Notre Dame University
Faculty of Engineering
Mechanical Engineering Department

Annual Report

Academic Year 2006-2007

July 2007

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1. Introduction

The Mechanical Engineering Department at Notre Dame University, Lebanon, is striving to graduate mechanical engineers able to cope with all challenging issues that normal engineers may face in nowadays societies. The challenges are not only technical, for which our graduates are well prepared, but also societal and, in this respect, ME graduates have the luggage necessary to help them move forward. To achieve that goal, the ME program at NDU involves a balance between not only theoretical and practical issues, but also between technical and non-technical or cultural aspects.

ME students at NDU are served by a group devoted faculty members, both full-timers and part-timers, spending their time to guide them in all their expectations. Moreover, the university offers them state-of-the-art laboratories, which are under continuous upgrade. The program is also continuously updated to include the latest ideas related to engineering education in order to offer an up-to-date degree in mechanical engineering.

2. Personnel

2.1 Full-Time Faculty

- Walid Assaf, Professor, Ph.D., Nuclear Engineering, 1965, Iowa State University (USA). Areas of interest: Thermodynamics, Energy.
- Ghazi Asmar, Assistant Professor, Ph.D., Mechanical and Aerospace Engineering, 1997, University of Missouri, Columbia (USA). Areas of interest: Mechanics of Materials, Vibrations, Numerical Techniques.
- Michel El Hayek, Assistant Professor & Chairperson, Docteur Européen, Sciences Appliquées, 1997, Faculté Polytechniques de Mons (Belgium). Areas of interest: Fluid Mechanics, Heat Transfer, Numerical Techniques.
- Francis Francis, Assistant Professor, Ph.D., Mechanical and Manufacturing Engineering, 2003, University of New South Wales (Australia). Areas of interest: Materials Science, Manufacturing.

2.2 Part-Time Faculty

- T. Jabbour, Ph.D., Mechanical Engineering, 1998, Ecole Polytechnique de Montréal (Canada). Areas of interest: Mechanical Design, Machinery, CAD/CAM.
- Ali Hammoud, Ph.D., Mechanical Engineering, 1990, University of Wales, Swansea (UK). Areas of interest: Applied Fluid Mechanics, HVAC.
- Nadim Zakhia, Ph.D., Mechanical and Aerospace Engineering, 1995, University of Central Florida (USA). Areas of interest: Thermal Sciences.

- Gaby Nehme, Ph.D., Materials Science and Engineering, 2004, University of Texas at Arlington (USA). Areas of interest: Materials Science, Tribology.
- Nagib Metni, Docteur, Génie Mécanique, 2006, Université de Nice, Sophia Antipolis (France). Areas of interest: Control, Mechatronics.
- Gaby Bachour, B.S., Architecture, 1960, American University of Beirut (Lebanon), Areas of interest: Drafting.

2.3 Full-Time Co-Academics

- Wissam Daou, B.E., Mechanical Engineering, 2000, Notre Dame University (Lebanon), Laboratory Instructor.

2.4 Full-Time Non Academics

- Marise Khalil-Abboud, B.A., Advertising and Marketing, 2002, Notre Dame University (Lebanon), Secretary.
- Maroun Eid, Laboratory Technician.

3. Promotions & Faculty Development

- Dr. Michel El Hayek has been promoted to the rank of associate professor in the mechanical engineering department at NDU effective October 1, 2007. Dr. El Hayek received his Mechanical Engineering Diploma from Faculté Polytechnique de Mons (Belgium) in 1987 and his "Doctorat en Sciences Appliquées" from the same institution in 1997. He has been also awarded the degree of "Doctorat Européen en Sciences Appliquées" in 1997 (Faculté Polytechnique de Mons - Belgium, Technische Universiteit Delft - The Netherlands, and Universidade Técnica de Lisboa – Portugal). He was a senior research engineer from 1988 to 1998, working on various European research projects (Joule), and joined NDU in 1998 as assistant professor. He has been appointed Chairperson of the Mechanical Engineering Department in October 2006. Dr. El Hayek is credited for many refereed publications related to his areas of interest.
- Dr. M. El Hayek received a "Certified Online Instructor" certificate in April 2007 after having successfully completed a training course on online instruction in January-March 2007 offered by Madonna University (USA) and Notre Dame University (Lebanon).

4. Statistics

Various statistics are given in this section to show the overall characteristics and performance of the mechanical engineering program at NDU.

