations - Boundary value problems for ordinary differential equations - Numerical solution of partial differential equations.
BS406	**PROBABILITY AND STATISTICS (1)**
BS522	Random variables and their distributions - Independence - Moments and moment generating functions Conditional probability - Estimation theory - Testing of hypotheses - Regression and correlation.
BS407	**COMPUTER SIENCES (1)**
BS523	Computer systems architectures – Introduction to information systems - Introduction to operating systems – File organization and database design – Data communications and networks - Introduction to graph theory.
BS414	**OPERATIONAL RESEARCH (1)**
BS524	Linear programming - Two-person zero-sum games - Integer linear programming - Goal programming - Nonlinear programming.
BS403	**FUNCTIONAL ANALYSIS**
BS525	Normed linear spaces – Banach spaces – Hilbert spaces – Distribution theory.
BS436	**FUNCTIONAL ANALYSIS**
BS526	**DIFFERENTIAL GEOMETRY (1)** Vectors - Scalar and vector products - Linear dependence and independence - Differentiation of vectors - Plane curves - Tangent - Normal unit vector - Curvature - Space curves - Tangents - Arc length - osculating plane - Binomial moving torsion - Frenet formulas - Intrinsic equations - Surface arc - Surfaces Tangent plane - Normal line - Arc length - surface area - First and second fundamental forms - Asymptotic lines - Geodesics.
BS431	**PROJECTIVE GEOMETRY (1)**
BS527	Introduction - Euclidean and projective geometry - Principal of duality - Projective and perspective pencils and sets - Theorems of projectivities - Cross ratio - Invariance of cross ratio - Disargue's theorem - Plane and space configuration - Harmonic sets Plane and space configuration - Parabolic and hyperbolic projections - Involutions - Conic - Poles and polar - Pascal and brianchon's theorems - Steelier circle - Plane affine and euclidean geometry.
BS415	**ANALYTICAL MECHANICS (1).**
BS528	Kinematics in a moving reference frame - Lagrange's equation of motion - Lagrange's equation of impulsive motion - Lagrange's equation of small oscillations - Motion of a particle in a central field force - Kinetics of a rigid body in three-dimensional motion - Vibrations.
BS408	**FLUID MECHANICS**

BS529	The equation of continuity and boundary conditions - Rate of change of linear momentum - The equation of motion of an inverted fluid - The energy equation - Irrotational motion pressure equation - Two dimensional motion and steam function - Applications on conformal representations - Blazes theorem - Katte and Joukovski's theorem - Two-dimensional - Source (special and doublets) - The style of images - Rectilinear monition and vortex sheet.
BS428	**ELASTICITY AND PLASTICITY**
BS530	Analysis of stress - Analysis of strain - Stress-strain relations - Extension torsion and flexure of beams - Two-dimensional elasto-static problems.
BS426	**APPLIED MATHEMATICS**
BS531	Fourier and Laplace transforms – Partial differential equations – Solution of initial and boundary conditions problems in physics and mathematics – Functions of complex variables.
BS427	**CONTINUUM MECHANICS**
BS532	Tensor algebra – stresses tensor – translation tensor and strain rate of change tensor – equilibrium equations - congruence equations – sustentation equations – arrangement relationships – Iri function.
BS430	**THERMODYNAMICS**
BS533	Thermal properties – First and second thermodynamics laws – un-reacted mixes – Conduction, charge, and radiation Heat transfer.
BS404	**INTRODUCTION TO GEOMETRY**
BS534	Euclid – Triangle geometry – Regular polygon geometry – Isometric geometry in Euclidean plane – 2 dimensional crystal geometry – Geometry of symmetry in Euclidean plane – Geometry of circles and spheres – Isometric geometry and symmetry in Euclidean plane – Geometry of coordinate systems – Geometry of complex numbers – Geometry of ideal quintuple bodies – Geometry of golden section and felotaxes – Regular geometry – Affine geometry – Projective geometry – Proper geometry – Hyperbolic geometry – Differential geometry for curves and surfaces – Geometry of extended quantities – Geometry of geodetic lines – Topological geometry of surfaces – 4 dimension geometry.
BS432	**ADVANCED DESCRIPTIVE GEOMETRY (1)**
BS535	Parallel and central affine geometry in plane and in space – Indexed projection – Objects representation – Position and metric problems – Solids – Applications of indexed projection in engineering science branches – Topographic and inclined surfaces – Fill and cut slopes and their intersection with natural earth surface.
BS437	**ADVANCED DESCRIPTIVE GEOMETRY (2)**
BS536	Normal axonometric projection – Main axes – point, line, and plane representation – Position and metric problems – Auxiliary projection – Circle – Polyhedra – Sphere – Cylinder – Cone – Inclined axonometric projection.
BS438	**GEOMETRY OF ALGEBRAIC CURVES (1)**
BS537	Theory of sets geometry – Algebraic basics – Algebraic systems – Integral domains – Fields – Domain homomorphism – Geometry of projective spaces – Projective coordinate system – Linear subspaces –

