King Fahd University of Petroleum & Minerals

Tactical/Operational Plan

Computer Engineering Department
College of Computer Sciences & Engineering
King Fahd University of Petroleum & Minerals
Rabiul Awwal 1423

Dhahran-31261, Saudi Arabia, Tel: (966-3) 860-1280, Fax: (966-3) 860-3059, Email: sadiq@ccse.kfupm.edu.sa

The Vision Statement

To be a model department focused on the enhancement and sustenance of an academic environment conducive to faculty's excellence in teaching and research.

The Mission Statement

A tactical bottom-up plan to enhance the academic environment that will facilitate faculty to maintain excellence in teaching, make valuable contribution to research, while keeping abreast with both academic and developmental issues**.**

Introduction

The field of Computer Engineering although relatively new, has for the last decade been experiencing a tremendous growth both in the number of aspiring students to seek education in the discipline, and the demand from the industry for well-trained graduates. Globally there is a universal dearth of competent and skilled computer engineers and this shortage is also increasingly evident in the Kingdom. It is the need to meet this growing challenge that places the impetus on the Computer Engineering department to strive for the student's growth and development through an enriched learning-experience. Working towards this objective requires a concerted effort towards cultivating a strong academic and research culture, achieved through addressing crucial factors such as the undergraduate and graduate academic programs, course structure, faculty's teaching performance, and their contribution to research. To achieve these goals a strong definitive framework is proposed in this plan. Drawing upon input from the department's faculty members and the advisory/action committees that they constitute, the plan addresses the relevant areas of concern, their current status, the challenges faced, and details the necessary steps to be taken.

Hence the overall goals of the department that this plan strives to achieve are:

- Provide students with a firm grasp of the foundations of computer engineering and help them build a broad and strong set of academic skills.
- Provide the necessary facilities and support to the faculty for maintaining excellence in teaching and making valuable contributions to research.
- Take steps to introduce technology into the society as a whole.

Philosophy

The Department of Computer Engineering is committed to maintain and further advance its present strong undergraduate and graduate programs. It is also dedicated to improve its PhD program, which is offered jointly with the ICS department. It is towards the purpose of achieving these objectives of enhanced and effective student learning that the challenges and strategy are addressed here.

Challenges

In reference to the departments long-term goals, the major challenges and concerns that the department faces are due to:

- The rapid development of new technology and its almost immediate absorption into the mainstream industry – This demands frequent revision and upgrade of the curriculum and labs besides requiring the faculty to constantly keep abreast with technology and research.
- The high student/faculty ratio – The high enrollment of students has dwarfed the faculty strength of the department leading to excessively large section sizes and/or a large number of sections per instructor. This consequently has an adverse effect on the teaching performance of the faculty and translates into an ineffective learning experience for the students.
- Lack of research facilities – The lack of space for setting up research facilities and labs has had a negative impact on the department's research programs and initiatives.

Strategy

The department has often centered its research on the following three primary areas of focus (1) Computer Communication Networks; (2) Architecture and Parallel Processing; and (3) VLSI System Design and Automation. The department should build upon these existing research strengths, which are also of particular relevance directly or indirectly to the Kingdom, thereby building a strong international reputation. Additionally these areas of focus have also enjoyed a certain degree of overlap with the sister departments of Electrical Engineering and Information & Computer Science. These parallel interests should be exploited thereby giving rise to a strong trend of multi-disciplinary courses and programs. An example of this is the recently proposed joint COE-ICS program for MS in Computer Networks.

This plan addresses the challenges mentioned earlier through classifying them into six key areas:

- **KA1 – Undergraduate Studies & Teaching**
- **KA2 – Graduate Studies**
- **KA3 – Research & Grants Support**
- **KA4 - Teaching & Research Support**
- **KA5 – Faculty/Staff Search & Recruitment**
- **KA6 – Industrial & Community Relations**

In this document, each key area is addressed with its specific aims, current status in the department, main concerns, short-term objectives, and initiatives. This tactical/operational bottom-up plan also contains statistics of the previous years, pertaining to respective key areas, based on which it is possible to augur realistic expectations.

Based on the current statistics given in the tables in each key area, the main concerns are enumerated. The proposed short-term objectives help in providing remedies to these concerns. These objectives can be achieved by the initiatives following it.

