Nevada System of Higher Education

The Nevada System of Higher Education, comprised of two doctoral-granting universities, a state college, four comprehensive community colleges and one environmental research institute, serves the educational and job training needs of the nation’s fastest growing state. The NSHE provides educational opportunities to more than 108,000 students and is governed by the Nevada Board of Regents.

Daniel Klaich
Chancellor

The Board of Regents wishes to advance student learning to the highest level, foster the expansion of knowledge through teaching and research, encourage community service, and enrich the lives of our students, our communities, our state, and the nation. In fulfillment of this purpose, we hold the following values at the center of our endeavor:

• Integrity
• Excellence
• Accountability
• Inclusiveness
• Creativity
• Innovation

Board of Regents
James Dean Leavitt, Chairman
Jason Geddes, Ph.D., Vice Chairman
Mark Alden
Robert J. Blakely
William G. Cobb
Cedric Crear
Dorothy S. Gallagher
Ron Knecht
Kevin J. Page
Dr. Raymond (Ray) Rawson
Dr. Jack Lund Schofield
Michael Wixom

Disclosures

Rights of Privacy Act of 1974
The Federal Family Education Rights and Privacy Act of 1974 affords persons who are currently, or who were formerly, in attendance at the university as registered students a right of access to their “educational records,” which contain information directly related to such persons and the right to challenge the accuracy of their records. The act also restricts the persons to whom the university may disclose a student’s educational records without the student’s written permission. The university’s policy is to comply fully with all provisions of the act, and a detailed statement concerning the rights afforded current and former students is available, at no cost, in the office of UNLV’s General Counsel. Any person who feels the university has failed to comply with the Federal Family Education Rights and Privacy Act may file a complaint with the Family Education Rights and Privacy Act Office, Department of Education, 300 Independence Avenue S.W., Washington D.C. 20201.

Annual Jeanne Clery Campus Safety and Security Report
In order to comply with provisions of “The Jeanne Clery Disclosure of Campus Security Policy and Campus Crime Statistics Act”, reports from the University community and local law enforcement agencies are compiled and published annually by the Department of Public Safety. As law enforcement professionals tasked with the maintenance of a safe and secure educational environment, it is our responsibility to provide a comprehensive report regarding the campus public safety environment including the incidence of crime.

Limitations
The 2009-2011 Graduate Catalog describes current academic programs of study, course descriptions and degree requirements at the graduate level for the academic years 2009-10 and 2010-11 at the University of Nevada, Las Vegas. The content of this catalog is current as of August 2009, but is subject to modification at any time to accommodate changes in university resources or educational plans.

This catalog does not constitute a contractual commitment that the university will offer all the courses or programs described, and the university reserves the right to revise catalog provision and fees at any time in accordance with the actions of the president the Nevada System of Higher Education, or any other governing body. The university reserves the right to eliminate, cancel, reduce in size or phase out courses, academic programs and/or limit enrollments in specific programs and courses, to change fees during the student’s period of study, and to require a student to withdraw from the institution for cause at any time.

Inquiries
Inquiries should be addressed to: Dean of the Graduate College, University of Nevada, Las Vegas, 4505 Maryland Parkway, Box 451017, Las Vegas, NV 89154-1017, (702) 895-3320, or call UNLV’s main switchboard at (702) 895-3011. Visit the UNLV Web site at http://www.unlv.edu. @2009
A Message from UNLV
President Neal J. Smatresk

As the new president of UNLV, I’m delighted to encourage you to consider graduate studies at the University of Nevada, Las Vegas. UNLV is a wonderful institution with exceptional programs, excellent faculty, and a supportive atmosphere where graduate education thrives.

As you explore graduate education at UNLV, you’ll be pleased to learn that nearly a quarter of UNLV’s students are currently enrolled in graduate/professional programs. The number of students in these programs has increased by 33 percent since 2003. These numbers should provide some indication of the significance of graduate studies at UNLV. We know that high quality graduate education is pivotal to the growth and sophistication of our institution.

In addition to supporting the educational and research missions of the university, graduate education also plays a pivotal role in preparing tomorrow’s leaders in many professions. It enables our students to move into the workplace with the kind of preparation that only advanced study can provide. Alumni of our graduate programs are the professionals who lead our community in health care, education, law enforcement, social work, business, art, and engineering, just to name a few critically important fields. Their contributions are vital to the quality of life that we enjoy here in Southern Nevada.

Again, we welcome your interest in UNLV and encourage you to join us in our dedication to research and graduate education as we create a bright future for our university and community.

Dr. Neal J. Smatresk
UNLV President
Table of Contents

Degree Programs 4
Academic Calendar 5
Web Resources 6
About UNLV 7
Program Accreditations 7
Division of Research & Graduate Studies 9
Admission & Registration Information 11
Academic Policies 16
Degree Progression Policies & Procedures 20
Tuition & Fees 24
Financial Assistance 27

College of Business 30
  Accounting 30
  Business Administration 33
  Economics 47
  Finance 51
  Management 52
  Management Information Systems 54

College of Education 60
  Counselor Education 62
  Curriculum & Instruction 67
  Educational Leadership 89
  Educational Psychology 106
  Special Education 116
  Sports Education Leadership 131

Howard R. Hughes College of Engineering 137
  Civil & Environmental Engineering 138
  School of Computer Science 148
  Construction Management 154
  Electrical & Computer Engineering 157
  School of Informatics 168
  Mechanical Engineering 171

College of Fine Arts 183
  School of Architecture 183
  Art 189
  Film 191
  Music 193
  Theatre 207

Division of Health Sciences 215
  School of Allied Health Sciences 215
    Health Physics & Diagnostic Sciences 215
    Kinesiology & Nutrition Sciences 219
    Physical Therapy 224
  School of Community Health Sciences 233
    Environmental and Occupational Health 238
    Health Care Administration & Policy 241
    Health Promotion 244
  School of Dental Medicine 248
  School of Nursing 261

  William F. Harrah College of Hotel Administration 253
    Recreation & Sport Management 276
  William S. Boyd School of Law 279

College of Liberal Arts 296
  Anthropology 296
  English 305
  Foreign Languages 313
  History 317
  Political Science 326
  Ethics and Policy Studies 328
  Psychology 334
  Sociology 342
  Women’s Studies 355

College of Sciences 358
  Chemistry 359
  Geoscience 366
  School of Life Sciences 376
  Mathematical Sciences 382
  Physics & Astronomy 392
  Water Resources Management 398

Greenspun College of Urban Affairs 400
  Communication Studies 401
  Criminal Justice 403
  School of Environmental & Public Affairs 408
    Environmental Studies 408
    Public Administration 411
  Hank Greenspun School of Journalism & Media Studies 419
  Marriage &Family Therapy 421
  School of Social Work 426

Index 436
Degree Programs

Accounting – M.S.
Anthropology – M.A.; Ph.D.
Architecture – M. Arch
Aerospace Engineering – M.S.
Art – M.F.A
Astronomy – M.S.; Ph.D.
Biochemistry – M.S.
Biological Sciences – M.S.
Biomedical Engineering – M. S.
Business Administration – M.B.A.; Executive M.B.A.
Business Administration/Dental Medicine – Dual M.B.A./D.M.D.
Business Administration/Hotel Administration – Dual M.B.A./M.S.
Business Administration/Law – Dual M.B.A./J.D.
Business Administration/Management Information Systems – Dual M.B.A./M.S.
Chemistry – M.S.; Ph.D.
Civil & Environmental Engineering – M.S.; Ph.D.
Clinical Mental Health M.S.
Communication Studies – M.A.
Community Health Counseling – M.S.
Computer Science – M.S.C.S.; Ph.D.
Construction Management – M.S.C.S.
Creative Writing – M.F.A.
Criminal Justice – M.A.
Crisis and Emergency Management – M.S.
Curriculum & Instruction – M.Ed.; M.S.; Ed.S.; Ed.D.; Ph.D.
Economics – M.A.
Education/Law – Dual Ph.D. in Education/J.D.
Educational Psychology – M.S.; Ed.S.; Ph.D.
Educational Psychology & Juris Doctor Dual Ph.D./J.D.
Electrical & Computer Engineering – M.S.E.E.; Ph.D.
English – M.A.; Ph.D.
Environmental & Occupational Health – M.P.H.
Environmental Science – M.S.; Ph.D.
Ethics & Policy Studies – M.A.
Exercise Physiology – M.S.
Film, Screenwriting – M.F.A.
Foreign Languages – M.A.
Geosciences – M.S.; Ph.D.
Health Care Administration – M.H.A.
Health Physics – M.S.
Health Promotion – M.Ed.
Higher Education Leadership – Ph.D.
Higher Education Leadership – M.Ed.
History – M.A.; Ph.D.
Hospitality Administration – Executive M.H.A; Ph.D.
Hotel Administration – M.S.
Hotel Administration/M.B.A – Dual M.S./M.B.A.
Hotel Administration/M.S. – Dual M.S./M.I.S.
Informatics – M.S.; Ph.D.
Journalism & Media Studies – M.A.
Kinesiology – M.S.
Learning & Technology – Ph.D.
Management Information Systems – M.S.
Management Information Systems & Business Administration Dual M.S./M.B.A.
Management Information Systems & Hotel Administration Dual M.S
Marriage & Family Therapy – M.S.
Materials & Nuclear Engineering – M.S.
Mathematical Sciences – M.S.; Ph.D.
Mechanical Engineering – M.S.E., Ph.D.
Music – M.M.
Musical Arts – D.M.A.
Nursing – M.S.N.; Ph.D.
Physical Therapy – D.P.T.
Physics – M.S.; Ph.D.
Political Science – M.A.; Ph.D.
Psychology – Ph.D.
Public Administration – M.P.A.
Public Affairs – Ph.D.
Public Health – M.P.H.; Ph.D.
Radiochemistry – Ph.D.
School Counseling – M.Ed.
Science – M.A.S.
Social Work – M.S.W.
Social Work/Law – Dual M.S.W./J.D.
Sociology – M.A.; Ph.D.
Spanish, Hispanic Studies – M.A.
Special Education – M.Ed.; M.S.; Ed.S.; Ed.D.; Ph.D.
Sport & Leisure Service Management – M.S.
Sport Education Leadership – M.Ed.; M.S.; Ph.D.
Teacher Education – Ph.D.
Theatre – M.A.; M.F.A.
Transportation – M.S.T.
Water Resources Management – M.S.
Workforce Education & Development – M.Ed; M.S.

Graduate and Advanced Graduate Certificate Programs

Addiction Studies (Counselor Education)
Advanced Graduate Certificate in Accounting (Accounting)
Graduate Certificate in Accounting (Accounting)
Graduate Certificate in Management (Management)
Family Nurse Practitioner (Nursing)
Finance Graduate Certificate (Finance)
Forensic Social Work (Social Work)
Management Information Systems (Management Information)
Marriage & Family Therapy (Marriage & Family Therapy)
Mental Health Counseling (Counselor Education)
New Venture Management Graduate Certificate (Management)
Nonprofit Management (Public Administration)
Nursing Education Post-Masters Certificate (Nursing)
Pediatric Nurse Practitioner Certificate (Nursing)
Public Management (Public Administration)
Women’s Studies (Women’s Studies)
# Academic Calendar

## Fall Semester 2009

<table>
<thead>
<tr>
<th>Month</th>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>August</td>
<td>24</td>
<td>Instruction begins.</td>
</tr>
<tr>
<td>September</td>
<td>7</td>
<td>Labor Day recess.</td>
</tr>
<tr>
<td>October</td>
<td>30</td>
<td>Nevada Day recess.</td>
</tr>
<tr>
<td>November</td>
<td>11</td>
<td>Veterans Day recess.</td>
</tr>
<tr>
<td>December</td>
<td>26-27</td>
<td>Thanksgiving Day recess.</td>
</tr>
<tr>
<td>December</td>
<td>7-12</td>
<td>Study Week.</td>
</tr>
<tr>
<td>December</td>
<td>12</td>
<td>Instruction ends.</td>
</tr>
<tr>
<td>October</td>
<td>10-15</td>
<td>Final examinations.</td>
</tr>
<tr>
<td>November</td>
<td>15</td>
<td>Semester ends.</td>
</tr>
<tr>
<td>December</td>
<td>15</td>
<td>December Commencement.</td>
</tr>
</tbody>
</table>

**Spring Semester 2010**

<table>
<thead>
<tr>
<th>Month</th>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>11</td>
<td>Instruction begins.</td>
</tr>
<tr>
<td>February</td>
<td>15</td>
<td>Washington's Birthday recess.</td>
</tr>
<tr>
<td>March</td>
<td>13</td>
<td>Mid-semester.</td>
</tr>
<tr>
<td>April</td>
<td>29</td>
<td>Spring Break begins.</td>
</tr>
<tr>
<td>May</td>
<td>1</td>
<td>Study Week begins.</td>
</tr>
<tr>
<td>May</td>
<td>26</td>
<td>Study Week ends.</td>
</tr>
<tr>
<td>May</td>
<td>8</td>
<td>Instruction ends.</td>
</tr>
<tr>
<td>May</td>
<td>8</td>
<td>Semester ends.</td>
</tr>
<tr>
<td>May</td>
<td>18</td>
<td>Martin Luther King holiday.</td>
</tr>
<tr>
<td>February</td>
<td>21</td>
<td>Washington's Birthday Recess.</td>
</tr>
<tr>
<td>March</td>
<td>14-19</td>
<td>Spring Break.</td>
</tr>
<tr>
<td>April</td>
<td>7</td>
<td>Study Week.</td>
</tr>
<tr>
<td>May</td>
<td>14</td>
<td>Study Week ends.</td>
</tr>
<tr>
<td>May</td>
<td>15</td>
<td>Semester ends.</td>
</tr>
<tr>
<td>June</td>
<td>1</td>
<td>Instruction ends.</td>
</tr>
</tbody>
</table>

**Summer Session 2010 I**

<table>
<thead>
<tr>
<th>Month</th>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>May</td>
<td>10</td>
<td>Instruction begins.</td>
</tr>
<tr>
<td>May</td>
<td>28</td>
<td>Instruction ends.</td>
</tr>
</tbody>
</table>

**Summer Session 2010 II**

<table>
<thead>
<tr>
<th>Month</th>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>May</td>
<td>31</td>
<td>Memorial Day Recess</td>
</tr>
<tr>
<td>June</td>
<td>1</td>
<td>Instruction begins.</td>
</tr>
<tr>
<td>June</td>
<td>2</td>
<td>Instruction ends.</td>
</tr>
<tr>
<td>July</td>
<td>5</td>
<td>Independence Day recess.</td>
</tr>
<tr>
<td>July</td>
<td>6</td>
<td>Instruction begins.</td>
</tr>
<tr>
<td>July</td>
<td>11</td>
<td>Instruction ends.</td>
</tr>
</tbody>
</table>

**Summer Session 2010 III**

<table>
<thead>
<tr>
<th>Month</th>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>July</td>
<td>5</td>
<td>Instruction begins.</td>
</tr>
<tr>
<td>August</td>
<td>6</td>
<td>Instruction ends.</td>
</tr>
</tbody>
</table>

**Fall 2010**

<table>
<thead>
<tr>
<th>Month</th>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>August</td>
<td>23</td>
<td>Instruction begins.</td>
</tr>
<tr>
<td>September</td>
<td>6</td>
<td>Labor Day recess.</td>
</tr>
<tr>
<td>October</td>
<td>29</td>
<td>Nevada Day recess.</td>
</tr>
<tr>
<td>November</td>
<td>11</td>
<td>Veterans Day recess.</td>
</tr>
<tr>
<td>November</td>
<td>25-26</td>
<td>Thanksgiving recess.</td>
</tr>
<tr>
<td>November</td>
<td>29</td>
<td>Study Week begins.</td>
</tr>
<tr>
<td>December</td>
<td>4</td>
<td>Study Week ends.</td>
</tr>
</tbody>
</table>

**Spring Semester 2011**

<table>
<thead>
<tr>
<th>Month</th>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>17</td>
<td>Martin Luther King holiday.</td>
</tr>
<tr>
<td>January</td>
<td>18</td>
<td>Instruction begins.</td>
</tr>
<tr>
<td>February</td>
<td>21</td>
<td>Washington's Birthday Recess.</td>
</tr>
<tr>
<td>March</td>
<td>14-19</td>
<td>Spring Break.</td>
</tr>
<tr>
<td>May</td>
<td>2-7</td>
<td>Study Week.</td>
</tr>
<tr>
<td>May</td>
<td>7</td>
<td>Instruction ends.</td>
</tr>
<tr>
<td>May</td>
<td>14</td>
<td>Semester ends.</td>
</tr>
<tr>
<td>May</td>
<td>15</td>
<td>Semester ends.</td>
</tr>
<tr>
<td>May</td>
<td>17</td>
<td>Commencement.</td>
</tr>
</tbody>
</table>

**Summer Session 2011 I**

<table>
<thead>
<tr>
<th>Month</th>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>May</td>
<td>16</td>
<td>Instruction begins.</td>
</tr>
<tr>
<td>May</td>
<td>30</td>
<td>Memorial Day Recess.</td>
</tr>
<tr>
<td>June</td>
<td>1</td>
<td>Instruction ends.</td>
</tr>
</tbody>
</table>

**Summer Session 2011 II**

<table>
<thead>
<tr>
<th>Month</th>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>June</td>
<td>6</td>
<td>Instruction begins.</td>
</tr>
<tr>
<td>July</td>
<td>4</td>
<td>Independence Day recess.</td>
</tr>
<tr>
<td>July</td>
<td>9</td>
<td>Instruction ends.</td>
</tr>
</tbody>
</table>

**Summer Session 2011 III**

<table>
<thead>
<tr>
<th>Month</th>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>July</td>
<td>11</td>
<td>Instruction begins.</td>
</tr>
<tr>
<td>August</td>
<td>13</td>
<td>Instruction ends.</td>
</tr>
</tbody>
</table>

*Dates are subject to change*
UNLV Web Resources

Graduate College:
http://graduatecollege.unlv.edu/

- Graduate Study Timeline
  http://graduatecollege.unlv.edu/current/guidance/
- Research and Graduate Studies
  http://research.unlv.edu/
- The Graduate & Professional Student Association
  http://gpsa.unlv.edu/

Academic Colleges & Divisions:

- Business
  http://business.unlv.edu/
- Education
  http://education.unlv.edu/
- Engineering
  http://engineering.unlv.edu/
- Fine Arts
  http://finearts.unlv.edu/
- Honors
  http://honors.unlv.edu/
- Hotel
  http://hotel.unlv.edu/
- Health Sciences (Division of)
  http://healthsciences.unlv.edu/
- Liberal Arts
  http://liberalarts.unlv.edu/
- Sciences
  http://sciences.unlv.edu/
- Urban Affairs
  http://universitycollege.unlv.edu/

Additional Resources, Departments, & Services:

- Campus Life
  http://studentaffairs.unlv.edu/units/campuslife/index.html
- Campus Recreation and Wellness Center
  http://srwc.unlv.edu
- Career Services
  http://hire.unlv.edu
- Cashiering and Student Accounts
  http://cashiering.unlv.edu
- Disability Resource Center
  http://studentlife.unlv.edu/disability
- Financial Aid and Scholarships
  http://finaid.unlv.edu/
- International Students and Scholars
  http://studentlife.unlv.edu/international/
- Jean Nidetch Women’s Center
  http://womenscenter.unlv.edu
- Library Services
  http://www.library.unlv.edu/
- Office of Student Conduct
  http://studentlife.unlv.edu/judicial/
- Parking Services
  http://parking.unlv.edu
- Rebel Card Services
  http://www.rebelcard.edu
- Registrar’s Office
  http://register.unlv.edu/
- Research Centers & Institutes
  http://research.unlv.edu/cli&m/centers-institutes.html
- Student Computing Help Desk
  http://oit.unlv.edu/students
- Student Counseling & Psychological Services
  http://studentlife.unlv.edu/caps/
- Student Diversity Programs & Services
  http://getinvolved.unlv.edu
- Student Health Center
  http://studentlife.unlv.edu/shc/
- Student Union
  http://studentunion.unlv.edu
- UNLV Bookstore
  http://unlv.bncollege.com
- UNLV Campus Dining
  http://www.unlvdining.org
- Veteran Services
  http://finaid.unlv.edu/veterans/
- Writing Center
  http://writingcenter.unlv.edu
About UNLV

The University of Nevada, Las Vegas, located in the vibrant and dynamic city of Las Vegas and surrounded by the Mojave Desert, embraces the traditional values of higher education adapted for the global community of the twenty-first century. UNLV assists students in meeting the intellectual and ethical challenges of responsible citizenship and a full and productive life through opportunities to acquire the knowledge and common experiences that enhance critical thinking, leadership skills, aesthetic sensitivity, and social integrity.

The university provides traditional and professional academic programs for a diverse student body and encourages innovative and interdisciplinary approaches to teaching, learning, and scholarship. UNLV simultaneously engenders collegial relationships and a sense of community among its members. UNLV embraces the interdependence of quality instruction, scholarly pursuits, and substantive involvements in campus and community life. The university offers artistic, cultural, and technical resources and opportunities to the broadest possible community. It promotes research programs and creative activities by students and faculty that respond to the needs of an urban community in a desert environment. UNLV is committed to developing a synergy between professional and liberal studies, between undergraduate education and graduate programs, and between superior teaching and meaningful research. UNLV increasingly is a dynamic resource for, and partner with, the community that it serves.

In its 50-year history, UNLV has undergone an amazing transformation from a small branch college into a thriving urban research institution of 28,000 students and 3,300 faculty and staff.

Along the way, the urban land-grant university has become a dynamic resource for one of the country's fastest-growing and most enterprising cities. UNLV's 332-acre main campus, located on the southern tip of Nevada in a desert valley surrounded by mountains, is home to more than 220 undergraduate, master's, and doctoral degree programs, all accredited by the Northwest Commission on Colleges and Universities.

UNLV Mission Statement

The University of Nevada, Las Vegas, is a research institution committed to rigorous educational programs and the highest standards of a liberal education. We produce accomplished graduates who are well prepared to enter the work force or to continue their education in graduate and professional programs. Our faculty, students, and staff enthusiastically confront the challenges of economic and cultural diversification, urban growth, social justice, and sustainability. Our commitment to our dynamic region and State centrally influences our research and educational programs, which improves our local communities. Our commitment to the national and international communities ensures that our research and educational programs engage both traditional and innovative areas of study and global concerns. UNLV’s distinctive identity and values permeate a unique institution that brings the best of the world to our region and, in turn, produces knowledge to improve the region and world around us.

- UNLV is committed to and driven by these shared values that will guide our decision making:
- High expectations for student learning and success;
- Discovery through research, scholarship, and creative activity;
- Nurturing equity, diversity, and inclusiveness that promotes respect, support, and empowerment;
- Social, environmental, and economic sustainability;
- Strong, reciprocal, and interdependent relationships between UNLV and the region around us;
- An entrepreneurial, innovative, and unconventional spirit.

Program Accreditations

All programs at UNLV are accredited by the Northwest Commission on Colleges and Universities (NWCCU). UNLV’s international programs are approved by the Council on International Educational Exchange (CIEE). For more accreditation information, visit the UNLV Program Accreditations webpage.

Accounting
The Association to Advance Collegiate Schools of Business (AACSB)

Architecture
National Architectural Accrediting Board (AAB)

Art
National Association of Schools of Art and Design (NASA)

Athletic Training
Commission on Accreditation of Athletic Training Education (CAATE)

Business Administration
The Association to Advance Collegiate Schools of Business (AACSB)

Computer Science
Accreditation Board for Engineering and Technology (ABET)

Construction Management
American Council for Construction Education (ACCE)
Didactic Program in Dietetics
Commission on Accreditation for Dietetics Education (CADE)

Dental Medicine
Commission on Dental Accreditation (CODA)

Economics
The Association to Advance Collegiate Schools of Business (AACSB)

Education
The National Council for Accreditation of Teacher Education (NCATE)

Engineering
Accreditation Board for Engineering and Technology (ABET)

Gerontology
Association for Gerontology in Higher Education (AGHE)

Health Care Administration
Association of University Programs in Health Administration (AUPHA)

Health Education
American Association for Health Education (AAHE)

Health Physics
Applied Science Accreditation Commission of the Accreditation Board for Engineering and Technology (ASAC ABET)

Interior Architecture and Design
Council for Interior Design Accreditation (CIDA)

Landscape Architecture
Landscape Architects Accreditation Council (LAAB)

Law
American Bar Association (ABA) (member of AALS)
Association of American Law Schools

Marriage and Family Therapy
Commission on Accreditation for Marriage and Family Therapy Education (COAMFTE)

Music
National Association of Schools of Music (NASM)

Nuclear Medicine
Joint Review Committee on Educational Programs in Nuclear Medicine Technology (JRCNMT)

Nursing
National League for Nursing (NLN)

Phlebotomy Certificate
National Accrediting Agency for Clinical Laboratory Sciences (NAACLS)

Physical Education
National Association for Sport & Physical Education (NASPE)

Physical Therapy
Commission on Accreditation in Physical Therapy Education (CAPTE)

Psychology (Clinical)
American Psychological Association (APA)

Public Administration
National Association of Schools of Public Affairs and Administration (NASPAA)

Radiography
Committee on Education in Radiologic Technology (JRCERT)

Recreation – Professional Golf
Management Professional Golf Association (PGA)

Social Work
Council on Social Work Education (CSWE)

Theatre
National Association of Schools of Theatre (NAST)
Division of Research & Graduate Studies

As Vice President for Research and Graduate Dean, I would like to extend a warm welcome to those interested in graduate study at UNLV. I believe you will find our graduate programs among the best in the country, attracting the best and brightest students nationally and internationally.

Offering nearly 120 graduate degree programs, including 36 doctoral and professional degrees, UNLV provides wide-ranging and unique areas of study to more than 6,000 graduate and professional students. The UNLV Graduate College seeks to provide its students with the highest quality academic experience, including excellent opportunities for research, scholarship, and creative activity. We pride ourselves on cultivating a campus culture that promotes involvement of graduate students in these activities.

We also seek to identify new and innovative ways to meet graduate students’ needs. We provide ample opportunities for financial assistance, offering a wide variety of assistantships, fellowships, and scholarships, and we maintain a customer service orientation in our efforts to meet student needs beyond the classroom and laboratory.

The Graduate College looks forward to working with your academic department to facilitate your education. We are dedicated to enhancing your experience at UNLV and will do our very best to guide you as you pursue graduate study.

Ron Smith, Ph.D.
Vice President & Graduate Dean
Division of Research and Graduate Studies

The UNLV Graduate College

The Graduate College strives to achieve the institutional mission by supporting a wide range of excellent master’s and doctoral degree programs in the major areas of human knowledge—the physical sciences, the social sciences, the humanities, and the arts—as well as in professional fields that respond to local, state-wide, and regional needs. It is clear that our institution’s mission of becoming a premier metropolitan research university with academically excellent programs that focus on student needs as well as issues and problems of the local community and state of Nevada rests, in large part, with the direction, growth and quality of UNLV graduate education. This commitment is further supported by the integration of the university’s research and graduate program management into the Office of Research and Graduate Studies. This structure strategically links the on-going development of UNLV’s research infrastructure with graduate education and directly enhances scholarship opportunities for graduate students.

The Graduate College seeks to support and advance graduate education, including the student learning, the research, scholarly, and creative activities, and the community and institutional services associated with it. The Graduate College is ideally suited to fulfill this purpose and, in this capacity, will assist academic departments and colleges as well as coordinate efforts with student service and administrative offices to meet the needs and interests of graduate students, graduate faculty, and graduate programs; encourage programs and programmatic emphases that meet the challenges of our rapidly growing local population, state, and region as well as the challenges facing the nation and world; articulate a standard of intellectual excellence that pervades university discussions and decisions about matters that affect graduate education; provide university-wide policies and guidance which define good practice in graduate program administration; and bring faculty and students together to encourage intellectual communication, multidisciplinary and interdisciplinary graduate instruction; and cooperative research and artistic projects.

The Graduate College, in all of its policies and actions, must reinforce and encourage that the institution is an intellectual community where students, faculty, and programs with different backgrounds and interests all pursue advanced knowledge and seek improvement of the human condition for the twenty-first century. This shared purpose ultimately defines the most important reason for the existence of a Graduate College and the larger community.

Equal Opportunity

It has been and will continue to be the policy of the University of Nevada, Las Vegas, to be an equal opportunity institution. All decisions of admissions and employment are based on objective standards that will further the goals of equal opportunity.

The university is committed to assuring that all programs and activities are readily accessible to all eligible persons without regard to their race, color, religion, gender, national origin, ancestry, age, disability, Vietnam Era and/or disabled veteran status, any protected class under relevant state and federal laws, and, in accordance with university policy, sexual orientation.

Persons having questions regarding university policies relating to nondiscrimination law are encouraged to contact
the Office of Human Resources and Diversity Initiatives, Campus Services Building, room 237 or call (702) 895-3504.

Your Graduate School Experience
The reasons for enrolling in graduate school are as varied as the people who make up the graduate student population. Your decision to seek an advanced degree means you share with other UNLV graduate students a spirit of adventure that comes with discovery— discovery of new information, new skills—and discovery of the depths of your own intellectual abilities. You will also share a capacity for hard work, because graduate study, whatever the subject matter, is difficult. But at the end of the sometimes tedious, oftentimes exhilarating work in your chosen field, you will have the satisfaction of having mastered a body of knowledge that places you in an elite group. Your achievement of a graduate degree will be a beginning, not an end. It will only be the start of your development and a forecast of your potential for future contributions to your chosen area of interest.

The university’s advanced degree programs are based on close working relationships between students and faculty. Although most programs can be developed to meet the needs and interests of the individual student, the student must also satisfy all departmental and Graduate College requirements. Therefore, it is important that all students carefully read the appropriate sections of this catalog and stay in close contact with the faculty members in their degree program. Students are responsible for being aware of and observing the policies and regulations stated in the Graduate Catalog.

The Graduate Dean with the advice of the Graduate Council determines policies and procedures of the Graduate College. The Council consists of one delegate from each academic department that sponsors an advanced degree program, and it operates with standing committees. The Graduate and Professional Student Association also has representatives on the Graduate Council. The Graduate Dean and Associate Graduate Dean are ex-officio members of the Graduate Council and each standing committee.

Once enrolled as a student, you will have various responsibilities within the academic community. The conduct of all persons affiliated with the University of Nevada, Las Vegas is governed by the Rules and Disciplinary Procedures for Members of the University Community. This code outlines the responsibilities of students, faculty, staff and administration as well as the rules, sanctions and hearing procedures in effect on the campus. Printed copies of the code are available in the Registrar’s Office. The UNLV Student Conduct Code is available through the UNLV Office of Student Conduct.

Services for Graduate Students
The Graduate College offers services to support graduate students in many different areas. In cooperation with various offices at the University of Nevada, Las Vegas, Graduate Student Services seeks to provide information and programs aimed at the unique needs of graduate students.

Orientation. Every semester, prior to the beginning of classes, the Graduate College conducts an orientation for new graduate students and Graduate Assistants. Each department and/or program offering a graduate degree provides additional orientation and advising for new students.

Recruitment. UNLV is committed to growing selectively, serving the region, and achieving distinction. In recognition of this commitment, the Graduate College seeks to develop, implement, coordinate, and monitor a university-wide graduate recruitment program. Primary goals of this program are to assist the individual graduate programs to identify potential graduate students and to encourage these students to apply and enroll. Also, the Graduate College participates in the UNLV McNair Scholars Program that helps to identify and prepare under represented and minority students for graduate school.

Thesis and Dissertation Support. For many programs, the thesis or dissertation represents the culmination of the graduate experience. The Graduate College provides guidance, oversight and direction to graduate students and faculty concerning the policies and procedures for final submission of the thesis or dissertation.

Professional Development Programs. The Graduate College works with other campus units to provide a formal, value-added experience for graduate students that will enhance their career development. For example, a Professional Development Program in College Teaching is currently offered in association with the University Teaching and Learning Center to individuals seeking academic careers.

Student Advising Services. The advising services provide informal and student-centered issue-resolution services, and general advising advice, to graduate students and prospective graduate students. The office offers guidance, information, and assistance when regular channels have failed to provide graduate students with the information that they need to solve problems or make informed decisions. Note: The office does not provide academic advising; students must consult with the graduate coordinator in their own graduate program, or program of interest, for academic guidance.

Graduate and Professional Student Association
The Graduate & Professional Student Association was formed in 1980 to provide additional opportunities for graduate students to interact, both socially and academically, and to provide a forum for dealing with problems specific to graduate student life. GPSA’s primary
goals are to improve the quality of graduate education and to offer graduate student grants for research and other scholarly projects.