	Dimensionality – Hyperplane coordinates – Dual spaces – Affine spaces – Relationship between affine and projective spaces – Colineation.
BS439	**COMPUTER GRAPHICS (1)**
BS538	In the light of PASCAL and visual BASIC programming – Graphics programming aims – 2 dimensional algorithms – Coordinate systems and transformations – Rotation – Matrices writing – Windows and interfaces – Line snaps – Automatic size and position adjustment – Application of recruitment – Curve fitting – Geometrical tools for 3 dimensional algorithms – Use of vectors in computer graphics – Inner product – Determinants – Vector product – Decomposition of polygons to triangles – Homogeneous axes – Translation and rotation in space – Perspective – Views transforms – Perspective transforms – Subscription of wire frame models – Projection directions – Invisible lines algorithms – Cylinder representation – Helical stairs – Spherical dome – 2 variable functions.
BS434	**KEINEMATIC GEOMETRY (1)**
BS539	Translations – Fixed transforms – Linear translations – Spherical translations – Positional translations – The motion – Rigid body motion – Induced motion – Multi parametric motion – Helix theory – Helix Coordinate transforms – Double vectors – Helix systems – Dual orthogonal matrices – Quadruple – Cliford algebra – Planer quadruples – Dual quadruples.
BS435	**CURVE FITTING**
BS540	Theory of probability – Least squares – Correlation factor – Polynomial functions – Exponential functions – Trigonometric functions – Logarithmic functions – Nonlinear trend – Use of programming in curve fitting – famous software for curve fitting.
BS441	**N-DIMENSIONAL GEOMETRY (1)**
BS541	Point coordinates in 4D – Intersections – 4D Euclidean space – Parallelism in 4D – Orthogonality in 4D – Minimum lines, planes, and hyper planes in 4D – 2^{nd} order hyper surfaces in 4D – Duality between line geometry in 3D and point geometry in 4D – N-Dimensional geometry – Projective spaces – Intersection of linear spaces in n-dimensions.
BS442	**FINITE GEOMETRY (1)**
BS542	Basic concepts in finite geometry – Finite plane – Isomorphic planes – Coincidence tables – Construction of finite and periodic planes – Gamma table for projective finite plane – Coordinate systems in finite plane – Galois planes and fields concepts – Closed sub plane for projective finite plane – Finite affine plane theory – Different types of hyperbolic finite planes – Galois planes and Disargues theory – Non-disargues plane – Galois geometry – Galois spaces theory – Generalization of Papas theory on Galois plane – Coordinates in Galois plane – Elliptical form concept in finite plane – Conic sections in Galois plane – Segret theory – Projective finite plane property – Disargues finite planes – Geometrical formation and networks – 2 pentagons inside each other – Pentagon theory and Disargues formation – Geometrical networks concepts.
BS419	**GENERAL ENGINEERING MATHEMATICS (1)**
BS543	Linear algebra – Eigen-values and iterative methods for finding them - Numerical solution of nonlinear equations - Interpolation and curve fitting - Systems of differential equations and its methods of solution.
BS440	**GENERAL ENGINEERING MATHEMATICS (2)**

BS544	Probability and statistics - Random variables and probability distributions - Principles of mathematical statistics and goodness of fit - Linear programming by graphs and by simplex method.
BS545	**GENERAL ENGINEERING MATHEMATICS (3)**
	Vector analysis - Gauss and Stoke's theorems - Boundary value problems in partial differential equations and methods of solution - Laplace transform and its applications.
BS546	**ENGINEERING STATISTICS**
	Random variables - Estimation theory - Goodness of fit - Testing of hypotheses - Regression - correlation.
BS547	**GENERAL ENGINEERING PHYSICS**
	Atomic structure and bonds - Structure of crystalline materials - Mechanical properties of materials - Properties of composite materials - Different - Techniques of determining the structure of materials - Introduction to wave mechanics - Electrical properties of semiconductors.
BS548	**GENERAL ENGINEERING CHEMISTRY**
	Atoms and molecules Types of bonds - Types of attractive forces between molecules - Distillation - Extraction - State of matter - Metals and alloys - Ceramics and polymers - Electrochemistry Dielectric materials.
BS549	**CERAMICS**
	Raw materials - Synthesis of ceramics - Types of ceramics - Cement - Refractors and ceramics insulation - Ceramics insulation - Ceramics plates and ceramics pastes.
BS550	**POLYMER SCIENCE AND ENGINEERING**
	Types of polymers: Natural and Synthetic polymers - Chemical principles of polymers - Characterization and testing of polymeric materials - Polymer structure – Polymer applications - Polymer and industry Polymer and building - Polymer and environment.