4.1 Student Enrollment

	Fall 2006	Spring 2007
Year 1	118	87
Year 2	67	68
Year 3	58	61
Year 4	31	44
Year 5	3	5
Transfer*	1	0
Total	**278**	**265**

*) Transfer students from other engineering majors at NDU

4.2 Graduates (see Appendix A for complete lists)

	Fall 2006	Spring 2007	Summer 2006
Total	**7**	**16**	**2**

4.3 New Students (accepted and enrolled)

	Fall 2006	Spring 2007	Summer 2006
Total	**46**	**8**	**0**

4.4 Courses Offered & Results (see Appendix B for detailed results)

		Fall 2006	Spring 2007
3-Credit Courses	**Number of Sections**	**21**	**23**
	Average Class Size	**25.9**	**27.52**
	Average GPA	**2.42**	**2.41**
1-Credit Courses	**Number of Sections**	**5**	**6**
	Average Class Size	**12.6**	**10.83**
	Average GPA	**2.87**	**3.42**
Project Courses	**Number of Sections**	**2**	**2**
	Average Class Size	**6.5**	**4.5**
	Average GPA	**4.0**	**3.87**
Overall Capacity Ratio		**105.08**	**107.94**

4.5 Work Load (in mechanical engineering only – credits taught in other departments / campuses are not included)

	Fall 2006	Spring 2007
W. Assaf	9	12
M. El Hayek	9	6
G. Asmar	15	13.5
F. Francis	12	12
W. Daou	4	5
Total Full-Time	***49***	***48.5***
A. Hammoud	6	6
T. Jabbour	6	9
G. Nehme	6	6
N. Zakhia	6	6
N. Metni	0	3
G. Bachour	1	2
Total Part-Time	***25***	***32***
Total	**74**	**80.5**

4.6 Advising Load

	Fall 2006	Spring 2007
W. Assaf	75	73
M. El Hayek	71	65
G. Asmar	65	59
F. Francis	67	68
Total	**278**	**265**

5. Curriculum Development

Various proposals to improve the ME program were investigated and approved by the Department's Curriculum Committee and then forwarded to higher committees for further approval.

1. Replace the three existing 1-credit graphics courses (CEN 170, CSC 270, and MEN 360) by a single 3-credit graphics course (MEN 205) involving both lectures and training sessions.
2. Increase the number of laboratory courses to 6 instead of the existing three using the equipment available.

3. Change the suggested ME program to include the above-mentioned modifications.

To be consistent with the general university policy concerning course numbering, stating that 100 courses are usually freshman courses, the ME Curriculum Committee approved a proposal to change the course number of MEN 101, Engineering Mechanics: Dynamics, and MEN 102, Mechanics of Materials I, to MEN 201, Engineering Mechanics: Dynamics, and MEN 202, Mechanics of Materials I, respectively. The proposal was approved by all higher curriculum bodies and will become effective next fall 2007.

A proposal to add PHS 203 or CEN 201 as prerequisite for MEN 210, Thermodynamics I, has been approved by the Department Curriculum Committee and will be implemented next Fall 2007.

A senior project policy is under investigation and will be issued once the approvals by the concerned committees are secured.

The department contributed to the proposals made by the Council of Chairpersons to add two new courses to the ENG series. The contribution of the ME Department was mainly related to the proposed course ENG 310 or "Engineering Ethics" by developing the course description and syllabus.

6. Laboratory Equipments

State of the art laboratory equipments are being used in the department in order to train students on various practical issues related to mechanical engineering. The list includes but not limited to:

- Large wind tunnel for various aerodynamics testing
- Energy testing (solar system, combustion, etc…)
- Turbomachines testing (centrifugal pumps, fans, Pelton wheel, Francis turbine, etc…)
- Air-conditioning testing (heating, cooling, refrigeration, etc…)
- Mechanical vibration testing
- Mechanical components and systems

Additional equipments are being added on regular basis. Expected equipments in the near future include machines-tools, advanced instrumentation, and control systems.

7. Research

All ME faculty members are involved in research and publications to various extents. The different fields of research are related to the areas of interest as listed under Personnel section. The following items deserve special mention:

- Dr. W. Assaf is acting as scientific advisor for a project on linear IC engine being developed by Phoenix Machinery, Indevco Group SAL.
- Dr. F. Francis initiated cooperation with Dr. I.A. Youssef, University of Technology, Baghdad (Iraq), on a research project entitled "Design and Manufacturing of an Electrochemical Cell for Fine Finish of Typical Metallic Surfaces". The project is to be carried out the next academic year 2007-2008 during the sabbatical leave of Dr. Youssef at NDU.