Each department on campus has a graduate student representative who communicates all pertinent information concerning the GPSA to his/her constituents. The GPSA has graduate student representation on all standing committees of the Graduate College and participates in at least one community service project each semester.

The GPSA office provides a study and social lounge, a copy service and a computer lab. The office is open year round, all day and some evenings. Meetings are held on the first Monday of every month, and all graduate students are encouraged to attend and participate. For more information contact the GPSA office, Lied Library, Room 3251 or call (702) 895-2261.

Admission & Registration Information

Admission to the Graduate College at the University of Nevada, Las Vegas is competitive; the minimum standard is evidence of the ability to matriculate in and complete an advanced graduate degree successfully. The rules and criteria established by the Board of Regents, University, Graduate College, and individual graduate programs determine admissibility.

The Graduate College processes applications and supporting materials when received for the semester indicated by the applicant. All application materials must be received by June 15 for fall and November 15 for spring admission (May 1 and October 1, respectively, for international applicants). Application deadlines vary by department, and many graduate programs have different admissions deadlines that applicants must meet to be considered for admission. Students should contact the department where they are seeking admission to get this information.

In consultation with the Graduate College, departments have the right to establish additional admission standards and criteria. It is the responsibility of the applicant to contact the appropriate department for information on additional departmental admission requirements. Please note that applicants must submit admissions materials to both the Graduate College and their graduate program of interest simultaneously in order to apply for admission. The process below describes the Graduate College requirements; please also follow the requirements, guidelines and deadlines of your degree program of interest.

Admission Requirements

Requirements for Domestic Applicants
Applicants must meet the following academic requirements:
1. Hold a baccalaureate or advanced graduate degree from a regionally accredited four-year college;
2. Have a minimum overall grade point average of 2.75 (4.00=A) for the bachelor’s degree, or a minimum 3.00 GPA (4.00=A) for the last two years of study;
3. A student who has an advanced degree from an accredited college or university with a minimum overall GPA of 3.00 may, at the option of the Graduate Dean and department, be admitted to an advanced degree program with an undergraduate grade point average of at least 2.00 but less than 3.00.

Requirements and Procedures for International Applicants
International applicants are considered for the Graduate Standing classification only. Besides the admission requirements listed previously, international applicants from countries where English is not the native language, or who did not receive a degree from an institution where English is the language of instruction, must show competency in English. The Graduate College requires a minimum score of 550 (written), or 213 (computerized), or 80 (internet-based) on the Test of English as a Foreign Language (TOEFL), 85 on the Michigan Test, or a 7 band or higher on the International English Language Testing System (IELTS).

Credentials not written in English must be accompanied by an English translation certified as true by a university official, an official representative of a United States embassy or consulate, the United States Information Service, the United States Education Foundation, or an approved professional translating service. Notarized copies of originals or translations are not considered official.

International applicants must submit a completed Certificate of Finance to the Office of International Students & Scholars, must satisfy the financial eligibility requirements, and receive their Letter of Admission from the Graduate College by July 1 if admitted for fall semester and November 15 if admitted for the spring semester before an I-20 will be issued.

For information concerning matters not related directly to the degree program (housing, fees, etc.), contact the Office of International Students and Scholars. Once admitted, international students must consult with this office and their academic advisor.

Application Procedures for Domestic and International Applicants
To be considered for admission, prospective students must complete two simultaneous application processes: one in the Graduate College and the other in the department that offers your program of study. The Graduate College requires the same application and admission materials from all prospective graduate students, regardless of department of
interest. Individual academic departments may require satisfactory composite scores on standardized tests, letters of recommendation, a personal statement, portfolio, or any combination of these or other items. Because departmental requirements vary, please refer to your department of interest for specific application requirements and deadlines. To apply to the Graduate College, submit the following admission materials for consideration:

- A completed application: The application is available for you to fill-out online by selecting the “Applying to Graduate School” link on the Graduate College homepage at http://graduatecollege.unlv.edu.
- A nonrefundable admission application fee, payable to the Nevada System of Higher Education by check, money order, or online by credit card.

*Note: Applications and materials will not be processed until the application fee is received. Applicants to multiple UNLV graduate programs must pay the admission application evaluation fee for each application filed. Denied applicants, who later seek admission to the same or other UNLV degree program, are required to pay an additional application fee to cover processing.

- One official transcript from every postsecondary institution the applicant has attended, showing all degrees and coursework, the dates awarded, and extension and correspondence work.

*Note: Only transcripts sent directly from the institution are considered official. Failure to disclose all course work and/or degrees awarded will result in rescission of admission.

Send Graduate College admission materials to:

University of Nevada, Las Vegas
Graduate College
FDH 352 Box 451017
4505 S. Maryland Parkway,
Las Vegas, NV 89154-1017

Mailing addresses for specific graduate programs are available on department websites via the Graduate College website. Applicants must submit admission materials to your department of interest by their deadline. Because departmental requirements vary, please be sure to refer to your department of interest for specific application requirements. Many graduate programs require some or all of the following documentation:

- One official transcript from all postsecondary institutions attended, showing all degrees and the dates awarded and extension and correspondence work. Only transcripts sent directly from the institution are considered official. Some departments only require unofficial transcripts; please check with your department of interest to confirm.

* Letters of recommendation sent by former instructors, employers, or other professionals who can evaluate the applicant’s potential to complete graduate study.
* Resume, portfolio, etc. Some departments may request additional materials (i.e., resume, portfolio, and statement of purpose, writing samples, and the like).
* Standardized test scores. In addition, some departments may require satisfactory composite scores on the Graduate Record Examination (GRE), Graduate Management Admission Test (GMAT), Miller Analogies Test (MAT), or other standardized tests. Information concerning standardized examinations required for admission to the degree program is available from the Student Development Center. Some examinations are given only four or five times a year and require that registration be completed a minimum of six weeks prior to the test date. With the exception of the Miller Analogies Test (MAT), students may take the required tests at other colleges or universities if taking them at UNLV is inconvenient for the applicant.

The Admission Process

1. A Student Admission File is created upon receipt of an admission application and fee. Applications are not processed until the Graduate College receives all required credentials. To avoid processing delays, students must submit the online admission application and fee prior to sending additional materials (i.e., transcripts, test scores, letters of recommendation, etc.). Applicants are responsible for making sure the Graduate College and department receive the appropriate credentials by the required deadlines. All application materials, including transcripts, become the property of the university and may not be released to the applicant or any individual.

2. The Graduate College evaluates the application materials and forwards them to the department for review. Upon review of the materials, the department will make a recommendation to the Dean of the Graduate College for approval. Early submission of all application materials to the Graduate College and department simultaneously, facilitates a more expeditious review process.

3. Applicants will be notified of their admission status on their Apply Yourself page (online). Those accepted to pursue a UNLV graduate degree will receive a Letter of Admission from the Graduate College. The Letter of Admission is an important document that the student should retain.

4. The admission process is completed upon enrollment in graduate-level courses for the specified term and degree program indicated on the Letter of Admission. Failure to enroll or withdraw from all course work, during the
Upon admission, the student must withdraw all necessary admission credentials to the Graduate College. If a degree results from the admission, there is no limit to the number of allowable future admissions.

Students are admitted to pursue an advanced degree in a department or program. To change to another department or program, students must submit a new application for admission, the required application fee, and supporting credentials required by the Graduate College and the new department or program. The Graduate College issues only two Letters of Admission for each student. Nevada professional certification may be considered as fulfilling this requirement. To be considered for admission for a future semester, the student must reapply and submit another application processing fee.

Transfer Work
Courses used to fulfill requirements for one degree may not be used toward another degree. For UNLV Non-Degree Seeking graduate students, a maximum of 15 graduate credits taken at UNLV may be applied toward a graduate program. Graduate work with a grade of B or higher (3.00, A=4.00) may be transferable into a degree program subject to departmental and Graduate Dean approval. Grades of B- or lower, and courses graded on a satisfactory pass/fail basis, are not transferable into graduate degree programs. With the department and Graduate College approvals, no more than one-third of the minimum number of credits required for the degree (not including credits for thesis, dissertation, and professional/scholarly papers) may be transferred from an accredited graduate degree granting institution.

Second Admission or Readmission to the Graduate College
Students may apply for a second master’s degree (in a different department) or a doctoral degree after completing a master’s degree. In these cases, students must submit a new application for admission, the fee, and supporting credentials required by the Graduate College and the new department or program.

The Graduate College issues only two Letters of Admission without earning a degree. If a degree results from the admission, there is no limit to the number of allowable future admissions.

Change of Department
Students are admitted to pursue an advanced degree in a specific department or program. To change to another department or program, students must submit a new application for admission, the required application fee, and all necessary admission credentials to the Graduate College. Upon admission, the student must withdraw in writing from the original department. Graduate students may not be enrolled in two degree programs simultaneously.

Revocation of Admission
It is assumed that the information provided on the application for admission is complete and accurate. Subsequent evidence to the contrary may result in the admission being revoked and the loss of any credit or degree stemming from the admission. To reapply for admission after a revocation, a new application and fee are required. Students should contact the Graduate College to determine what additional materials are needed. Materials from the previous application, such as official transcripts, may be used.

Admission Status and Classification of Students

Graduate Standing
Students accepted to pursue a program leading to an advanced degree are classified as having Graduate Standing. The Graduate Standing classification allows students to plan and matriculate in a degree program, to request formation of an advisory committee, and to be assigned or select a faculty advisor, depending on the degree program.

Graduate Provisional
Students whose previous academic records are not strong enough to merit Graduate Standing may be granted probationary admission and classified as Graduate Provisional. This classification does not apply to students with deficiencies or insufficient undergraduate credits in the chosen field of study. The Graduate College and the student’s department determine placement in this classification.

A provisional student must complete nine credit hours of graduate-level course work selected by the department and listed on the Letter of Admission. The student must complete this course work within one calendar year of admission, with grades of B or higher. (B- grades are unacceptable) before taking additional course work. Failure to complete the required course work in the specified period or a grade less than B (3.00) will automatically cancel the student’s admission.

When the Graduate College receives the grades covering the required course work, the student will be given Graduate Standing status. A student may only be admitted as a Graduate Provisional student once.

Conditional Admission
A Conditional Admission status may be granted when the applicant must submit additional material before finalizing admission, i.e., a final transcript of course work in progress while applying for admission. Graduate Standing or Graduate Provisional students may also be classified as Conditional Admission. The Letter of Admission will specify which material must be submitted and the date the Graduate College must receive it. Failure to meet the
condition(s) will automatically cancel the student’s admission.

**Non-Degree Student**
The Non-Degree Student status is assigned to individuals with baccalaureate degrees who wish to take graduate courses but not pursue an advanced degree. Registration for classes as a Non-Degree Student is processed through the Graduate College. Generally, Non-Degree Students may enroll in up to 12 credit hours per semester.

Department faculty are responsible for determining the adequacy of preparation of Non-Degree Students before allowing them to take upper-division or graduate courses which are open to Non-Degree Graduate Students. The student should check with the department about graduate courses accessible to Non-Degree Students. It is the student’s responsibility to provide proof of adequate preparation.

A Non-Degree Graduate Student wishing to seek a degree must apply for admission to the Graduate College and pay an application processing fee. Non-Degree Graduate Students may transfer up to fifteen UNLV credits with grades of B or higher into a degree program. Courses taken as a Non-Degree Graduate Student count toward the degree program at the discretion of the graduate coordinator, and/or department chair, and Graduate Dean.

**Undergraduates Taking Graduate-Level Courses**
Undergraduates with a minimum 90 semester hours of credit and 3.00 or higher grade point average may enroll in graduate courses. Students in the Honors Program must have a minimum of 45 semester hours of credit and a 3.00 or higher grade point average. The Approval for an Undergraduate to Enroll in 700-level Course Work Form must be completed and necessary signatures obtained and approved by the Graduate College prior to registration. Students may enroll in up to six hours of graduate-level courses during one semester.

**Reserving Courses for Graduate Credit.** Upon approval, UNLV undergraduates may take 600/700-level course work and reserve the credits earned for possible use in an advanced degree program. Course work reserved for graduate credit may not be used to satisfy baccalaureate degree requirements.

**Graduate Courses for Undergraduate Credit.** Upon approval, UNLV undergraduates may take 600/700-level course work for use in an undergraduate degree program. Courses used in an undergraduate program may not be applied toward an advanced degree at a later date.

**Immunization Requirement**
Nevada state law requires all new University of Nevada, Las Vegas graduate students to submit proof of immunization before they may register for classes. New students are required to provide proof of immunity to remove a registration hold. The Graduate College sends immunization forms along with the admission notification. For further information, contact the Student Health Center at (702) 895-3370.

**Nevada Residency**
The Dean of the Graduate College determines the Nevada residency of graduate students according Board of Regents regulations and the laws of the State of Nevada. Persons, such as Nevada certified school teachers and Armed Forces personnel stationed in Nevada, are normally accorded residency status. A full statement of the regulations is available online.

**Registration Policies**
The university outlines specific registration procedures in the Schedule of Classes, which is made available prior to each semester by the Registrar’s Office. Students must register for classes using the procedures outlined in the class schedule including enrolling by the dates and times specified for each semester or special session. Students paying fees after the date and time specified in the schedule may be charged a late fee. An administrative drop may result for nonpayment of fees. The registration or enrollment of a student ineligible to attend the university is subject to immediate cancellation. A full-time graduate student is one who is enrolled in nine or more semester credits or equivalent or six credits for graduate assistants.

**Adding or Dropping Classes**
Students may add or drop a course up to the close of the late registration period. After this date, and with approval, students may make changes only when the circumstance is sufficiently extraordinary to warrant an exception.

**Dropping/Withdrawing From Classes**
The terms drop and withdraw are used interchangeably. The academic policies and calendar dates for dropping and withdrawing are the same. Drop generally refers to dropping one or more courses during a given semester. Withdrawal generally refers to the act of dropping all courses during a given semester.

A student may drop or withdraw from full semester courses during the free drop period (first ten weeks of the fall or spring semester) without a grade. The instructor must provide a preliminary evaluation of the student’s grade before the end of the free drop period. No drops or withdrawals will be permitted after the end of the free drop period as published in the current class schedule (see Grades and Examinations). Refer to the appropriate class schedule for drop dates for special modular courses, short courses, extended education and summer term courses. Students who stop attending class and fail to file an official drop request form with the Registrar will receive a grade of F.
Students who wish to withdraw from all classes must obtain a Withdrawal form from the Registrar’s Office, obtain all required signatures, and return the form to the Registrar’s Office. The withdrawal is official only after the Registrar’s Office accepts it.

A student who has officially dropped a class and who is no longer registered for credit or audit is ineligible for further attendance in that class.

Cancellation of Registration
The university reserves the right to cancel any registration in specific courses for which the student is ineligible. The registration of any student who is ineligible to attend the university is subject to immediate cancellation. The university also reserves the right to cancel the registration of an individual whose attendance, in the opinion of the appropriate administrative officials, would not be mutually beneficial to that person and to the institution.

Cancellation of Courses and Programs
The university reserves the right to cancel any registration in which the enrollment is insufficient to warrant offering the course and/or to eliminate, cancel, phase out or reduce in size courses and/or programs for financial, curricular or programmatic reasons.

Repeat Policy
Any course may be repeated, regardless of the grade received. Credit will be allowed only once for successful completion of the course, except for courses designated in the catalog as allowable repeats. A student may repeat any UNLV course once at UNLV and not have the original grade included in the computation of the grade point average. The repeat grade must be on the same grading option as the original grade. The original grade will remain on the student’s academic record with suitable notation. For courses repeated prior to February 1971, both the original grade and the repeat grade are included in the grade point average. Students are responsible for providing the Registrar’s Office with written notification when a repeat course is completed. Computer-printed grade reports may not initially compensate for repeated courses. Grade point averages, credits attempted, and credits earned will be manually adjusted.

When a course is repeated more than once, only the original grade is omitted in computing the grade point average. The fact that UNLV has granted a degree to a student shall not preclude the student’s right to repeat a course for the purpose of improving a grade. However, class standing will not be affected by the results. A student receiving a final grade of ‘F’ in a course can obtain credit by pre-registering for the course, repeating the class work, and receiving a passing grade.

A failed course cannot be challenged by examination. A failed course does not have to be repeated unless the course is a specific college or department requirement. A student may be allowed to repeat any course once and not have the original grade computed in the graduation GPA. If a course is repeated more than once, only the original grade is omitted in computing the graduation GPA.

Unit of Credit
The unit of credit, or semester hour, is generally defined as one 50-minute lecture a week for a semester. Two or three laboratory hours per week, depending on the amount of outside preparation required, usually carries the same credit as one lecture hour.

Course Numbers
Graduate-level courses are numbered 500-799. Undergraduate-level courses are numbered 100-499.

Symbols
Numbers separated by a hyphen indicate courses which must be taken in sequence. The first semester is prerequisite for the second, for example, 701-702. Numbers separated by a comma indicate courses which may be taken one without the other, for example (701, 702). Various areas of the same course may be taken for credit. They are indicated by letters, for example A., B., etc.

Grading System
The following symbols are used in reporting and recording student grades:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Superior</td>
</tr>
<tr>
<td>B</td>
<td>Above Average</td>
</tr>
<tr>
<td>C</td>
<td>Average</td>
</tr>
<tr>
<td>D</td>
<td>Below Average</td>
</tr>
<tr>
<td>F</td>
<td>Failing</td>
</tr>
<tr>
<td>AD</td>
<td>Audit</td>
</tr>
<tr>
<td>I</td>
<td>Incomplete</td>
</tr>
<tr>
<td>S</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>X</td>
<td>Hold Grade</td>
</tr>
</tbody>
</table>

Note: Faculty members have the option of using plus (+) and minus (-) for grades of A, B, C, and D. Exception: A+ grades are not given.

I or Incomplete Grade
The following regulations apply to the ‘I’ or Incomplete grade:

1. The ‘I’ grade is used for content/lecture type courses designed to be completed within one semester and where the student has failed to complete all of the requirements. The instructor is responsible for determining if the reason for non-completion is satisfactory.
2. An ‘I’ is given only when a minor part of the course work remains incomplete and the major portion has been completed at a level which is clearly passing.
3. Graduate students receiving an ‘I’ grade in 500, 600- or 700-level courses have one calendar year to complete all course requirements and remove the ‘I’ grade; however, the instructor may require that it be made up in less time. If course requirements are not completed within...
one year, the Registrar’s Office will automatically record a grade of ‘F’. Students must make up an Incomplete in a 400-level or lower course in one semester.

**S or F (Satisfactory or Failing) Grades**
The Satisfactory (S) or Failing (F) mark is used upon completion of the thesis, dissertation, professional paper or for noncredit or satisfactory/fail courses. Grade-point values are not assigned for S. Many graduate and professional schools may not accept satisfactory/fail credits, or accept them only if accompanied by written evaluations of the work accomplished in such courses that bear upon the field of specialization. Additional evidence such as GRE or other advanced test results may also be required. UNLV does not accept graduate courses graded satisfactory/fail for use in a degree program except thesis, dissertation, or professional paper credits.

**X (Hold) Grade**
The X grade is restricted to 500-, 600- or 700-level research or clinical practicum courses where the course requirements extend beyond one semester.

**Grade Changes**
A reported grade may be changed because of a clerical error made by the instructor or Registrar. Grade changes require the approval of the Graduate College Dean. Under present university regulations, the Registrar cannot change a grade once six months have passed following issuance of the official student grade report.

**Transcripts of Credit**
Official transcripts bear the University Seal, the Registrar’s signature, and reflect all academic work attempted at UNLV. Upon written request, the Office of the Registrar will issue official UNLV transcripts. Requests should be made at least one week before the date the transcripts are needed. The Registrar will not issue transcripts for any student having a delinquent indebtedness to the university. In addition, transcripts of work from other institutions will not be issued. Work in progress does not appear on the transcript until the semester or registration period officially ends. Transcripts are not prepared during final examination, grade recording, and registration periods.

**Academic Policies**
The policies and regulations of the graduate program or department, the Graduate College, the University of Nevada, Las Vegas, and the Board of Regents are subject to review and change. The Graduate College Policy Manual and the UNLV Student Conduct Code are available by request in the Graduate College and on our website. It is the responsibility of students to know and observe all regulations and procedures relating to their graduate program, the Graduate College, and UNLV. In no case will any regulations be waived or an exception granted based on a plea of ignorance of, or contention that the graduate program, Graduate College, or university did not inform a student of the regulations or procedures. Questions regarding graduate-level study regulations and their interpretation should be addressed to the Graduate College.

**Academic Integrity**
All members of the UNLV community are dedicated to learning. The university and the graduate college expect nothing less than a high level of scholarly integrity and academic honesty on the part of students, faculty, staff, and administrators.

Quality academic work requires honesty. The UNLV faculty and administration regard any attempt by a student to present as his or her own work that which he or she has not solely produced as a serious offense. Students are considered to have cheated, for example, if they copy the work of another; use unauthorized Note: or other aids during an examination; turn in a paper or an assignment written, in whole or in part, by someone else as their own. Students are guilty of plagiarism, intentional or not, if they copy material from books, magazines, or other sources without identifying and acknowledging the sources, or if they paraphrase ideas from such sources without acknowledging them. Students guilty of, or assisting others in, either cheating or plagiarism on an assignment, quiz, examination, or other scholarly endeavor may receive a grade of ‘F’ for the course involved, and may be suspended or removed from the program. Additionally, UNLV has established policies regarding research misconduct among students, faculty and staff. Research misconduct pertains to commission of any of the following acts: falsification of data, improper assignment of authorship, claiming another person’s work as one’s own, unprofessional manipulation of experiments or of research procedures, or misappropriation of research funds. (Adapted from the 1994¬-95 Graduate Catalog Northern Illinois University).

If a student is deemed by a faculty member to be guilty of academic dishonesty, where applicable, the student may be assigned a failing grade for the corresponding segment of the course or for the entire course. The faculty member or administrator also may initiate disciplinary review under procedures described in the Nevada System of Higher Education document Rules and Disciplinary Procedures for Members of the University Community.

Disciplinary sanction options described therein include warning, probation, suspension, and expulsion or revocation of a degree if a degree has been previously awarded. In all cases the faculty member is responsible for recording the circumstances, notifying the student in writing, and for
Credit may be used toward the graduate degree for courses taken while an undergraduate at UNLV only if the course was reserved for graduate credit. See the Admissions section for this information.

Transfer Credit Limitations: Prior to Admission and Enrollment
Not more than one-third of a student’s degree program (not including the thesis, dissertation, or professional/scholarly paper) may be transferred from another university at the time admission is granted. Courses used to fulfill requirements for one degree may not be used to reduce credit hour requirements in another degree program. For UNLV Non-Degree graduate students, a maximum of 15 graduate credits taken at UNLV may be applied toward a graduate degree program.

Transfer Credit Limitations: After Admission and Enrollment
Once admitted to an advanced degree program, students must obtain prior written consent of the department and the Graduate Dean to take course work elsewhere and use it in their degree program. Such work must be graduate level, graded, and must not be experimental, correspondence, or extended in nature.

The department chair, the graduate coordinator, the academic dean responsible for approving the student’s degree program, and the Graduate Dean must approve all credits taken prior to admission or transfer credit. To be considered for use:

1. The work must have been taken at an accredited institution;
2. The work must have been completed with a grade of B or higher (B- is not acceptable);
3. Official transcripts covering the work must be sent directly from the issuing institution to the Graduate College; and
4. The work must be posted to the student’s permanent academic record.

Transfer credit is approved only when evidence exists that the work is certifiably graduate level and has not been used in another degree program. The age of the transfer work under consideration, or the year taken, may also be a factor. The student is responsible for providing this evidence. Courses used to fulfill requirements for a previous degree may not be used toward another degree.
After admission, credits (workshops and correspondence courses will not be considered) taken at another institution may be applied toward the degree if prior permission is obtained. Contact the Graduate College for the request form, additional information and the conditions of transfer credits.

**Limitation on Credit Load**
The university considers a graduate student taking nine credits per semester as full-time (six credit hours if the student is a graduate assistant). Please note that the number of credits enrolled impacts financial aid. Contact the office of Financial Aid and Scholarships for further information.

Graduate students normally may not take more than 12 credit hours (10 if a graduate assistant) during the fall and spring terms. They may take no more than six credit hours in a single five-week Summer Term and earn no more than a total of 12 credits during the Summer Term (pre, post, and regular five-week sessions combined). Overload petitions are available in the Graduate College office. Petitions must be approved by the Graduate Dean prior to registration.

**Grade Point Average**
A candidate for an advanced degree must have an overall grade point average of 3.00 for all graduate program approved courses. The GPA, computed by the Graduate College, includes all completed graduate course work accepted at admission and all subsequently approved course work.

**Continuous Enrollment**
After admission to a graduate program, students must register for a minimum of six semester hours each calendar year. Students working on a thesis or dissertation must register for three semester hours of credit each semester (excluding summer), until the document has been completed and has been given final approval. Students who have not registered for academic work within one calendar year will be separated from their program and must reapply for admission should they wish to continue. Exceptions to the above policy, as with a request for a leave of absence, are made only with the approval of the student’s advisor, department chairperson or graduate coordinator, academic dean and the Graduate Dean. Any student using the services of the academic staff or university facilities must be registered for the period during which the services are rendered or the facilities are used. Students must be registered during the semester they intend to graduate and/or take final, comprehensive, preliminary, examinations, defend a thesis or dissertation.

**Six-Year and Eight-Year Policy**
The Six-Year and Eight-Year Policy applies to all course work, including all approved transfer degree course work. In special circumstances, the student’s faculty advisory committee may recommend that the Graduate Dean extend these degree time limits. Each department may establish shorter periods than those previously discussed contingent upon the approval of the Graduate Dean and inclusion in the Academic Policies section of this catalog.

Students violating the six-year and eight-year policy and/or the continuous enrollment policy are no longer automatically eligible to complete their program under the requirements in place at the time of admission. This decision is left to the discretion of the department. Students are considered making satisfactory progress toward the degree as long as they are completing six degree program credits per calendar year. Students not meeting this requirement will be separated from the Graduate College.

**Master’s Degree Students:** All master’s degree requirements must be completed within six years. Course work completed more than six calendar years before the term in which all degree requirements are met may not be used in the degree program.

**Doctoral Degree Students:** A student beginning a doctoral degree program and holding a master’s degree in an appropriate field of study must complete all doctoral degree program requirements within six years. A student beginning a doctoral degree program without a master’s degree must complete all requirements for the degree within eight years.

**Leave of Absence**
When necessary a student may request approval for a leave of absence from a degree program. During the leave of absence, the student should remain in contact with the department. However, all degree requirements must be completed within the six- and/or eight-year policy as stated previously.

**Probation and Separation**
Departments are to review the academic performance of graduate students at the end of each semester and/or academic year. If a department determines that a student is not making satisfactory progress toward the degree, it may request the Graduate Dean separate the student from the college or place the student on probation. The department must provide the student with the specific requirements, including deadlines, which must be completed to be removed from probation. If the Graduate Dean approves the request, the student will be placed on probation. Failure to meet the conditions of the probation will result in separation from the Graduate College.

Failure to make satisfactory progress may include: failure to complete six credits per calendar year toward the degree program; unsatisfactory grades (including Incompletes, grades below a B, or Withdrawals); failure to consult with the advisor when requested; failure to establish a graduate committee; failure to develop an official, approved degree program; failure to establish the groundwork for an acceptable thesis or dissertation; and failure of comprehensive and qualifying examinations.
Students must prove that they are making satisfactory progress. Departments may establish their own benchmarks for progress, consistent with degree program requirements and standards in the field. Satisfactory academic progress also involves maintaining the standards of academic and professional integrity expected in a particular discipline or program. Failure to maintain these standards may result in termination of the student’s admission to a graduate degree program.

A UNLV graduate student who has been dismissed for academic reasons is not eligible for admission or re-entry. The student must petition the Graduate College for academic reinstatement.

**Administrative Drops and Classroom Conduct**

Failure to attend a course or to submit required work will result in a grade of F. The student who neglects a course is solely responsible for dropping the course or withdrawing from the university. However, an administrative drop may be initiated at the discretion of the instructor, who will record the circumstances. The approval of the academic dean offering the course is required. Deadlines for an administrative drop are the same as for a drop initiated by the student and are based on the date received at the Registrar’s Office. The student will be notified by the final grade report.

Students have a responsibility to conduct themselves in class and in the libraries in ways that do not interfere with the right of other students to learn or of instructors to teach. Use of electronic devices such as pagers, cellular phones, or recording devices, or other potentially disruptive activities, is permitted only with prior explicit consent of the instructor. The instructor may rescind permission anytime during the course.

If a student does not comply with requirements or obstructs the functioning of the class, the instructor may initiate an administrative drop. The instructor must record the circumstances. The approval of the dean of the college offering the course is required. Before a decision, the dean will consult with the student and other parties as appropriate.

Serious cases of misconduct, as defined by the Rules and Disciplinary Procedures for Members of the University Community, will be referred to the appropriate administrative officer for action.

**Change of Address**

Any change of address should be reported immediately to the Registrar’s Office and the Graduate College. Any correspondence from the university mailed to the last address provided by the student to the Registrar and Graduate College will discharge all university responsibility for notification.

**Appeals and Procedures**

Appeals are to request reconsideration of a course grade, alleged unfair practice, and relief or waiver from a UNLV and/or Graduate College policy or requirement. Appeals must be filed with the Graduate College Office (FDH 3 09) in a timely manner. The Graduate College must receive grade appeals within 60 calendar days from the last day of the term/semester in question. The Registrar’s Office must receive notification to change a grade due to clerical error within 60 calendar days from the last day of the term/semester. Each appeal is reviewed individually and a decision will be based on the merits and documentation provided.

It is the student’s responsibility to provide a clear and concisely written statement of the appeal and to provide all relevant documentation to be reviewed. Written appeals must include:

1. UNLV Graduate College Appeal Form as a cover sheet
2. Written Statement of Appeal addressed to the appropriate UNLV administrator
3. Relevant documentation and support. For example, documents may include medical records, work verification, police reports, death certificates, airline receipts, letters from professors on university letterhead, transcripts, etc. If the issue is not resolved between the student and course instructor, a written appeal should first be directed to the Graduate Coordinator of the department in question. If the problem remains unresolved to the student’s satisfaction, appeals must be directed in progressive order to the Department Graduate Coordinator, Department Chair, College Dean, then subsequently to the Graduate Dean. The Graduate Dean may act to resolve the problem or request the Graduate College Committee on Faculty and Student Issues to review the problem and make its recommendation to the Graduate Dean. The Graduate Dean will inform the student of the final decision.

Advisors and departments may have varying methods of processing appeals. Your department should be contacted for specific policies and procedures. The Graduate College Graduate Faculty and Student Issues Committee is the designated College Committee to hear certain graduate student and faculty appeals and is composed of graduate faculty a graduate student representative.

**Waiver of Regulations**

The Graduate Dean will consider a student’s written request for waiver of a regulation upon a written recommendation from the student’s department and committee chair. The regulation in question must be specified and the reason for the exception clearly stated. The Graduate Dean will notify both the student and the department of the decision.
Policies and Procedures on the Protection of Research Subjects

Human Subjects: Graduate students conducting research must adhere to UNLV policies and procedures regarding the use of human subjects. All research projects in which human subjects are involved must be reviewed and approved under the authority of the UNLV Institutional Review Board (IRB), which consists of two committees - Biomedical Sciences Committee and Social and Behavioral Sciences Committee. The IRB is responsible for the development and monitoring of university policy and procedures involving the use of human subjects in research. The provision for the protection of human subjects in research applies to all studies in all locations, whether funded or unfunded, and whether conducted by faculty, students, or staff. It also applies to persons unaffiliated with UNLV, who wish to investigate subjects under the protection of the university. Students should contact the Office of Sponsored Programs to obtain appropriate forms and further information.

Animal Subjects: It is university policy that: 1) the proper care and management of laboratory animals is essential to the welfare of the animals, to the validity of research data, and to the health and safety of those caring for or using animals; and 2) the university will comply with federal and state regulations regarding animal welfare. All animal protocols involving vertebrate animals (including farm animals and wild animals) conducted at, funded through or sponsored by UNLV must be submitted for prior Institutional Animal Care and Use Committee (IACUC) review and periodic review after approval in accordance with university policies and procedures that are required by federal law.