Postgraduate Courses Syllabus
for Physics and Mathematics Engineerig Department
Level 600

BS600	**ADVANCED SOLID STATE PHYSICS**
	Semiconductor band structure - Kohn-luilinger method for quantum well band structure - Band structure in diffraction through strain - Carrier transport - The hydrodynamic model obtained from boltzmann's transport equation - Low field transport: Mobility - High field transport: Starvation velocity The gun effect - Electron-phonon interaction - Acoustic phonon scattering (intravalley) - Optical phonon scattering - Polar optical phonon scattering - Transport in hetero-structures - Parallel transport in quantum wells and MDDFET Mobility in a MDDFET quantum well - Transport in quantum wires - Real space change transfer - Quantum transport: resonant tunneling - Interaction of photons with semiconductors.
BS601	**ADVANCED QUANTUM MECHANICS**
	Helium atom - Theory of scattering - Approximation methods - Time dependent perturbation theory - Elastic and inelastic collisions.
BS602	**SOLID STATE ELECTRONICS**
	Crystallography Statistics - Elements of quantum mechanics - Energy band structure - Effective mass - Phonons relaxation times - Mobility - Diffusion - Generation - Recombination - Absorption - Emission - Transport equations - Junction and tunnel devices luminescence in solids.
BS603	**SOLID STATE DEVICES**
	Characteristics - Models and limitations of selected semiconductor device structures: Diodes, transistors, Integrated circuit devices, Charge-coupled devices and Multi-layer devices - Selected topics from the general areas of opto-electronic and magnetic devices -Electro-luminescent - Photovoltaic and photo-detector devices - Magnetic bubble devices - Memory devices - Magneto-elastic devices - Noise.
BS604	**THIN FILM TECHNOLOGY**
	Vacuum technology Thin film deposition technology - Techniques for measuring the thickness of thin films - Analytical techniques for the composition of thin films - Structure of thin films - Applications of thin films.
BS605	**PHYSICAL PROPERTIES OF THIN FILMS**
	Mechanical effects in thin films - Transport phenomena in metal films - Transport phenomena in semi conducting films - Transport phenomena in insulating films Optical properties of thin films - Ferromagnetism in thin films.
BS606	**INTRODUCTION TO LASERS AND ELECTRO-OPTICS**
	Semiconductor physics - Laser operating principles - Laser structures and properties - Opto-electronic modulators and devices - Opto-electronic integrated circuits.

BS607	**OPTO-ELECTRONIC DEVICES**
	Overview of optical properties of semiconductors and elements of plane wave propagation - Theory and design of light emitting diodes - Laser

	diodes and detectors - Optical spectra and transitions - Spontaneous and stimulated emission - Population inversion - Carrier and optical confinements in hetero-structures Quantum-well lasers - Qpto-electronic detectors - Bandage engineered graded structures Staircase type or super-lattice structures for detectors - Detailed quantum efficiency calculations and detector noise considerations - Introduction to monolithic integrated circuits.
BS608	**NUCLEAR PHYSICS (2)**
	Applications of many body techniques to nuclear structure and nuclear matter - Experimental methods - Medium energy phenomena - Theory of nuclear reaction.
BS609	**ATOMIC PHYSICS (2)**
	Zeeman effect - X-rays - Molecules and molecular spectrum - Raman effect - Nuclear structure.
BS610	**MATERIAL SCIENCE (2)**
	Imperfections in metals - Mechanical properties of metals - Structure and properties of alloys Physics of polymers - New materials with desired properties.
BS611	**QUANTUM OPTICS**
	Atomic orbits - Probability densities - Energy levels - Quanta - Lasers – Holography – Magnet topics and electro optics Dual nature of light.
BS612	**ADVANCED SEMICONDUCTOR DEVICE PHYSICS**
	Modern semiconductor device concepts: VLSI, MQSFET, SQL, Biomes and Hetero-junctions - Super-lattice and quantum-well structures and their application to state of the art solid devices.
BS613	**OPTICAL PROPERTIES OF SEMICONDUCTOR**
	Crystal structure and bonding excitation - Lattice vibration - Transport electrons in bands - Electron-phonon interaction - Diffusion and optical properties.
BS614	**SOLAR CELLS**
	Solar radiation and ideal conversion efficiency - Optical absorption and reflection in semiconductors - P-N junction - Hetero-junction and thin-film solar cells – Material selection and design consideration - Antireflection coatings-grids-encapsulating concentrators Solar cell arrays.
BS615	**MICROWAVE DEVICES**
	Physics of microwave semiconductor devices - Varactors - Gunn diodes - Schottky barrier diodes - MESFET GaAs transistors - HEMT and quantum well devices - IMPATT and related transient time diode - Circuit application of microwave analog and digital devices - Parametric amplifiers up converters Oscillators - Amplifiers - Switches - Phase shifters.