KA1 - Undergraduate Studies & Teaching

The department's strong undergraduate program is its main cornerstone, with a present enrollment of above 750 students. Despite its depth and strength, the program has to be periodically updated and restructured to reflect the rapid advances that are reshaping the computer and technology industry.

Specific Aims

- **A - Undergraduate Program**: Restructure the undergraduate program with the primary focus on updating the course curriculum to maintain pace with the technological advances in computer engineering.
- **B - Faculty & Student Performance**: Strive for teaching excellence by the faculty, emphasizing on strong student performance and course evaluation.

The importance of this crucial key area requires each of the above specific aims to be addressed individually.

A - Undergraduate Program

Current Status
The present undergraduate curriculum was last revised in 1997. A restructuring of the program would allow introducing new technological advances into mainstream education.

Main Concerns
1. Dissatisfaction with the design component in some COE courses.
2. Overlap between certain series of topics in different courses.

Short-Term Objectives
Revision of the present COE undergraduate program by bringing the curriculum at par with major technological advances.

Initiatives
1. Update the present course content with the aim of introducing new technologies.
2. Provide consistency between courses that complement each other thereby minimizing overlap.
3. Introduce new elective courses to offer broader options to students.

B - Faculty & Student Performance

There exists a strong relationship between faculty performance drawn from student evaluations and the overall student performance. Hence, these two issues are addressed as a single aim.

Current Status

Table 1 provides a statistical listing of faculty evaluations over the last 5 years (1997-2001) and the projected expectations for 2002-03.

Table 1: Current and projected status of Teaching Performance Evaluation

	Previous 5 Years					Next 2 Years	
	1997	1998	1999	2000	2001	2002	2003
Min	6.82	6.41	5.55	6.06	6.00	7.00	7.00
Max	9.94	9.84	9.85	9.79	9.31	9.90	9.90
Mean	8.56	8.60	8.65	8.52	7.73	8.50	8.55
Deviation	0.73	0.80	0.91	0.79	0.81	0.75	0.75

Table 2 shows the student performance and the projected expectations over the same period.

Table 2: Current and projected status of Graduating Student Performance

	Previous 5 Years					Next 2 Years	
	1997	1998	1999	2000	2001*	2002	2003
Min. GPA	2.020	2.039	2.009	2.018	2.012	2.1	2.2
Max. GPA	4.000	3.968	3.902	3.924	3.879	3.95	3.98
Mean	2.939	2.899	2.708	2.698	2.687	2.75	2.85
Deviation	0.569	0.560	0.504	0.550	0.519	0.5	0.5
# of Students	42	60	81	79	31	90	90

*For term 011 only.

Table 3 show the percentage of students who graduated with a GPA less the 2.5 in the past five years. In addition, the projected expectations are shown.

Table 3: Percentage of graduating students with GPA < 2.5 & its projected status

	Previous 5 Years					Next 2 Years	
	1997	1998	1999	2000	2001	2002	2003
Students graduated	42	60	81	79	31	90	90
GPA < 2.5	11	18	35	37	14	25	20
Percentage	26%	30%	43%	46%	46%	27%	22%

Main Concerns

1. Observed decline in teaching performance of some faculty members.
2. Observed decrease in the average GPA of graduating students.

Short-Term Objectives

1. Decrease the teaching load on new faculty for the first term.

2. Introduce a mechanism to transfer the teaching experience of senior faculty to junior faculty.
3. Institute a ceiling on the maximum number of students per class in all COE courses, especially for 200- and 300-level core courses.
4. Introduce a student-performance 'Consultation and Assessment Committee' in the department.
5. Introduce an outcome assessment mechanism: The teaching process should be evaluated based on its outcome. (i.e. Student quality)

Initiatives

1. Institute annual excellence awards and other rewarding mechanisms for distinguished faculty based on their teaching performance, course files and innovations in teaching.
2. Introduce incentives for faculty, including lecturers to improve their student evaluations.
3. Stress on increased faculty and student interaction by restricting the class size to maximum of 20 students.
4. Coordinate with the Academic Development Center (ADC) and draw advantage from their student consultation and advising programs.

The above objectives and initiatives underline the department's commitment towards maintaining a strong and internationally reputable undergraduate program producing competent and qualified graduates capable of putting the Kingdom firmly on the map of technology-savvy countries of the world.