The provision for the protection of animal subjects in research applies to all studies in all locations, whether funded or unfunded, and whether conducted by faculty, students, or staff. It also applies to all studies in all locations, whether funded or unfunded, and whether conducted by faculty, students, or staff. It also applies to persons unaffiliated with UNLV, who wish to investigate subjects under the protection of the university. Students should contact the office of Sponsored Programs to obtain appropriate forms and further information.

UNLV Student Computer Use Policy
Public computer laboratories and mainframe computers are provided as a service to students. Use is a privilege, not a right. Users should be good citizens; they must refrain from doing anything that annoys others or disrupts the educational experiences of their peers. Failure to comply with the regulations below may result in suspension under the NSHE Code, or civil or criminal action under the Nevada Revised Statutes, or federal law. It is a violation of UNLV policy to:

1. Copy any copyrighted software provided by UNLV. It is a criminal offense to copy any software protected by copyright, and UNLV will treat it as such.
2. Use licensed software in a manner inconsistent with the licensing arrangement. Information on licenses is available at the tutor stations or through NSHE Computing Services.
3. Copy, rename, alter, examine, or delete the files or programs of another person or UNLV without permission.
4. Use a computer to annoy others, including, but not limited to, sending offensive messages or knowingly causing a system to crash.
5. Create, disseminate or run a self-replicating program (virus), whether destructive in nature or not.
6. Use a computer for non-university work, such as for a private business or non-UNLV sanctioned club.
7. Tamper with switch settings or do anything that could damage terminals, computers, printers, or other equipment.
8. Collect, read, or destroy output other than your own work without the permission of the owner.
9. Use the computer account of another with or without permission unless it is designated group work.
10. Use software in the lab not owned by UNLV unless the student is the legally licensed owner.
11. Continue to use a computer account after withdrawing from the class for which it was obtained.
12. Access or attempt to access a host computer, either at UNLV or through a network, without the owner’s permission, and/or through use of log-in information belonging to another person.

Student Use of Hazardous Materials
Certain courses may require students to work with potentially hazardous materials in the lab, darkroom, or workshop. Instructors will provide instructions regarding the safe handling of all materials. Questions should be directed to the specific academic department or instructor.

Degree Progression Policies & Procedures
Degree requirements are usually completed under the policies and regulations listed in the Graduate Catalog in effect at the time of admission. However, and with departmental and Graduate College approval, the Graduate Catalog in effect during the semester in which degree requirements are completed may be used. All students seeking an advanced degree must adhere to the regulations discussed in this section. With Graduate College approval, departments may have additional specific degree
requirements that students must meet to receive an advanced degree.

**Forms**

All students are responsible for submitting the proper forms to the Graduate College as he or she progresses through their degree program. Failure to do so may cause a delay in the student’s graduation.

**The Advisor**

Students are assigned an advisor by their graduate program at the time of admission into the Graduate College. The advisor is typically selected by the department from among its Graduate Faculty; after which, if required by degree program, it is the responsibility of the student to personally select an advisor to serve as chair of his or her advisory committee. At any time after admission, a student may request a change of advisor and, upon departmental recommendation and Graduate College approval, the advisor will be changed.

**The Advisory Committee**

The advisory committee is responsible for guiding the student through the graduate program, assisting with the thesis or dissertation (if required), and administering the final examination. Not all graduate degree programs require the appointment of an advisory committee. Students should consult with their advisor to determine whether or not an advisory committee is necessary. All members of the committee should have expertise in the student’s area of concentration. Generally, four Graduate Faculty members comprise an advisory committee: three from the student’s department and one graduate faculty member from another department to serve as the Graduate College representative. One of the three graduate faculty members from the department serves as the student’s advisor and committee chair. The Graduate College must approve the Graduate College representative suggested by the student and advisor to serve on the committee. Occasionally, it is permissible for an additional graduate faculty member(s) to be placed on the committee. This exception requires the approval of the Graduate Dean. Master’s and doctoral students must submit the Appointment of Advisory Committee form to the Graduate College before establishing the degree program.

**The Degree Program**

Students, with their advisor and advisory committee, must prepare a proposed graduate degree program. This degree program, which outlines the courses the student will complete for the degree, should be thoughtfully prepared. The degree program of study must comply with the regulations of the graduate program or department, Graduate College, and university. The degree program requires the approvals of the student, advisor, the graduate coordinator, the appropriate academic dean, and the Graduate Dean.

For master’s students, the proposed graduate degree program must be submitted to the Graduate College prior to students completing 16 credit hours of work toward the degree. If students request that 12 or more credit hours taken prior to admission be considered for use toward the degree, the program must be submitted to the Graduate College by the sixth week of the first semester of enrollment. Doctoral students must submit the proposed graduate degree program by the end of the third semester of enrollment. By recommendation of a student’s department, limited changes in the degree program may be made with Graduate College approval.

**Final Research/Creative Documents**

The most important component of graduate education is the student’s culminating experience. This generally takes the form a final scholarly research project, a professional paper, a course, an exam and sometimes a defense. The culminating experience demonstrates the student’s mastery of their research, scholarship, creative abilities, and/or written communication skills in the chosen discipline. The final document is intended to benefit the student, the academic discipline or profession, and sometimes, society.

Final documents, including theses, dissertations, professional or scholarly papers, and projects must meet acceptable standards of the given profession. Theses and dissertations must also meet Graduate College standards according to The Guide to Preparing & Submitting a Thesis or Dissertation. The Graduate College and advisory committees expect students to give careful attention to the style and format of the final scholarly or creative documents.

Students required to complete and defend a final research or creative document must submit the Prospectus Approval Form to the Graduate College along with a brief written statement describing the content of the document. The Graduate College requires students working on a final research or creative document to register for three semester hours of credit each semester (excluding summer) until the document has been completed and has been given final approval. Students should contact the department to determine which document is required to complete their degree program.

**Thesis and Dissertation**

Some departments require a thesis, or offer the option of a thesis, for the master’s degree. All academic doctoral programs require a dissertation. Students must submit the Prospectus Approval form to the Graduate College at the same time the degree program is submitted for master’s students and to advance to candidacy for doctoral students. The thesis or dissertation should demonstrate the student’s ability to select a specific problem or topic, to assemble pertinent and necessary data, to do original research, to organize ideas and data acceptably, and to prepare a written report in clear and effective English. The Guide to Preparing & Submitting a Thesis or Dissertation is available on the
Graduate College website. Students must follow the instructions in the guide. Matters of form with respect to capitalization, abbreviation, quotations, footnote: and bibliography should conform to the discipline’s standards. Departments will advise the student on which style manual is appropriate.

The minimum number of thesis credits required for a master’s degree program is six. For the doctoral degree program, the minimum number of dissertation credits required is twelve. A grade is not reported for thesis or dissertation credits. When the final copy of the thesis/dissertation are submitted electronically to the Graduate College and approved by the Graduate Dean, the title of the thesis/dissertation is posted on the student’s transcript with the number of credits given. Unless approved for a leave of absence, a student must register for a minimum of three thesis/dissertation or non-thesis/dissertation credits each semester (summer excluded) until the thesis or dissertation is completed, submitted to the Graduate College, and the student graduates. However, students intending to complete, defend, submit a thesis or dissertation to the Graduate College, and/or graduate during the summer term, must be registered for a minimum of three credits. It is strongly suggested that no later than eight weeks prior to the last day of instruction in the term the student will graduate, a draft of the work should be submitted to the advisory committee. The committee will review the thesis or dissertation for any corrections and changes, which must be incorporated before the final examination (oral defense) and final typing. The completed, unbound work must be resubmitted to the committee at least one week prior to the final examination. The Graduate College must approve all theses and dissertations for final electronic submission. It is recommended that an initial format check be performed by the Graduate College by the eighth week of the semester the student intends to graduate. Upon approval, the thesis or dissertation must be submitted electronically to the Graduate College not later than two weeks prior to the end of instruction of the term the student intends to graduate. All members of the advisory committee must approve the thesis or dissertation for submission to the Graduate College. The Graduate Dean only can give permission for an extension of this deadline.

In rare circumstances a student may be permitted to complete the thesis or dissertation away from campus. After considerable progress has been made in collecting data and outlining the work, the student may petition to complete the thesis or dissertation in absentia, waiving the registration requirement. If the petition is approved, the advisor and Graduate Dean along with the student will determine the requirements for completion of the work.

**Professional or Scholarly Papers or Projects**

Master’s students not pursuing a thesis option may be required to complete a professional/scholarly paper or project as part of the degree program. Students are encouraged to use The Guide to Preparing & Submitting a Thesis or Dissertation available in the Graduate College when preparing a professional paper. Professional/scholarly papers or projects are not, however, reviewed, retained, or approved by the Graduate College. Some graduate programs require students doing a professional paper to have a graduate committee and to defend their work; other departments incorporate final papers into culminating experience courses or have other requirements. Please check with your department for detailed guidelines.

**Graduate Program Examinations**

There are three major examinations which students may be required to pass in order to complete a graduate program. The following descriptions are general and may be used interchangeably by departments or programs. For the application of these terms and their use by a particular department or graduate program, refer to the appropriate section of this catalog.

**Qualifying Examinations**

Some departments may require doctoral students to take a qualifying examination as part of the admission screening process or for diagnostic purposes shortly after admission. The examination may be written, oral, or both.

**Comprehensive and Final Examinations**

Most graduate degree programs require students to successfully complete one or more comprehensive or final examinations. For master’s students, the comprehensive, or final, examination is generally conducted during the last semester or term of enrollment in which a student intends to graduate. For doctoral students, the comprehensive, or preliminary, examinations are generally taken after all course work, other than dissertation credits, has been completed and before advancing to candidacy. The examination is intended to test the student’s knowledge of the area of specialization and may be written, oral, or both at the discretion of the department. If the examination is written, members of the advisory committee may submit questions, all must read the questions in advance, and all must read and evaluate the student’s answers. If oral, all members of the advisory committee must be present and may question the student. The comprehensive, final, or preliminary examination must be administered at least three weeks before the last day of instruction of any given semester or term. Students must be enrolled for at least one graduate-level credit during the semester or term the comprehensive or preliminary examination is taken. For comprehensive and final examination requirements, contact the department or refer to the appropriate section of this catalog. In the examination, the student must be able to demonstrate a comprehensive understanding of a broad field of study and a detailed understanding of one or more specialized fields of expertise. The advisory committee must unanimously pass the student.

22 University of Nevada, Las Vegas
If the committee votes unanimously to fail the student or the vote is not unanimous to pass, the student, in consultation with his/her advisor, may request the committee to administer a second examination. The student must wait at least three months before taking the second examination. The advisory committee must provide formal documentation to the student clearly indicating its decision.

Oral Defense
Graduate students completing a thesis or dissertation are required to demonstrate their ability to select a specific problem or topic, to assemble pertinent and necessary data, to do original research, to organize ideas and data acceptably, and to prepare a written report in clear and effective English. This demonstration takes the form of an oral defense of the finished document. For some master’s and specialist students, completing a professional/scholarly paper or project an oral defense may be required. All members of the advisory committee must be present and may question the student.

The oral defense must be held at least three weeks before the last day of instruction in the term in which the student plans to complete the degree requirements. It may be conducted before that term only with the Graduate Dean’s permission. Students must be enrolled during the term the oral defense is conducted.

Satisfactory performance on a final examination will consist of a presentation and defense of the student’s original thesis or dissertation research. At a minimum, the defense consists of an oral presentation to university graduate faculty and a closed deliberation and vote by the advisory committee. The oral presentation will be open to UNLV Graduate Faculty, graduate students, relevant administrators, and invited guests. The invited guests must be approved by the advisory committee chair prior to the defense.

The oral presentation may be followed by general questions of clarification from attendees [other than the advisory committee members]. The advisory committee and chair may choose to include a session of more in-depth questioning open only to the advisory committee and the UNLV Graduate Faculty. An additional phase of questioning with only the advisory committee and candidate may also be included. The final phase of closed deliberation, and the vote to pass or fail the student, will only be open to the student’s appointed advisory committee.

The Graduate College must be notified not less than two weeks in advance of the examination. A public announcement regarding an oral defense must be made to the appropriate department’s graduate faculty a minimum of seven (7) days prior to the oral defense.

During the oral defense, the student must be able to demonstrate a comprehensive understanding of a broad field of study and a detailed understanding of a more limited field. The advisory committee must unanimously pass the student. If the committee votes unanimously to fail the student or the vote is not unanimous to pass, the student, in consultation with his/ her advisor, may request the committee to administer a second examination. The student must wait at least three months before taking the second examination. The department may require additional course work, substantial reworking of the thesis, dissertation, or professional/scholarly paper or project or whatever is believed necessary to prepare the student for the second examination. The Graduate College will not approve third examination requests.

Advancement to Candidacy
The Graduate College designates the advancement to candidacy status for doctoral students only. Doctoral students are advanced to candidacy upon successful completion of all course work, passing the comprehensive examination, and completing the dissertation prospectus. The date of advancement is recorded on the students’ official UNLV transcript.

Graduation Procedures
Application for Graduation
Students are responsible for applying for graduation by the semester deadline. Doing so triggers your graduate evaluator to review your file and make sure that everything is in order for you to graduate. The graduation application is available for downloading on the Graduate College website. The application form must be signed and returned to the Graduate College by the deadline posted on the Graduate College website. Applications for graduation will not be processed unless all required forms and documents have been submitted to the Graduate College including degree program, and if required the prospectus approval, appointment of advisory committee, and for doctoral students the advancement to candidacy form.

If students do not complete the degree requirements in the term anticipated, it is expected that they will do so in the next regular term (summer excluded). A new application for graduation must be filed, and an additional diploma fee will be charged. In addition, students must be enrolled in a minimum of 3 credits during the term they apply for and expect to graduate.

Granting of Degrees
Degrees are awarded three times a year in May, December, and August. Students must be enrolled in a minimum of 3 credits during the term they intend to graduate. When students apply for graduation, the Graduate College reviews the degree program. The Graduate Dean certifies that they have met degree requirements and a recommendation is forwarded to the Board of Regents. If any requirement has not been met, the degree will not be awarded. The degree will be revoked if it is awarded in error, or if it is later discovered that the degree requirements were not met, or if fraudulent claims are later discovered.
Commencement
Students may not participate in commencement prior to completion of all degree program requirements. Commencement is held twice a year in May and December. August graduates may participate in the December commencement following the completion of degree requirements.

Tuition & Fees
Fees: All fees assessed by the university are subject to change by the Board of Regents. Every effort is made to keep fees low as possible while rendering the desired level of service. Nonresident fees are calculated to cover a major part of the direct cost of instruction.

Graduate Tuition and Fees*
*The fees listed below are applicable to Fall 2009 and Spring 2010.

<table>
<thead>
<tr>
<th>Graduate Per Credit Hour Fee</th>
<th>$217.25</th>
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<tbody>
<tr>
<td>Non-Resident Graduate Fees:</td>
<td></td>
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<tr>
<td>1-6 credits</td>
<td>$457.25 per credit hour</td>
</tr>
<tr>
<td>7 or more credits</td>
<td>$6170.00 per semester</td>
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<tr>
<td></td>
<td>+$217.75 graduate per credit hour fee</td>
</tr>
<tr>
<td>Good Neighbor Graduate Fee</td>
<td>$457.25 per credit hour</td>
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<tr>
<td>Other Fees</td>
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<tr>
<td>Graduate and Professional Student Association</td>
<td>$18.00 per semester</td>
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<td>International Education</td>
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<td>Rebel Recycling</td>
<td>$1.00 per semester</td>
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<td>Student Health</td>
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<td>Technology</td>
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<td>Student Life Facilities</td>
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<td></td>
<td>for 4 or more credits</td>
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<tr>
<td>International Student</td>
<td>$145.00 per semester</td>
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<td>(international students only)</td>
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<tr>
<td>Integrate</td>
<td>$3.00 per credit</td>
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<tr>
<td>New Graduate Student Orientation</td>
<td>$35.00</td>
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</table>

Nonresident Tuition
Students who are not Nevada residents must pay a nonresident tuition fee in addition to the per credit hour fees per semester. Nonresident students taking less than seven credits should contact the Admissions Office for up-to-date fee information. Students eligible under Good Neighbor regulations pay a reduced nonresident tuition fee in addition to the per credit hour registration fee per semester.

Audit Fee
The fee for audit is the same as the fee for registering for credit. The equivalent credits of an audit course are considered in determining if the student is assessed out-of-state tuition.

Nevada Residency for Tuition Purposes

Residency Decisions
The Board of Regents establishes Nevada residency for tuition purposes regulations. For admitted degree-seeking graduate students, residency status is determined at the time of admission to a degree-seeking program and is indicated in the official Letter of Admission from the Graduate College. Non-degree-seeking graduate students will generally be classified as out-of-state until and unless Nevada residency is determined via the residency application process. If the residency status is not “Nevada,” out-of-state tuition will be assessed. Residency decisions are made during the application process and will be posted on the admission acceptance letter.

Qualifying for Nevada Residency
The following categories qualify for Nevada resident status:
1. A member of the Armed Forces of the United States
2. Full-time licensed personnel employed by a public school district in Nevada
3. A teacher who is currently employed full time in Nevada
4. A professional or classified employee of the University and Community College System of Nevada
5. Company relocation (also applies to spouse and children)
6. Family relocation to the state
7. Millennium scholarship recipients
8. A student who has lived in the state for a period of 12 months

Applying for Nevada Residency
To apply for residency, download and complete the Residency Application and include photocopies of supporting documents. Mail or fax documentation to the Office of Admissions by the application deadline listed in the Academic Calendar and Registration Guide. Residency review for fall applications begins June 1; spring review begins Nov. 1.

Good Neighbor Regulations for Reduced Nonresident Tuition
Students who claim residence for at least 12 months in a qualifying Arizona or California county, or graduates from a high school or community college in a qualifying Arizona or California county may be eligible to attend the university at a reduced tuition cost. Those claiming residency for 12 months must have maintained legal bona fide residence for
at least 12 consecutive months prior to the first day of the semester in which enrollment is sought. Applications are available online or in the Graduate College. Requests for Good Neighbor status must be filed by the close of late registration for the semester in which the student has applied for admission. Any student who enrolls under this policy shall not be eligible for reclassification as a resident student unless the student has subsequently enrolled as a non-Good Neighbor nonresident for the period of one year, or did not enroll in an Nevada System of Higher Education institution for at least 12 months immediately prior to the date of application for reclassification to resident student status.

**Approved Good Neighbor Counties:**
- Alpine
- El Dorado
- Inyo
- Lassen
- Modoc
- Mono
- Nevada
- Placer
- Plumas
- San Bernardino
- Sierra Counties

**Special Fees and Charges**
An application fee of $60 (domestic) is charged to any person applying for admission. It is not refundable or applicable to any other fee. International applicants must pay an additional $15 evaluation fee ($75.00 total). Special charges may be made according to current costs for the following:

a. Courses requiring equipment, facilities or materials not available on the campus, i.e., golf and certain field courses.
b. Courses requiring use of high technology equipment, e.g., computer courses or health profession courses.
c. Private instruction in music and similar arts
d. Noncredit courses, conferences, workshops, postgraduate professional seminars and similar educational offerings.
e. Courses requiring field trips or travel.
f. Personal expenses incurred by students in connection with field trips.
g. Lab and computer usage fees.

3. The following fees are either assessed or identified at registration:

a. A late registration fee of $25 per day to a maximum of $250 is assessed to students who do not complete registration by the date designated. Summer Term students are assessed a late registration fee of $25 per day until the end of the late registration period for that Summer Session. In case the time designated for registration is not adequate, the Registrar may defer the assessment of this fee for one day.
b. Returned Check Fee. Personal checks are accepted in payment of fees owed to the university, although no counter checks or checks altered in any way are accepted. A collection fee of $25 is assessed for any check returned unpaid by a bank. The check must be made good within 10 days or it will be turned over to a collection agency, and the student will be liable for all collection costs and any other related costs. If a personal check is returned from the bank, the university reserves the right to place the student on a cash basis only and withdrawal procedures may be initiated at the option of the university. A stop payment placed on a check does not constitute withdrawal from courses. Official withdrawal must be processed as returned checks and are subject to the same fees and collection cost.
c. A graduation fee of $50 will be billed to the student’s account after the application for graduation is filed in the Graduate College. If a student fails to meet graduation requirements after a diploma has been ordered, $2.50 of the fee is forfeited.
d. Late application for graduation, $20.
e. A fee of $55 for Master Thesis publication and $65 for Doctoral Dissertation publication will be billed to the student’s account after the application for graduation is filed.

**Student Health Fee**
The Student Health program fees for Fall, Spring, and Summer semester classes are not to be confused with the voluntary Student Health Insurance plan. Program fees support various services offered by the Student Wellness Cluster.

The Student Health program facilitates on-campus educational experiences and leadership opportunities for all UNLV students; is responsible for public health protection of the UNLV community; provides access to health care and provisions or coordination of health needs for students; provides student counseling and psychological services; and includes the Jean Nidetch Women’s Center.

**Group Health and Accident Insurance Fee**
The Student Health Insurance plan is available to students formally admitted and currently enrolled taking six or more undergraduate credits or graduate students taking three or more credit hours. This plan is not to be confused with the student health program fee that all registered students pay for fall, spring, and summer sessions.

The Student Health Insurance provides services beyond those available through the Student Health Center for eligible on and off campus medical services. You may sign up for the Student Health Insurance by picking up an enrollment packet at the Student Health Center or Bursar’s Office prior to the beginning of Fall, Spring, and Summer sessions or by accessing the web.
Grants-in-Aid
Each student is expected to pay all assessed fees on registration day unless a grant-in-aid is secured prior to registration day. Students are responsible to pay their portion on time. Late fees and/or withdrawal may be initiated for a student’s portion and/or reported to a credit bureau. Legal proceedings may be initiated for any default accounts receivable.

Delinquent Accounts
A student or former student having a delinquent account receivable or an overdue student loan of any amount with any division of the Nevada System of Higher Education shall not be permitted to register, receive any type of transcript of records, grades, diploma or certificate or obtain services from any division. The university reserves the right to refer any delinquent account to a collection agency and/or report to a credit bureau. Legal proceedings may be initiated for any delinquent account.

Deferred Payment Option
Deferred payment is available to students who are registered for seven credits or more and are not receiving any sort of financial aid, grant-in-aid, etc. There is a $20.00 service charge for all deferred fee payment plans. The $20.00 service charge plus 50 percent of the per credit fee, nonresident tuition (if applicable), and 100 percent of special fees are due by the first installment date. Second installment is due by Friday of the fourth week of instruction. Failure to pay the second half of the deferred payment on schedule will constitute withdrawal from the university. The tuition will still be owed, but the student will not receive credit for the courses. Any delinquent accounts may be reported to a credit bureau. All delinquent accounts not paid as required will be sent to a collection agency. The student is responsible for all collection costs, attorney fees, etc. All students must pay their tuition in full at registration or be on an approved deferred payment to be considered enrolled for the semester. All unapproved accounts will be disenrolled. No exceptions. The university reserves the right to deny deferred payment to any student who does not pay tuition and fees as scheduled, including late fees.

Refund of Fees
Students who withdraw from the university receive a refund of fees according to the schedule below, which is subject to change by the Board of Regents. All requests for exception to the refund policy for extraordinary circumstances must be made to Student Enrollment Services or the Fee Appeal Committee. An appeal form is available at Student Enrollment Services, Cashier’s Office or the Bursar’s Office website.

1. For all UNLV students, including auditors, for net credit load reductions and withdrawals from the university, the refund policy is as follows:
   A. WITHIN THE FIRST WEEK OF INSTRUCTION.
   B. AFTER THE FIRST WEEK OF THE INSTRUCTIONAL PERIOD OF A REGULAR TERM.
      *50 percent credit for total withdrawals from all courses until the end of the sixth week. No credit for total withdrawals after the end of the sixth week.
      * 0 percent credit for partial withdrawals.
   2. For all UNLV students, including auditors, for net credit load reductions and withdrawals from the university during the Summer Term, the refund policy is as follows:
      A. Courses dropped prior to the first day of the instructional period will receive a 100 percent credit.
      B. Courses dropped within the first 20 percent of the course period, as defined by Student Enrollment Services, will receive a 50 percent credit.
      C. There will be no credit for courses dropped after 20 percent of the course period has passed.
   3. No credit shall be made for health and accident insurance premiums.
   4. Modular courses follow different refund policies than stated above. Inquire at Student Enrollment Services for details regarding a particular modular course’s refund policy.
   5. Upon written approval of the Vice President for Student Life, a full refund of all registration fees and tuition shall be given upon official withdrawal at any time during the first eight weeks of the semester in the following circumstances:
      A. Induction of the student into the U.S. Armed Forces;
      B. Death of a parent, spouse, child or legal guardian of the student; or
      C. Death of a student.
      D. No refund is made if withdrawal is after eight weeks, regardless of the circumstances. All refunds are made by check.
   6. In most cases, federal regulations require that refunds for students receiving financial aid must be refunded back to the financial aid program rather than the student. For information about exemptions to this policy, please contact Student Financial Services. Dropping below full time for students on financial aid may invalidate eligibility for financial aid. Students may owe UNLV for financial aid refunds.

Room and Board Refund
Students withdrawing from the residence hall will receive refunds according to the terms and conditions of the residence and dining hall contract.
Financial Assistance

The University of Nevada, Las Vegas subscribes to the following statement that has been adopted by the Council of Graduate Schools in the United States and by most of the leading graduate schools in North America: Acceptance of an offer of a graduate scholarship, fellowship, traineeship, or graduate assistantship for the next academic year by an actual or prospective graduate student completes an agreement which both student and the graduate school expect to honor. In those instances in which the student indicates acceptance prior to April 15 and subsequently desires to change plans, the student may submit in writing a resignation of the appointment at any time through April 15 in order to accept another scholarship, fellowship, traineeship, or graduate assistantship. However, an acceptance given or left in force after April 15 commits the student not to accept another appointment without first obtaining formal release for that purpose. It is further agreed by the institutions and organizations subscribing to the above resolution that a copy of this resolution should accompany every scholarship, fellowship, traineeship, and assistantship offer sent to a first-year graduate student before April 15.

Student Financial Services
The University of Nevada, Las Vegas provides a wide variety of assistance to finance higher education expenses. Grants, scholarships, part-time employment, and educational loans are available to help students with educational costs while attending UNLV. Students are encouraged to explore all possible resources. Financial Aid Administrators are available to discuss the variety of resources available and to assist graduate students in the application process. For further information, contact Graduate Student Financial Services at (702) 895-5569 and UNLV Student Financial Services, located in the Student Services Complex, at (702) 895-3424. The Graduate Student Financial Services office is located in the Graduate College on the 3rd floor of the Flora Dungan Humanities Building.

Federal Loan Programs

Federal Perkins Loans
A Federal Perkins loan is a low-interest (5 percent) loan available to graduate students that is made through the university. Actual award amounts depend on federal and institutional funding levels. Preference is given to those applicants who are attending at least half time and have the greatest financial need. The total amount awarded is determined by financial need.

Application must be made with the FAFSA, which must be mailed to the federal processing center by February 1. Priority is given to those with the greatest need whose federal financial aid information is received by UNLV before the priority filing date.

Federal Direct Stafford Loans
Direct Stafford loans are low interest loans to assist you in paying for your college education. The interest rate is variable and set annually, not to exceed 8.25 percent. You may call Student Financial Services or contact the Federal Aid Information number at 1-800-433-3243 for the current interest rate. Your loans may assist you in meeting your tuition and or living expenses. You do not have to start repaying them until you drop below half-time enrollment, withdraw completely from school, or graduate.

There are two types of Stafford loans:

a. The Federal Direct Subsidized Stafford Loan is available to students regardless of financial need. Interest on this loan is paid by Federal taxpayers while you are in school attending at least half-time.

b. The Federal Unsubsidized Loan is available to students regardless of financial need. You will be charged interest from the time the loan is disbursed until it is paid in full.

Graduate Assistantships
A number of state-supported and extramurally funded graduate assistantships are available. The most important regulations governing these positions are:
1. Applications must be sent to the department which you are seeking employment no later than March 1 proceeding the fall semester in which an assistantship is sought. Applications may be submitted after this date in case of unexpected openings occurring for the fall semester. In rare cases where an assistantship is available for the spring semester, the application deadline is November 15th.

2. Application forms are available from the Graduate College Office and on our website.

3. An assistantship is normally offered for a full academic year. If a student seeks renewal of an assistantship for the next year, a new application form must be submitted.

4. Currently, a graduate assistantship carries with it a stipend paid monthly for the academic year. This stipend may vary for extramurally funded assistantships. Tuition waivers are also included with the assistantship. These waivers are approved only for work directly related to the student’s degree program (courses numbered 500 and approved for graduate credit and 700-level courses). This waiver covers a significant portion of the per credit hour fee. The tuition waiver covers the full amount of out-of-state tuition. Tuition waiver amounts may vary or extramurally funded assistantships.

5. Graduate assistantships are not generally available during Summer Term. However, tuition waivers are available for Summer Term before and after a contract year has been completed. Tuition waivers are not
available for undergraduate or audited courses. The above policies may differ for extramurally funded assistantships.

6. Graduate assistants must have graduate standing status at the time they begin their assistantships.

7. International students whose graduate assistantship includes instructional duties (lecture, discussion groups, laboratory supervision, tutoring) must have received a successful grade on the Test of Spoken English (TSE) prior to assuming these instructional duties.

8. Graduate assistants must carry a minimum of six semester hours of graduate credit per semester. To carry more than twelve semester hours of credit, the department chair, academic dean, and the Graduate Dean must approve an Overload Petition.

9. Graduate assistants are expected to spend on the average 20 hours per week on departmental duties in either instruction and/or research.

10. Graduate assistants may not accept employment on or off campus without written permission from their faculty advisor, department chair, and Graduate College Dean. Graduate assistants are normally prohibited from being employed for more than 10 hours per week beyond their assistantship.

11. Graduate assistants are expected to report in the same time-frame as faculty, i.e., during academic semesters and not during break or vacation times. Graduate Assistants must report one week prior to commencement of classes both fall and spring semester. Exceptions to this statement may be negotiated at the time of employment; however, both parties must agree to the arrangement and approval must be obtained from the Chairperson, Academic Dean and Graduate Dean.

12. New graduate assistants are expected, as part of their contract obligation, to attend the Graduate Assistant Teacher Training and General Orientation Sessions that are offered at the beginning of each fall semester.

13. Graduate assistantships will be terminated if the student does not satisfactorily perform assigned duties. Assistantships will also be terminated if a student does not make satisfactory progress toward the degree. Unsatisfactory progress includes, but is not limited to: filing a degree program late; receiving a grade of less than B; failing to remove an Incomplete grade after one calendar year; and failing comprehensive or qualifying examinations as required by the degree program.

14. Offers of assistantships, whether state-supported or extramurally funded, are valid only if they come from the Graduate College Dean.

**Graduate Scholarships and Fellowships**

Updates on fellowship and scholarship information are available on the Graduate College website.

**For New Students: McNair Post-Baccalaureate Scholarships**

McNair Post-Baccalaureate Scholarships, administered by the Graduate College, are awarded in open competition to first-year graduate students who participated in a McNair Scholars program at UNLV or at another institution as an undergraduate.

To be considered, applicants must:

1. Have an undergraduate GPA of 3.0 and graduate standing status at the time the scholarship begins.
2. Enroll in a minimum of nine credit hours for two consecutive semesters.

**For Current Students:** The following fellowships and scholarships are only available to graduate students already admitted to the Graduate College.

**President's Graduate Fellowships**

The President’s Graduate Fellowships are provided through funding from the UNLV Foundation as directed by UNLV’s president for the research support of doctoral students. Up to three awards are given annually, each offering a fellowship package including a stipend, tuition (up to 12 credits), fees, and health benefit totaling $24,000.

Nominees must:

- Be doctoral students working primarily on the dissertation.
- Have a minimum graduate GPA of 3.5.
- Hold full-time student status (at least nine graduate credits) in each semester of the fellowship year.

Nominations must be submitted through department chairs. (Only one letter of nomination may be submitted from each department.)

**Barrick Graduate Fellowships**

Barrick Graduate Fellowships were established by an endowment from philanthropist Marjorie Barrick. They are given to outstanding doctoral students who have demonstrated excellent scholarship during their graduate study at UNLV. Two awards are given, each offering a $14,000 fellowship with full fees paid (up to 12 credits), including all out-of-state tuition, if applicable.