8. Senior Projects

The following senior projects were successfully presented during the academic year 2006-2007 and copies of the corresponding reports were forwarded to the central library for archiving.

8.1 Summer 2006

Senior Project	Prepared by	Advised by
Solar Air-Conditioning: System Design for an Office Building in Beirut	Bachir El-Youssef	Dr. M. Hayek
Analysis & Design of the Mechanical Systems for the Crown Plaza Hotel	Charbel Khalil Sannine Beaino Simon Slan	Dr. A. Hammoud

8.2 Fall 2006

Senior Project	Prepared by	Advised by
Fire Fighting Design For A Factory	Roy C. Khalil	Dr. M. Hayek
Numerical Predictions of Slip Microflows with Heat Transfer	Joe A. Rached Nancy M. Daher	Dr. M. Hayek
Numerical Analysis of Water Distribution Networks	Ramzi Azar	Dr. M. Hayek
Renovating and Modifying OPTIMA Diaper Packaging Machine	Pierre Abi Sleiman Jihad Bou Chrouch Alain Sfeir	Dr. G. Asmar

8.3 Spring 2007

Senior Project	Prepared by	Advised by
Numerical Analysis of Vehicle Suspension	Hady Haydamous	Dr. M. Hayek
Numerical Techniques for Drag Reduction: Transpiration	Michel Akiki	Dr. M. Hayek

Numerical Techniques for Drag Reduction: Longitudinal Grooves	Joseph Ghobeira	Dr. M. Hayek
Numerical Techniques for Drag Reduction: Circular & Triangular Grooves	Nadim Zgheib	Dr. M. Hayek
Numerical Prediction of VTOL Aircrafts Performance During Take-Off	Kevork Kazanjian	Dr. M. Hayek
New Concept Car: Design & Aerodynamic Analysis	Youssef Ghoussoub	Dr. M. Hayek
Stress Field Calculation in a Thin Isotropic Plate Under Bending Containing Two Circular Holes	Elias Sfeir	Dr. G. Asmar
Stress Analysis of Multidirectional Composite Laminates Containing One Circular Hole	Ramzi Akl	Dr. G. Asmar
Shape Memory Alloys	Nicolas Nasrallah	Dr. G. Asmar
Abrasive Water Jet Machine	Jalal Samaha Jack Fahd	Dr. G. Asmar
Floor Heating Design	D. Merheb-Bassil Samir Dekko	Dr. A. Hammoud
Water Distribution System & Reverse Osmosis Plant for Kempinski Hotel in Verdun	Charbel El Aaraj Georges Naoufal	Dr. A. Hammoud
HVAC Design for KEMPINSKI Hotel	Sayed Abbas	Dr. A. Hammoud

9. Publications

The following papers were published by ME Faculty during the academic year 2006-2007. All publications are in internationally refereed journals and conferences.

1. F. Francis, Environmentally Conscious Quality Function Deployment – A Tool for Sustainable Manufacturing, 6th International Conference on Intelligent Processing and manufacturing of Materials, Salerno, Italy, 25-27 June 2007.
2. M. El Hayek, A. Hammoud, Prediction of Liquid Jet Pump Performance Using Computational Fluid Dynamics, Proceedings of the 4th WSEAS International Conference on Fluid Mechanics and Aerodynamics, pp.148-153, IASME/WSEAS, 2006.
3. M. El Hayek, A. Hammoud, Numerical Versus Experimental and Analytical Predictions of Liquid Jet Pump Overall Performance, WSEAS Transactions of Fluid Mechanics, Vol.1, pp. 399-406, 2006.
4. T. Jabbour, G. Asmar, A Multi State Feature-Based Assembly Model, International Journal of Product Development, Vol. 3, Nos.3-4, pp.388-403, 2006.
5. T. Jabbour, G. Asmar, C. Ghaith, Analysis of Plastic Helical Gears, Proceedings of the 8th Biennial ASME Conference on Engineering Systems Design and Analysis, Torino, Italy, July, 2006.