KA2 - Graduate Studies

The departments' graduate student body comprises of Graduate Assistants (GA), Research Assistants (RA) as well as full-time (FT) and part-time students. The department's strong graduate program addresses advanced issues and topics in computer engineering with emphasis on a research-oriented model of study.

Specific Aims

1. Increase the enrollment of qualified and competent graduate students by publicizing the department's offered programs: MS in COE, and the joint MS (Computer Networks) and PhD programs.
2. Advocate a diverse graduate student body by encouraging applications from a large number of countries.
3. Implement an efficient joint administration system for multidisciplinary programs such as those with the ICS department.
4. Improve the diversity and content of core/elective graduate courses.
5. Study the feasibility of Masters of Engineering Program (ME, a non-thesis option for part-time graduate students).

Current Status

The number of graduate students enrolled into the COE Masters program over the past four years is shown in Table 4. As it is seen from the table, the department requires more graduate students enrolled, not only for the COE department but also for the new graduate program in Computer Networks.

Table 4: Number of graduate students hired in the last five years

	Previous 5 Years					Next 2 Years	
Number of	1997	1998	1999	2000	2001	2002	2003
RAs	6	7	7	8	0	10	15
GAs	6	2	4	8	4	8	7
Part-timers	14	10	5	8	4	9	11
Full-timers	0	1	1	2	0	3	3
Total	26	20	17	26	8	30	36

Main Concerns

1. Low enrollment in the graduate program.
2. High drop rate among part-time students.

There are two primary reasons for the low enrollment of foreign graduate students (RAs) – the lack of publicity for the university's programs, and the significant delay in admission process. This poor graduate strength has a direct negative impact on the department's research programs. The problem is further accentuated by the

significant percentage of part-time students who have to drop courses or even drop the entire graduate program due to other work commitments.

Short Term Objectives

1. Increase the enrollment of RAs to a minimum of 10 for the following academic year, taking advantage of the new graduate program in computer networks being offered jointly by the ICS and COE departments.
2. Streamline the mechanisms for evaluation of graduate student applications and their subsequent admission.

Initiatives

1. Recruit competent graduate students (RAs) from a wide spectrum of countries through;
   a. Publicizing the university's programs in foreign schools and media.
   b. Requesting faculty to take a direct interest by carrying university and department brochures while going to conferences, business trips and on vacations.
2. Devising a smooth well-defined graduate student evaluation and admission procedure by;
   a. Forming a joint committee with ICS to evaluate applicants for joint programs.
   b. Building a database of past COE graduate students, to relate their performance at KFUPM with the schools they came from, their background, and their BS score/standing in that school.
3. Offer a well-diversified set of elective courses, possibly serving more than one of the graduate programs. (This requires both the availability of sufficient faculty and graduate student population).
4. Work towards filling the two Chair Positions proposed in the areas of Computer Security and Parallel Processing.

KA3 - Research & Grants

The department has always viewed research as a means of furthering its reputation and interests, as well as bringing faculty together through the creation of research and focus groups. All professorial rank faculty are expected to be involved in research and externally funded projects.

Specific Aims

1. Create a strong research-oriented environment by establishing research focus groups.
2. Initiate active research groups to establish strong collaborative research among faculty and graduate students.
3. Increase the number of funded research projects per faculty.
4. Procure external funds for research projects.

Current Status

Table 5 shows the statistics for previous and ongoing funded research projects as well as the department's expectations for the next two years.

Table 5: Number of funded research projects in the last five years & expectation for the next two years

	Previous 5 Years					Next 2 Years	
	1997	1998	1999	2000	2001	2002	2003
KACST	2	4	1	1	2	2	3
KFUPM	2	1	2	2	1	2	2
Industry	-	-	-	5	4	4	5
Total	4	5	3	8	7	8	10

Table 6 shows the number of publications for the past five years & its expectations for the next two years. The number of publications is related to the number of projects at hand, as they are the outcomes of these research projects. Thus, concentration on getting more projects for the department is of prime importance.

Table 6: Number of publications in the last five years & expectation for the next two years

	Previous 5 Years					Next 2 Years	
	1997	1998	1999	2000	2001	2002	2003
Journal	22	14	23	21	7	20	25
Conferences	27	24	13	24	27	20	25
Conf. Attendance	5	11	15	13	14	15	18
Seminars	7	1	14	8	23	25	30
Project Reports	3	5	2	2	1	6	8
Book/Chapters	-	1	1	1	1	1	1

Main Concerns

1. Low number of funded projects.
2. Low number of publications in journals & conferences.
3. Absence of research groups.