Applicants must:

- Be a doctoral-level student.
- Have completed at least 24 credits of doctoral study (at the time of application).
- Have a minimum graduate GPA of 3.5.
- Enroll as a full-time graduate student (at least nine graduate credits) in each semester of the fellowship year in order to devote maximum effort to doctoral study. Criteria for selection will also include demonstrated excellence in research.
Scholarships

**Alumni Association Scholarships** are awarded to outstanding master’s students who received their undergraduate degrees from UNLV. Three awards are given, each offering a $1,000 scholarship for the academic year.

Applicants must:
- Be a master’s-level or specialist student.
- Have completed at least 12 credits of graduate study at UNLV (by the end of the current spring semester).
- Have minimum UNLV undergraduate and graduate GPAs of 3.5.
- Enroll in six or more graduate credits in each semester of the scholarship year.
- Hold an undergraduate degree from UNLV.

**James F. Adams/GPSA Scholarships.** The UNLV Graduate & Professional Student Association established these scholarships in honor of Dr. James F. Adams, former dean of the Graduate College (1980-85), to recognize academic achievement of master’s-level students. Six awards are given, each offering a $1,000 scholarship. Applicants must:
- Be a master’s-level or specialist student.
- Have completed at least 12 credits of graduate study at UNLV (by the end of the current spring semester).
- Have a minimum graduate GPA of 3.5.
- Enroll in six or more credits in each semester of the scholarship year.

**Summer Session Scholarships** are designed to enable summer study for doctoral students, however excellent master’s and specialist’s students may be considered. Ten awards are given, each offering a $2,000 scholarship during the summer.

Applicants must:
- Have completed at least 12 credits of graduate study at UNLV (at the time of application).
- Have a minimum graduate GPA of 3.0.
- Enroll in six credits in any one or combination of summer sessions.

Criteria for selection will include summer plans for conducting dissertation or thesis research.

Employment

**On-Campus Employment.** Several campus departments and offices employ students in a variety of positions. These jobs can be viewed on the Student Financial Services website. On-campus employment listings are available to graduate students enrolled in at least five credits at UNLV. Financial need is not a criterion for on-campus employment.

**Job Location and Development.** Employment opportunities are offered to UNLV students by community businesses and individuals. These jobs can be viewed on the Student Financial Services website. In addition to job listings, the JLD Program sponsors biannual Job Fairs where employers from businesses, government agencies, and hospitals, to name a few, come to campus to discuss part-time employment opportunities.

**Federal Work Study.** The Federal Work Study Program is a federally funded financial aid program awarded as part of the financial aid package. This program enables students to earn a portion of their college expenses through employment with a UNLV department or office or off campus with contracted nonprofit agencies.

Community service is a major goal of this program. If available, students may choose jobs related to their academic majors and career objectives. Work hours may also be arranged according to class schedules.

To qualify for a Federal Work Study job, applicants must meet the eligibility requirements of the federal financial aid programs. One requirement, financial need, is determined by Student Financial Services and based on income and asset information entered on the Free Application for Federal Student Aid (FAFSA) application.

Funds are limited. Therefore, applicants must mail the completed FAFSA application to the federal processing center by February 1. Questions concerning the eligibility requirements or application process may be directed to Student Financial Services, second floor, Student Services Complex.
Howard R. Hughes
College of Engineering

Welcome to the Howard R. Hughes College of Engineering. We believe you will find UNLV and the College of Engineering a great place to pursue your studies. With more than 60 faculty, 400 graduate students, and 1,400 undergraduates, we have a dynamic community of scholars. Beyond that, we’ve made innovations that have resulted in an imaginative, student-centered educational and research environment. We are growing, and our future looks very promising. UNLV is now a Research Intensive University, a distinction that the College of Engineering has played a major role in helping the university achieve.

Graduate students in the College of Engineering study a variety of disciplines, including computer science, construction management, civil and environmental, electrical and computer, informatics, and mechanical engineering. New programs are underway, and we are building first-class research facilities.

Graduate students are involved in all of the new and ongoing research being conducted by the faculty. Some of our research areas include transmutation of radioactive water, air and water quality, data mining, materials research for the DOE stockpile stewardship program, vehicle and mass transit transportation, renewable energy (wind and solar), threat and terrorist defense, aerospace, and parallel processing and computer code development. One study we are currently conducting is with a “team” of five robots that play soccer and communicate with one another. This interdependent “soccer team” of robots is hoped to fuel the excitement of scientific and engineering discovery and to ultimately develop into research outcomes that serve mankind in a variety of ways. Some of these ways include automating many tasks in nonmanufacturing industries such as agriculture, construction, health care, entertainment, and education.

As the boundaries of science continue to expand, the College of Engineering is committed to offering students a variety of competitive programs. New master’s programs in aerospace engineering, bioengineering, and materials and nuclear engineering are currently being considered by the university administration. Entertainment engineering, a joint program with the College of Fine Arts, is also underway. The joint venture is anticipated to eventually become the premier program for entertainment technology in the country.

The College of Engineering is an exciting place to pursue your graduate studies. We hope that you will join us at UNLV.

Eric Sandgren, Dean
(2003), Professor and Dean; BSME, MSME, Ph.D. Purdue University.

University of Nevada, Las Vegas
Civil & Environmental Engineering

Chair
Neumann, Edward S.  
(1991), Professor; B.S.C.E., Michigan Technological University; M.S., Ph.D., Northwestern University.

Graduate Coordinator
Karakouzian, Moses  
(1988), Professor; B.C.E., American University of Beirut; M.S., M.B.A., Ph.D., Ohio State University; P.E., Ohio.

Graduate Faculty
Ahmad, Sajjad  
(2006), Assistant Professor; B.S., University of Engineering and Technology, Lahore, Pakistan; M.E., Asian Institute of Technology, Bangkok, Thailand; Ph.D., University of Western Ontario, London, Ontario, Canada.

Batista, Jacimaria Ramos  
(1997), Associate Professor; B.S., Federal University of Ouro Preto; M.S., Montana College of Mineral Science and Technology; Ph.D., Pennsylvania State University.

Ghafouri, Nader  
(2003), Professor; B.S.C.E., Texas Tech University; M.S.C.E., University of Miami.

James, David E.  
(1990), Associate Professor; A.B., University of California, Davis; M.S., Ph.D., California Institute of Technology.

Kaseko, Mohamed S.  
(1993), Associate Professor; B.S., University of Dares-Salaam; M.S., Cornell University; Ph.D., University of California, Irvine.

Ladkany, Samaan  
(1984), Professor; B.S., American University of Beirut; B.S., M.S., Ph.D., University of Wisconsin, Madison.

Luke, Barbara  
(1995), Professor; A.A., University of Florida; B.S., Ph.D., University of Texas at Austin; M.S., University of California, Berkeley.

Paz, Alexander  
(2008), Assistant Professor; B.S., University of Cauca, Colombia; M.S., University of Puerto Rico, Mayaguez Campus, PR; Ph.D., Purdue University.

Piechota, Thomas  
(1999), Associate Professor; B.S., Northern Arizona University; M.S., Ph.D., University of California, Los Angeles.

Said, Aly  
(2006), Assistant Professor; B.S., Ain Shams University, Cairo, Egypt; MScA, Universite de Moncton, Moncton, New Brunswick, Canada; MEng, McMaster University, Hamilton, Ontario, Canada; Ph.D., University of Western Ontario, London, Ontario, Canada.

Teng, Hualiang  
(2004), Assistant Professor; B.S., M.S., Northern Jiaotong University; M.S.C.E., West Virginia University; Ph.D., Purdue University.

Tian, Ying  
(2007), Assistant Professor; B.S., Hebei Polytechnic University; M.S., Tsinghua University; M.S., Ohio State University; Ph.D., University of Texas at Austin.

Professor Emeriti
Frederick, Gerald R.  
(1993), Emeritus Professor; B.S., University of Toledo; M.S., Ph.D., Purdue University.

Vodrazka, Walter C.  
(1990), Emeritus Professor; B.C.E., Manhattan College; M.S., Mississippi State University; Ph.D., Purdue University.

Wyman, Richard V.  
(1969-1992), Emeritus Professor; B.S., Case Western Reserve University; M.S., University of Michigan; Ph.D., University of Arizona.

Well-equipped facilities developed by the department faculty include a Computer Assisted Design Laboratory, an Engineering Geophysics Laboratory and Test Site, an Environmental Engineering Laboratory, A Soil and Rock Mechanics Laboratory, the UNLV Transportation Research Center, and a Water Resources Laboratory. These facilities provide state-of-the-art research tools. Among these are a MTS dynamic testing machine, a triaxial testing apparatus, a 50-foot tilting flume, concrete testing facilities, a portable wind tunnel, a broad geophysical test equipment base anchored by a 7,000-lb (3 metric ton) programmable seismic source with 144-channel recording system, PCs, workstations, and current software programs are available within these facilities, with additional facilities being available in the college. Additional assets include access to high speed multiprocessor computers housed in the National Supercomputing Center for Energy and the Environment. All facilities are located in the Thomas Beam Engineering Complex. Additional research facilities nearby include one of twelve national EPA laboratories (located on campus) and the Department of Energy’s Nevada Test Site, which has been designated an Environmental Research Park.

Students with backgrounds in civil engineering as well as related disciplines are invited to apply. Students with science backgrounds desiring admission to the graduate program will be required to complete course work, prerequisite or otherwise, that will assure successful completion of the graduate program. Specific course work requirements will depend on the area of specialization desired by the applicant.

Applicants must identify a specialization from one of the following areas: environmental, fluids/ hydraulics,
Applications for admission to the program are evaluated by faculty representing each of the respective areas of specialization. Applications from international students must reach the Graduate College by the dates specified in the catalog in order to be considered for financial aid. Offers of financial aid are made in writing by the department, which assumes no responsibility to provide financial support unless an offer is made in writing. Also, when the department has made an offer to provide financial support, it has no obligation to honor the offer unless the student attends UNLV and enrolls in the Civil and Environmental Engineering graduate program during the initial semester for which financial aid was offered.

Applicants should notice that some documents must be mailed to the Graduate College while others must be mailed to the Department of Civil and Environmental Engineering, as outlined below. It is imperative that the documentation is sent to the appropriate location to aid fast processing of the application.

**Documents Required for Admission Consideration by the Department of Civil and Environmental Engineering:**

1. One official transcript from each post-secondary institution attended. Only transcripts sent directly from the institution are considered.
2. Letters of recommendation (two for M.S. and three for Ph.D. applicants).
3. One-page statement indicating the reasons why you wish to earn a M.S. or Ph.D. degree.
4. GRE General test scores taken in the last five years.

**Documents Required for Admission Consideration by the Graduate College:**

1. A complete application form and a non-refundable fee.
2. One official transcript of each post-secondary institution attended. International students must submit official translated copies of transcripts. Only transcripts sent directly from the institution to the UNLV Graduate College are considered.
3. Official TOEFL or Michigan Test Scores (only if English is not native language) taken in the last two years.
4. High School Leaving Certificate (for international students only)

The deadlines for application to the Civil and Environmental Engineering Department as well as the Graduate College:

**Spring Semester** August 30 for international students and November 15 for domestic students

**Fall Semester** March 15 for international students and June 15 for domestic students

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**Engineering M.S.E.**

**Admission Requirements**

In addition to the general requirements for admission to the Graduate College, an applicant for the M.S.E. program must have a bachelor’s degree in engineering or a closely related discipline. Applicants desiring to specialize in environmental engineering who have baccalaureate degrees in the natural sciences may require at least an additional semester of full-time study to complete engineering prerequisite undergraduate course work; this may include fluid mechanics, calculus through differential equations, engineering physics, chemistry and engineering economics. Successful environmental engineering applicants are expected to complete a set of graduate courses in engineering hydrology, hydraulics, statistics, water and wastewater treatment, and wastewater treatment plant design during their graduate study. All applicants must submit a one-page Statement of Objectives indicating the area of civil engineering in which they wish to pursue graduate work and the reason they wish to earn a master’s degree. All applicants are required to take the verbal, quantitative, and analytical writing portions of the GRE General Test and submit the scores to the Civil and Environmental Engineering department. Successful applicants generally have a combined verbal and quantitative GRE score of at least 1000 and GRE analytical writing score of at least 3. Applicants from countries where English is not the native language must take the Test of English as a Foreign Language, earn scores of at least 213 (computerized) or 550 (written), and submit an official report of the score to the Graduate College.

**Degree Requirements**

Procedures and requirements for the M.S.E. will be as prescribed by the Graduate College under Academic Policies, with additional provisions as follows:

1. At least 15 credits must be earned from courses numbered 700 or above, of which at least 12 credits must be offered by the College of Engineering.
2. The program of study for each student must be approved by the student’s advisory committee. Subject to the approval by the student’s graduate committee, the student may choose one of these options: Thesis Option. Requires the satisfactory completion of CEE 700 during the first year and 21 credits of approved graduate courses plus six credits of work associated with the master’s level thesis, for a total of 30 credits. The final examination will include a defense of thesis. Non-Thesis Option. This course-only option requires satisfactory completion of 33 credits of graduate courses approved by the student’s advisory committee, of which at least 50 percent must be 700 level offered by the College of Engineering.
3. Satisfactory progress is defined as filing an approved program before the completion of nine credits of course
work, completion of at least six credits of the approved program per calendar year, maintenance of a GPA of 3.00 (4.00), no grades below C and compliance with the letter and spirit of the Graduate Catalog and published policies of the Howard R. Hughes College of Engineering. Additionally, no more than nine credits below B are allowed in the student’s graduate program. If progress is not satisfactory, probation and separation may result, in accordance with the rules of the Graduate College. Any student whose GPA falls below 3.00 will be placed on probation and will have one semester to raise it to 3.00 or above.

4. The student’s Advising Committee should be composed of at least four members of the UNLV Graduate Faculty of which at least two must be tenured or tenure-track members of the Department of Civil and Environmental Engineering, the third from the Department of Civil and Environmental Engineering or a related field, and the fourth must be appointed by the Graduate College.

5. Each student’s program should show suitable breadth and coherence, as specified in the Graduate Catalog. Prior to filing, the program must receive approval by the student’s committee. An approved program must be filed before the completion of nine credits of course work after admission (regular or provisional). The responsibility rests with the student. Students will be dropped from the graduate engineering program if they neglect this requirement.

Requirements for M.S.E. with special emphasis in Geographic Information Systems

Procedures and requirements for the M.S.E. in Civil and Environmental Engineering with special emphasis in Geographic Information Systems are as prescribed in the general M.S.E. requirements as stated above, with additional provisions as follows:

1. Seventeen credits must be earned by successful completion of the following courses:
   
   CEE 668 - GIS Applications in Civil Engineering  
   CEE 768 - Applied Geographic Information Systems  
   or  
   EGG 768 - Applied Geographic Information Systems  
   CS 733 - Geographic Data Base Systems  
   STA 751 - Spatial Statistics  

   and one of the following two courses:  

   STA 667 - Introduction to Mathematical Statistics  
   STA 691 - Statistics for Scientists I

2. Recommended undergraduate electives (not for graduate credit) include:

   CS 135 and Computer Science I

   and

   CS 202 Computer Science II  
   CS 117 - Programming for Scientists and Engineers  
   MAT 265 - Computing Linear Algebra

3. Recommended graduate electives (not to satisfy remaining Civil and Environmental Engineering M.S.E. credits) include:

   CS 680 - Computer Graphics  
   EGG 769 - Applied Modeling with Geographic Information

Engineering Ph.D.

Admission Requirements

Admission to the program leading to the Ph.D. in Engineering in the field of Civil and Environmental Engineering is open to those students completing the following requirements:

1. Application must be made to the Department of Civil and Environmental Engineering. Applications must include all documentation as required by the Graduate College. The Department of Civil and Environmental Engineering will admit the student and supervise the student’s Ph.D. program.

2. The applicant must have a Master of Science in Engineering degree or equivalent with a major in civil engineering or a closely allied field. Students with nonengineering backgrounds will be required to complete a set of course work requirements that will assure successful completion of the Ph.D. specialization and qualify the student to sit for the Fundamentals of Engineering (FE) exam. Special cases will be decided upon by the Graduate Program Committee (GPC).

3. The applicant must submit a written statement of purpose indicating interests and objectives in working toward a Ph.D. degree. In addition, three letters of recommendation for Ph.D.-level study must be submitted.

4. Applicants from countries where English is not the native language must take the Test of English as a Foreign Language, earn scores of at least 213 (computerized) or 550 (written), and submit an official report of the score to the Graduate College.

5. The GPC will examine the applicant’s academic record and make the final determination of the applicant’s admissibility to the Ph.D. program. In general, a minimum post-baccalaureate GPA of 3.20 on a 4.00 scale or equivalent is required for admission.

6. All applicants are required to take the verbal, quantitative, and analytical writing portions of the GRE General Test and submit the scores to the Civil and Environmental Engineering department. Successful
Degree Requirements
The degree requirements for the Ph.D. in Engineering in the Department of Civil and Environmental Engineering include the following:

1. A Doctoral Advisory Committee composed of at least five members of the UNLV graduate faculty is to be formed for the student. At least three of the committee members must be from tenured or tenure-track members of the Department of Civil and Environmental Engineering, the fourth from the Department of Civil and Environmental Engineering or a related field, and the fifth must be appointed by the Graduate College.

2. The program of study must be submitted by the second semester of study. The program of study is to be prepared by the student and his/her doctoral advisor, and must be approved by the student's Doctoral Advisory Committee and the GPC.

3. A minimum of 27 credit hours of course work beyond the degree of Master of Science in Engineering or equivalent is required. A minimum of 18 of these credits must be 700-level courses. Doctoral students must complete CEE 700 prior to taking the Qualifying Examination. For students who have completed CEE 700, or equivalent, during their Master of Science studies, CEE 700 may be waived and replaced by another 700-level course. The student’s Doctoral Advisory committee may add additional requirements in accordance with the individual’s background and area of study.

4. In addition to these course requirements, a dissertation consisting of at least 18 credits (CEE 799) is required.

5. Students whose mother tongue is not English must demonstrate a satisfactory command of the English language by passing the advanced level on the Michigan test during the first year of study.

6. In order to show breadth and depth of knowledge in his/her discipline, the doctoral student must pass either a written qualifying exam, an oral qualifying exam, or both as determined by the student’s Doctoral Advisory Committee. These examinations are prepared by the faculty and supervised by the GPC. These qualifying exams must be scheduled after the completion of one year of study but not before the completion of at least 12 credits of course work.

7. The doctoral student must pass a preliminary exam consisting of the preparation of a written proposal for the dissertation research followed by an oral defense of the proposal. The dissertation must be approved by the student’s Doctoral Advisory Committee. Students are advanced to candidacy for the Ph.D. upon the completion of all course work and approval of the dissertation research proposal.

8. All requirements for the Ph.D. are met upon the satisfactory completion of the proposed research, the submission of a satisfactory dissertation, and the successful oral defense of the dissertation before the Doctoral Advisory Committee.

Transportation M.S.T.

The Master of Science in Transportation degree program is terminal in nature and oriented toward the practice of transportation science, with emphasis on the planning and operations aspects of transportation systems. It is intended for applicants who have backgrounds in areas other than engineering or closely related disciplines, and who either presently work for or aspire to work for transportation agencies or firms.

Admission Requirements
Applicants must have a Bachelor of Science or Bachelor of Arts degree. It is desirable to have a degree in one of the following areas: urban or regional planning, architecture, business, economics, public administration, quantitative geography, computer science, mathematics, operations research, statistics, political science, physical science, or similar discipline. The undergraduate GPA must be at least 3.00 and credit must have been earned in the following subjects, or equivalent subjects, with a grade of B or better: MAT 180 (3 credits), PHY 155 (4 credits), computer Science or Management Information Systems (3 credits), ECO 201 or ECO 202 (3 credits), and STA 391 or ECO 261 (3 credits). CEE 362 (3 credits) also is required of applicants who have not had at least one year of acceptable experience with a transportation agency. Applicants are required to submit scores from the verbal, analytical, and quantitative portions of the GRE General Test, and a two-page Statement of Objectives indicating a) previous work experience, particularly in transportation, b) the reason they wish to pursue the M.S.T. program; and c) how the degree will be utilized following graduation. Applicants also must submit two letters of recommendation from individuals familiar with their skills and abilities. Contact the department for additional information. All applicants are required to take the verbal, quantitative, and analytical writing portions of the GRE General Test and submit the scores to the Civil and Environmental Engineering department. Successful applicants generally have a combined verbal and quantitative GRE score of at least 1000 and GRE analytical writing score of at least 3.

Applicants from countries where English is not the native language must take the Test of English as a Foreign Language, earn scores of at least 213 (computerized) or 550 (written), and submit an official report of the score to the Graduate College.
The degree offered is a Master of Science in Transportation (M.S.T.). Completion of the degree does not qualify the student with a nonengineering background to sit for the Fundamentals of Engineering (FE) exam. Satisfactory progress is defined as filing an approved program before the completion of nine credits of course work, completion of at least six credits of the approved program per calendar year, maintenance of a GPA of 3.00 (4.00), not grades below C and compliance with the letter and spirit of the Graduate Catalog and published policies of the Howard R. Hughes College of Engineering. Additionally, no more than nine credits below B are allowed in the student's graduate program. If progress is not satisfactory, probation and separation may result, in accordance with the rules of the Graduate College. Any student whose GPA falls below 3.00 will be placed on probation and will have one semester to raise it to 3.00 or above. The student’s Advising Committee should be composed of at least four members of the UNLV Graduate Faculty of which at least two must be tenured or tenure track members of the Department of Civil and Environmental Engineering, the third from the Department of Civil and Environmental Engineering or a related field, and the fourth must be appointed by the Graduate College.

Degree Requirements
The program of study for each student must be approved by the student’s advisory committee. The degree requires completion of 33 credits including a three-credit project; a minimum of 21 credits must be taken in civil engineering courses, and 12 credits may be taken from other departments.

The program is highly quantitative in nature and requires aptitude and familiarity with analytic and mathematical reasoning. Course work is rigorous, and students in the program will be taking the same courses offered to engineering students.

Required Courses
A total of six additional civil engineering elective credits are taken from two options.

- CEE 609 - Engineering Project Management
- CEE 663 - Traffic Engineering
- CEE 760 - Transportation Planning and
- CEE 765 - Public Transportation Systems

Course Descriptions

- CEE 604 - Open Channel Flow
- CEE 606 - Hydrologic Analysis and Design
- CEE 609 - Engineering Project Management
- CEE 610 - Highway Construction Materials
- CEE 612 - Advanced Mechanical Properties of Engineering Materials
- CEE 621 - Professional Engineering Practice
- CEE 632 - Geological Engineering
- CEE 634 - Rock Mechanics
- CEE 635 - Foundations Engineering
- CEE 636 - Engineering Geophysics
- CEE 644 - Steel Structural Design
- CEE 650 - Unit Operations/Processes in Environmental Engineering
- CEE 650L - Unit Operations/Processes Laboratory
- CEE 651 - Water and Wastewater Quality Analysis
- CEE 652 - Air Pollution Control Fundamentals
- CEE 654 - Solid and Hazardous Wastes Engineering
- CEE 655 - Chemical Processes for Water Quality Control
- CEE 663 - Traffic Engineering
- CEE 664 - Airport Design
- CEE 665 - Fire Protection Engineering
- CEE 666 - Geometric Design of Highways
- CEE 667 - Computer Applications in Transportation
- CEE 668 - GIS Applications in Civil Engineering
- CEE 676 - Earthquake Engineering
- CEE 677 - Design of Underground Structures
- CEE 678 - Applied Finite Element Analysis
- CEE 680 - Concrete Design
- CEE 682 - Design of Timber Structures
- CEE 695 - Special Topics

Note: The upper-division engineering courses listed above are open to graduate students, provided it demonstrates a level of accomplishment suitable to graduate study. The Undergraduate Catalog should be consulted for a description of the course. In the Undergraduate Catalog, the course is numbered as 4XX, where the XX represents the same last two digits as the 600 course listed (for example, the description for CEE 604 appears under CEE 404).

CEE 700 - Research Methods in Civil and Environmental Engineering
Credits 3
Methods to improve and develop research skills and prepare students for professional careers at the graduate level. Includes principles of scientific research, ethics, writing skills, methods for compiling scientific literature, identification of research questions and specific hypotheses, presentation of research results, writing research papers, proposal preparation, preparation of grant proposals, thesis and dissertation.

CEE 703 - Turbulence
Credits 3
Topics include the origin of turbulence, dynamics of turbulent flows, free shear flows, bounded shear flows, transport phenomena, semiempirical theories, statistical descriptions, spectral dynamics. Prerequisites: Graduate standing and ME 700. 3 credits.
CEE 704 - Environmental & Water Systems
Credits 3
Introduction to techniques to evaluating alternatives in environmental and water resources systems. Topics include southwest U.S. water economic analysis, optimization using linear and dynamic programming, systems modeling using STELLA, analysis of droughts, and current research topics. Applications focus on surface water systems, operation, and reservoirs, water distribution and environmental systems. Prerequisites: CEE 413

CEE 705 - Fluid Dynamics in Porous Media I
Credits 3
Engineering analysis of fluid flows in porous media. Includes development of the basic equations, analysis of steady and unsteady flows, multidimensional flows, analytical solutions using conformal mapping, analog methods, finite difference and finite element modeling, and transport phenomena. Prerequisites: ME 700 or consent of instructor.

CEE 706 - Fluid Dynamics in Porous Media II
Credits 3
Finite element solution of flow problems in porous media. Topics include steady and unsteady saturated flows, unsaturated flows, mass transport problems, and coupled transport problems such as combined mass-thermal flows. Prerequisites: ME 700 or consent of instructor.

CEE 708 - Hydraulic Transients
Credits 3
Analysis of unsteady fluid flow problems in liquid and gas transmission systems of practical interest. Emphasis placed on computer solutions. Topics include methods of characteristics, water-hammer, effect of pumps, turbines, valves, etc.; column separation; control of transient conditions; oscillatory flow and resonance; open channel transient flow. Prerequisites: Graduate standing or consent of instructor.

CEE 709 - Numerical Methods in Mechanics
Credits 3
Numerical solution of partial differential equations arising from problems in mechanics. Emphasis on finite difference techniques. Topics include classification of equations: solutions of elliptic, parabolic, and hyperbolic equations; stability, consistency and convergence and nonlinear equations; multidimensional problems; systems of equations; discontinuous solutions. Prerequisites: MATH 466 or ME 445 or consent of instructor.

CEE 711 - Continuum Mechanics
Credits 3
Matrices and tensors, stress deformation and flow, compatibility conditions, constitutive equations, field equations and boundary conditions in fluids and solids, applications in solid and fluid mechanics. Prerequisites: MATH 431 and graduate standing.

CEE 722 - Advanced Air Pollution Control
Credits 3
Fundamental chemical and physical principles of generation and control of air pollutants, and applications to pollution control equipment. Pollutant and particle formation during combustion. Gas absorption and absorption fundamentals and tower/column design. Pollution control strategies. Prerequisites: CEE 452/652, MATH 432, ME 311, or equivalents. Strongly recommended: ME 314 and MAT 665 or equivalents.

CEE 731 - Pavement Materials and Design
Credits 3
In-depth study of pavement materials such as soils, asphaltic concrete and Portland cement concrete; analytical and empirical methods for design of flexible and rigid pavements; pavement rehabilitation management. Includes highway and airfield pavements. Prerequisites: CEE 334, CEE 334L, CEE 362

CEE 732 - Advanced Foundation Engineering
Credits 3
Detailed study and analysis of the mechanical properties of soils with applications to foundation behavior. Prerequisites: CEE 334, CEE 334L, CEE 435

CEE 734 - Advanced Soil Mechanics
Credits 3
Stress-strain properties and shear strength of soil: settlements and stability analysis. Prerequisites: CEE 334, CEE 334L

CEE 735 - Earth Dams and Embankments
Credits 3
Principles governing the flow of water through soils and their applications to design of earth dams and embankments. Methods of earth dam design, including earthquake design, theory of wells, and groundwater flow. Prerequisites: CEE 334 and CEE 478/678

CEE 736 - Earth Slopes and Retaining Structures
Credits 3
Analysis and design of stable earth slopes, including slopes cut from natural deposits and engineered embankments. Analysis and design of earth retaining structures. Both theoretical and practical aspects of design discussed. Prerequisites: CEE 334, CEE 334L

CEE 737 - Soil Dynamics and Earthquake Engineering
Credits 3
Use of dynamics in geotechnical engineering, for nondestructive characterization of engineering materials, and for design of foundations subjected to dynamic loads. Geotechnical aspects of earthquake engineering, particularly effect of soils on ground-surface motions, and soil
liquefaction during earthquakes. **Prerequisites:** CEE 334, CEE 334L.

**CEE 741 - Design of Highway Bridge Structures**
Credits 3
Review of types of highway bridges. Application of the AASHTO Bridge Specifications including dead load, live load and impact. Design of steel, reinforced and prestressed concrete bridge superstructures and their substructures. Span lengths through 150 feet. **Prerequisites:** CEE 444, CEE 480 and graduate standing.

**CEE 743 - Design of Masonry Structures**
Credits 3
Study of the principles of masonry design applied to structural design of building components and retaining walls. Discussion of wind and seismic loadings. Analysis and design of shear walls. **Prerequisites:** CEE 480 and graduate standing.

**CEE 744 - Design of Prestressed/Post-Tensioned Concrete Structures**
Credits 3
Study of principles of prestressed concrete, both pre-tensioned and post-tensioned, applied to structural design of buildings and bridges. Discussion of effects of lateral loads on structures. Introduction to analysis and design of shear walls. Discussion of connections between members. **Prerequisites:** CEE 480 or consent of instructor.

**CEE 745 - Advanced Topics in Concrete and Steel Structures**
Credits 3
Advanced theoretical analysis and design of reinforced concrete, prestressed and composite steel-concrete structures. Topics include beam torsion, stability of tall columns, local buckling effects, biaxially loaded columns, composite decks, ponding on steel roofs, and introduction to prestressed concrete structures. **Prerequisites:** CEE 480 or consent of instructor.

**CEE 747 - Introduction to Analysis and Design of Plates and Shells**
Credits 3
Introduction to the analysis and design of plates and shell structures. Bending of flat rectangular and circular plates with various boundary and loading conditions. Membrane analysis of spherical, cylindrical shells, and shells of revolution with ring reinforcement. **Prerequisites:** CEE 381 and graduate standing.

**CEE 748 - Advanced Design of Timber Structures**
Credits 3
Study of wood as an engineering material used in various types of construction. Strength properties of timber, structural properties of plywood, analysis and design of timber beams, timber columns, analysis and design of connections using nails, bolts, and adhesives. **Prerequisites:** MATH 431 and any one of CEE 444, 480 or 482.

**CEE 749 - Advanced Topics in Finite Element Analysis**
Credits 3
Properties and applications of isoparametric elements, solids of revolution elements, plate bending elements, finite elements of dynamics, vibrations and buckling instability. Introduction to nonlinear problems using finite element analysis. **Prerequisites:** CEE 478 or consent of instructor.

**CEE 750 - Urban Runoff Quality and Control**
Credits 3
Study of the quality of urban runoff during wet and dry periods. Topics include: review of hydrologic concepts, modeling water quantity and quality in stormwater systems, water quality of non-point sources, control structures or Best Management Practices (BMPs), evaluation of current research, discussion of current regulations. **Prerequisites:** CEE 413 and CEE 450 or consent of instructor.

**CEE 751 - Advanced Topics in Wastewater Engineering**
Credits 3
Fundamentals of aeration and gas transfer, natural systems for effluent polishing, impacts of effluent discharges in natural water systems. Wastewater reuse issues. Sludge management including dewatering, conditioning, composting, and final disposal. **Prerequisites:** Graduate standing and CEE 450/650 or equivalent.

**CEE 752 - Advanced Water and Wastewater Analysis**
Credits 3
Fundamentals and quantitative analysis or the standard methods used by environmental engineers to analyze drinking water and wastewater and control water quality. Topics include total organic carbon, solids analysis, alkalimetry, UV/VIS spectrophotometry, carbon absorption, ion exchange, AA spectrometry, ion chromatography (IC), phase partitioning, advanced oxidation. **Prerequisites:** CEE 451/651 and graduate standing, or consent of instructor.

**CEE 753 - Air Pollution Atmospheric Processes**
Credits 3
Fundamentals of aerosol composition, formation and coagulation. Atmospheric photochemistry and atmospheric transport. Computer methods emphasized. Applications to pollution control strategies for urban areas. **Prerequisites:** CS 117, CEE 452/652 or equivalent, MATH 431.
CEE 754 - Biochemical Wastewater Treatment Fundamentals
Credits 3
Underlying chemical, microbiological, and biochemical principles considered when designing suspended and attached growth biological processes for water quality control. Topics covered include activated sludge design, selector design, filamentous growth control, toxicity to biological systems, biofilm processes, and design of nutrient (phosphorus and nitrogen) removal systems. **Prerequisites:** CEE 450/650 or equivalent.