BS616	**SEMICONDUCTOR DEVICE PROCESSES**
	Physical Chemical and metallurgical processes used in fabrication of modem semiconductor devices Doping Chemical vapor deposition - Oxidation – Diffusion Epitaxy - Implantation Ion etching Metal and dielectric deposition.
BS617	**SIMULATION AND MODELING OF SEMICONDUCTOR DEVICES**

	Monte-Carlo method The foundation of modeling and electronic transport bulk properties of solids and low-dimensional – Simulation of solids Steady state simulation of devices Wandering gunn domains - Theory of noise turbulence and chaos.
BS618	**SELECTED TOPICS IN ADVANCED PHYSICS**
	Theoretical physics Nuclear physics and reactors Physics of condensed matter - Theory of dielectric Solid state devices Photo-conductivity of solids.
BS619	**THIN FILM DEVICES AND SENSORS**
	Thin film resistors - Capacitors and inductors - Thin film circuit and integrated circuits - Continuous thin films as temperature - Strain and gas sensors - Discontinuous thin metal films as temperature Strain and gas sensors-porous thin films as humidity sensors.
BS620	**SURFACE PROPERTIES OF SOLIDS**
	Thermodynamics of solid surfaces and kinetics of surface diffusion and crystal growth - Chemical bonding - Crystal structure and anisotropy of properties - Elasticity Plastic deformation - Macro and micro diffusion Phase transformations in solids.
BS621	**ADVANCED LASER PHYSICS**
	Radiation with gases - Density Matrix formalize - Optical block equations - Coherence effects - Saturation spectroscopy - Optical pumped lasers - Selected topics in advanced laser physics.
BS622	**SEMICONDUCTOR DIODE LASER PHYSICS**
	Examination of the theory of operation - Manufacture - Application of semiconductor diode lasers InGaAsp diode lasers Applications in optical communication systems.
BS623	**PHOTO-ELECTROCHEMICAL PROPERTIES OF SEM ICON DUCTOR**
	Potentials and thermodynamic of cell - Kinetics of electrodes reaction and electrolyte solution - Processes at semiconductor electrodes - Electrochemical instrumentation - Spectrometric and photochemical experimental.
BS624	**GROUP THEORY**
	Group concept - Point groups Space groups - Reducible and irreducible representations of groups - Construction of brillioun zones and symmetry groups - Related fields in physics.
BS625	**ELECTRODYNAMICS (2)**
	Basic notions in quantum field theory Electron-photon interaction Relativistic perturbation theory - Feynman diagrams.
BS626	**RELAXATION PROCESSES IN SOLIDS**
	Crystal structure and the amorphous state - Lattice defects - Internal friction of solids ultrasonic attenuation - Magnetic loss.
BS627	**TRANSPORT THEORY IN MATERIALS**
	Charge carrier scattering - type of scattering - Temperature and external field dependence of charge carrier mobility and relaxation time - Kinetic phenomena - Boltzmann's kinetic equation - Kinetic coefficients - Galvano-magnetic phenomena.
BS628	**THEORETICAL PHYSICS**
	Plasma physics General relativity - Group theory Chaos in dynamic systems.