The following paper, resulting from senior project research, was published by two ME students during the same academic year:

1. J. Rached, N. Daher, Numerical Prediction of Slip Flow and Heat Transfer in Microchannels, Proceedings of the 6th FEA Student Conference, AUB, pp.109-114, 2007.

10. Reviewing

Dr. M. El Hayek is acting as reviewer of the following events:

- 5th IASME / WSEAS Int. Conf. on Fluid Mechanics and Aerpdynamics (FMA'07) , Vouliagmeni Beach, Athens, Greece, August 24-26, 2007, http://www.wseas.org/conferences/2007/athens/fma
- 5th IASME / WSEAS Int. Conf. on Heat Transfer, Thermal Engineering, and Environment (HTE'07), Vouliagmeni Beach, Athens, Greece, August 24-26, 2007, http://www.wseas.org/conferences/2007/athens/hte

Dr. M. El Hayek completed the review of one journal paper for the Transactions of the ASME - Journal of Applied Mechanics.

Dr. W. Assaf and Dr. M. El Hayek are undertaken a research proposal review for the LNCSR.

Dr. M. El Hayek acted as the local NDU coordinator for the mechanical engineering section of the 6th FEA Student Conference at AUB, May 23-24, 2007.

11. Students' Excellence

- Nancy Daher received the Said Akl's Award for her outstanding performance in mechanical engineering. She is now pursuing a master of engineering degree at AUB with scholarship.
- Nancy Daher and Joe Rached presented a paper entitled "Numerical Prediction of Slip Flow and Heat Transfer in Microchannels" at the 6th FEA Student Conference on May 23-24, 2007, AUB, Beirut, Lebanon.
- Michel Akiki has been accepted at the University of Tennessee – Space Institute (UTSI) to pursue a master degree with full scholarship. He has been also awarded the Lloyd Crwaford Award (UTSI) for his outstanding performance while still at NDU.
- Nadim Zgheib has been accepted at the University of Tennessee – Space Institute (UTSI) to pursue a master degree with full scholarship.

12. Exchange Programs

Within the framework of the exchange program with Vaxjo University, Sweden, the ME Department received Dr. Samir Khoshaba, Program Director, Product Development and Industrial Design, during summer 2006 for a two-week period at NDU. During his stay, Dr. Khoshaba acted as guest speaker in the course MEN 437, Mechanical Design, and delivered various lectures related to class materials.

Dr. Khoshaba is also expected this summer 2007 for a similar 2-week stay during which, a series of seminars about mechanical design and failure modes is to be organized.

13. Committees & Services

All full-time faculty members were involved in a way or another in committee works at all levels, from the departmental level up to the university level.

13.1 Departmental Level

The department control bodies are made of the following three committees with their composition:

- Department Personnel Committee: Dr. M. El Hayek (Chairperson), Dr. G. Asmar, Dr. F. Francis (Secretary).
- Department Curriculum Committee: Dr. M. El Hayek (Chairperson), Dr. W. Assaf, Dr. G. Asmar, Dr. F. Francis (Secretary).
- Department Outcomes Assessment Committee: Dr. G. Asmar (Chairperson), Dr. W. Assaf, Dr. F. Francis (Secretary).

Various meetings were organized throughout the academic year for which minutes were issued and archived in the department files.

13.2 Faculty Level

The department contributes to the control bodies of the faculty as following:

- Council of Chairpersons: Dr. M. El Hayek.
- Faculty Personnel Committee: Dr. M. El Hayek
- Faculty Curriculum Committee: Dr. G. Asmar.

13.3 University Level

The department contributes also to various control bodies at the university level. During the academic year 2006-2007, ME faculty members were representing the Faculty of Engineering in the following committees:

- University Curriculum Committee: Dr. W. Assaf.
- University Student Affairs Committee: Dr. G. Asmar

13.4 Community Services

Besides committee works, the ME faculty members are well known for their commitment and continued services to ME students and to the entire NDU community in general. In fact, two student branches of learning societies are operating within the mechanical engineering department, namely, the ASME Students Branch, advised by Dr. G. Asmar, and the ASHRAE Students Branch, advised by Dr. M. El Hayek. Beyond that, the same ME faculty members are also advisors for two major student clubs operating at a university scale.