CEE 755 - Advanced Physicochemical Methods for Water Treatment
Credits 3
Fundamentals of chemical equilibrium, ion exchange, chemical kinetics, gas transfer and absorption theory. Applications to design of water treatment facilities, including disinfection basins, ion exchange and activated carbon columns for treatment of water for drinking, agriculture, and industry. **Prerequisites:** CEE 455/655 and MATH 431 or equivalent.

CEE 756 - Advanced Waste Treatment Design
Credits 3
Application of optimization methods to the physical, chemical, and biological reaction engineering principles used in air, water, and solid waste treatment plant design. Review and critique of plans for existing treatment works, and incorporation of new technologies. Waste minimization. **Prerequisites:** CEE 450/650 or CEE 455/655 or equivalent.

CEE 757 - Engineering Modeling of Natural Systems
Credits 3
Application of physical, chemical, and ecological concepts to mathematical modelling of fluid mixing, nutrient cycling and population dynamics. Applications to waste treatment and impacts in natural water systems. **Prerequisites:** CS 117, CEE 450/650, MATH 431

CEE 758 - Air Quality Modeling
Credits 3
Data requirements for inputs to air quality models. Review of photochemical and transport processes used in models. Influence of local topography and meteorology. Review of photochemical computer models. Use of models in evaluation of strategies for improvement of air quality. **Prerequisites:** CEE 753 or equivalent; course in numerical methods recommended.

CEE 759 - Mass Transfer in Environmental Systems
Credits 3
Fundamentals of mass transfer by diffusion and advection. Solutions to steady-state and transient problems in several dimensions. Applications to natural and engineered systems. **Prerequisites:** CEE 367, MATH 432, and ME 400/600 or ME 700, or equivalent, or consent of instructor.

CEE 760 - Transportation Planning
Credits 3
Network representation methods; minimum-path trees; traffic assignment algorithms and their performance; trip distribution models; travel surveys and data needs; applications of statistical methods to develop methods of ownership, trip generation, vehicle occupancy, and model choice. **Prerequisites:** CEE 362 and graduate standing, or consent of instructor.

CEE 761 - Transportation Demand Analysis
Credits 3
Problems dealing with transportation-systems as they affect travel behavior; study of the demand for transportation theoretical concepts and analytical methods; urban and regional travel demand analysis, forecasting methods and behavioral demand models. **Prerequisites:** CEE 362 and graduate standing, or consent of instructor.

CEE 762 - Operations Research Applications in Civil Engineering
Credits 3
Analysis of civil engineering systems using operations research methods and techniques. Methods covered include optimization models in deterministic systems, network models, and modeling of stochastic systems, including queuing theory. Applications drawn from various civil engineering contexts, particularly transportation systems. **Prerequisites:** MATH 466 or STAT 411, or consent of instructor.

CEE 763 - Advanced Traffic Engineering
Credits 3
Theories of traffic flow and signal operations with application to activated, coordinated, and networked intersections using computerized models such as PASSER, NETSIM, TRANSYT, SOAP, CALSIG. Analysis of arterial/freeway operations techniques including HOV and reverse lanes, ramp metering, freeway surveillance, TSM, demand modification. Evaluation of objectives, measures of effectiveness. Notes: Two hours lecture, three hours laboratory. **Prerequisites:** CEE 463/663 or consent of instructor.

CEE 764 - Air Transportation
Credits 3
Nature of civil aviation, aviation system planning, airline operations, aircraft characteristics, airline economics, structure of the airline industry, aircraft fleet planning and scheduling, aviation safety. **Prerequisites:** CEE 362 and graduate standing, or consent of instructor.
CEE 765 - Public Transportation Systems
Credits 3
Analysis and evaluation of mass transit systems; their operation and management: demand and cost analysis; route design, schedules and fare policy. Technology of transit systems including vehicles and structures. Transit financing. Impact on land use and environment. **Prerequisites:** CEE 362 and graduate standing, or consent of instructor.

CEE 766 - Analysis of Hazardous Materials Transportation
Credits 3
Hazardous materials transportation analysis using probabilistic risk assessment, including concept measures, models, and methodologies; routing analysis including measures and models, background and scope of hazardous materials transportation issues; mitigation including engineering applications in risk management and emergency preparedness. **Prerequisites:** CEE 362 and graduate standing, or consent of instructor.

CEE 767 - Human Factors in Transportation Engineering
Credits 3
Application of human factors to transportation system planning, design, operation, and management with emphasis on transportation safety; ergonomic principles; driver, vehicle, and guideway interaction; highway safety problems; human factors analytical methods; engineering and management solutions. **Prerequisites:** CEE 362, or consent of instructor.

CEE 768 - Applied Geographic Information Systems
Credits 4
Review of data structures and algorithms for surfaces, volumes and time, elevation models, spatial interpolation. Error modeling and data uncertainty. Visualization of spatial data. Decision making in a GIS context. Emphasis on interdisciplinary group project constructing a data base and maps involving several areas of expertise using popular GIS software. Same as (EGG 768) **Prerequisites:** EGG 668, STA 751, and CS 733 or CS 432.

CEE 770 - Shell Structures, Bending and Membrane Theories
Credits 3
Analysis and design of curved thin shell structures using two methods: the approximate membrane force analysis and the exact bending moment and membrane force analysis combined. Introductions provided to the theory of elasticity and specialized solutions to partial differential equations as needed for the analysis of shell structures. **Prerequisites:** CEE 342 and graduate standing.

CEE 772 - Theory of Composite Structures
Credits 3
Analysis and design of structures using composite materials and sandwich construction. Elasticity and failure theories of fiber composites and laminates discussed, unidirectional, multidirectional and random fiber reinforcement considered. **Prerequisites:** CEE 381 and graduate standing.

CEE 774 - Introduction to Theory of Elasticity and Plasticity I
Credits 3
Introduction to theoretical and applied elasticity and plasticity theory-solutions to engineering problems in structural mechanics and geotechnical engineering. Response of isotropic, orthotropic and layered media to applied stresses and strains. **Prerequisites:** MATH 431 and graduate standing only.

CEE 775 - Seismic Response of Structures
Credits 3
Application of principles of vibration theory to structures. Determination of natural frequencies and mode shapes using classical methods and energy techniques. Response of structures to harmonic, impulse, periodic and earthquake loadings. **Prerequisites:** CEE 381 and graduate standing.

CEE 776 - Experimental Techniques in Structural Mechanics
Credits 3
Application of various experimental techniques to stress analysis problems. Comparison of experimental and analytical methods. Theory of electric resistance strain gages. Brittle lacquer coatings and their photoelasticity and its application including photoelastic coatings. Introduction to similitude. **Prerequisites:** CEE 381 and graduate standing.

CEE 778 - Theory of Elastic Stability
Credits 3
Buckling of centrally loaded and eccentrically loaded compression members. Variational methods of determining critical loads. Stability of rigid frame members, effective lengths of compression members in trusses, lateral buckling of beams, torsional buckling. Buckling of compressed rings and curved bars. **Prerequisites:** CEE 381 and graduate standing.

CEE 785 - Construction Engineering Management
Credits 3
Concepts of construction project management of heavy civil, and capital facility projects. Covers the project phases: pre-project planning, engineering, procurement, construction and start up. **Prerequisites:** Graduate standing in civil engineering or consent of instructor.
CEE 791 - Independent Study in Civil Engineering
Credits 1 – 3
Independent study of a selected civil engineering topic.
Notes: May be repeated to a maximum of six credits.
Prerequisites: Graduate standing in civil engineering and consent of instructor.

CEE 795 - Special Topics in Civil Engineering
Credits 1 – 6
Outlet for experimental and other topics of current interest.
Notes: May have a laboratory. May be repeated for credit.
Prerequisites: Graduate standing in civil engineering and consent of instructor.

CEE 796 - Design Project in Civil Engineering
Credits 1 – 3
Synthesis course to involve students in the design process from analysis and proposal to solution.
Notes: May be repeated to a maximum of three credits. Not permitted for students pursuing the M.S.E. Thesis option or for those in the Ph.D. Program.
Prerequisites: Graduate standing in civil engineering and consent of instructor.

CEE 797 - Thesis in Civil Engineering
Credits 3 – 6
Notes: May be repeated but only six credits will be applied to program. Grading S/F grading only.
Prerequisites: Graduate standing in civil engineering.

CEE 799 - Dissertation Research
Credits 1 – 6
Research analysis and writing towards completion of dissertation and subsequent defense.
Notes: May be repeated with a maximum of 18 credits allowed the used towards the degree.
Grading S/F grading only.
Prerequisites: Graduate standing in Ph.D. program and consent of advisor.

General Engineering
EGG 651 - Ergonomics
EGG 695 - Special Topics

Note: These upper-division engineering courses are open to graduate students, provided it demonstrates a level of accomplishment suitable to graduate study. The Undergraduate Catalog should be consulted for a description of the course. In the Undergraduate Catalog, the course is numbered as 4XX, where the XX represents the same last two digits as the 600 course listed (for example, the description for CEE 604 appears under CEE 404).

EGG 747 - Orthopedic Biomechanics - Lower Extremities and Spine
Credits 3
Biomechanics of the lower extremities and spine; engineering properties and physiology of bone, cartilage, and tendon; analysis of gait; effects of orthopedic impairment and injury; design and surgical implantation of prosthetic joints and fracture fixation devices; engineering of tissue regeneration and replacement. Same as (ME 747)
Prerequisites: Graduate standing in engineering or kinesiology or consent of instructor.

EGG 748 - Prosthetic Systems Engineering
Credits 3
Engineering design to prosthetic feet, ankles, knees, and prehension devices; materials and manufacturing; the biomechanics of movement using a prosthesis; residual limb morphology and surgical enhancements; socket design and tissue response; myoelectric devices; microprocessor control; psychophysical and motor control considerations; aspects of clinical science. Emphasis on R&D needs. Same as (ME 748)
Prerequisites: Graduate standing in engineering or kinesiology or consent of instructor.

EGG 750 - Analysis of Human Movement
Credits 3
Analysis of the kinematics and kinetics of human movement in two and three dimensions with emphasis on methods used in motion capture, including joint and segment position; acceleration, velocity, force and torque; work and power; and inverse solution methods. Same as (ME 750)
Prerequisites: Graduate standing in engineering or kinesiology or consent of instructor.

EGG 768 - Applied Geographic Information Systems
Credits 4
Review of data structures and algorithms for surfaces, volumes and time, elevation models, spatial interpolation. Error modelling and data uncertainty. Visualization of spatial data. Decision making in a GIS context. Emphasis on interdisciplinary group project constructing a data base and maps involving several areas of expertise using popular GIS software.
Prerequisites: EGG 668, STA 751, and CS 733 or CS 432.

EGG 769 - Applied Modeling with Geographic Information Systems
Credits 3
Design and interfacing of civil engineering models of transportation and finite element, finite difference, and hydrologic models with geographic data base systems. Applications in general air, water, transportation, and land use management.
Prerequisites: EGG 768

EGG 795 - Special Topics
Credits 3
Directed research course under the supervision of a member of the graduate faculty culminating in a written paper.
Notes
School of Computer Science

Director
Minor, John T.
(1985), Associate Professor; B.A., Rice University; Ph.D., University of Texas, Austin.

Graduate Coordinator
Datta, Ajoy K.
(1988), Professor; B.S., M.S., Ph.D., Jadavpur University.

Graduate Faculty
Bein, Wolfgang
(1998), Associate Professor; M.S., Ph.D., University of Osnabruck.
Berghel, Hal
(1999), Professor; B.A., M.A., Ph.D., University of Nebraska, Lincoln.
Gewali, Laxmi P.
(1989), Professor; B.S., Gauhati University, India; M.S., Tribhuwan University, Nepal; M.S., Ph.D., University of Texas-Dallas.
Kim, Yoohwan
(2004), Assistant Professor; B.A., Seoul National University, Korea. M.S., Ph.D., Case Western Reserve University.
Larmore, Lawrence L.
(1994), Professor; B.S., Tulane University; Ph.D., Northwestern University; Ph.D., University of California, Irvine.
Nartker, Thomas A.
(1986), Professor; B.S., University of Dayton; M.S., University of Tennessee; Ph.D., Texas A&M University.
Ogawa, Roy H.
(1983), Associate Professor; B.A., M.A., University of Hawaii; Ph.D., University of California, Berkeley.
Pedersen, Jan B.
(2003), Assistant Professor; B.S., M.S., University of Aarhus, Denmark; Ph.D., University of British Columbia.
Pinelle, David
(2007), Assistant Professor; B.S., Texas Tech University; Ph.D., University of Saskatchewan.
Taghva, Sidkazem
(1987), Professor; B.S., Pahlavi University; M.S., University of Kansas; Ph.D., University of Iowa.
Yfantis, Evangelos A.
(1979), Professor; B.S., University of Athens; M.S., Fairleigh Dickinson University; M.S., Rutgers University; M.S., New Jersey Institute of Technology; Ph.D., University of Wyoming.

The School of Computer Science offers programs leading to the Master of Science and the Doctor of Philosophy degrees in Computer Science. Areas of school strength include both theoretical and experimental computer science, especially within such areas as information and network security, Internet forensics, real-time algorithms, information retrieval, document analysis, graphics, computational geometry, networking and distributed systems, parallel programming, artificial intelligence, software engineering, and human-computer interfaces.

The distributed computing environment of the College of Engineering is housed in the Thomas T. Beam Engineering Complex. Several hundred modern computing systems are operated for purposes of instruction, experimentation, laboratory instrument control, data acquisition, and research. More than 50 of the systems are in public laboratories accessible to all engineering students. These laboratories contain both Windows and Unix/Linux clients and servers in a variety of modern configurations. Students can also obtain permission to access the machines of the National Supercomputer Center for Energy and the Environment (NSCEE).

Computer Science M.S.C.S.

Admission Requirements
Applicants must submit the following to the Graduate College: an application and official transcripts of all college level work with a minimum GPA of 3.00. Two letters of recommendation concerning the student’s potential for succeeding in the graduate program, another set of official transcripts, and the results of the Graduate Record Examination current to within five years should be sent directly to the school. In addition, applicants must have completed courses and their Prerequisites: equivalent to our undergraduate Programming Languages CS 326), Operating Systems (CS 370), Discrete Mathematics II (MATH 351), and Statistical Methods I (STAT 411) with an average grade of B or better. The Computer Science Admission Committee may elect to admit an outstanding applicant who has not satisfied all of the background requirements on a conditional basis. The student must complete these requirements before full admission to the program is granted.

The deadline for all application materials is February 1 for the fall semester and October 1 for the spring.

Degree Requirements
The student must pass at least 30 credits of 600- and 700-level courses with grades of C or better, subject to the conditions and Graduate College policy shown below.
Computer Science
At least 24 credits must be in computer science. Non-CS courses must be related to the student’s research area and be approved by the school graduate committee.

700-level Requirements
18 credits of computer science courses must be at the 700-level.

Requirements
CS 656 - Automata and Formal Languages*
CS 677 - Analysis of Algorithms*
CS 660 - Compiler Construction*
*If equivalent courses have not been taken previously, these courses must be included.

Thesis or Project Option
At most six credits of:
CS 791 - Thesis (Thesis Option)
or three credits (Project Option) can be included:
CS 790 - Master’s Project

Notes for Thesis or Project Option: The student must also select either the Thesis Option or the Project Option. If the Thesis Option is selected, the student must submit a thesis conforming to the specifications of the Graduate College and pass a final oral examination covering the thesis and relevant course work. For the Project Option, the student must complete a computer science project and report approved by his advisor and pass a final oral examination over the project and relevant course work.

Notes
Courses in which the student earns a grade lower than C cannot be included in his or her program, and the student’s total grade point average (GPA) must be 3.00 or higher while in the program. A student whose GPA falls below 3.00 will be placed on academic probation. That student must have an overall GPA of at least 3.00 by the end of two subsequent semesters, otherwise the student will be separated from the graduate program. A student on probation will not be allowed to register for CS 690, CS 790, CS 791, CS 792, CS 799, or equivalent courses in another department.

Computer Science Ph.D.

Admission Requirements - Doctoral Degree Program
In addition to the requirements of the Graduate College, applicants for admission to the Ph.D. program in computer science must meet the following:
1. Students are expected to have a master’s degree in computer science before applying to the Ph.D. program. On rare occasions, an unusually capable student may be admitted to work directly for the Ph.D. degree without having a master’s degree.
2. A GPA of 3.30 (on a 4.00 scale) or higher in postbaccalaureate course work is required for admission.
3. At least three letters of recommendation (preferably from academic sources) attesting to the applicant’s professional competence and academic potential are required.
4. A personal statement of purpose, which should be as specific as possible and should include the applicant’s objectives and area(s) of interest, is required.
5. Satisfactory scores on both the general test of the Graduate Record Examination (GRE) and from the Computer Science subject test (C29) are required. Official score reports from the last five years are acceptable.

Degree Requirements
The Ph.D. degree is awarded to a candidate who has demonstrated breadth of knowledge in computer science in general and has displayed depth of knowledge in the area of specialty as well as the ability to make original contributions to the body of knowledge in this field.

To successfully complete the Ph.D. program, a student must fulfill all the Graduate College degree requirements and the following requirements:
1. Complete 48 credits of course work.
2. Satisfactorily pass a written comprehensive examination.
3. Satisfactorily pass an oral qualifying examination.
4. Prepare a dissertation that must be acceptable to his or her Ph.D. committee.
5. Satisfactorily pass an oral defense of the dissertation.
6. Maintain a satisfactory rate of progress.

Course Requirements
A student entering the Ph.D. program with a master’s degree in computer science is required to take at least 48 credits of course work subject to the following conditions:

At least 42 credits must be in computer science.
2. At least 18 credits of computer science courses must be at the 700 level (excluding CS 799 credits).
3. Must include exactly three credits of: CS 792 - Research Seminar.
4. Must include a maximum of 18 credits of: CS 799 - Dissertation Research.

A student entering the Ph.D. program with a bachelor’s degree is required to take at least 24 extra credits of 600- and 700-level computer science courses in addition to the above 48 credits (at least half of them must be at the 700 level).

The Comprehensive Examination
The written comprehensive examination will be given twice a year. The comprehensives will assess the student’s breadth of knowledge through three examinations covering the six
Core Areas listed below and another examination in two other areas of his or her choice.

Core Areas
1. Automata and formal languages; Algorithms and data structures
2. Programming languages; Compiler construction
3. Computer architecture; Operating systems

Application Areas
1. Artificial intelligence
2. Computer graphics and image processing
3. Computer simulation and networks
4. Database systems
5. Software engineering and reliability
6. Document analysis
7. Networks and distributed computing
8. Geometric applications

The level of the examination is that of 600-level and 700-level courses in each area. A syllabus will be published well in advance of the exams listing the topics to be covered in each exam. Students are expected to take the comprehensive examination within two years of entering the Ph.D. program. All Ph.D. students are urged to take this examination as early as possible. Preference is given in the allocation of student financial support to those who have passed the comprehensive examination. The comprehensive examination may be attempted at most twice. Students who do not pass the comprehensive examination the first time must retake the examination at the next scheduled offering. Failure to pass the comprehensive examination after two attempts will normally lead to dismissal from the Ph.D. program. After passing the comprehensive examination, a research topic of mutual interest to the student and his/her proposed committee is selected. At this point, the student formally begins his/her research study.

The Qualifying Examination
The qualifying examination is an oral examination designed to test the depth of the student’s knowledge in his or her area of research specialization. It must be taken before either (a) two years after passing the comprehensive examination or (b) four years after entering the Ph.D. program. It generally focuses on his/her dissertation proposal. The main purpose of this exam is to evaluate the technical merits and feasibility of the student’s proposal for his/her Ph.D. dissertation. The student’s Ph.D. committee must conduct the examination. This committee consists of five faculty members of whom one must be from outside the school of computer science. The student’s advisor is the chairperson of this committee. The faculty member from outside the school is selected by the Graduate College from three faculty members who are suggested by the student in consultation with his or her advisor. The student must prepare a dissertation proposal before taking this examination. The student’s advisor should have already approved this proposal. This proposal must be given to the Ph.D. committee members at least two weeks before the date of the qualifying exam. The proposal must contain a discussion of the background literature on the problem area, description of the specific topic of research proposal approach, feasibility arguments, the objective of the research project, and a list of references. The student begins the exam with a presentation of the dissertation proposal. The remaining time is used for discussion and asking questions to determine if the student has sufficient depth of knowledge to carry out the proposed research. The examination cannot be taken more than twice. After successful completion of the qualifying examination, the student is advanced to candidacy for the doctoral degree.

Preparation of Dissertation
The candidate must prepare a dissertation on his or her research. The doctoral dissertation should represent a significant original research contribution to the field of computer science and be publishable in a recognized refereed journal.

Oral Defense
After completion of the dissertation, the candidate must pass a final oral defense of his/her dissertation. The candidate must make the final changes, if any, in the dissertation as early as possible. Preference is given in the allocation of student financial support to those who have passed the comprehensive examination. The examination may be attempted at most twice. Students who do not pass the comprehensive examination the first time must retake the examination at the next scheduled offering. Failure to pass the comprehensive examination after two attempts will normally lead to dismissal from the Ph.D. program. After passing the comprehensive examination, a research topic of mutual interest to the student and his/her proposed committee is selected. At this point, the student formally begins his/her research study.

Satisfactory Progress
To maintain satisfactory progress in the Ph.D. program a student must:
1. Pass the comprehensive examination within 2.50 years of entering the Ph.D. program.
2. Maintain a minimum grade point average required by the College of Engineering.
3. Pass the comprehensive examination within four years of entering the Ph.D. program.
4. Maintain satisfactory progress towards research.
5. Students who enter the Ph.D. program with a master’s degree must complete all requirements for the Ph.D. degree within six years. Those who enter the Ph.D. program with a bachelor’s degree must complete all requirements for the Ph.D. degree within eight years. If these requirements are not met, the department may place the student on academic probation or drop him/her from the Ph.D. program.

Course Descriptions

CS 617 - Introduction to Computer Simulation
CS 620 - Human-Computer Interaction

University of Nevada, Las Vegas 150
Introduction to other computational models, such as the lambda-calculus, Post systems, Markov algorithms and recursive function theory. The Church-Turing thesis and proofs of equivalence between the models. **Prerequisites:** CS 656

**CS 719 - Advanced Automata and Formal Languages**  
Credits 3  
Extensive study of context-sensitive, recursive and recursively enumerable languages, including ambiguity and closure properties: decidable and undecidable properties of the different language classes: the halting problem and Post's correspondence problem; properties of the deterministic context-free languages; LR(k) and LL(k) grammars. **Prerequisites:** CS 656

**CS 733 - Geographic Data Base Systems**  
Credits 3  
Spatial data types and operators: point queries, range queries, translation, rotation, and scaling. Data structures for object representation: arc tree, quadtrees. Commercial data bases vs. spatial data bases: relational, hierarchical, network. Note: (May not be used to satisfy degree requirements in Computer Science.) **Prerequisites:** CS 135 or CS 117 or equivalent and STAT 611.

**CS 740 - Statistical Pattern Recognition**  
Credits 3  
Concepts and formal theoretical structures necessary for design and implementation of a pattern recognition system. Topics include: parametric and non-parametric methods, linear and non-linear classifiers and clustering algorithms. **Prerequisites:** STAT 667, MATH 253 or 265, and CS 302.
CS 750 - Computational Algorithms in VLSI
Credits 3
Application and inherent limitations of using VLSI to implement computational algorithms, design and analysis of algorithms for design of VLSI circuits, introduction to VLSI implementation of computational algorithms represented by logical circuits, lower bounds on area and time, systolic arrays and their applications, VLSI layout algorithms, VLSI test generation and simulation. Prerequisites: CS 677

CS 754 - Discrete Optimization
Credits 3
Network optimization problems, use of advanced data structures. Topics may vary and include maximum-flow algorithms, multiterminal maximum flows, minimum cost flows and circulations, matching algorithms, approximation algorithms, and applications. Hamiltonian circuits in dense graphs, disjoint paths, the postman problem, introduction to combinatorial geometry, and linear programming. Prerequisites: CS 677

CS 756 - Formal Semantics
Credits 3
Coverage of formal methods for defining the semantics of programming languages, including the operational, denotation and axiomatic approaches. Proof techniques for verifying properties of programs. Consistent and complementary definitions for a Pascal-like language discussed. Prerequisites: CS 326 and CS 656.

CS 758 - Computational Geometry
Credits 3
Geometric searching, point location, range searching, convex hull, Graham's scan, gift wrapping, dynamic convex hull, proximity closest pair, Voronoi diagram, triangulation. Intersection, visibility shortest paths, geometry of rectangles. Prerequisites: CS 677

CS 763 - Advanced Computer Architecture
Credits 3
Advanced study of various current computer architectures. Examples taken from specialized architectures that support modern general-purpose programming, operating systems, artificial intelligence and data bases. SIMD and MIMD parallel architectures. Prerequisites: CS 326 and CS 663.

CS 767 - Advanced Computer Graphics
Credits 3
Hidden line elimination algorithms and implementation. Perfect interpolators, cubic and bicubic splines, Kriging, Hermite surfaces, nonperfect interpolators, Bezier curves and surfaces, B-splines, ray tracing algorithms, shading, lightness, motion, moving pictures, two- and three-dimensional fractals. Special topics. Prerequisites: CS 680

CS 768 - Surface Estimation for Computer-Aided Geometric Design
Credits 3
Affine maps, function spaces, the DeCasteljans algorithm, Bernstein polynomials, Bezier surfaces, nonparametric curves, Lagrange polynomials, C continuity, G continuity, gamma splines, beta splines, geometric continuity, tensor product interpolants, volume deformations, curvatures. Prerequisites: CS 767

CS 769 - Advanced Data Base Management
Credits 3
Continuation of CS 632, including normalization of relational data bases using functional and multivalued dependencies. Query processing, query interpretation, query optimization, and methods for implementing and optimizing logic queries. Knowledge data bases, distributed data bases and object-oriented data bases. Prerequisites: CS 657

CS 770 - Advanced Operating Systems
Credits 3
Study of the design principles, organization, and performance analysis of large-scale computer operating systems. Particular subjects emphasized include coordination of tasks, solutions of deadlock problems, theories of segmentation and paging, and performance prediction. Prerequisites: CS 370

CS 771 - Concurrent Computation
Credits 3
Study of concurrent programming methods and applications; event spaces; models of concurrency, such as Petri nets, CCS and CSP. Synchronization, data sharing and communication. Concurrency constructs in various programming languages. Scheduling and implementation techniques. Applications of concurrency in operating system design, fault-tolerance, and reliability. Prerequisites: CS 326 and CS 370.

CS 772 - Software Architecture
Credits 3
Survey of advanced techniques for specifying and designing large software systems. System verification. Reliability and project management. Prerequisites: CS 370, CS 672, and CS 660, or consent of instructor.

CS 777 - Parallel Algorithms
Credits 3
Methods for creating and analyzing parallel algorithms. Parallel programming languages and programming models of shared-memory and distributed architectures. Measuring complexity of parallel algorithms. NC-class versus P-class algorithms. Prerequisites: CS 677
CS 778 - Advanced Translation  
Credits 3  
Formal semantics, automatic compiler generation, attribute grammars. Language issues as they relate to compiler generation. **Prerequisites:** CS 660

CS 779 - Supercompliers for Parallel and Vector Computers  
Credits 3  
Dependence analysis, Diophantine equations, the GCD test, the Banerjee test, do-loop normalization, concurrency in loops, vector code generation, control dependence and vectorization, parallel code generation for doall-loops, parallel code generation for doacross-loops, shared memory parallelization, parallelization for distributed memory architectures. **Prerequisites:** CS 778

CS 780 - Distributed Computing and Algorithms  
Credits 3  
Methods and algorithms of distributed computing. Topics may include architecture and design goals, formal approaches to distributed computing problems, networks and protocols, models of distributed computing, synchronization and communication, synchronous and asynchronous systems, fault-tolerance and reliability, self-stabilization, distributed algorithms and applications. **Prerequisites:** CS 370, CS 677

CS 781 - Automated Deduction  
Credits 3  
Use of computers for forming deductions and proving theorems in symbolic logic covered. Topics include resolution, unification, proof strategies, and equality. Also examines areas of application: problem solving, question answering, program verification, automatic programming and logic programming (Prolog). **Prerequisites:** CS 682

CS 782 - Expert System Construction  
Credits 3  
Design, organization, and construction of expert systems. Includes general concepts, characteristics, elements, advantages, and examples of expert systems. Also rule-based knowledge representations, inference techniques, implementation tools and shells, and advanced topics. **Prerequisites:** CS 682

CS 783 - Genetic Algorithms and Neural Networks  
Credits 3  
A study of the utility of adaptive methods and their limitations across optimization problems spanning areas of engineering. Topics include genetic algorithms and genetic programming, simulated annealing, tabu search, neural networks, artificial life. Use of software tools for implementations.

CS 785 - Computational Linguistics  
Credits 3  
Introduction to linguistics and computational linguistics, for natural language. Phonology, morphology, syntax, semantics, and lexicology. Text analysis and processing; construction of lexicons, and indexes and concordances. Introduction to text retrieval, translation, speech understanding and generation. **Prerequisites:** CS 656

CS 786 - Advanced Computational Linguistics  
Credits 3  
Advanced study of computational linguistics. Emphasis on cognitive methods in natural language understanding and generation. Pragmatics and discourse. **Prerequisites:** CS 785

CS 788 - Computational Environmetrics  
Credits 3  

CS 789 - Topics in Advanced Computer Science  
Credits 3  
Graduate-level course in some field of computer science, at advanced level, depending upon the current interest of the staff and the students. Note: May be repeated with a different subject matter to a maximum of nine credits. **Prerequisites:** Consent of instructor.

CS 790 - Master's Project  
Credits 1 – 3  
Note: May be repeated, but only three credits will be applied to the student's program. Grading S/F grading only. **Prerequisites:** Consent of instructor.

CS 791 - Thesis  
Credits 3 – 6  
Note: May be repeated, but only six credits will be applied to the student's program. Grading S/F grading only. **Prerequisites:** Consent of instructor.

CS 792 - Research Seminar  
Credits 1  
Oral presentation of assigned articles. Note: May be repeated to a maximum of four credits. **Prerequisites:** Consent of instructor.
Construction Management

Director
Shields, David
(2003), Associate Professor; B.S., M.S., Texas A&M University; Ph.D., University of Texas at Austin, P.E. (Arizona).

Graduate Coordinator
Opfer, Neil
(1989), Associate Professor; B.S., B.A. Washington State University; M.B.A. Purdue University; P.D., University of Wisconsin.

Graduate Faculty
Shrestha, Pramen P.
(2007), Assistant Professor; B.S., National Institute of Technology, India; M.S., Oklahoma State University; Ph.D., University of Texas at Austin.

The Master of Science in Construction Management (M.S.C.M.) degree provides graduate-level study for those seeking mid- and upper-level management positions in the construction industry or continued study for the doctorate. Students with degrees in construction management, engineering, science, architecture, business, as well as related disciplines are invited to apply. Applications for admission to the program are evaluated on an individual basis by the program’s faculty.

Documents Required by the Construction Management Program for Admission Consideration:

1. One official transcript from each post-secondary institution attended. Only transcripts sent directly from the institution are considered.
2. Two letters of recommendation.
3. One-page statement indicating the reasons why you wish to earn an M.S. degree.
4. GRE test scores taken in the last five years.

Documents Required by the Graduate College:

1. A complete application form and a non-refundable fee. The most current application fees for U.S. citizens and international applicants are available online at graduatecollege.unlv.edu/admissions.
2. One official transcript of each post-secondary institution attended.

International students must also submit to the Graduate College:

1. Official translated copies of transcripts. Only transcripts sent directly from the institution to the UNLV Graduate College will be considered.
2. Official TOEFL or Michigan Test Scores (only if English is not native language) taken in the last two years.
3. High School Leaving Certificate (for international students only)

**The Confidential Financial Certificate must be submitted to the Office of International Students and Scholars. Program

Construction Management M.S.C.M.

Admission Requirements

Applicants are considered on an individual basis. Candidates can be admitted on a regular or provisional status. Qualified applicants who are not admitted on either status can take graduate courses as a non-degree student. A maximum of 15 credits taken as a UNLV non-degree graduate student may be applied toward the M.S.C.M. degree.