BS629	**ELEMENTARY PARTICLE PHYSICS**
	Comparison between cosmic ray sources and laboratory sources of elementary particles - Conservation laws and their relations to different elementary particles - Fundamental properties of elementary particles and methods to determine them - Strong interactions of elementary particles - Electromagnetic interactions of elementary particles - Weak interactions of elementary particles within the framework of quantum mechanics.
BS630	**REACTOR PHYSICS**
	Chain nuclear reaction and reactor fuel characteristics - Control of speeds of neutron fluxes and moderator characteristics - Control of temperature and neutron flux - Different types of nuclear reactors and their design - Nuclear reactors manipulation and safeguard measures against nuclear reactor accidents - Nuclear shielding measures and safe measures to store radiation wastes Relation between nuclear reactors and other energy generation sources.
BS631	**RESONANCE PARTICLE PHYSICS**
	Detection methods of resonance particles - Resonance interactions of mesons - Resonance interactions of baryons - Quantum treatment of resonance interaction.
BS632	**PLASMA PHYSICS (2)**
	Occurrence of plasma in nature - Definition of plasma - Concept of temperature - Plasma parameter - Criteria of plasmas - Applications of plasma physics - Single particle motions - Plasmas as fluids - Waves in plasmas - Diffusion and resistively -Equilibrium and stability - Kinetic theory - Nonlinear effects - Introduction to controlled fusion.
BS633	**SPECIAL THEORY OF RELATIVITY**
	Lorentz transformations - Four-dimensional velocity and acceleration - Relativistic dynamics - Moment and energy of particles - Action in a relativistic particle.
BS634	**RADIATION DAMAGE OF SEMICONDUCTOR DEVICES**
	Evaluation of the damage introduced in SI during irradiation - gamma irradiation - Interaction of X-rays with matter - Radiation - Induced space - Charge build up in MOS structure - Radiation testing - Effects of X-radiation on the characteristics of transistors - Dependence of the voltage shift on the irradiation close.
BS635	**X-RAY SPECTROSCOPY**
	Nature of X-rays - Bragg's x-ray spectro-meter - X-ray spectra — continuous and characteristic spectra - X-ray dispersion - Detectors and counting equipment - X-ray flower scene (XRF) - Electron probe analysis - Qualitative and quantitative x-ray spectrometric analysis.
BS636	**CRYSTALLOGRAPHY**
	Symmetry principle in crystal lattice - Crystal projection and the reciprocal lattice - Non-periodic and quasi-periodic structure - Defects in crystals and symmetry operations - Methods of determination of crystal structure - Some physical properties of crystals and its relation to the symmetry of crystals.
BS637	**FUNCTIONS OF COMPLEX VARIABLE (2)**
	Infinite products - Entire functions - Analytic continuation - Reimann surfaces.

BS638	**SPECIAL FUNCTIONS**
	Special functions in the real and complex domains - Bessel - legendre - Hermite - etc. - Applications.
BS639	**ORDINARY DIFFERENTIAL EQUATIONS (2)**
	Existence and uniqueness of solutions - Linear systems with constant, Periodic and analytic coefficients - Singularities of autonomous systems - Self-adjoint eigenvalue problem -Expansion in terms of eigen functions - Stability theory and liapunov functions.
BS640	**INTEGRAL TRANSFORMS**
	Detailed study of different kinds of integral transforms with their properties and applications.
BS641	**INTEGRAL EQUATIONS**
	Volterra integral equations - Resolvent kernel - Euler integrals - Fredholm equations of the second kind - Iterated kernels - Degenerate kernel - Approximate methods of solving integral equations.
BS642	**OPERATOR THEORY**
	Spaces of operators and dual spaces - Linear functions and operators on Hilbert space - Rings of operators - Sequences of operators - Fixed point principle.
BS643	**PROBABILITY AND STATISTICS (2)**
	Markov chains - Queuing theory - Reliability theory - Information theory and coding.
BS644	**GENERAL TOPOLOGY**
	Set theory - Cardinal and ordinal number - Topological spaces - Metric spaces Plane topology Continuity - Connectedness and compactness.
BS645	**COMPUTER SCIENCE (2)**
	Analysis of algorithms - Programming languages - Introduction to automata theory - Computer graphics - Artificial intelligence Application of discrete mathematics to computers.
BS646	**GENERAL APPLIED MATHEMATICS**
	Systems of linear differential equations - Matrices - Vector analysis - Tensor analysis - Fourier integral with application to differential equations - Sturm-lioville problems - Bessel and legendre functions and series - Calculus of variation - Integral equations.
BS647	**DISCRETE MATHEMATICS**
	Logic and proofs - Algorithms - Counting methods - Pigeonhole principle - Network models - Petri nets.
BS648	**GRAPH THEORY**
	Permutations and combinations - Generating functions - Recurrence relations and difference equations Analysis of an algorithm - Basic theory of directed and undirected graphs - Sub-graphs - Chains - Circuits - Paths - Cycles - Connectivity and trees - Minimal paths - Applications to computer science.
BS649	**OPERATIONAL RESEARCH (2)**
	Penalty for techniques - Theory of algorithms - Continuous static games - Dynamic programming - Vector optimization problems.
BS650	**FINITE ELEMENT METHODS**
	Ritz method and its convergence - The method of finite differences - Finite element method - Two-and three-dimensional poisson-equations -