Short Term Objectives

It is our belief that research proposals give direction to work and their funding brings resources to the department. Also, funded research serves as a means of quality control (since funding agencies require proposals to be reviewed prior to committing of funds)[1]. Thus our main objectives are:

1. To involve every faculty in at least two funded research proposals, by the end of this year.
2. Establish research groups in the three departmental focus areas.

Initiatives

1. Disseminate information among faculty on funded research projects through meetings.
2. Establish and support research-oriented labs and groups.
3. Attract regional and international exposure to the university by organizing research workshops and symposiums.
4. Advocate exchange of ideas by hosting international scholars and experts.
5. Work towards organizing an international scientific symposium/conference.

Through the above initiatives, the department is striving to create a strong research environment, which will inevitably bring international focus and reputation.

[1] Note that factors such as authoring of journal/conference papers, seminars, etc., are not emphasized at this stage as these will be natural outcomes of accepted research proposals. Given the short-term nature of this plan, the expectations over the next two years are to get faculty in line with research activity.

KA4 - Teaching & Research Support

A comprehensive educational curriculum has to emphasize the need for laboratory sessions and projects, as these are the best medium to achieve effective student understanding through their hands-on approach. Hence, the department has always stressed on developing and upgrading the laboratory facilities both from the perspective of education and research.

Specific Aims

1. Expand and upgrade the present teaching-laboratory facilities to accommodate the growing student enrollment.
2. Establish dedicated research and project labs fully equipped to provide the students and faculty with state-of-the-art research opportunities and facilities.

Current Status

Table 7 shows the measures taken in expanding the department's teaching and research labs over the past five years as well as the projected expectations for 2002-03. Table 8 lists the total number of computers over the same period.

Table 7: Past and projected statistics for the number of laboratories added/developed & expectation for the next two years.

	Previous 5 Years					Next 2 Years	
	1997	1998	1999	2000	2001	2002	2003
Research Labs Added	-2	0	0	0	0	2	2
Research Labs Developed	1	1	1	1	1	2	2
Teaching Labs Added	1	0	0	0	0	2	2
Teaching Labs Developed	1	1	1	1	1	2	2

Table 8: Past and projected statistics for number of computers available in the department & expectation for the next two years

	Previous 5 Years					Next 2 Years	
	1997	1998	1999	2000	2001	2002	2003
Total number of PCs (Offices, Research labs, etc)	26	114	117	94	98	120	135

One of the hurdles for our proposed initiatives has been the lack of available space for setting up new labs with state-of-the-art technology. As shown in Table 7, since 1997, two research labs were lost and only one new teaching lab was added. However, some significant steps were taken towards the substantial upgrading of the Networks and Computer Communications Laboratory, which now boasts of excellent hardware equipment as well as a highly reputed network simulation/development tool (OPNET).

Main Concerns

1. Inability to accommodate the growing student population given the present laboratories and facilities. This would have a negative impact on the quality of education.
2. Lack of research facilities for the faculty and graduate students.
3. Lack of space for new teaching labs will limit the curriculum development.

Short Term Objectives

1. Establish a new (second) digital logic design lab to accommodate the increasing student enrollment.
2. Setup a Senior Project Lab equipped with workstations, prototyping and instrumentation equipment etc.
3. Establish well-equipped research labs aligned with the three core-focus interests of the department that were mentioned earlier – 1) Networks, Multimedia, and Performance Evaluation, 2) Parallel processing and Robotics and 3) VLSI and Computer Architecture.

Initiatives

1. Perform periodical audits of lab equipment to identify and replace faulty or sub-standard apparatus.
2. Institute committees to oversee and review laboratory experiments corresponding to changes in the curriculum and thereby recommend for upgrades and installation of new equipment.
3. Earmark labs to be upgraded over the next two years, introducing new technologies and methods. The labs short listed for this are – a) The logic design lab (COE200), with the use of FPGA's instead of discrete gates, b) The Microprocessor lab (COE305) with the use of superior design kits allowing more advanced systems to be designed and built, c) Network labs (COE442) with the installation of wireless networking equipment. d) Digital System Design Lab (COE400) with procurement of equipment to support more advanced design projects.