To be considered for admission:

1. Applicants must have an earned baccalaureate degree from a regionally accredited four-year college or university with preferred study in construction, engineering, architecture, business, or closely related area.
2. Overall undergraduate GPA should be at least 2.75 (4.00=A) for the bachelor’s degree or at least 3.00 (4.00=A) for the last two years of undergraduate work.
3. Credit (in semester hours) must have been earned in the following subjects or their equivalents:
   - MATH 181 Calculus I
   - PHYS 151 General Physics I
   - CEM 250/250L Construction Materials & Methods
   - CEM 270 Construction Engineering Mechanics
   - A course in construction or engineering graphics
   - The leveling courses required of a student before entering the M.S.C.M. program will be determined on an individual basis. The student will be notified in writing of any deficiencies prior to admission to the program. Students with deficiencies exceeding two courses may need to satisfactorily complete them before admission to the graduate program.
4. The applicant must obtain a satisfactory score on the Graduate Record Examination (GRE) as determined by the Graduate Program Committee (GPC). Native language, or do not receive a degree from an institution where English is the language of instruction, must show
competency in English. A minimum score on the Test of English as a Foreign Language (TOEFL), of at least 213 (computerized), or 550 (written), or 80 (Internet-based) or the Michigan Test with a score of 85. An official report of the score must be submitted to the Graduate College.

6. Please refer to the sections under Admission and Registration Information for complete details of Graduate College application deadlines, admission requirements, and application procedures for domestic and international students. Admission is on a competitive basis.

7. Each applicant must submit official transcripts from all previously attended postsecondary institutions to the Graduate College.

8. Each applicant must also submit to the program two letters of recommendation from individuals familiar with their knowledge, skills and abilities, and a one-page Statement of Objectives describing the reasons why they wish to earn a master's degree and indicating the area of concentration within the construction management discipline in which they wish to pursue graduate work.

Degree Requirements
Procedures and requirements for the M.S.C.M. degree will be as prescribed by the Graduate College under Academic Policies, with additional provisions as follows:

1. Each student in conjunction with the Program’s Graduate Coordinator will select either the Thesis option or Project Option.
      i. Student’s pursuing the thesis option shall have an Advising Committee composed of at least four members of the UNLV Graduate Faculty of which at least two must be tenured or tenure-track members of the Construction Management Program, the third from the Construction Management Program or a related field, and the fourth must be appointed by the Graduate College.
      ii. Requires completion of at least 30 credits, comprised of 18 required 600/700-level credits of CEM and MBA course work (see 2.a and 2.b), six credits of approved electives, and six credits of thesis research. The final examination will include a defense of the thesis. Completion of a thesis requires the student to make a unique contribution to the existing knowledge in the field of construction management or engineering. The effort must include the development of a contemporary research topic and the methodology for investigating the topic. The student is required to undertake the research effort to investigate the topic. The thesis prepared as part of this option shall include a literature review, description of the research topic, methodology, and results, and present conclusions obtained from the research effort and recommendations for further work.
      iii. The thesis option student’s program of study must be approved by the student’s advisory committee.
   b. Project Option: Requires completion of at least 36 credits comprised of 18 required 600/700-level credits of CEM and MBA course work (see 2.a and 2.b), 15 credits of approved electives of which nine credits must be 600/700-level credits of CEM (see 2.c).

   Additional course requirement: CEM 796 - Special Project in Construction Engineering and Management (minimum 3 credits)

Completion of a project requires the student to investigate and solve, or propose solutions to, a problem related to the field of construction management. It is expected that the results of this effort will be beneficial for and applied to other construction-related projects or problems. The project report prepared for this option shall include a description of the issue investigated, how the investigation was performed, the results obtained, conclusions regarding the investigation, and recommendations for further work.

2. Program course requirements. Both graduate degree options require students to:
   a. Complete the following courses:
      CEM 651 - Construction Estimating I
      CEM 653 - Construction Scheduling and Resource Optimization
      CEM 700 - Construction Seminar I
      CEM 750 - Advanced Construction Scheduling or
      CEM 751 - Construction Cost Analysis and Estimating
      CEM 685 - Construction Law and Contracts or
      CEM 740 - Construction Safety and Performance Improvement or CEM 775 - Construction Operations and Management or
      CEM 705 - Construction Engineering Management
      MBA 702 - Statistical Analysis

      Other courses may be substituted upon written permission of the student’s graduate faculty advisor. Students who have credit in CEM 451 and CEM 453 or equivalent courses will select two other courses from the approved elective list.
   b. Complete the following courses within the first two semesters of study:
      MBA 702 - Statistical Analysis
      CEM 700 - Construction Seminar I
   c. The student’s graduate program to show suitable breadth and coherence. As specified in the Academic Policies section of this catalog, the
proposed graduate degree program must be submitted to the Graduate College prior to completion of 16 credit hours of course work toward the degree. The responsibility for meeting this requirement rests with the student. Students will be placed on probation or separated from the program if they neglect this requirement.

i. The thesis option program of study will be jointly developed by the student and advisor, approved by the student’s committee, and then filed with the Graduate College.

ii. The project option program of study will be jointly developed by the student and advisor, then filed with the Graduate College.

3. Performance Requirements: Students must make satisfactory progress and comply with all Graduate College and Howard R. Hughes College of Engineering policies. If progress is not satisfactory, probation and separation from the graduate program may result, in accordance with the rules of the Graduate College. Satisfactory progress is defined as filing an approved graduate degree program before the completion of 16 credit hours of course work, completion of at least six credits of the approved program per calendar year, maintenance of a GPA of 3.00 (4.00), no grades below C and compliance with the letter and spirit of the Graduate Catalog and published policies of the Howard R. Hughes College of Engineering. Additionally, no more than nine credits below B are allowed in the student’s graduate program. If progress is not satisfactory, probation and separation may result, in accordance with the rules of the Graduate College. Any student whose GPA falls below 3.00 will be placed on probation and will have two semesters to raise it to 3.00 or above. Students who are awarded a graduate assistantship must be enrolled in 9 credit hours per semester and must elect the thesis option.

Course Descriptions

CEM 632 - Temporary Construction Structures
CEM 651 - Construction Estimating I
CEM 651L - Construction Estimating Laboratory
CEM 653 - Construction Scheduling and Resource
CEM 654 - Heavy Construction Equipment & Methods
CEM 685 - Construction Law and Contracts
CEM 693 - Independent Study
CEM 695 - Special Topics in Construction Management

Note: Graduate credit may be obtained for courses designated 600 or above. A full description of this course may be found in the Undergraduate Catalog under the corresponding 400 number. Credit at the 600 level normally requires additional work.

CEM 700 - Construction Seminar I
Credits 1
Introduction to research process, design, measurement, sampling, analysis, and results, research information resources, and literature review. Corequisite: MBA 702 or STAT 463 or equivalent or consent of instructor.

CEM 701 - Construction Seminar II
Credits 1
Presentations by students on research studies or projects. Presentations and discussions by local construction industry representatives on current construction engineering and management research and practice topics. Prerequisites: CEM 700

CEM 705 - Construction Engineering Management
Credits 3
Technical project management applications for pre-project planning, design, pre-construction services, value engineering, construction, start up/commissioning and decommissioning of capital facilities. Prerequisites: CEM 651 and CEM 653.

CEM 740 - Construction Safety and Performance Improvement
Credits 3
Introduction to construction safety issues, regulations and ways to improve safety on the job site. Accidents and their causes, OSHA regulations, and worker safety programs. Productivity concepts, data collection, and analysis of data and factors affecting construction productivity. Means for improving production and study of productivity improvement programs. Prerequisites: CEE 381 or ABS 341, and graduate standing.

CEM 750 - Advanced Construction Scheduling
Credits 3

CEM 751 - Construction Cost Analysis and Estimating
Credits 3
Advanced topics in construction estimating including value engineering, pricing strategies, and computer concepts. Development of estimating data. Computer-aided design and cost integration. Range, factor, and parametric estimating. Production factors. Prerequisites: CEM 451 or CEM 651 or consent of instructor.
CEM 775 - Construction Operations and Management
Credits 3

CEM 780 - Construction Engineering
Credits 3
Advanced topics in construction engineering addressing techniques and sequences employed in the construction of civil engineering facilities. Focus on methods improvement and the analysis and design of temporary structures, formwork, and rigging for construction. Case studies. Note: May be taken concurrently with CEM 751. Prerequisites: EGG 307, CEE 381, CEM 740, CEM 751

CEM 793 - Advanced Independent Study
Credits 1 – 3
Advanced independent study of a selected construction topic. Paper required. Note: May be repeated to a maximum of six credits. Prerequisites: Graduate standing and consent of instructor.

CEM 795 - Advanced Special Topics in Construction Management
Credits 1 – 6
Outlet for experimental and other topics of interest in advanced construction management. Paper required. Topics and credits to be announced. Note: May be repeated to a maximum of six credits. Prerequisites: Graduate standing in major.

CEM 796 - Special Project in Construction Engineering and Management
Credits 1 – 3
Development and undertaking of a project investigating a topic of interest related to construction engineering or construction management. Note: May be repeated for a maximum of three credits. Prerequisites: Graduate standing.

CEM 797 - Research Thesis in Construction Engineering and Management
Credits 1 – 3
Development and undertaking of a research study on a contemporary topic related to construction engineering or construction management. Preparation and presentation of a research thesis. Preparation of a project report. Note: May be repeated for a maximum of six credits. Prerequisites: Graduate standing.

Electrical & Computer Engineering

Chair
Selvaraj, Henry
(1994), Professor; M.S., Ph.D., Warsaw University of Technology.

Graduate Coordinator
Jiang, Yingtao
(2001), Associate Professor; B.E., Chongqing University; M.S.E.E., Concordia University, Montreal; Ph.D., University of Texas at Dallas.

Graduate Faculty
Baghzouz, Yahia
(1987), Professor; B.S., M.S., Ph.D., Louisiana State University.
Das, Biswajit
(2003), Professor; B.S.E.E., Indian Institute of Technology, Kharagpur; M.S.E.E., Southern Illinois University, Ph.D., Purdue University.
Latifi, Shahram
(1989), Professor; B.S., M.S., Teheran University; M.S., Ph.D., Louisiana State University.
McGaugh, Eugene E.
(1989), Associate Professor; B.S., University of Kansas; M.S., University of Missouri; Ph.D., University of Kansas.
Muthukumar, Venkatesan
(2001), Associate Professor; B.S.E.E., Anna University India; M.S.E.E., Ph.D., Monash University, Australia.
Regentova, Emma
(2001), Associate Professor; M.S.C.E., Ph.D., State Engineering University of Armenia.
Saberinia, Ebrahim
(2004), Assistant Professor; B.S.E.E., M.S.E.E., Sharif University of Technology; Ph.D., University of Minnesota.
Schill, Robert A.
(1993), Professor; B.S.E.E., Milwaukee School of Engineering; M.S.E.E., Ph.D., University of Wisconsin-Madison.
Singh, Sahjendra N.
(1986), Professor; B.S., Patna University; M.E., Indian Institute of Science; Ph.D., The Johns Hopkins University.
Stubberud, Peter
(1991), Associate Professor; B.S., M.S., Ph.D., University of California, Los Angeles.
Venkat, Rama
(1989), Professor; B.Tech., Indian Institute of Technology; M.S., Ph.D., Purdue University.
Yang, Mei
(2004), Assistant Professor; B.E.C.E., M.E.C.E., University of Electronic Science and Technology of China; Ph.D., University of Texas at Dallas.

Professors Emeriti
Brogan, William L.
(1990-1998), Emeritus Professor; B.S.M.E., State University of Iowa; M.S., Ph.D., University of California, Los Angeles.
Martinez, Ramon
Tryon, John G.
(1975-1986) Emeritus Professor; B.Phys., University of Minnesota; Ph.D., Cornell University.

Electrical engineering is the application of scientific and mathematical principles to the design, manufacture, and control of structures, machines, processes, and systems. In the past, the work of electrical engineers has had a direct and vital impact on people’s lives. For example, electrical engineers have been responsible for the creation of electric power, modern electronics, computers, electronic communication systems, modern flight controllers, automated manufacturing and medical diagnostic tools. An electrical engineering education continues to provide opportunities for solving problems of great social significance and for increasing people’s quality of life. The Department of Electrical and Computer Engineering at UNLV has excellent facilities for graduate education and research in electrical engineering. In addition, our faculty are experienced and knowledgeable in many of the electrical engineering disciplines, including communications, computer engineering, control system theory, electromagnetics and optics, electronics, power systems, signal processing, nano technologies and solid state devices. At UNLV, students have the opportunity for personal interaction so that programs and research projects can be tailored to student interests.

The Department of Electrical and Computer Engineering offers a wide array of high-technology computing and research facilities. Through the department, as well as the college, graduate students have access to a large network of personal computers and scientific workstations. These include a number of high-performance Sparc stations, Silicon Graphics workstations, Windows-based personal computers, and Apple Macintosh computers. Available software includes layout tools, logic synthesis tools, processing and demo modeling tools, signal and image processing tools, and microwave design tools. Further, graduate students have access to Cray YMP 2/216 and Convex C220 supercomputers. The department’s high technology research equipment includes a C-V profiler, Hall mobility measurement system, diffusion furnace, vacuum evaporative system, pulsed power systems, precision power analyzer, state-of-the-art test and measurement equipment including spectrum and network analyzers and digital scanners.

Electrical Engineering M.S.E.E.

Applications are considered on an individual basis. Candidates can be admitted on a regular or provisional status. Qualified applicants who are not admitted on either status can take graduate courses as a non degree student but not completing all of the M.S.E.E. degree requirements. Only 15 credits taken as a UNLV non degree student will count for an M.S.E.E. degree.

To be considered for admission to the M.S.E. program, an applicant must:
1. Have a Bachelor of Science (B.S.) degree in electrical engineering, computer engineering or a closely related discipline. (Applicants who possess a bachelor’s degree in a closely related discipline, such as physics or mathematics, may be admitted on provisional status. These students will be required to complete certain undergraduate courses before they can attain regular status. The graduate committee determines these courses on an individual basis. Graduates with degrees in engineering technology ordinarily have an inadequate background to be admitted to the graduate program.)
2. Have a minimum grade point average (GPA) of 3.00 (A=4.00) for their bachelor’s degree. (Applicants who have an overall GPA below 3.00 must submit Graduate Record Examination (GRE) scores to the department. These applicants may be admitted subject to the discretion of the Electrical and Computer Engineering Graduate Committee. Applicants who want to be considered for an assistantship, or who feel that their GRE scores will enhance their chances for admission, are strongly encouraged to submit GRE scores.)
3. Submit GRE scores if the applicant did not obtain his bachelor’s degree from an ABET accredited institution. (An applicant possessing a bachelor’s degree from an ABET accredited institution is not required to submit GRE scores.)
4. Submit a completed application form and official transcripts of all college-level work to the Graduate College. In addition, submit a one page written statement of purpose indicating the applicant’s research interests, motivations and objectives, three dated letters of recommendation concerning the applicant’s potential for succeeding in the graduate program and an additional set of transcripts of all college-level work directly to the Department of Electrical and Computer Engineering.
5. For international applicants to be considered for admission, the Graduate College requires that they take the Test of English as a Foreign Language (TOEFL)
and obtain a minimum score of 80 on the internet based examination. Students whose first language is not English may be required to take the English as a Second Language Placement Test upon arrival at UNLV. If necessary, they will be required to take English as a Second Language (ESL) courses at UNLV. These courses will not count towards their graduate degree.

**Degree Requirements**

All M.S.E.E. candidates must maintain an overall minimum grade point average (GPA) of 3.00 (B) and a minimum GPA of 3.00 (B) each semester. Students who do not maintain an overall GPA of 3.00 (B) and a GPA of 3.00 (B) each semester will either be placed on probation or expelled from the program. The Electrical and Computer Engineering Graduate committee and the Graduate College will determine the terms of the student’s probation in accordance with the Graduate College and department policy. All regular status graduate students must file an approved program before the completion of their second semester. The student’s advisor, the graduate coordinator, and the Graduate College Dean must approve this program.

All regular and provisional status graduate students must show satisfactory progress towards completion of their degree by completing at least six credits of their approved program per calendar year. If progress towards their degree program is not satisfactory, students will either be placed on probation or expelled from the program.

**Specific requirements**

1. Satisfy the M.S.E.E. degree program admission requirements and be admitted to the M.S.E.E. program on a regular status.

2. Complete a minimum of 30 credits of graduate-level courses with an overall minimum GPA of 3.00 (B) and a minimum GPA of 2.70 (B-) in each class applied towards the 30 credits. Grades below B- are not counted towards the M.S.E.E. degree and must be repeated or replaced. Continued enrollment of a student who earns more than one grade below B- is contingent upon the approval of the committee.

   **Thesis Option:** A total of 30 credits is required for the Thesis Option. Of the 30 required credits, a minimum of 18 credits must be in electrical engineering courses, a minimum of 15 credits must be excluding ECG 796 and ECG 797, and no more than three credits may be from ECG 791 - Independent Study in Electrical Engineering Graduate Independent Study. Students opting for the Thesis Option must complete at least six credits of: ECG 797 - Electrical Engineering Thesis (Electrical Engineering Thesis). Although ECG 797 can be taken repeatedly, no more than six credits can be applied towards the M.S.E.E. degree.

   **Course Only Option:** A total of 33 credits is required for the Course Only Option. Of the 33 required credits, a minimum of 18 credits must be in electrical engineering courses, a minimum of 15 credits must be in 700-level electrical engineering courses and no more than three credits may be from ECG 791 (Graduate Independent Study). The Course Only Option is a terminal degree.

3. Successfully complete a minimum of three credits in at least three of the following areas:
   a. Computer Engineering
   b. Communications
   c. Control Systems
   d. Electromagnetics and Optics
   e. Electronics
   f. Power Systems
   g. Signal Processing
   h. Solid State Electronics, Materials and Devices

4. **Thesis Option Only:** Complete a thesis. Before beginning a thesis, students must have their thesis topic approved by their advisor, and the necessary paper work must be filed with the Graduate College. The student must complete a thesis containing original research and defend it before his/her advisory committee at the Thesis Exam. The student can receive no more than six credits of ECG 797 (Electrical Engineering Thesis) for the work associated with the thesis. Students who plan to continue their studies beyond the M.S.E.E. degree program are strongly encouraged to select this option.

   **Thesis Exam:** Prior to the student’s defense of the thesis before his/her advisory committee, the student must submit a complete copy of the thesis to each member of his/her advisory committee of the date, time and location of the oral defense of the thesis or project at least two weeks in advance.

**Time Limits**

The Department of Electrical and Computer Engineering requires that the M.S.E.E. degree be finished within a period of six years. Courses taken more than six years prior to graduation may not be applied toward the M.S.E.E. degree.

**No Risk Ph.D. Pre-Qualifying Exams**

A full graduate standing master’s degree candidate who is interested in pursuing a doctoral degree may be allowed to take the Ph.D. qualifying exam without penalty during his/her period as an M.S. student. The exam may be taken as many times as desired but no more than once a semester. Those areas that the student passes will count towards his/her qualifying exam requirement upon entering the Ph.D. program. The candidate must complete an M.S. degree in the Electrical and Computer Engineering department. Once the student receives an M.S. degree in Electrical Engineering, the student must abide by the requirements outlined in the Ph.D. program. This option is not available to nondegree students.
Electrical Engineering Ph.D.

The Department of Electrical and Computer Engineering at UNLV offers a program leading to the Ph.D. degree in Engineering in the field of Electrical Engineering. Specific major areas of study currently available include: Communications, Computer Engineering, Control System Theory, Electromagnetics and Optics, Power Systems, Signal Processing, and Solid State Materials and Devices.

Admission Requirement
Applicants are considered on an individual basis. One may be admitted to the Ph.D. program by one of two mechanisms. The Conventional Ph.D. Option requires the student to complete an M.S. degree in Electrical and Computer Engineering. The Direct Ph.D. Option allows those undergraduates with outstanding undergraduate backgrounds to enter the Ph.D. program without having to complete an M.S. degree in Electrical and Computer Engineering. All requirements leading to a Ph.D. are still required beyond the B.S. degree in Electrical and computer Engineering excluding the completion of a master’s thesis.

Conventional Ph.D. Option
Applications are considered on an individual basis. Candidates can be admitted on a regular or provisional status. Qualified applicants who are not admitted can take a few graduate courses as a non degree student not completing all of the Ph.D. requirements. Only 15 credits taken as a graduate non admitted student can count toward the degree. To be considered for admission to the Ph.D. program, an applicant must:
1. Have a Master of Science (M.S.) degree in electrical engineering or computer engineering;
2. Have a minimum overall grade point average (GPA) of 3.50 (A=4.00) for their bachelor’s degree;
3. Submit GRE scores to the department and have obtained the following minimum scores:

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<td>Quantitative</td>
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4. Submit a completed application form and official transcripts of all college-level work to the Graduate College. In addition, submit a one page written statement of purpose indicating the applicant’s research interests, motivations and objectives, three letters of recommendation concerning their potential for succeeding in the Ph.D. program, and official transcripts of all college-level work directly to the Department of Electrical and Computer Engineering.

Direct Ph.D. Option
Applications are considered on an individual basis. To be considered for admission to the Ph.D. Program, an applicant must:

1. Have a minimum overall grade point average (GPA) of 3.50 (A=4.00) for their bachelor’s degree;
2. Submit GRE scores to the department and have obtained the following minimum scores:

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<td>Quantitative</td>
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3. Submit a completed application form, a written statement of purpose indicating the applicant’s interests and objectives, three letters of recommendation concerning their potential for succeeding in the Ph.D. program, and official transcripts of all college-level work to the Graduate College.

4. Submit a completed application form and official transcripts of all college-level work to the Graduate College. In addition, submit a one page written statement of purpose indicating the applicant’s research interests, motivations and objectives, three dated letters of recommendation concerning the applicant’s potential for succeeding in the graduate program and an additional set of transcripts of all college-level work directly to the Department of Electrical and Computer Engineering.

International Applicants
Before international applicants can be considered for admission, the Graduate College requires that all international applicants take the Test of English as a Foreign Language (TOEFL) and obtain a minimum score of 550. Students whose first language is not English may be required to take the English as a Second language Placement Test upon arrival at UNLV. If necessary, they will be required to take English as a Second Language (ESL) courses at UNLV. These courses will not count toward their graduate degree.

Ph.D Degree Requirements
All Ph.D. candidates must maintain a minimum overall grade point average (GPA) of 3.20 and a minimum GPA of 3.20 each semester. Ph.D. candidates who do not maintain an overall GPA of 3.20 and a GPA of 3.20 each semester will either be placed on probation or expelled from the program. The Electrical and Computer Engineering Graduate Committee and/or the Graduate College will determine the terms of the student’s probation in accordance with the rules of the Graduate College.

All regular status graduate students must file an approved program before the completion of their first semester. This program must be approved by the student’s advisor and the graduate coordinator. All regular and provisional status graduate students must show satisfactory progress towards completion of their degree by completing at least six credits of their approved program per calendar year. If their progress towards their degree program is not satisfactory, students will either be put on probation or expelled from the program.
Consecutive order of specific requirements for both the Direct and the Conventional Ph.D. options are:

1. Satisfy the Ph.D. degree program admission requirements and be admitted to the Ph.D. program on a regular status.
2. Pass the Qualifying Exam within two semesters of being admitted to the Ph.D. program on a regular status. The Qualifying Exam is offered once every Fall semester and once every Spring semester. This exam cannot be taken more than twice. The Qualifying Exam is described in Section 4.3 of the Graduate Program Document.
3. During the first semester, a Ph.D. student must select a faculty advisor. The faculty advisor does not have to be the one to whom the student was assigned upon entering the Ph.D. program. In coordination with the faculty advisor, the student must also form a doctoral advisory committee. A doctoral advisory committee is composed of at least five members of the UNLV Graduate Faculty. Three of these faculty members must be from the Department of Electrical and Computer Engineering, the fourth from a relevant supporting field, and the fifth is appointed by the Graduate College.
4. Beyond the M.S. degree, a Ph.D. student must complete a minimum of 27 credits of graduate-level courses with an overall minimum GPA of 3.20 and a minimum GPA of 2.70 (B-) in each class applied towards the 27 credits. Candidates in the Direct Ph.D. program must complete a minimum of 51 (24 M.S. + 27 Ph.D.) required credits. Grades below B- are not counted towards the Ph.D. degree and must be repeated or replaced.

**Direct Ph.D. Option**

Continued enrollment of a student who earns more than one grade below B- is contingent upon the approval of the graduate committee. Of the 51 required credits, a minimum of 33 credits must be in 700-level courses, and no more than six credits may be from ECG 791 (Graduate Independent Study). The student’s doctoral advisory committee may add more requirements in accordance with the individual’s background and field of study.

1. Beyond the bachelor’s degree, a Ph.D. student must complete a minimum of 15 credits in an approved major field, nine credits in each of the two approved minor fields. A minimum GPA of 3.33 (B+=3.30) must be obtained in each of the minor fields. Approved major and minor fields are described in detail in Section 4.8 of the Graduate Program Document.
2. After passing the Qualifying Exam, successfully completing all courses for a major field, and successfully completing all courses for the minor fields, students are eligible to take the Comprehensive Exam. All students must have passed the Comprehensive Exam within two semesters after successfully completing all required course work except for the 18 credits of ECG 799 (Dissertation). NOTE: Up to six credits of:

3. ECG 799 - Dissertation taken prior to the successful completion of the Preliminary Exam may count toward the degree program. The Comprehensive Exam cannot be taken more than once per semester and cannot be taken more than twice. If the student’s GPA during his/her Ph.D. study is 3.8 or higher, comprehensive exam can be waived upon the approval of the Graduate Program Committee (GPC). If the student’s GPA is below 3.8, he/she will need to write this exam. The Comprehensive Exam is described in detail in Section 4.4 of the Graduate Program Document.
4. After successfully completing all required course work and passing the Comprehensive Exam, the students must pass the Preliminary Exam. The Preliminary Exam cannot be taken more than once per semester but may be repeated until passed. The Preliminary Exam is described in detail in Section 4.5 of the Graduate Program Document.
5. Complete a minimum of 18 credits of; ECG 799 - Dissertation and complete a dissertation containing original research. Upon completion, the student must pass the Final Exam in which the student defends his/her dissertation. The Final Exam is described in detail in Section 4.6 of the Graduate Program Document.

**Conventional Ph.D. Option**

Continued enrollment of a student who earns more than one grade below B- is contingent upon the approval of the graduate committee. Of the 27 required credits, a minimum of 18 credits must be in 700-level courses, and no more than three credits may be from ECG 791 (Graduate Independent Study). The student’s doctoral advisory committee may add more requirements in accordance with the individual’s background and field of study.

**Ph.D. Major and Minor Fields**

Beyond the bachelor’s degree, a Ph.D. student must complete a minimum of 15 credits in a major field, nine credits in a minor field of a single area in Electrical and Computer Engineering, and another nine credits in a second minor field. Currently, the Department of Electrical and Computer Engineering at UNLV offers Communications, Computer Engineering, Control System Theory, Electromagnetics and Optics, Electronics, Power Systems, Signal Processing, and Solid State Materials and Devices as major fields. Specific courses that can be applied to specific fields are listed in detail later in this section of the manual. Each student must complete two minor fields. To complete a minor field, a student must complete a minimum of nine credits in an approved minor field and have an overall minimum GPA of 3.33 (B+=3.30) for the nine minor field credits. Of the nine required credits in each minor field, a minimum of six credits must be in 700-level courses.
Specific courses that can be applied to specific minor fields are listed in detail in this section of the manual. Some courses may be listed under two different fields. Such a course can be applied to only one field. With the written approval of the major advisor and the student’s advisory committee, a mixed minor field may be formed with courses inside and/or outside of the Electrical Engineering department’s approved fields (e.g., a mixed minor in mathematics and physics, a mixed minor in computer engineering and computer science, a physics minor, a mechanical engineering minor, sold state and electromagnetics mixed minor, etc.). A mixed minor may not be composed of courses in the Electrical Engineering Department that satisfy course work in the major and other minor field. The only exception is when a course may be used in more than one field. In this case, the course may not be counted twice but may be used for either minor area. However, the student must complete at least one minor field in Electrical Engineering in a single area. Refer to the department’s Graduate Program Handout regarding specific courses than can be applied to specific minor fields.

**International Applicants**
For international applicants to be considered for admission, the Graduate College requires they take the Test of English as a Foreign Language (TOEFL) and obtain a minimum score of 550 or 85 on the Michigan Test. Student’s whose first language is not English may be required to take the English as a Second Language Placement Test upon arrival at UNLV. If necessary, they will be required to take English as a Second Language (ESL) courses at UNLV. These courses will not count toward their graduate degree.

**Graduate Teaching Assistantships**
The Department of Electrical and Computer Engineering has a limited number of Teaching Assistantships that are awarded to superior students. To be considered for a teaching assistantship, a student must submit Graduate Record Examination (GRE) scores to the Department of Electrical and Computer Engineering. Prospective students should contact the department’s Graduate Coordinator for additional information and refer to the Graduate Catalog for submission deadlines.

Teaching Assistants perform an average of 20 hours per week of teaching related service and are required to complete a minimum of six credit hours per semester. Teaching Assistants who are also working toward the M.S.E.E. degree must take the Thesis Option. Teaching Assistants who do not adhere to these requirements, do not perform their teaching duties satisfactorily, or do not maintain the minimum GPA requirements specified by their degree programs can lose their assistantships and/or will be placed on probation. The Electrical and Computer Engineering Graduate Committee will determine the terms of the student’s probation. International Teaching Assistants are required to receive a passing score (50 out of 60 points) on the Test of Spoken English (TSE) prior to assuming any type of instructional duties.

**Course Descriptions**

**ECG 600 - Computer Communication Networks**
Credits 3
Computer network architecture; the OSI Model: network protocols; local area networks; fiber optics communication; ISDN; elements of Queueing Theory, with emphasis on hardware design issues.

**ECG 604 - Modern Processor Architecture**
Credits 3

**ECG 605 - Data Compression Systems**
Credits 3

**ECG 607 - Biometrics**
Credits 3
Taxanomics of devices and applications, probability and statistical testing methods, one and tow dimensional transform techniques, finger printing, voice recognition., facial recognition, and iris scanning, large scale identification applications, multibiometrics, social, legal, and ethical concerns.

**ECG 608 - Digital Design Verification and Testing**
Credits 3
A study of complete digital design testing during all design flow stages - from writing code to testing chips after manufacturing, creating and implementing effective test scenarios and assertion techniques, designing self-testing devices. Students will get hands-on experience with various EDA tools for design testing, verification, logic and fault simulation.

**ECG 610 - Hardware Description Language: VHDL**
Credits 3
Modern methodologies in design and test of digital/computer systems. Primary focus on very high speed integrated circuit systems. Primary focus on very high speed
integrated circuit hardware description languages, in particular, VHDL. Verilog and other hardware programming languages explored. Behavior level simulation, debugging. Introduction to synthesis, placement and routing.

ECG 615 - Introduction to VLSI System Design
Credits 3
Introduction to the theory, design and implementation of digital VLSI systems including MOS transistor theory and integrated circuit fabrication technology, digital system design, layout and design rules and use of CAD tools.

ECG 622 - Introduction to Analog Integrated Circuit Design
Credits 3
Design of CMOS, BICMOS, and bipolar analog integrated circuits. Topics include device models, current mirror design, single stage amplifier design, differential amplifier design, frequency response analysis and noise analysis.

ECG 630 - Transmission Lines
Credits 3
Telegraphist's equations; transient response—steady state response; reflection diagrams; Smith chart; matching techniques and designs; narrow and broadband impedance matching techniques; scattering matrix; introduction to stripline and microstrip devices.

ECG 631 - Engineering Optics
Credits 3
Fundamentals of antennas and antenna design; linear wire, loop, and antenna arrays; antenna measurements.

ECG 632 - Antenna Engineering
Credits 3
Fundamentals of antennas and antenna design; linear wire, loop, and antenna arrays; antenna measurements.

ECG 633 - Active and Passive Microwave Engineering
Credits 3
This 600-level course has been approved by the Graduate College for possible inclusion in graduate programs. A full description of this course may be found in the Undergraduate Catalog under the corresponding 400 number.

ECG 642 - Power Electronics
Credits 3
Topics include: diode circuits and rectifiers, power semiconductor diodes and transistors, thyristors and static switches, controlled rectifiers, AC voltage controllers, DC choppers, inverters, AC and DC drives, power supplies and protection of devices and circuits.