	Higher-order approximations - Fixed-element shapes - Field theory - Galois theory - Introduction to homological algebra - Structure theory for rings with the minimum condition.
BS651	**ABSTRACT ALGEBRA (2)**
	Fields theory – Galoa Theory – Homological algebra – Structure theory for loops with minimum value condition.
BS652	**REAL ANALYSIS (2)**
	Euclidean and metric spaces - Series - Differentiability - Riemann-stieltjes integral - Sequences and series of functions - Measure and integration - Lebesgue integral - Fubini's theorem - Lp spaces.
BS653	**FUNCTIONAL ANALYSIS**
	Normed linear spaces - Banach spaces - Hubert spaces - Distribution theory.
BS654	**PARTIAL DIFFERENTIAL EQUATIONS (2)**
	Laplace's equation Green's functions - Complex variable methods - Sturm-llioville problem and eigen-function expansions - Hilbert space methods for elliptic equations - Existence - Uniqueness - Regularity.
BS655	**NUMERICAL ANALYSIS (2)**
	Approximation by spline functions - Minimization of multivariate functions - Approximation of functions - Detailed examination of numerical methods for solving differential equations with emphasis on error propagation.
BS656	**PROJECT1VE GEOMETRY (2)**
	Axioms of incidence - Homogeneous coordinates - Some fundamental projective theorems - Pappus theorem - Designees theorem - Principle of duality - Cross-ratio - One-to-one correspondence - Ranges and pencils - Harmonic pencils - Involution - Comics analytically treated - Degenerate comic - Pole and polar - Parametric form of comic - Isotropic lines.
BS657	**DIFFERENTIAL GEOMETRY (2)**
	Vectors - Multiplication and products - Differentiating - Dependence - Plane and space curves - Tangents - Arc length - Osculating plane - Moving tetrahedron - Torsion - surfaces - Tangent plane - Normal line - Area - First and second fundamental forms - Angles - Geodesics - Principal and gaussian curvature - Mapping and transformations of surfaces - Conformal mapping - Mercator - Stereographic maps - Isometric mapping -Developable surfaces - Equal maps - Lambert's map.
BS658	**FOUR DIMENSIONAL DESCRIPTIVE GEOMETRY**
	Introduction to higher-dimensional geometry - Analytical discussion for the elements of the high-dimensional spaces - System of reference - Representation of the geometrical elements - Problems of position - Metric problems - Representation of polytopes - Hypersphere - Hyperfine - Hypercylnder etc.
BS659	**ADVANCED DESCRIPTIVE GEOMETRY (3)**
	Indexed projection - Representation of the geometrical elements - Problems of position - Metric problems - Solids - Topographic surfaces - Slopes of excavation and filling - Axonometric projection - System of reference - Representation of elements – Straight line - Plane - Polyhedrons - Circle - Sphere - Cone - Cylinders - Surfaces of revolution - The helical surfaces - Inclined axonometric projection.

BS660	**CENTRAL PROJECTION**
	Representation of the geometrical elements - Position and metric problems - The central affinity - Solids - Polyhedrons - Circle - Sphere - Cone - Cylinder - Drawing the perception on a vertical picture plane by the metric points method and by the vanishing point method.
BS661	**THE GEOGRAPHICAL MAPS**
	Methods of projection and their properties - Orthogonal projection - The stereo-graphic projection - Gonomonic projection - Lambert and mercator maps.
BS662	**GEOMETRICAL PRINCIPLES OF PHOTOGRAMMETRY**
	Vertical and inclined photos - Data of internal and external orientation of the photo - Measure from one photo - Connections and some graphical solutions – Graphical determination of the data of outer orientation - Problems of resection in the space.
BS663	**KINEMATICS GEOMETRY**
	Definitions - Curves related to mechanical engineering - Evolutes and involutes - engineering applications - Gears theorem - helical motions.
BS664	**NON-EUCLIDEAN GEOMETRY**
	Definitions - Axioms and comparison with Euclidean geometry - Parabolic geometry - Elliptical geometry - Hyperbolic geometry.
BS665	**COMPUTER GRAPHICS (2)**
	In the light of visual c++ programming – Motives of computer graphics programming – 2D algorithms – Coordinate systems and their transforms – Rotation – Matrices writing - Windows and interfaces – Line snaps – Automatic size and position adjustment – Application of recruitment – Curve fitting – Geometrical tools for 3 dimensional algorithms – Use of vectors in computer graphics – Inner product – Determinants – Vector product – Decomposition of polygons to triangles – Homogeneous axes – Translation and rotation in space – Perspective – Views transforms – Perspective transforms – Subscription of wire frame models – Projection directions – Invisible lines algorithms – Cylinder representation – Helical stairs – Spherical dome – 2 variable functions.
BS666	**ANALYTICAL MECHANICS (2)**
	Variation principle and lagrange's equation - Two-body central force problem - Kinematics of rigid body motion - Rigid body equation of motion - Hamilton equations of motion - Canonical transformations - Hamilton-jacobi theory - Small oscillations -Introduction to the lagrangian and hamiltonian formulations in continuous systems and fields.
BS667	**STATISTICAL MECHANICS**
	Principles of statistical mechanics - Applications of the canonical distribution - Statistical thermodynamics of gases - Applications of fermi and bose statistics - Strongly interacting systems - Fluctuations and kinetic theories.