KA5 - Faculty/Staff Search & Recruitment

Achieving successful student learning and maintaining a high quality of education requires the effectual conveyance of knowledge and ideas between the teacher and the student. This requires the important task of attracting, hiring and retaining highly qualified and competent faculty.

Specific Aims

1. Recruit qualified and competent faculty specializing in at least one of the three core focus areas of the department.
2. Achieve and sustain a healthy student/faculty ratio of approximately 20:1.
3. Attain a balanced workload between the teaching and administration duties.
4. Encourage the professional development and growth of the faculty through emphasis on research opportunities.

Current Status

Presently the faculty strength in the department is not sufficient to make up for the growing student enrollment, resulting in excessive load being assigned to the available faculty. Table 9 shows the number of faculty, students and the corresponding student-faculty ratio over the past five years and the projected growth for the following two years. The expected increase in the number of faculty will reduce the student/faculty ratio, which will increase the interaction between them.

Table 9: Table listing the past and projected student-faculty ratio

	Previous 5 Years					Next 2 Years	
	1997	1998	1999	2000	2001	2002	2003
Lecturers	7	8	12	15	14	14	15
Professors (F)	13	16	16	16	14	25	25
Students (S)	488	555	680	726	789	750	750
S/F Ratio	38	35	42	45	56	30	30

Main Concerns

1. High student/faculty ratio (standing at 56:1 for academic year 2001/2002) has resulted in more than two sections being assigned per faculty or excessively large class sizes.
2. High administrative load due to shortage of faculty in the department is having a negative impact on the level of research activity and professional development of the faculty.
3. Non-zero outflow of faculty.
4. The breadth of faculty's specialties and expertise is limited.

Short Term Objectives

1. At least seven new faculty members are required for the department's programs over the next academic year. All PhD faculty hired should be able to teach a good subset of the undergraduate courses and will be expected to offer courses at both undergraduate and graduate levels.
2. Propose a projected rate for faculty recruitment to maintain a suitable student-faculty ratio.
3. Recruit an additional full-time secretarial staff-member to meet this expected increase in the department faculty strength.

Initiatives

1. Take steps for retaining faculty by providing opportunities for their professional growth. This can be achieved most significantly through an emphasis on research and its related facilities.
2. Publicize the departments programs and openings extensively through conference mailing lists, electronic advertising media etc. In addition, faculty traveling on conference/business trips are encouraged to carry publicity and application material.
3. Reduce the processing time between receiving applications and decision-making. An example of this is the use of special forms to be filled by applicants prior to their interview, reflecting their confidence in teaching courses offered by the department's undergraduate/graduate program.
4. Establish and maintain immediate contact with all potential faculty upon receiving their applications thereby reflecting the departments commitment and interest.
5. Provide incentives in the form of increments and salary adjustments as a means of awarding performance excellence for existing faculty. Attracting new faculty with inflated salaries has been discouraged, since this affects the morale of present faculty members.

The capability and expertise of faculty members is a primary factor in defining comprehensive and effective student learning. The above concerns and initiatives reflect the department's dedication towards creating and sustaining a sound educational environment.

KA6 – Industry & Community Relations

Asserting a strong and mutually beneficial relationship with regional and national industries should be a prime focus area for the department and the University. Besides providing a medium for training and consultation services for the industry, a collaborative relationship would provide students with much needed field exposure. Focus is drawn especially on the Student coop programs where each student is required to work 28 weeks in a professional company/industrial environment.

Specific Aims

1. Enhance student exposure to the industry through well-planned and effective student coop programs.
2. Promote and publicize the department's programs to both the student community and the overall society with the aim of spreading technology awareness in the community.
3. Promote the department's consultation services and programs to the regional and national industries and organizations.
4. Promote department graduates for placement in government and private organizations through all possible means.

This key area is addressed under the following three distinct subclasses:

A. Industrial Relations.
B. Cooperative Training Program.
C. Public Information Services.

A - Industrial Relations

Current Status

The department annually organizes several short courses in both core and advanced topics in Computer Engineering and Networking. The significant enrollment of executives and working professionals in these courses reflects the potential to forge a strong mutual relationship with the industry.

Main Concerns

1. Lack of fruitful collaboration between the department and industry.
2. Insufficient awareness of the department's research projects and programs.