ECG 650L - Solid State Characterization Laboratory
Credits 1
Capacitance and voltage. Hall mobility and carrier concentration, oxidation and etching silicon dioxide processing of silicon.

ECG 651 - Electronic and Magnetic Materials and Devices
Credits 3
Semiconductors, dielectrics, ferroelectrics, antiferromagnetics, ferromagnetics, ferrimagnetics, crystal structure, structure-property relations, device applications.

ECG 652 - Optoelectronics
Credits 3
Topics include: modulation of light, display devices, lasers, photodetectors, fiber optics, engineering applications, and systems.

ECG 653 - Introduction to Nanotechnology
Credits 3

ECG 662 - Advanced Digital Communications
Credits 3
Information theory and fundamental limits on performance, digital coding of waveforms, pulse shaping for baseband transmission, digital bandpass modulations, channel coding.

ECG 672 - Digital Control Systems
Credits 3
Introduction to discrete time of control. State space representation of linear systems; stability; the concepts of controllability and observability. Sample data control system design techniques, including pole placement, observer design.

ECG 674 - Recent Topics in Control
Credits 3
This 600-level course has been approved by the Graduate College for possible inclusion in graduate programs. A full description of this course may be found in the Undergraduate Catalog under the corresponding 400 number.

ECG 680 - Discrete-Time Signal Processing
Credits 3
Review of discrete linear system theory including the z-transforms, the Fourier transform, discrete and fast Fourier transform. Sampling, reconstruction multirate systems and quantization noise. IIR and FIR digital filter design including digital filter structures and finite word length effects.
ECG 680L - Digital Signal Processing Laboratory
Credits 1
Laboratory projects and exercises in digital signal processing including the design and implementation of FIR, IIR, and multirate systems.

ECG 682 - Introduction to Biomedical Signals and Systems
Credits 3
Introduction to biomedical signals, transduction devices, bioelectric potentials and sensors. Application of electrical signal and system principles to biosignals, such as cardiovascular electrical signals, neural electrical communication, and diagnostic ultrasound. Includes current biomedical engineering topics.

ECG 695 - Special Topics
Credits 1-4
Covers experimental and other topics which may be of current interest. Topics and credits to be announced. Note: May be repeated once under a different topic. May have a laboratory.

ECG 700 - Advanced Computer System Architecture
Credits 3
High performance computer architecture including pipelining techniques, high speed memory systems, vector processors, parallel processing, and interconnection networks. Prerequisites: ECG 300 or consent of instructor.

ECG 701 - Reliable Design of Digital Systems
Credits 3
D-algorithm, Boolean difference, test generation for combinational and sequential circuits, self checking circuits, fault tolerant design, design for testability, and topics in reliability and maintainability. Prerequisites: ECG 300 or consent of instructor.

ECG 702 - Interconnection Networks for Parallel Processing Applications
Credits 3
Interconnection networks models, comparison of single-stage networks: PM2I, HYPERCUBE Illiac and shuffle-exchange, partitioning single-state networks, multistage networks, survey and comparison of fault-tolerant multistage networks. Prerequisites: ECG 300 or consent of instructor.

ECG 703 - Advanced Digital Logic
Credits 3
Sets, relations, and lattices. Switching algebra and its applications, functional decomposition and symmetric functions, Turing machine, finite state recognizer. Prerequisites: ECG 100

ECG 704 - Coding with Applications in Computers and Communication Media
Credits 3
Error correcting codes, design and analysis of encoder/decoder circuitry, applications to reliable communication and fault tolerant computing, compression encoding schemes. Prerequisites: ECG 300, MATH 453, or consent of instructor.

ECG 705 - Fault-Tolerant Computing
Credits 3
Fault-tolerant design of digital systems. Static, dynamic, hybrid, self-purging redundancies. Error-correcting codes and system diagnosis. Fault-tolerance in multiprocessor and VLSI based-systems, including token BUS, shared memory interconnections, and tree, binary cube and loop networks. Examples of practical fault-tolerant systems. Prerequisites: ECG 300

ECG 706 - Analysis of Telecommunication and Data Networks
Credits 3

CG 707 - Logic Synthesis Engineering
Credits 3
Theory and application of Boolean Minimization, functional decomposition and logic synthesis for FPGAs, serial and parallel decomposition strategies, and design implementation using FPGAs. Design entry, introduction to VHDL, BDD, FSM, and BLIF. Placement and routing in Xilinx and Aleira. Prerequisites: Graduate standing in computer engineering or consent of instructor.

ECG 708 - Biosurveillance
Credits 3
Introduction to biosurveillance systems (biowatch, ESSENCE, RODS), initiatives (biosense) and biodata organizations (CDC, HIS, DHS), biosensors, biosurveillance, data collection and analysis, false positive/negative rates, sensitivity and specificity. Statistical signal processing tools used in classification and decision making, real-time biosurveillance and network support. Prerequisites: Graduate standing.

ECG 709 - Synthesis and Optimization of Digital Systems
Credits 3
Study of the high-level synthesis and optimization algorithms for designing SOCs and MPSOCs. Topics including algorithms for high-level synthesis, scheduling,
resource binding, real-time systems, application specific instruction processors, embedded systems and hardware/software code designs. Simulate and synthesize algorithms using HDL languages (Verilog and SystemC). Use of simulators and emulators. **Prerequisites:** CPE 300 and C/C++ knowledge or Instructor permission.

**ECG 720 - Electronic Design with Integrated Circuits**  
Credits 3  
Designing electronics systems using linear and digital integrated circuits. Topics include operational amplifiers, linear and nonlinear applications, waveform generation, low noise circuits, active filters, digital ICs. A/D conversion, grounding and shielding, and system design. Intended for electrical and electronic students. **Prerequisites:** ECG 421, ECG 420 and consent of instructor.

**ECG 721 - Low Noise Electronics**  
Credits 3  
Noise mechanisms in semiconductor devices, noise calculations, low noise designs, high gain multistage amplifiers, matched filters, shielding. **Prerequisites:** Graduate standing or consent of instructor.

**ECG 730 - Advanced Engineering Electromagnetics I**  
Credits 3  
Conformal transformation with application to static field problems in engineering; wave harmonics with engineering applications; theorems of waves and media; Special Theory of Relativity with engineering applications; wave propagation in various media; engineering application of scattering. **Prerequisites:** ECG 330 or consent of instructor.

**ECG 731 - Theoretical Techniques in Electromagnetics**  
Credits 3  
Review and introduce mathematical techniques basic to the study of engineering electromagnetics, including coupled mode theory; complex analysis; and Green's function. **Prerequisites:** ECG 330 or consent of instructor.

**ECG 732 - Advanced Engineering Electromagnetics II**  
Credits 3  
Scattering; particle and beam radiation; selected topics in advanced antenna and microwave engineering. **Prerequisites:** ECG 330 or consent of instructor.

**ECG 733 - Plasma I**  
Credits 3  
Single particle motion; adiabatic invariants; plasmas as fluids; waves in plasmas; diffusion; resistivity; introduction to kinetic theory; Landau damping. **Prerequisites:** ECG 330

**ECG 740 - Computer Analysis Methods for Power Systems**  
Credits 3  
Power system matrices, programming considerations, conventional power flow studies, approximate and fast power flow studies, optimal dispatch, fault studies, power system stability, stochastic methods in power systems analysis. **Prerequisites:** ECG 440, ECG 440L or consent of instructor.

**ECG 741 - Electric Power Distribution System Engineering**  
Credits 3  
Electric load characteristics, distribution transformers, design of subtransmission lines and distribution substations, design of primary and secondary systems, voltage drop and power loss calculation, capacitor applications, voltage regulation, distribution system protection and reliability. **Prerequisites:** ECG 440, ECG 440L or consent of instructor.

**ECG 742 - Power System Stability and Control**  
Credits 3  
Power equipment dynamic characteristics and modeling, control of active and reactive power, small-signal stability, transient stability, voltage stability, sub-synchronous oscillations, mid- and long-term stability, methods of improving stability. **Prerequisites:** ECG 440, ECG 440L or consent of instructor.

**ECG 750 - Optical Electronics I**  
Credits 3  
Propagation of rays and beams, optical beams in fibers, resonators, laser oscillation, electro-optic, modulation, laser systems. **Prerequisites:** MATH 432, ECG 330, ECG 452 or consent of instructor.

**ECG 751 - Optical Electronics II**  
Credits 3  
Detection of optical radiation, optical dielectric waveguides, semiconductor lasers, phase conjugate optics, laser applications including holography. **Prerequisites:** ECG 750

**ECG 752 - Physical Electronics**  
Credits 3  
Quantum Theory, electron in potential well, harmonic oscillator. Hydrogen atom, Band Theory of Solids, Kronig-Penny model, theory of metallic state, diffraction by crystals, electronic structure of solids. **Prerequisites:** ECG 320 or consent of instructor.
ECG 753 - Advanced Topics in Semiconductor Devices I
Credits 3
Topics of current interest in solid state electronic devices: physics of semiconductors, thermal and optical and electronic properties of semiconductors, bipolar junction devices, field effect devices, surface related effects, optoelectronic devices, semiconductor lasers. Applications and the design of circuits using these devices. Intended for electrical and electronic engineers, physicists and qualified senior students in engineering and physics. Prerequisites: PHYS 411 and 483 or ECG 421, ECG 420 and consent of instructor.

ECG 754 - Hybrid Microelectronics
Credits 3
Vacuum theory, thin and thick film fabrication, electron transport phenomena, electronic properties active and passive films, distributed networks, designing hybrid microcircuits. Prerequisites: Graduate standing or consent of instructor.

ECG 755 - Monolithic Integrated Circuit Fabrication
Credits 3
Fabrication of integrated silicon and gas circuits, thermal oxidation, solid state diffusion, epitaxial growth, ion implantation, photo and electron lithography, design considerations, surface effect. Prerequisites: Graduate standing or consent of instructor.

ECG 756 - Advanced Topics in Semiconductor Devices II
Credits 3
Topics of current interest in solid state electronic devices: ultrafast electronics, high electron mobility transistors, superlattices, heterostructure devices, transfer electron devices and III-V and II-VI compounds, novel device structures. Novel approaches to device modeling such as Monte Carlo simulations, self-consistent solution of Schrodinger and Poisson and other approaches. Prerequisites: ECG 753

ECG 757 - Electron Transport Phenomena in Solid State Devices
Credits 3
Phenomenological transport equations, Boltzmann transport equation, relaxation time approximation, low field and high electron transport in Si and GaAs, moments of BTE, Monte Carlo simulation, spatial and temporal transients, device analysis, Quantum transport. Prerequisites: ECG 450 or ECG 753.

ECG 758 - Numerical Methods in Engineering
Credits 3
Computational course with emphasis on both the numerical analysis and the programming aspects of computer-aided design using simulation methods. Coverage includes understanding and use of CAD programs such as ECAP, CIRCUS, ICECREM, SUPREM, etc. Prerequisites: Graduate standing or consent of instructor.

ECG 760 - Random Processes in Engineering Problems
Credits 3
Basic probability theory, random variables, probability and densities, expectation, static estimation, random processes, power spectral density, mean square calculus, Wiener integrals. Prerequisites: ECG 460, MATH 461 or consent of instructor.

ECG 761 - Spectral Analysis and Time Series
Credits 3
Stationary random processes. Spectral representation. Estimation of correlation functions and spectra. Higher order spectra and nonlinear system models. Prerequisites: ECG 460, ECG 760 or consent of instructor.

ECG 762 - Detection and Estimation of Signals in Noise
Credits 3
Hypothesis testing, matched filters, estimation theory, Kalman and Wiener filters, applications to communication systems. Prerequisites: ECG 460, ECG 760 or consent of instructor.

ECG 770 - Linear Systems Theory
Credits 3
Mathematical systems theory, state space concepts, canonical forms, time and frequency domains, controllability and observability, state feedback, compensator design, and algebraic systems theory. Prerequisites: ECG 470, MATH 431 or consent of instructor.

ECG 771 - Optimal and Modern Controls
Credits 3
Review of analysis of linear control systems, optimal control systems, time and frequency domains, regulator problems, deterministic and random processes. Note: Topics selected according to the interests of the class. Prerequisites: ECG 770.

ECG 772 - Nonlinear Systems I
Credits 3
Introduction, differential equations, approximate analysis methods, Lyapunov stability, input-output stability. Prerequisites: ECG 770 or consent of instructor.

ECG 773 - Multivariable Control
Credits 3
Mathematical preliminaries, frequency domain representation, differential operator representation, linear state feedback, frequency domain compensation, fractional approaches, recent topics in control. Prerequisites: ECG 770 or consent of instructor.
ECG 774 - Stochastic Control
Credits 3
Introduction, stochastic processor, state estimation, Kalman Filter, nonlinear estimation, stochastic control. 
Prerequisites: ECG 770 or consent of instructor.

ECG 775 - Nonlinear Systems II
Credits 3
Geometric approach to nonlinear systems, inversion of input-output map, decomposition, noninteraction, disturbance decoupling, exact linearization, nonlinear control synthesis, Volterra series, realization theory.
Prerequisites: ECG 772 or consent of instructor.

ECG 776 - Adaptive Control
Credits 3
Introduction, model reference control, hyperstability, Popov criterion, parameter identification, adaptive control of discrete systems, adaptive predictor, adaptive state estimation. 
Prerequisites: ECG 770 (formerly EEG 760) or consent of instructor.

ECG 777 - Robotic Systems Control
Credits 3
Dynamics of rigid and elastic robotic systems, trajectory planning, inverse torque computation, adaptive control, variable structure control, torque and force feedback control.
Prerequisites: Consent of instructor.

ECG 780 - Digital Signal Processing
Credits 3
Introduction to the theory and applications of digital signal processing. Discrete-time signals, linear systems and difference equations. Sampling and multirate systems. One sided and two sided z-transforms. Finite impulse response (FIR) and infinite impulse response (IIR) systems. The discrete and fast Fourier transforms (FFT). 
Prerequisites: ECG 460, MATH 431 or consent of instructor.

ECG 781 - Digital Filters
Credits 3
Theory and applications of digital filters. Structures for discrete time systems. Finite precision numerical effects in digital systems. Finite impulse response (FIR) and infinite impulse response (IIR) digital filters designs including windowing techniques, optimization techniques, analog to discrete time transformation techniques and wave digital filters. 
Prerequisites: ECG 780

ECG 782 - Multidimensional Digital Signal Processing
Credits 3
Theory and applications of multidimensional (M-D) digital signal processing. M-D signals and systems. M-D z-transform. M-D DFT and FFT. Design and implementation of M-D FIR and IIR filters. Applications to image processing such as image enhancement and restoration.

Advanced topics chosen according to class interests.
Prerequisites: ECG 780

ECG 783 - Adaptive Signal Processing with Neural Networks
Credits 3
Prerequisites: ECG 780 or equivalent.

ECG 791 - Independent Study in Electrical Engineering
Credits 1 – 3
Supervised independent work in a topic of electrical engineering. Note: May be repeated to a maximum of six credits with consent of electrical engineering faculty. 
Prerequisites: Graduate standing in electrical engineering or related field and consent of instructor.

ECG 795 - Advanced Special Topics in Electrical Engineering
Credits 1 – 3
Advanced special topics in modern electrical engineering as defined in the announcement of the course. Note: May be repeated to a maximum of six credits. 
Prerequisites: Graduate standing in electrical engineering or related field and consent of instructor.

ECG 796 - Electrical Engineering Project
Credits 1 – 3
Advanced project in electrical engineering. 
Note: May be repeated to a maximum of six credits.
Prerequisites: Graduate standing in electrical engineering or related field and consent of instructor.

ECG 797 - Electrical Engineering Thesis
Credits 3 – 6
Note: May be repeated, but only six credits will be applied to a student's program. Grading S/F grading only. 
Prerequisites: Graduate standing in electrical engineering or related field and consent of instructor.

ECG 799 - Dissertation
Credits 1 – 6
Research analysis and writing toward completion of dissertation and subsequent defense. 
Note: May be repeated to a maximum of 18 credits allowed toward the degree. Grading S/F grading only.
Prerequisites: Graduate standing in electrical engineering or related field and consent of instructor.
School of Informatics

Director
Berghel, Hal
(1999), Professor; B.A., M.A., M.A., Ph.D., University of Nebraska, Lincoln.

Graduate Coordinator
Nasoz, Fatma
(2006), Assistant Professor; B.S., Bogazici University; M.S., Ph.D., University of Central Florida.

Graduate Faculty
Aalberts, Robert J.
(1991), Leid Professor; B.A., Bemidji State University; M.A., University of Missouri; J.D., Loyola University.
Brewer, Kathleen Pearl
(1993), Professor; B.S., M.S., Ph.D., Purdue University.
Jo, Ju-Yeon
(2006), Assistant Professor; B.S., Dongguk University; M.S., The University of Connecticut; Ph.D., Case Western Reserve University.
Palmer, Craig
(1995), Adjunct Professor; B.S., Brigham Young University; Ph.D., University of Missouri-Columbia.
Rice, Stephen
(1996), Professor; B.S., M.Engr., Ph.D., University of California, Berkeley.

Informatics addresses the impact technology has on people, the development of new uses for technology and the application of information technology in the context of another field. Information technology (IT) is rapidly changing the world, creating new challenges and opportunities every day. In fact, the impact of IT is so great that a new field, informatics, was created to study it. Informatics equips students to study IT, consider its social impact, and find ways to use technology to solve problems. Usually, informatics is used within another field, and a number of specializations are now identified, such as bioinformatics, cybersecurity, chemical informatics, human-computer interaction design, new media, and healthcare informatics.

The following are exemplars of new informatics areas:
- developing medical information system tools (Healthcare Informatics)
- digitizing the choreography of a play (Entertainment Informatics)
- understanding the human genome (BioInformatics)

In many ways, informatics is a bridge connecting IT to a particular field of study such as biology, chemistry, fine arts, telecommunications, geography, engineering, business, economics, journalism, etc. Because of this, all Informatics students choose a field or discipline that interests them (which we call a cognate). The cognate allows them to follow their own personal interests, and take courses in other programs at UNLV.

Some cognates lead to recently recognized disciplines, as ecology leads to eco-informatics. Other cognates lead to well-understood careers that are just now emerging as disciplines, such as fine arts leading to the design of interactive Internet Web sites, animations, digital motion pictures, and interactive art. For those interested in computers and programming, the computer science cognate adds further technology strength to our human-centered, problem solving curriculum.

Graduates from the School of Informatics will possess the skills to apply information technology deeply and effectively in related disciplines, referred to as cognate areas. These graduates will be ideally suited to achieve profound advances in these cognate areas. At the graduate level, the School of Informatics offers M.S. and Ph.D. degree programs in Informatics. Each degree program has different curriculum requirements.

Informatics M.S.

The objective of the M.S. in Informatics is to provide graduates with a balanced mix of theoretical and practical knowledge of Informatics. Graduates will be capable of assisting organizations of all sizes in leveraging information technology in other disciplines.

Admission Requirements
Admission to the program may be granted for either the Fall or Spring semester. Admission requirements include:
1. Online application to the Graduate College.
2. Bachelor's degree degree in informatics, computer science, information systems, information science or one of the cognate areas.
3. A minimum undergraduate GPA of 3.0 or a 3.25 for the last 2 years of undergraduate work is required.
4. GRE 1200 minimum with no less than 500 in either the verbal or quantitative test.
5. TOEFL minimums of 213 (Computer), 550 (paper), 80 (Internet) for international applicants.
6. Three letters of recommendation from former instructors or employers that address the applicant’s potential as a graduate student in the informatics area.
7. Academic transcripts.
8. Resume.
9. A personal statement of purpose, which should be as specific as possible, and should include the applicant's objectives and areas of interest(s).

Degree Requirements
The degree is comprised of 36 credits of coursework. Fifteen (15) credits comprise an essential set of core courses. Fifteen (15) credits address elective topics or pre-approved courses from cognate areas. Students must complete:

INF 790 - Informatics Project and:
INF 792 - Internship.

The informatics core courses include:

INF 700 - Theoretical Foundations of Informatics
INF 710 - Informatics Systems and Networks
INF 720 - Information Security
INF 730 - Human Computer Interaction
INF 740 - Digital Media Design, Technology and Representation

Notes:
* Master’s degree with “thesis-option” is also available. The thesis option would be consisted of the same coursework load as the “non-thesis option” except that at least 6 credits of M.S. thesis work would take the place of INF 790 Informatics Project and one of the Cognate or Informatics Elective Course.
* Students must meet a minimum 3.0 GPA for graduation. Students must also agree to abide by the Association for Computing Machinery’s “Code of Ethics and Professional Conduct” for computing professionals (http://www.acm.org/constitution/code.html).

Informatics Ph.D.

The objective of the Ph.D. in Informatics is to provide graduates with an extensive conceptual framework for, and background in Informatics and to prepare them to conduct research in the field.

Admission Requirements
In addition to the requirements of the Graduate College, applicants for admission to the Ph.D. program in Informatics must meet the following requirements.
1. Online application to the Graduate College.
2. Master's degree in informatics, computer science, information systems, information science, other closely related discipline, or one of the cognate areas. An unusually capable student with a Bachelor's degree may be admitted to work directly for the PhD degree.
3. A GPA of 3.3 or higher in post-baccalaureate course work.
4. GRE 1200 minimum with no less than 500 in either the verbal or quantitative test.
5. TOEFL minimums of 213 (Computer), 550 (paper), 80 (Internet) for international applicants.
6. Three letters of recommendation from former instructors or employers that address the applicant’s potential as a graduate student in the informatics area.
7. Academic transcripts.
8. A personal statement of purpose, which should be as specific as possible, and should include the applicant's objectives and areas of interest(s).
9. Resume

Degree Requirements
The Ph.D. degree is awarded to a candidate who has demonstrated breadth of knowledge in informatics in general, and has displayed depth of knowledge in the area of specialty as well as the ability to make original contributions to the body of knowledge in this field. To successfully complete the Ph.D. program a student must fulfill all the Graduate College degree requirements as well as the following requirements:
1. Complete a minimum of 81 credits of course work (or Master’s in Informatics + a minimum of 45 credits at PhD level)
2. Complete 18 credits of:
   INF 799 - Dissertation Research.
3. Complete 9 credits of Research Methods courses, 3 of which must be in Informatics.
4. Satisfactorily pass the written comprehensive examination.
5. Satisfactorily pass an oral qualifying examination.
6. Prepare a dissertation that must be acceptable to his or her Ph.D. committee.
7. Satisfactorily pass an oral defense of the dissertation examination.
8. Maintain a satisfactory rate of progress.

A student entering the Ph.D. program with a master’s degree in Informatics is required to take at least 45 credits of course work subject to the following conditions:
1. At least 15 credits must be in informatics (including 3 credit INF Research Methods).
2. At least 9 credits must be outside of informatics, i.e., in a cognate area (including 6 credit Research Methods).
3. At least 12 credits of informatics courses must be at the 700-level (excluding INF 799 credits).
4. Includes 18 credits of:
   INF 799 - Dissertation Research.
5. Includes 9 credits of Research Methods courses, 3 of which must be in Informatics.

Students must meet a minimum 3.0 GPA for graduation. Students must also agree to abide by the Association for Computing Machinery’s “Code of Ethics.
and Professional Conduct” for computing professionals (http://www.acm.org/constitution/code.html).

The Qualifying Examination
The qualifying examination is an oral examination designed to test the depth and breadth of the student’s knowledge in his or her area of research specialization. It must be taken before either (a) 2 years after passing the comprehensive examination or (b) 4 years after entering the Ph.D. program. It generally focuses on his/her dissertation proposal. The main purpose of this exam is to evaluate the technical merits and feasibility of the student’s proposal for his/her Ph.D. dissertation. The examination must be conducted by the student’s Ph.D. committee. This committee consists of five faculty members of whom one must be from outside the Proposed School of Informatics. The student’s advisor is the chairperson of this committee. The faculty member from outside the school is selected by the Graduate College from three faculty members who are suggested by the student in consultation with his or her advisor.

The student must prepare a dissertation proposal prior to taking this examination. This proposal should have already been approved by the student’s advisor. This proposal must be given to the Ph.D. Advisory Committee members at least two weeks before the date of the qualifying exam. The proposal must contain a discussion of the background literature on the problem area, description of the specific topic of research proposal approach, feasibility arguments, the objective of the research project, and a list of references.

The student begins the exam with a presentation of his or her dissertation proposal. The remaining time is used for discussion and asking questions to determine if the student has sufficient depth of knowledge to carry out the proposed research. The examination cannot be taken more than twice. After successful completion of the qualifying examination, the student is advanced to candidacy for the degree.

Preparation of Dissertation
The candidate must prepare a dissertation on his or her research. The Ph.D. dissertation should represent a significant original research contribution to the field of informatics.

Oral Defense
After completion of the dissertation the candidate must pass a final oral examination in defense of his/her dissertation. The candidate must make the final changes, if any, in the dissertation within three months from the date of the oral defense.

A candidate can defend his or her dissertation at most twice. The Ph.D. dissertation must be approved by each member of the student’s PhD Advisory Committee.

Satisfactory Progress
To maintain satisfactory progress in the Ph.D. program a student must:
1. Pass the comprehensive examination within 2.5 years of entering the Ph.D. program.
2. Maintain a minimum grade point average required by the Proposed School of Informatics.
3. Pass the qualifying examination within 4 years of entering the Ph.D. program.
4. Maintain satisfactory progress towards research.
5. Students must complete all requirements for the Ph.D. degree within six years.

If these requirements are not met the school may place the student on academic probation or drop him/her from the Ph.D. program.

Course Descriptions

INF 700 - Theoretical Foundations of Informatics
Credits 3
Overview of theoretical concepts in informatics, including first-order logic, computability theory, graph theory, sets and relations, combinatorial math, and statistics. Prerequisites: Consent of instructor.

INF 710 - Informatics Systems and Networks
Credits 3
In-depth study of various types of information systems and networks. Topics include: types of information systems; data and knowledge management; computer networks and the Internet; wireless and mobile network; e-business and e-commerce; network management. Prerequisites: Consent of instructor.

INF 720 - Information Security
Credits 3
Overview of the principles and the technologies behind information security. Topics include: risks and vulnerabilities; principles of information security; encryption; security mechanisms in information systems; administration of information security, information crime, and legal and ethical issues. Prerequisites: Consent of instructor.

INF 730 - Human Computer Interaction
Credits 3
Covers the fundamental concepts and techniques for design, implementation, and evaluation of human computer interfaces. Topics include Foundations of Human computer interaction, design and implementation techniques for graphical user interfaces, evaluation techniques, and different interface models. Prerequisites: Consent of instructor.
INF 731 - Advanced HCI - Design and Implementation
Credits 3
This course is organized around readings that reinforce the student's knowledge in Human Computer Interaction guidelines, principles, and theories and mainly around projects that allow students to apply theoretical knowledge to the design, implementation, and evaluation of interactive computer systems. **Prerequisites:** INF 730

INF 732 - Affectively Intelligent Systems
Credits 3
Focuses on computational emotion modeling which spawns from a variety of interest: improving basic understanding of the functional role of emotions in humans; integrating emotion recognition and prediction techniques; synthesizing emotion and expression of emotion to apply to synthetic characters, autonomous software agents or robots; understanding social implications of affective information and communication technology. **Prerequisites:** INF 700

INF 740 - Digital Media Design, Technology and Representation
Credits 3
Covers principles of design to visualize new media concepts in any medium. Exposes students to new and emerging digital media technologies and applications. **Prerequisites:** Consent of instructor.

INF 760 - Advanced Theoretical Foundations of Informatics
Credits 3
Advanced course to cover mathematical methods for information modeling, analysis, and manipulation. Requires various research article reading and discussions. Topics include proof techniques, first-order logic, computability theory, complexity theory, model theory, and statistics. **Prerequisites:** INF 700

INF 770 - Social Foundations of Informatics
Credits 3
Covers the relationships between social systems and information and communication technologies. Focuses on social factors that influence the organization of information technologies in social and organizational systems, and how the human social factors and technological tools mutually contribute to the field of Informatics. Prerequisite: Consent of instructor.

INF 780 - Special Topics in Informatics
Credits 3
Emphasis is on new developments and research in science, humanities, fine arts, and other domain informatics. **Prerequisites:** INF 700

INF 790 - Informatics Project
Credits 3
Advanced project in informatics. Note: May be repeated for different project topics, but only three credits will be applied to the student's program. **Prerequisites:** INF 700 and consent of instructor.

INF 792 - Internship
Credits 3
Supervised internship in business, industry, government, or educational institution providing practical experience to use skills and knowledge acquired in informatics and cognate course work. **Prerequisites:** INF 700 and consent of instructor.

INF 794 - Research Methods
Credits 3
Examination of research methods including: the scientific method, sampling, statistics, research design, analytical technique, literature review, technical writing, professional ethics, faculty research areas and potential topics for thesis. **Prerequisites:** INF 700

INF 795 - Independent Study in Informatics
Credits 1-6
Supervised independent work in a topic of Informatics. Note: May be repeated but no more than 6 credits will be allowed in the degree. Grading S/F grading only. **Prerequisites:** INF 700 and Instructor consent

INF 797 - Master's Thesis
Credits 1-6
Research analysis and writing towards completion of Master's thesis and subsequent defense. Note: May be repeated but no more than 6 credits will be allowed in the degree. Grading S/F grading only **Prerequisites:** INF 700 and Instructor consent

INF 799 - Dissertation Research
Credits 1 – 6
Research analysis and writing towards completion of dissertation and subsequent defense. Note: May be repeated but no more than eighteen credits will be allowed in the degree. **Prerequisites:** Passing the written comprehensive examination.

Mechanical Engineering

Chair
Trabia, Mohamed
(1987), Professor; B.S., M.S., Alexandria University; Ph.D., Arizona State University.

Graduate Coordinator
Yim, Woosoon
(1987), Professor; B.S., Hanyang University; M.S., Ph.D., University of Wisconsin-Madison.
Graduate Faculty
Boehm, Robert F.
(1990), Professor; B.S., M.S., Washington State University; Ph.D., University of California, Berkeley; P.E., California.

Chen, Yi-Tung
(1993), Associate Professor; B.S., Feng Chia University; M.S., Ph.D., University of Utah.

Cook, Daniel
(2005), Assistant Professor; B.S., Ohio State University; M.S., Ph.D., University of California, Berkeley.

Culbreth, William G.
(1985), Associate Dean of College of Engineering, Associate Professor; B.S., California State Polytechnic University, Pomona; M.S., Ph.D., University of California, Santa Barbara.

Mauer, Georg F.
(1986), Professor; Diploma-Ingenieur; Ph.D., Technical University of Berlin.

Moujaes, Samir F.
(1984), Professor; B.S., M.S., American University of Beirut; Ph.D., University of Pittsburgh; P.E., Nevada.

O’Toole, Brendan J.
(1992), Associate Professor; B.S., M.S., Ph.D., University of Delaware.

Pepper, Darrell W.
(1992), Professor; B.S., M.S., Ph.D., University of Missouri-Rolla.

Quan, Shizhi
(2005), Assistant Professor; B.S., Ph.D., Huazhong University of Science and Technology; Ph.D., University of Pennsylvania.

Reynolds, Douglas D.
(1983), Professor; B.S., Michigan State University; M.S., Ph.D., Purdue University.

Rice, Stephen
(1996), Associate Vice President for Research & Economic Development; B.S., M.Engr., Ph.D., University of California, Berkeley.

Roy, Ajit
(2001), Associate Professor; B.S., University of Calcutta, M.S., University of Aston, Ph.D., Case Western Reserve University.

Eric Sandgren
(2003), Professor and Dean; BSME, MSME, Ph.D. Purdue University

Wang, Zhiyoung
(1998), Associate Professor; B.S., M.S., Ph.D., Harbin University of Science and Technology.

Wells, William R.
(1986), Professor; B.S., Georgia Institute of Technology; M.A., Harvard University; M.S., Ph.D., Virginia Polytechnic Institute.

Among the subjects taught and researched by the faculty of the mechanical engineering program are the following:

Aerospace Engineering M.S.A.E.
The objectives of the M.S.A.E. degree are to provide a quality graduate educational program that will complement the existing undergraduate and graduate curricula in mechanical engineering. The aerospace graduate program will improve and enhance the capabilities of those students seeking careers in the aerospace field and supporting engineering work for the aerospace and aviation technology community. The majority of students seeking the M.S.A.E. degree will have undergraduate degrees in the fields of mechanical or aerospace engineering, or closely related fields of engineering, applied physics, or applied mathematics; some will already have graduate degrees in the more conventional areas of engineering or the sciences. Those individuals with engineering (as well as physical science) interests will use the M.S.A.E. to develop careers as well as improve their skills in the aerospace and aviation industry. Students enrolling in the program on a full-time basis will likely assist engineering faculty in obtaining sponsored project funding and performing innovative aerospace and aviation engineering research.