14. Student Activities

Several activities were organized by the department during the academic year 2006-2007, especially by students clubs and local branches. Some of them are listed here:

- Lecture entitled "Vision-Inertial SLAM using Natural Features in Outdoor Environments" by Dr. D. Asmar (AUB), December 08, 2006. ASME/ASHRAE.
- Field trip to API SAL organized by the ASHRAE student branch, March 28, 2007.
- Lecture entitled "Engineering Maintenance" by G. Issa (Sanita SAL), April 24, 2007. ASME.
- Training seminar "Mathematica" by Dr. G. Asmar (NDU), May 16, 2007 ASME/ASHRAE.
- Training seminar "Pro/E" by Dr. T. Jabbour (NDU), June 01, 2007. ASME/ASHRAE.

15. Future Plans

Even though the department was operating smoothly and in a satisfactory way over the past years, the time has come to move forward by upgrading strategies and equipments. Several plans are being considered in order to improve the overall performance of the department in meeting students' and market needs.

- Expansion of the laboratories to includes new tools and systems that can be used to operate a set of new laboratory courses being studied by the appropriate committees. On top of the list are equipments to operate a manufacturing laboratory (set of machines tools for student training) and instruments to operate correctly all mechanical engineering laboratories, especially the wind tunnel for which appropriate measurement systems (LDV or PIV) are needed. Such an expansion will turn the ME laboratories at NDU into a testing center that can offer services to both NDU users and the local industry.

- Development of computational facilities by acquiring both the hardware and software required. Such facilities may be used to create a kind of computational research center whose main goal may be to serve both NDU users and the local industry in term of computational expertise.

To achieve those goals and to sustain possible expansion, additional faculty members may be needed in a near future. The capacity of the department to add new faculty members is rather large taking into account the non-negligible percentage of services being fulfilled by part-time faculty (see section 4, Statistics, for more details).

Appendix A: ME Graduates 2006-2007

Summer 2006 ME Graduates

ID #	Name (First … Last)	GPA	Major GPA
2000 1642	Charbel Elias Khalil	2.38	2.35
2002 0547	Rawad Said Eid	2.66	2.54

Fall 2006 ME Graduates

ID #	Name (First … Last)	GPA	Major GPA
2001 1124	Ramzi Said Azar	2.70	2.89
2001 2586	Sannine Tanios Beaino	2.49	2.48
2002 0092	Nancy Mikhael Daher	3.82	3.84
2002 0192	Jihad Mounir Bou Chrouch	2.53	2.55
2002 0364	Roy Charbel Khalil	3.64	3.48
2002 0577	Simon Pierre Slan	2.66	2.69
2002 0767	Joe Antoine Rached	3.02	3.15