BS667	**STATISTICAL MECHANICS**
	Principles of statistical mechanics - Applications of the canonical distribution - Statistical thermodynamics of gases - Applications of fermi and bose statistics - Strongly interacting systems - Fluctuations and kinetic theories.
BS668	**VIBRATION MECHANICS**
	Systems with one degree of freedom - Natural frequency - Equations of motion - nonlinear vibrations - Damping - Vibration isolation - Shock and impact - Multiple degrees of freedom - Stiffness properties of elastic systems - Free vibrations - Dynamic response - Response of structures to motion of its base - Shock, Impact and collision. Bodies with continuous mass distribution - Random vibrations - Generation of dynamic models.
BS669	**THEORY OF ANGULAR MOMENTUM**
	Theory of groups - The quantization of angular momentum - Coupling of angular momentum vectors - Finite rotations - Spherical tensors and operators - Construction of invariants from the vector coupling coefficients.
BS670	**ADVANCED ENGINEERING MATHEMATICS (1)**
	Laplace transform - Series solution of differential equations - Special functions including Bessel and Legendre functions - Function of a complex variable - Evaluation of real integrals by residues.
BS671	**ADVANCED ENGINEERING MATHEMATICS (2)**
	Systems of linear differential equations - Vector analysis - Tensor analysis – Fourier integral applied to ordinary and partial differential equations - Calculus of variation - Boundary value problems and green's functions.
BS672	**ENGINEERING NUMERICAL ANALYSIS**
	Number representation and errors - Iterative methods in matrix algebra – Eigen-values - Nonlinear equations - Numerical differentiation and integration - Numerical solution of ordinary and partial differential equations - Splines.
BS673	**ENGINEERING PROBABILITY AND STATISTICS**
	Random variables and their distributions - independence - Moments and moment generating functions - Conditional probability - Estimation theory - Testing of hypotheses Regression and correlation.
BS674	**SPECIAL TOPICS IN MATHEMATICS**
	Selected topics in engineering mathematics: Differential equations - Integral equations - Linear algebra - Numerical analysis - Probability and statistics Partial differential equations - Graph theory - Discrete mathematics.
BS675	**GEOMETRY OF ALGEBRAIC CURVES (2)**
	Geometry of planar algebraic curves – Curves in affine space – Intersection of a line with a curve – Intersection of curves – Pizot theory – Curves linear systems – Logical curves – Conic and cubic sections – Geometry of exponential form series – Domain and field – Curve parametric – Exponential fractional series – Geometry of curve transforms – Logical functions on a curve – Space curves – Geometry of linear series – Entire series – Curve classification.
BS676	**KINEMATIC GEOMETRY (2)**