Short-Term Objectives

1. Increase the interaction between the department and industry through technical exchange meetings as well as consultation and training services.
2. Promote and publicize the department's research projects identifying the various venues for collaborative efforts.

Initiatives

1. Prepare a package for presentations focusing on the faculty expertise, their possible areas for consultation services as well as the labs and facilities available in the department.
2. Host speakers from the industry, one per semester, to talk on technology trends, present research and advances.
3. Arrange visits to the industries and organizations including field trips for students.
4. Prepare a list of related companies and contact them for possible collaboration on joint senior projects and/or potential coop opportunities for students.

B – Cooperative Training Program

Current Status

Table 10 shows the past and projected statistics for the number of students enrolled for summer & coop training.

Table 10: Number of students in Summer & Coop training and expectation for the next 2 years

	Previous 5 Years					Next 2 Years	
Number of Students	1997	1998	1999	2000	2001	2002	2003
Summer	46	59	52	62	72	74	79
Coop	-	9	19	18	32	37	43

Main Concerns

1. Need to enhance coordination and supervisory interaction between the student and coop advisor.
2. Need to emphasize on system design aspects.
3. Placement problems for students in industries and organizations.

Short-Term Objectives

1. Enhance the quality of coop training through close and constant monitoring and evaluation of student performance.
2. Revise evaluation procedure for coop programs and student performance by taking steps to control grade inflation.
3. Establish communication with industrial firms and organizations soliciting their cooperation for drawing up an effective coop training program as per their specializations.

Initiatives

1. Compile a list of companies that can provide training programs related to computer engineering and encourage student placement in these organizations.
2. Solicit cooperation from selected organizations in realizing the departments objectives and expectations from coop students.
3. Evaluate coop training proposals stressing on design aspects and practical experience. Encourage proposals that involve teamwork in the company.

4. Ensure close interaction between the student, advisor and company supervisor throughout the coop period.

C – Public Information Services

Current Status

The department receives visitors from regional schools as well as organizes tours for orientation students aimed towards promoting the awareness of the programs offered and available opportunities.

Main Concerns

There is insufficient publicity for the department's programs among orientation students as well as in the overall community.

Short-Term Objectives

1. Promote the department's programs and available opportunities among orientation students.
2. Update students with the achievements and ongoing research projects in the department.

Initiatives

1. Promote easy access to all required information through the department website, providing interactive features for user feedback.
2. Promote and sponsor national and international educational exhibitions, events and workshops.
3. Encourage student participation for prestigious awards such as the "Prince Mohammad award for the Eastern Province" by exhibiting their projects and ideas in regional and national exhibitions.
4. Establish a mechanism for local student patents, motivating students to seek international acknowledgement for any new ideas or projects accomplished.

Recommendations Summary

Following is the summary of the recommendations of each key area:

KA1 – Undergraduate Studies & Teaching

- Revise the curriculum.
- Increase and maintain average faculty evaluation above 8.5/10.

KA2 – Graduate Studies

- Expedite evaluation procedure with College of Graduate Studies and increase the overall graduate student enrollment to 30.
- Work towards filling the two Chair Positions proposed in the areas of Computer Security and Parallel Processing.

KA3 – Research & Grants

- Encourage each faculty involvement in at least two funded projects.
- Mandate one journal publication per faculty per year.
- Work towards organizing an international scientific symposium/conference.

KA4 – Teaching & Research Support

- Develop two new labs and add two new labs in the next two years.
- Review & upgrade four existing labs.

KA5 – Faculty/Staff Search & Recruitment

- Recruit 10 faculty in the next two years.
- Reduce application-processing time.

KA6 – Industry/Community Relations

- Strengthen ties with industry and revise coop evaluation.
- Revise evaluation procedure for coop program.

Contributions

Being a bottom-up tactical/operational plan, chairmen of all departmental standing committees were members of the ad-hoc planning committee. Below is the list of all contributors:

Chairman of Faculty Search committee	: Dr. Mohammad K. Ibrahim
Chairman of Graduate committee	: Dr. Alaaeldin Amin
Chairman of Industrial Relations	: Dr. Aiman Helmi El-Maleh
Chairman of Information committee	: Mr. Wasim Raad
Chairman of Lab committee	: Dr. Mohammed El-Rabaa
Chairman of Research committee	: Dr. Mayez Al-Mouhamed
Chairman of Undergraduate committee	: Dr. Mostafa Abd-El-Barr

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