Spring 2007 ME Graduates

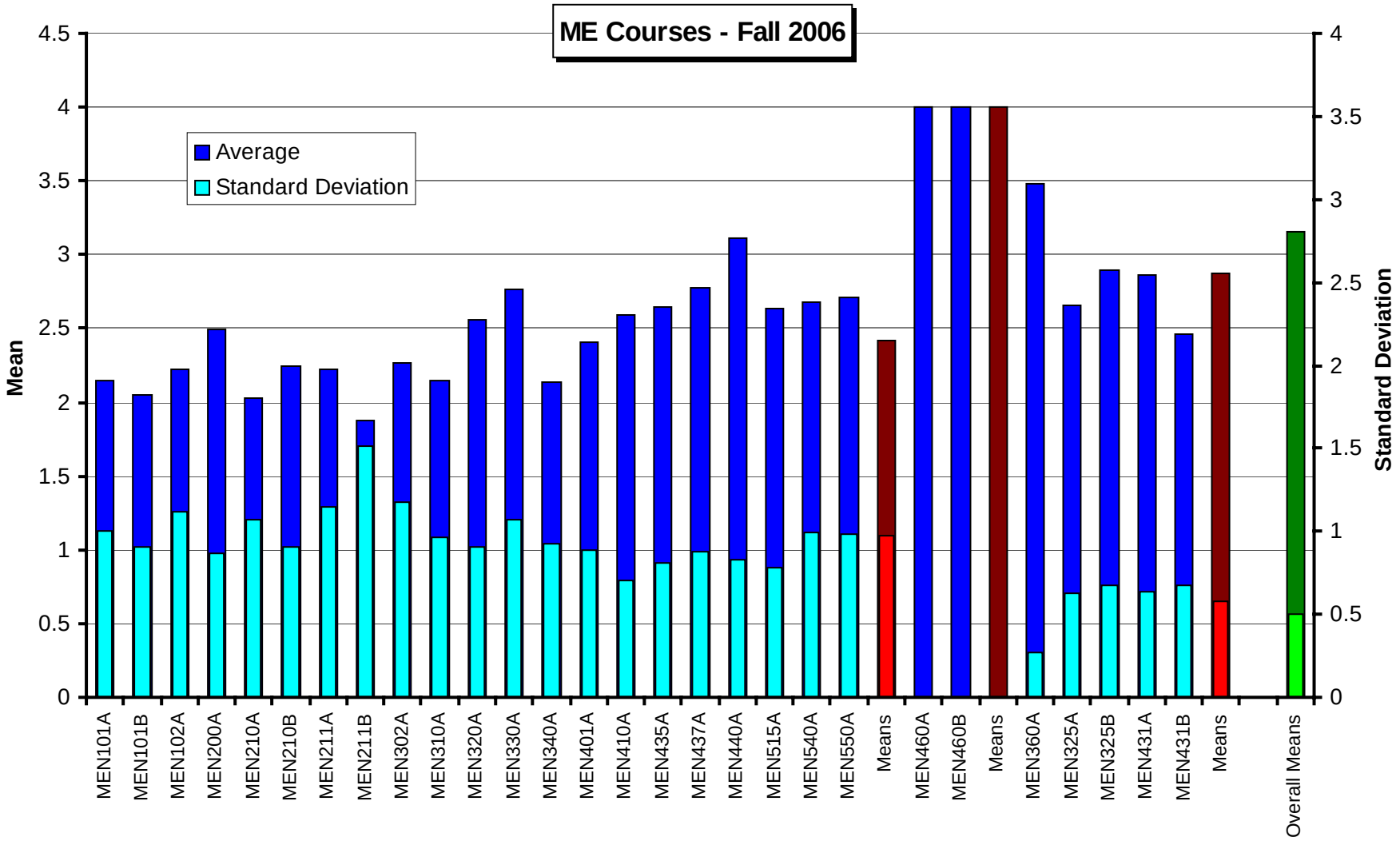
ID #	Name (First … Last)	GPA	Major GPA
98-0140	Hady Elias Haydamous	2.82	2.90
2000-2614	Pierre Chawki Abi Sleiman	2.13	2.22
2001-1255	Elias Joseph Sfeir	3.38	3.21
2001-1301	Jacques Samir Fahd	2.53	2.34
2001-2522	Nadim Yaacoub Zgheib	3.79	3.76
2001-2834	Jalal Selim Samaha	2.69	2.66
2002-0049	Charbel Samir El Aaraj	3.04	3.09
2002-0165	Kevork George Kazanjian	3.35	3.33
2002-0476	Ramzi Atef Akl	2.52	2.61
2002-0593	Imad Antonios Taok	3.55	3.67
2002-0610	Alain Youssef Sfeir	2.50	2.62
2002-1003	Joseph Michel Ghobeira	2.83	2.92
2002-1007	Michel Henri Akiki	3.90	3.92
2002-1323	Georges Toufic Naoufal	2.68	2.77
2002-2001	Youssef Iskandar Ghoussoub	3.71	3.64
2004-6554	Nicolas Farid Nasrallah	2.91	2.82