	Kinematics – Kinematics in plane – Kinematics on sphere – Kinematics in space – Construction equations – General form – Planar mechanisms – Spherical mechanisms – Positional mechanisms - Constrained forks.
BS677	**N-DIMENSIONAL GEOMETRY (2)**
	N-dimensional quadratic hyper surfaces – N-dimensional intersection of quadratic surface with hyper plane – N-dimensional linear spaces in quadratic surface – N-dimensional stereographic projection of quadratic surface - N-dimensional line geometry applications - N-dimensional metric space - N-dimensional least projection for n-space.
BS678	**FINITE GEOMETRY (2)**
	Some harmonic applications for finite geometry – Hyperbolic space conversion theory – Harmonic and finite geometry – Reflexive geometry applications - finite geometry theory – Fano plane and Glaison theory – Obtaining new planes from Galois plane – Generalization of affine plane concept.
BS679	**HIGHER GEOMETRY**
	One dimensional geometry – Fields and domains – Projectivity – 2dimensional geometry – Point and line coordinates in the plane – 2^{nd} degree and 2^{nd} order curves – Linear transformations – Projective scale – Transformations convergence in the plane – triple periodic coordinates – 3dimensional geometry – Spherical coordinates – Point and line coordinates – 2^{nd} degree and 2^{nd} order surfaces – Transformations – Sphere in Cartesian coordinates – Pentaspherical coordinates – 4dimensional and more geometry – Line coordinates in 3dimensional space – Spherical coordinates – Point coordinates in 4dimensional space – N-dimensional geometry.
BS680	**ALGEBRAIC SURFACES GEOMETRY**
	Basic concepts – Coordinate systems – Algebraic curves – Sublimed functions – Polynomial sets – Special functions in mathematical physics - Special functions in probability and statistics – Several curves – 3dimensional curves – Algebraic surfaces – Sublimed surfaces – Trigonometric functions – Logarithmic functions – Exponential functions – Spherical surfaces harmony – Nonderivative and divergent functions – Polygons – Regular polygons – Nonregular triangles – Nonregular quadruples – Polyhedra and surfaces enveloped with edges – Regular polyhedra – Nonregular polyhedra.
BS681	**ROBOTICS GEOMETRY**
	Basic concepts – Robot and computer sciences – Representation of physical objects and operations – Manual handling for objects representation – Induction – Abstracts – Computational geometry – Algorithmic motion planning – Motion planning problems classification – Disc motion – Ladder motion – General motion planning problem solution – Convergent recursion for cells components – Lower limits – Forms approximation and analysis – Intersection, convergence, and Voronoi diagrams problems – Planaer intersection detection algorithm – General planar Voronoi diagrams – Voronoi diagram applications – Precise construction of Voronoi diagram – Dynamic intersection and convergence problems – 3dimensional case – Wire frames formation – Wire frame algorithm – Objects reconstruction – Views formation - No name views deduction.

BS682	**COMPUTATIONAL GEOMETRY**
	Hierarchical search – Binary search – Rectangular search – General polygonal search – Dynamic polygonal search – Analyzable search problems – Hierarchical calculations - Divide and conquer calculations – Convex planar envelopes – Dynamical convex envelopes - Analyzable problems order – Geometrical transformations – Point and line duality – Point with point commutative inverse.
BS683	**MECHANISMS GEOMETRY**
	velocity and motion criteria – Rigid body motion – Rigid body instantaneous center – Velocity finding – Fixed polod and movable polod for a motion – Polar velocity – Polods relative motion – Elliptical motion – Cardioids motion – Shell motion – Kinematics' inverse – Relative motion – General theory – Application of Kindy's law on engaged mechanism which produces elliptical motion and on other that has engaged acceleration from general type – Curvatures and envelops – Curvature theory – Curvature fix throughout Kendy's principle for three poles – Hartman principe for curvature fix – Reflex circle – Constancy curvature – Cubic ness for elliptical motion – Cycloid position for motion plane – Cardin position for motion plane – Shell position for motion plane – Accelerations – Acceleration distribution for one movable plane – Acceleration construction – Complex motions accelerations – Connate theory – Plagiographics – Curve convoy for engaged connections – Reflexives – Focal mechanisms – Entire and elliptic couple motions – Symmetrical couple curves.
BS684	**ALGEBRAIC GEOMETRY**
	Basic concepts – Linear numerical systems in complex numbers - Linear numerical systems in certain field – Characteristic polynomials – Algebraic affine geometry: (Algebraic sets – Helbert theory – Shortness impossibility – Unusual functions and morphism) – Laurent theory – Isomorphism – Empty state: (Investigations – Controlness – Observationallity – Equivalency) – Algebraic affine geometry: (Product quotients – Graphs - Views) – Set actions – Equivalency – Constants – Geometrical determinant theory: (Closed tropics – Constants loaps) - Algebraic affine geometry: (Dimension – Morphism tissues – Simple points – Variables) – Alimentation theory and pole position.
BS685	**AFFINE GEOMETRY**
	Basic concepts – Parallel and Disargues axioms – Amplitudes – Affine coordinates – Area – Grids in the plane – Vectors and intermediate centers – Paricentric coordinates – Affine space – Grids in space – Planar and space affine types – Affine applications.