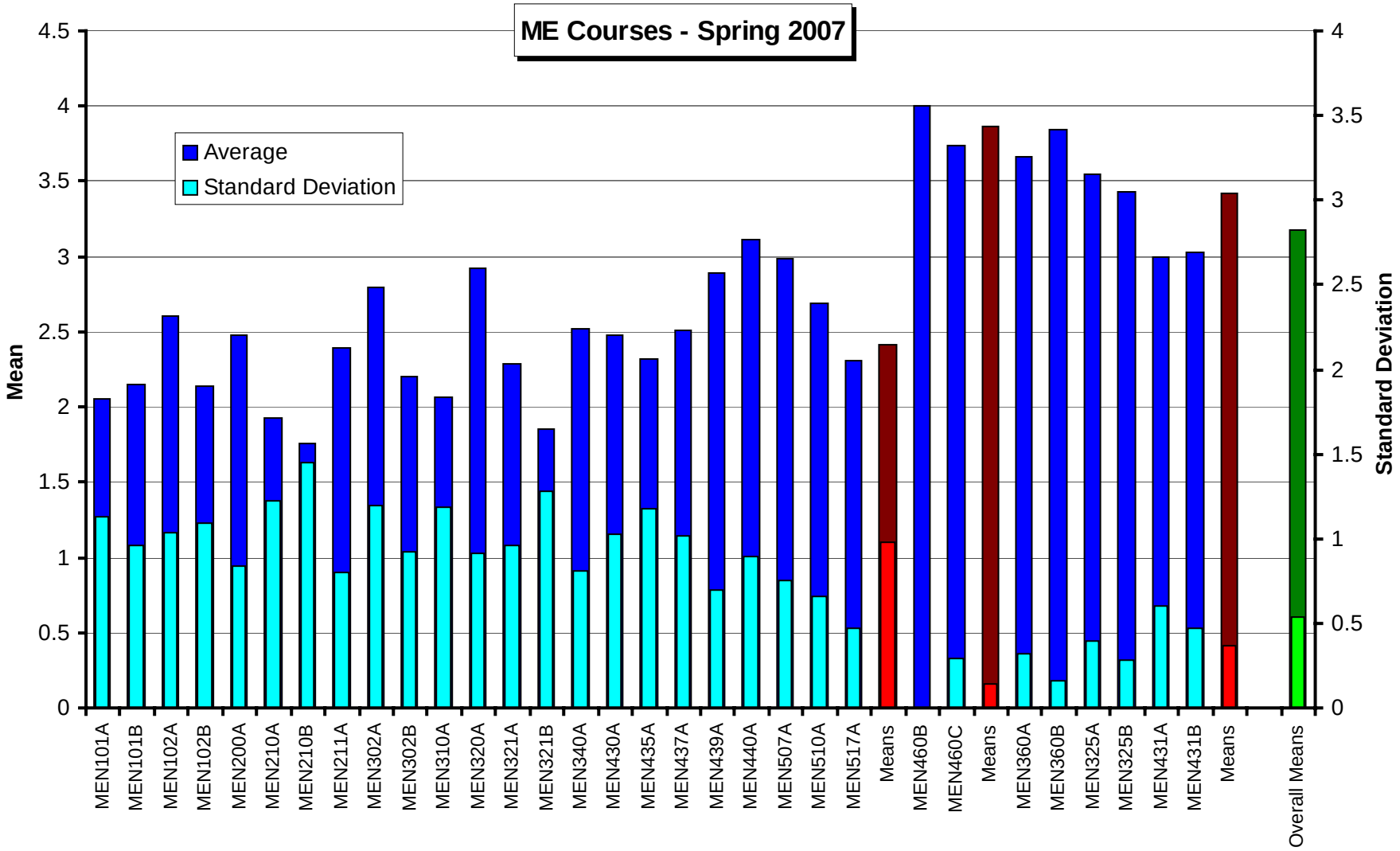
Appendix B
ME Courses 2006-2007 - Grades Statistics

The following two charts show the distribution of grades and their standard deviations for all courses offered by the Mechanical Engineering Department in Fall 2006 and Spring 2007. The courses are grouped in three categories:

- 3-credit regular courses
- Senior projects (MEN 460)
- 1-credit courses

For each category the mean value and average standard deviation are given along with the overall mean value and standard deviation for the entire set of courses.


ME Courses - Fall 2006
Average
Standard Deviation
Mean
Standard Deviation
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
MEN101A
MEN101B
MEN102A
MEN200A
MEN210A
MEN210B
MEN211A
MEN211B
MEN302A
MEN310A
MEN320A
MEN330A
MEN340A
MEN401A
MEN410A
MEN435A
MEN437A
MEN440A
MEN515A
MEN540A
MEN550A
Means
MEN460A
MEN460B
Means
MEN360A
MEN325A
MEN325B
MEN431A
MEN431B
Means
Overall Means


ME Courses - Spring 2007
Average
Standard Deviation
Mean
Standard Deviation
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
MEN101A
MEN101B
MEN102A
MEN102B
MEN200A
MEN210A
MEN210B
MEN211A
MEN302A
MEN302B
MEN310A
MEN320A
MEN321A
MEN321B
MEN340A
MEN430A
MEN435A
MEN437A
MEN439A
MEN440A
MEN507A
MEN510A
MEN517A
Means
MEN460B
MEN460C
Means
MEN360A
MEN360B
MEN325A
MEN325B
MEN431A
MEN431B
Means
Overall Means