Admission Requirements
In addition to the general requirements for admission to the Graduate College, the applicant must have a bachelor’s degree in engineering or a closely related discipline. Students with non-engineering backgrounds will be required to complete a set of course work requirements that will assure successful completion of the M.S. specialization and qualify the student to sit for the Fundamentals of Engineering (FE) exam. The Graduate Program Committee (GPC) will decide upon special cases.
The Integrated BS-MS degree program is designed to provide high-achieving MEG undergraduate students with the opportunity to be exposed to graduate courses and to encourage them to continue with graduate degree by reducing the time needed for degree completion. Up to nine credit hours of approved graduate-level course work can be taken as technical electives for the grade of B or better during the senior year and those credit hours will be waived for the graduate degree. The following conditions are needed to enroll in the Integrated BS-MS program:

1. A minimum of two semesters of full-time enrollment in B.S. of Mechanical Engineering program is required.
2. Applications are normally submitted with two semesters remaining in the senior year.
3. A minimum of 90 credit hours of course work applicable to the B.S. of Mechanical Engineering degree with a cumulative GPA of 3.50 or higher must be completed before beginning the joint degree program.
4. Student has to choose the thesis option.

**Degree Requirements**

Procedures and requirements for the M.S.A.E. will be prescribed by the Graduate College under Academic Policies, with additional provisions as follows:

1. At least 15 credits must be from 700-level courses, and at least 15 credits must be from engineering courses.
2. Students may choose, subject to approval by the student’s graduate committee, one of the two options listed below.

**Thesis Option:** Requires 24 credits of approved graduate courses plus six credits of work associated with the master’s level thesis, for a total of 30 credits. The final examination will include a defense of thesis.

**Non-Thesis Option:** Requires 33 credits of approved graduate courses. At least 18 credits must be earned from 700-level courses, of which 15 must be in engineering. To complete the Non-Thesis option, students must also successfully complete the Design Project course (ME 796 - Design Project in Mechanical Engineering) or pass a comprehensive written and oral exit exam before receiving their degree.

3. Satisfactory progress is defined as filing an approved program before the completion of nine credits of course work, completion of at least six credits of the approved program per calendar year, maintenance of a GPA of 3.00 (4.00 scale), no grades below C, (C- is not acceptable) and compliance with the letter and spirit of the Graduate Catalog and published policies of the Howard R. Hughes College of Engineering. If progress is not satisfactory, probation and separation may result, in accordance with the rules of the Graduate College. Any student whose GPA falls below 3.00 will be placed on probation and will have one semester to raise it to 3.00 or above.

4. Only those courses in which a student received a grade of C or better may be used for graduate credit. Students must comply with Graduate College policy.

5. Each student’s program should show suitable breadth and coherence. As specified in the Graduate Catalog, the program of study will be developed by the student and advisor and filed with the Graduate College. Prior to filing, the program just receive approval by the student’s committee. An approved program must be filed before the completion of nine credits of course work after admission (regular or provisional). The responsibility rests with the student. Students will be dropped from the graduate engineering program if they neglect this requirement.

Students must choose three courses from the following list of courses:

- ME 700 - Advanced Fluid Mechanics I
- ME 701 - Advanced Fluid Mechanics II
- ME 702 - Computational Fluid Dynamics
- ME 705 - Conduction Heat Transfer
- ME 706 - Convective Heat Transfer
- ME 740 - Advanced Dynamics
- ME 741 - Energy and Variational Methods in Applied Mechanics I

In addition students must select at least two courses selected from the following list:

- ME 704 - Finite Element Applications in Mechanical Engineering
- ME 711 - Advanced Thermodynamics
- ME 717 - Transport Phenomena
- ME 720 - Acoustics I
- ME 721 - Acoustics II
- ME 725 - Vibrations I
- ME 726 - Vibrations II
- ME 729 - Advanced Robotics
- ME 774 - Introduction to Theory of Elasticity and Plasticity I
- ME 777 - Application of High-Performance Computing Methods in Science and Engineering

**Biomedical Engineering M.S.B.E.**

The objective of the M.S.B.E. degree program is to provide a graduate-level educational experience that will prepare individuals to undertake design and research in the area of biomedical engineering. The program is multidisciplinary and integrates knowledge from the traditional engineering sciences, the life sciences, and medicine. Specific goals of the program include development of 1.) a thorough grounding in the life sciences; 2.) mastery of engineering tools and approaches; 3.) familiarity with the problems of making and interpreting quantitative measurements of living systems; 4.) the ability to use modeling techniques; and 5.)
the ability to formulate and solve problems with medical relevance, including the design of devices, systems, and processes to improve human health.

Students are required to take a common core of introductory biomedical engineering and health science courses plus courses in at least one of the following areas: 1) biomechanics, ergonomics, and human factors; 2) imaging and instrumentation; or 3) fluid mechanics and transport processes.

**Admission Requirements**
In addition to the general requirements for admission to the Graduate College, an applicant for the M.S. program must complete the following requirements:

1. Application must be made to the Department of Mechanical Engineering. Applications must include all documentation as required by the Graduate College. The Department of Mechanical Engineering will admit the student and supervise the student’s M.S. program.
2. The applicant must have a bachelor’s degree in engineering or a closely related discipline. Students with non-engineering backgrounds will be required to complete a set of course work requirements that will assure successful completion of the M.S. specialization and qualify the student to sit for the Fundamentals of Engineering (FE) exam. The Graduate Program Committee (GPC) will decide upon special cases.
3. The applicant must submit a written statement of purpose indicating interests and objectives in working toward a M.S. degree. In addition, two letters of recommendation for the M.S.-level of study must be submitted. The statement and letters should be sent to the department.
4. Foreign applicants must take and obtain a satisfactory score of a minimum of 550 (213 computerized) on the TOEFL exam as required by the Graduate College.
5. The applicant must obtain a satisfactory score on the Graduate Record Exam (GRE) as determined by the GPC.
6. The GPC will examine the applicant’s academic record and will make the final determination of the applicant’s admissibility to the M.S. program. In general, a minimum postbaccalaureate GPA of 3.00 on a 4.00 scale or equivalent is required for admission in addition to a GPA of 3.00 on a 4.00 scale or equivalent in all engineering courses.
7. The UNLV Graduate College must formally admit the applicant.

**Integrated BS-MS Degree Program**
The Integrated BS-MS degree program is designed to provide high-achieving MEG undergraduate students with the opportunity to be exposed to graduate courses and to encourage them to continue with graduate degree by reducing the time needed for degree completion. Up to nine credit hours of approved graduate-level course work can be taken as technical electives for the grade of B or better during the senior year and those credit hours will be waived for the graduate degree. The following conditions are needed to enroll in the Integrated BS-MS program:

1. A minimum of two semesters of full-time enrollment in B.S. of Mechanical Engineering program is required.
2. Applications are normally submitted with two semesters remaining in the senior year.
3. A minimum of 90 credit hours of course work applicable to the B.S. of Mechanical Engineering degree with a cumulative GPA of 3.50 or higher must be completed before beginning the joint degree program.
4. Student has to choose the thesis option.

**Degree Requirements**
Procedures and requirements for the M.S.B.E. will be prescribed by the Graduate College under Academic Policies, with additional provisions as follows:

1. At least 15 credits must be from 700-level courses, and at least 15 credits must be from engineering courses. Students are required to take a common core of introductory biomedical engineering and health science courses plus courses in an area of specialization. The areas of specialization include 1) transport processes, 2) Imaging and Instrumentation, 3) biomechanics and human factors and:

**Biomedical Sciences Core**
All students must take at least two of the courses below (note that courses numbered below 600 do not count toward the hours required for the M.S.B.E. degree).

- BIO 209 Introduction to Cell Biology
- BIO 360 Mammalian Physiology
- CHE 225 Organic Chemistry I
- BIOL 730A-D - Special Lectures in Life Sciences
- KIN 738 - Human Physiology

**Transport Processes Option (T)**
Students in this option must take at least three courses from the following list:

- KIN 744 - Thermoregulation During Physical Work
- ME 616 - Introduction to Biomechanical Engineering or ME 416 Introduction to Bioengineering (T1)
- ME 700 - Advanced Fluid Mechanics I
- ME 702 - Computational Fluid Dynamics
- ME 704 - Finite Element Applications in Mechanical
- ME 706 - Convective Heat Transfer
- ME 710 - Transport Phenomena in Bioengineering
- ME 711 - Advanced Thermodynamics
Imaging and Instrumentation Option (I)
Students in this option must take at least three courses from the following list:
- CS 669 - Introduction to Digital Image Processing
- ECG 456 Introduction to Biomedical Signals & Systems (I1)
- ECG 656 Introduction to Biomedical Signals & Systems (II)
- ECG 731 - Theoretical Techniques in Electromagnetics
- ECG 732 - Advanced Engineering Electromagnetics II
- ECG 751 - Optical Electronics
- ECG 752 - Physical Electronics
- ECG 753 - Advanced Topics in Semiconductor Devices I
- ECG 756 - Advanced Topics in Semiconductor Devices II
- ECG 758 - Numerical Methods in Engineering

Biomechanics and Human Factors Option (B)
Students in this option must take at least three courses from the following list:
- ME 616 - Introduction to Biomechanical Engineering
- CEE 678 - Applied Finite Element Analysis
- CEE 767 - Human Factors in Transportation Engineering
- CEE 774 - Introduction to Theory of Elasticity and
- ME 774 - Introduction to Theory of Elasticity and Plasticity I
- CEE 776 - Experimental Techniques in Structural
- EGG 651 - Ergonomics
- KIN 736 - Biomechanical Applications in Kinesiology
- KIN 743 - Research Techniques in Biomechanics
- ME 625 - Robotics
- ME 653 - Mechanical Vibrations
- ME 643 - Design Techniques in Mechanical Engineering
- ME 646 - Composite Materials
- ME 670 - Experimental Mechanics of Materials
- ME 703 - Continuum Mechanics
- ME 725 - Vibrations I
- ME 726 - Vibrations II
- ME 727 - Engineering Optimization
- ME 729 - Advanced Robotics
- ME 746 - Experimental Design and Analysis of Digital
- Process Control Systems
- ME 740 - Advanced Dynamics
- ME 741 - Energy and Variational Methods in Applied
- Mechanics I
- ME 742 - Energy and Variational Methods in Applied
- Mechanics II

Additional Degree Requirements
2. Students may choose, subject to approval by the student’s graduate committee, one of the two options listed below:
   - **Thesis Option**: Requires 24 credits of approved graduate courses plus six credits of work associated with the master’s level thesis, for a total of 30 credits. The final examination will include a defense of thesis.
   - **Non-Thesis Option**: Requires 33 credits of approved graduate courses. At least 18 credits must be earned from 700-level courses, of which 15 credits must be in engineering.
3. Satisfactory progress is defined as filing an approved program before the completion of nine credits of course work, completion of at least six credits of the approved program per calendar year, maintenance of a GPA of 3.00 (4.00 scale), no grades below C, (C- is not acceptable) and compliance with the letter and spirit of the Graduate Catalog and published policies of the Howard R. Hughes College of Engineering. If progress is not satisfactory, probation and separation may result, in accordance with the rules of the Graduate College. Any student whose GPA falls below 3.00 will be placed on probation and will have one semester to raise it to 3.00 or above.
4. Only those courses in which a student received a grade of C or better may be used for graduate credit. Students must comply with Graduate College policy.
5. Each student’s program should show suitable breadth and coherence. As specified in the Graduate Catalog, the program of study will be developed by the student and advisor and filed with the Graduate College. Prior to filing, the program must receive approval by the student’s committee. An approved program must be filed before the completion of nine credits of course work after admission (regular or provisional). The responsibility rests with the student. Students will be dropped from the graduate engineering program if they neglect this requirement.

Materials & Nuclear Engineering M.S.M.N.E.
M.S.M.N.E. is intended to provide the student with a solid background in either applied nuclear science and engineering, with an emphasis in used fuel management, criticality, or radiation detection, or material science and engineering, with an emphasis in materials performance. The program consists of two master’s degree tracks: Materials Engineering and Nuclear Engineering. The materials engineering track consists of a core curriculum in material science, metallurgy, and materials performance, which is to be augmented by advanced-level classes in corrosion engineering, physical metallurgy, mechanical metallurgy, mechanics of materials, and nuclear materials. The nuclear engineering track consists of a core curriculum in applied nuclear science and engineering, coupled with advanced classes in the student’s subdiscipline.

Admission Requirements
In addition to the general requirements for admission to the Graduate College, an applicant for the M.S. in Materials and Nuclear Engineering program must complete the following requirements:
1. Application must be made to the Department of Mechanical Engineering. Applications must include all documentation as required by the Graduate College.
The Department of Mechanical Engineering will admit the student and supervise the student’s M.S. program.

2. The applicant must have a bachelor’s degree in engineering or a closely related discipline. Students with non-engineering backgrounds will be required to complete a set of course work requirements that will assure successful completion of the M.S. in Materials and Nuclear Engineering degree and qualify the student to sit for the fundamentals of Engineering (FE) exam. The Graduate Program Committee (GPC) will decide upon special cases.

3. The applicant must submit a written statement of purpose indicating interests and objectives in working toward a M.S. degree. In addition, two letters of recommendation for the M.S.-level study must be submitted. The statement and letters should be sent to the department.

4. Foreign applicants must take and obtain a satisfactory score of a minimum of 550 (213 computerized) on the TOEFL exam as required by the Graduate College.

5. The applicant must obtain a satisfactory score on the Graduate Record Exam (GRE) as determined by the GPC.

6. The GPC will examine the applicant’s academic record and will make the final determination of the applicant’s admissibility to the M.S. program. In general, a minimum postbaccalaureate GPA of 3.00 on a 4.00 scale or equivalent is required for admission in addition to a GPA of 3.00 on a 4.00 scale or equivalent in all engineering courses.

7. The UNLV Graduate College must formally admit the applicant.

**Integrated BS-MS Degree Program**

The Integrated BS-MS degree program is designed to provide high-achieving MEG undergraduate students with the opportunity to be exposed to graduate courses and to encourage them to continue with graduate degree by reducing the time needed for degree completion. Up to nine credit hours of approved graduate-level course work can be taken as technical electives for the grade of B or better during the senior year and those credit hours will be waived for the graduate degree. The following conditions are needed to enroll in the Integrated BS-MS program:

1. A minimum of two semesters of full-time enrollment in B.S. of Mechanical Engineering program is required.
2. Applications are normally submitted with two semesters remaining in the senior year.
3. A minimum of 90 credit hours of course work applicable to the B.S. of Mechanical Engineering degree with a cumulative GPA of 3.50 or higher must be completed before beginning the joint degree program.
4. Student has to choose the thesis option.

**Degree Requirements**

Procedures and requirements for the M.S. degree will be prescribed by the Graduate College under Academic Policies, with additional provisions as follows:

1. At least 15 credits must be from 700-level courses and six credits of thesis are required. The remaining nine credits may be taken at the 600 or 700 level. Students must choose one of the following tracks:

   a. **Materials Engineering Track** - Students must take three out of the following four courses:
      - ME 734 - Fracture of Engineering Materials
      - ME 732 - Mechanical Metallurgy
      - ME 741 - Energy and Variational Methods in Applied Mechanics I
      - ME 630 - Corrosion Engineering

   b. **Nuclear Engineering** – For the Nuclear Engineering Track, students must take three out of the following courses:
      - PHYS 631 - Nuclear and Elementary Particle Physics
      - RCDS 701 Applied Nuclear Physics
      - ME 655 - Fundamentals of Nuclear Engineering
      - ME 656 - Radioactive Waste Management
      - ME 706 - Convective Heat Transfer

**Suggested Electives for Materials Engineering Track**

- ME 742 - Energy and Variational Methods in Applied Mechanics II
- ME 650 - Physical Metallurgy
- ME 646 - Composite Materials
- ME 670 - Experimental Mechanics of Materials

**Suggested Electives for Nuclear Engineering Track**

- ME 702 - Computational Fluid Dynamics
- ME 705 - Conduction Heat Transfer
- ME 707 - Radiation Heat Transfer
- ME 708 - Convective Boiling and Condensation
- ME 711 - Advanced Thermodynamics
- ME 615 - Design of Thermal Systems

**Additional Degree Requirements**

2. Students may choose, subject to approval by the student’s graduate committee, one of the two options listed below.

   **Thesis Option**: Requires 24 credits of approved graduate courses plus six credits of work associated with the master’s level thesis, for a total of 30 credits. The final examination will include a defense of thesis.

   **Non-Thesis Option**: Requires 33 credits of approved graduate courses. At least 18 credits must be earned from 700-level courses, of which 15 must be in engineering. To complete the Non-Thesis option, students must also successfully complete the Design Project course: ME 796 - Design Project in Mechanical Engineering.
Engineering or pass a comprehensive written and oral exit exam before receiving their degree.
3. Satisfactory progress is defined as filing an approved program before the completion of nine credits of course work, completion of at least six credits of the approved program per calendar year, maintenance of a GPA of 3.00 (4.00 scale), no grades below C, (C- is not acceptable) and compliance with the letter and spirit of the Graduate Catalog and published policies of the Howard R. Hughes College of Engineering. If progress is not satisfactory, probation and separation may result, in accordance with the rules of the Graduate College. Any student whose GPA falls below 3.00 will be placed on probation and will have one semester to raise it to 3.00 or above.
4. Only those courses in which a student received a grade of C or better may be used for graduate credit. Students must comply with Graduate College policy.

Each student’s program should show suitable breadth and coherence. As specified in the Graduate Catalog, the program of study will be developed by the student and advisor and filed with the Graduate College. Prior to filing, the program must receive approval by the student’s committee. An approved program must be filed before the completion of nine credits of course work after admission (regular or provisional). The responsibility rests with the student. Students will be dropped from the graduate engineering program if they neglect this requirement.

Mechanical Engineering M.S.E.

The Master of Science degree is designed to give postbaccalurate students an in-depth understanding of a specific area within mechanical engineering.

Admission Requirements
In addition to the general requirements for admission to the Graduate College, an applicant for the M.S. program must complete the following requirements:
1. Application must be made to the Department of Mechanical Engineering. Applications must include all documentation as required by the Graduate College. The Department of Mechanical Engineering will admit the student and supervise the student’s M.S. program.
2. The applicant must have a bachelor’s degree in engineering or a closely related discipline. Students with non-engineering backgrounds will be required to complete a set of course work requirements that will assure successful completion of the M.S. specialization and qualify the student to sit for the Fundamentals of Engineering (FE) exam. The Graduate Program Committee (GPC) will decide upon special cases.
3. The applicant must submit a written statement of purpose indicating interests and objectives in working toward a M.S. degree. In addition, two letters of recommendation for the M.S.-level of study must be submitted. The statement and letters should be sent to the department.
4. Foreign applicants must take and obtain a satisfactory score of a minimum of 550 (213 computerized) on the TOEFL exam as required by the Graduate College.
5. The applicant must obtain a satisfactory score on the Graduate Record Exam (GRE) as determined by the GPC.
6. The GPC will examine the applicant’s academic record and will make the final determination of the applicant’s admissibility to the M.S. program. In general, a minimum postbaccalaureate GPA of 3.00 on a 4.00 scale or equivalent is required for admission in addition to a GPA of 3.00 on a 4.00 scale or equivalent in all engineering courses.
7. The UNLV Graduate College must formally admit the applicant.

Degree Requirements
Procedures and requirements for the M.S. will be prescribed by the Graduate College under Academic Policies, with additional provisions as follows:
1. At least 15 credits must be from 700-level courses, and at least 15 credits must be from engineering courses. Students must choose one of the following options and take at least three of the courses listed under each respective option:
   a. Dynamic Systems and Controls
      ME 625 – Robotics
      ME 629 - Computer Control of Machines and Processes
      ME 653 - Mechanical Vibrations
      ME 725 - Vibrations I
      ME 726 - Vibrations II
      ME 729 - Advanced Robotics
      ME 740 - Advanced Dynamics
      ME 741 - Energy and Variational Methods in Applied Mechanics I
      ME 746 - Experimental Design and Analysis of Digital Process Control Systems
   b. Fluid/Thermosciences
      ME 700 - Advanced Fluid Mechanics I
      ME 701 - Advanced Fluid Mechanics II
      ME 702 - Computational Fluid Dynamics
      ME 703 - Continuum Mechanics
      ME 704 - Finite Element Applications in Mechanical Engineering
      ME 705 - Conduction Heat Transfer
      ME 706 - Convective Heat Transfer
      ME 707 - Radiation Heat Transfer
      ME 708 - Convective Boiling and Condensation
      ME 710 - Transport Phenomena in Bioengineering
      ME 711 - Advanced Thermodynamics
      ME 714 - Computational Aspects of Solar Energy
      ME 717 - Transport Phenomena
   c. Materials and Mechanics

University of Nevada, Las Vegas
ME 641 - Advanced Mechanical Engineering Design
ME 643 - Design Techniques in Mechanical Engineering
ME 646 - Composite Materials
ME 732 - Mechanical Metallurgy
ME 734 - Fracture of Engineering Materials
ME 742 - Energy and Variational Methods in Applied Mechanics II
ME 741 - Energy and Variational Methods in Applied Mechanics I
ME 743 - Applied Dynamic Finite Element Analysis
e. Engineering Management
CEE 609 - Engineering Project Management
MBA 702 - Statistical Analysis
MBA 706 - Law, Regulations and Ethical Issues
MBA 707 - Organizational Behavior
MBA 710 - Applied Economic Analysis
MBA 715 - Market Opportunity Analysis
ME 626 - Manufacturing Processes
ME 727 - Engineering Optimization
ME 701 - Advanced Fluid Mechanics II
e. Mechanical and Environmental Systems
ME 618 - Air Conditioning Engineering Systems
ME 653 - Mechanical Vibrations
ME 634 - Noise Control
ME 700 - Advanced Fluid Mechanics I
ME 706 - Convective Heat Transfer
ME 720 - Acoustics I
ME 725 - Vibrations I
ME 726 - Vibrations II
ME 721 - Acoustics II
f. Nuclear Engineering
ME 630 - Corrosion Engineering
ME 655 - Fundamentals of Nuclear Engineering
ME 656 - Radioactive Waste Management
ME 705 - Conduction Heat Transfer
ME 707 - Radiation Heat Transfer
ME 708 - Convective Boiling and Condensation
g. Aerospace
ME 700 - Advanced Fluid Mechanics I
ME 701 - Advanced Fluid Mechanics II
ME 702 - Computational Fluid Dynamics
ME 705 - Conduction Heat Transfer
ME 706 - Convective Heat Transfer
ME 741 - Energy and Variational Methods in Applied Mechanics I
ME 740 - Advanced Dynamics
2. Students pursuing the engineering management option are required to choose the Non-Thesis Option listed below. Students pursuing the engineering management option are required to choose the Non-Thesis Option listed below. Students pursuing options other than the engineering management option may choose, subject to approval by the student’s graduate committee, one of the two options listed below.

Thesis Option: Requires 24 credits of approved graduate courses plus six credits of work associated with the master’s level thesis, for a total of 30 credits. The final examination will include a defense of thesis.

Non-Thesis Option: Requires 33 credits of approved graduate courses. At least 18 credits must be earned from 700-level courses, of which 15 credits must be in engineering.

3. Satisfactory progress is defined as filing an approved program before the completion of nine credits of course work, completion of at least six credits of the approved program per calendar year, maintenance of a GPA of 3.00 (4.00 scale), no grades below C, (C- is not acceptable) and compliance with the letter and spirit of the Graduate Catalog and published policies of the Howard R. Hughes College of Engineering. If progress is not satisfactory, probation and separation may result, in accordance with the rules of the Graduate College. Any student whose GPA falls below 3.00 will be placed on probation and will have one semester to raise it to 3.00 or above.

4. Only those courses in which a student received a grade of C or better may be used for graduate credit. Students must comply with Graduate College policy.

5. Each student’s program should show suitable breadth and coherence. As specified in the Graduate Catalog, the program of study will be developed by the student and advisor and filed with the Graduate College. Prior to filing, the program must receive approval by the student’s committee. An approved program must be filed before the completion of nine credits of course work after admission (regular or provisional). The responsibility rests with the student. Students will be dropped from the graduate engineering program if they neglect this requirement.

Mechanical Engineering Ph.D.

Admission Requirements
In order to be admitted to the Ph.D. program in Engineering in the field of Mechanical Engineering, a student must complete the following requirements:

1. Application must be made to the Department of Mechanical Engineering. Applications must include all documentation as required by the Graduate College. The Department of Mechanical Engineering will admit the student and supervise the student’s Ph.D. program.

2. The applicant must have a Master of Science in Engineering degree or equivalent with a major in mechanical engineering or a closely allied field. Students with nonengineering backgrounds will be required to complete a set of course work requirements that will assure successful completion of the Ph.D.
specialization and qualify the student to sit for the Fundamentals of Engineering (FE) exam. The Graduate Program Committee (GPC) will decide upon special cases.

3. The applicant must submit a written statement of purpose indicating interests and objectives in working toward a Ph.D. degree. In addition, three letters of recommendation for the Ph.D.-level study must be submitted. The statement and letters should be sent to the department.

4. Foreign applicants must take and obtain a satisfactory score of a minimum of 550 (213 computerized) on the TOEFL exam as required by the Graduate College.

5. The GPC will examine the applicant’s academic record and will make the final determination of the applicant’s admissibility to the Ph.D. program. In general, a minimum postbaccalaureate GPA of 3.20 on a 4.00 scale or equivalent is required for admission.

6. The applicant must obtain satisfactory scores on the Graduate Record Exam (GRE) as determined by the GPC.

7. The UNLV Graduate College must formally admit the applicant.

Degree Requirements
The degree requirements for the Ph.D. in Engineering in the field of Mechanical Engineering include the following:

1. A Doctoral Advisory Committee composed of at least five members of the UNLV graduate faculty is to be formed for the student. Three of these faculty must be from the Department of Mechanical Engineering, the fourth from a relevant supporting field, and a fifth as appointed by the Graduate College.

2. The program of study must be submitted by the second semester of study. The program of study is to be prepared by the student and his/her doctoral advisor, and must be approved by the student’s Doctoral Advisory Committee and the GPC.

3. Doctoral students must complete a minimum of 21 credit hours of course work beyond the degree of Master of Science in Engineering (M.S.) or equivalent. A minimum of 18 of these credits must be 700-level courses. The student’s Doctoral Advisory Committee may add other requirements in accordance with the individual’s background and area of study. All Ph.D. candidates must maintain a minimum overall grade point average (GPA) of 3.20 and a minimum GPA of 3.20 each semester. Ph.D. candidates who do not maintain an overall GPA of 3.20 and a GPA of 3.20 each semester will be placed on probation.

4. In addition to these course requirements, a minimum of 18 credits of Dissertation Research: ME 799 - Dissertation is also required.

5. In order to show breadth and depth of knowledge in his/her discipline, the doctoral student must pass either a written qualifying exam, or an oral qualifying exam, or both as determined by the student’s Doctoral Advisory Committee. Each student must choose one of the following areas as a major and another as a minor: Dynamics and Control, Fluid Mechanics, Material Science, Solid Mechanics and Mechanical Design, and Thermal Sciences. In addition, all students will be tested in Mathematics. These examinations are on the undergraduate senior level. They are prepared by the department. Qualifying exams are held every semester. The qualifying exams must be scheduled during the first year of study. The qualifying exam can be taken a maximum of two times. Failure to take the exam within the first year or failure to pass the exam in the second attempt will automatically result in terminating student from the program.

6. The doctoral student must pass a preliminary exam consisting of a written proposal for the dissertation research, followed by an oral defense of the proposal. The Doctoral Advisory Committee must approve the dissertation research proposal. The student is advanced to candidacy for the Ph.D. upon completion of all course work and approval of the dissertation before the Doctoral Advisory Committee.

7. All requirements for the Ph.D. are met upon the satisfactory completion of the proposed research, the submission of a satisfactory dissertation, and the successful oral defense of the dissertation before the Doctoral Advisory Committee.

Course Descriptions

ME 600 - Intermediate Fluid Mechanics
ME 602 - Computational Methods for Engineers
ME 611 - Engineering Thermodynamics II
ME 615 - Design of Thermal Systems
ME 616 - Introduction to Biomechanical Engineering
ME 618 - Air Conditioning Engineering Systems
ME 619 - Advanced HVAC and Energy Conservation Systems
ME 625 - Robotics
ME 626 - Manufacturing Processes
ME 627 - Manufacturing Systems
ME 629 - Computer Control of Machines and Processes
ME 630 - Corrosion Engineering
ME 634 - Noise Control
ME 641 - Advanced Mechanical Engineering Design
ME 642 - Advanced Mechanism Design
ME 643 - Design Techniques in Mechanical Engineering
ME 646 - Composite Materials
ME 650 - Physical Metallurgy
ME 650L - Physical Metallurgy Laboratory
ME 653 - Mechanical Vibrations
ME 655 - Fundamentals of Nuclear Engineering
ME 656 - Radioactive Waste Management
ME 660 - High School Mentoring for Engineering Design
ME 662 - Vehicle Design Projects
ME 670 - Experimental Mechanics of Materials
ME 680 - Gas Dynamics I
ME 682 - Aerodynamics
ME 695 - Special Topics in Engineering

Note: Graduate credit may be obtained for courses designated 600 or above. A full description of the courses listed above may be found in the UNLV Undergraduate Catalog under the corresponding 400 number. Credit at the 600-level normally requires additional work.

ME 700 - Advanced Fluid Mechanics I
Credits 3
Covers area of viscous laminar fluid flow. Presents concept of shear stresses and develops Navier-Stokes equation. Applications such as boundary layer flow studied as are some solutions of viscous fluid flow. Prerequisites: Graduate Standing or Instructor Consent

ME 701 - Advanced Fluid Mechanics II
Credits 3
Potential flow theory with emphasis on complex representations, conformal mapping, Schwarz Christoffel transformations, airfoils. Compressible flow, free shear layers, shock waves, compressible boundary layers, two- and three-dimensional supersonic flows. Prerequisites: ME 700 or consent of instructor.

ME 702 - Computational Fluid Dynamics
Credits 3
Application of numerical methods to solve highly nonlinear equations of motion and energy associated with fluid dynamics. Among other methods, finite difference and finite element methods discussed along with use of commercial software packages. Prerequisites: Graduate Standing or Instructor Consent

ME 703 - Continuum Mechanics
Credits 3
Matrices and tensors, stress deformation and flow, compatibility conditions, constitutive equations, field equations and boundary conditions in fluids and solids, applications in solid and fluid mechanics. Formerly (CEG 711) Prerequisites: Graduate Standing or Instructor Consent

ME 704 - Finite Element Applications in Mechanical Engineering
Credits 3
Finite Element Method used historically for structurally related problems. Advances in application and development of Finite Element Method particularly useful in fluid flow and heat transfer related problems. PC, workstation, and mainframe finite element computer codes used to assist students in solving fluid and heat transfer problems. Prerequisites: Graduate Standing or Instructor Consent

ME 705 - Conduction Heat Transfer
Credits 3
Designed to solve more advanced heat transfer problems by conduction. Analytical and numerical techniques in heat conduction covered. Review of elementary problems presented. Advanced analytical methods using Bessel functions, separation of variables and Laplace transforms, among others. Solutions using finite differences covered. Prerequisites: ME 314 and ME 445 or equivalent or consent of instructor.

ME 706 - Convective Heat Transfer
Credits 3
Conservation principles, fluid stresses and flux laws, boundary layer equation, laminar and turbulent heat flow inside tubes. Heat transfer in laminar and turbulent boundary layers. Influence of temperature dependent fluid properties and free-convection boundary layers. Prerequisites: Graduate Standing or Instructor Consent

ME 707 - Radiation Heat Transfer
Credits 3
Advanced engineering analysis of thermal radiation heat transfer. Spectral and gray-body analysis. Exchange of radiation between surfaces and through absorbing, emitting, and scattering media. Radiation combined with conduction and convection. Prerequisites: Graduate Standing or Instructor Consent

ME 708 - Convective Boiling and Condensation
Credits 3
Basic models, empirical treatments of two-phase flow. Introduction to convective boiling, subcooled boiling, void fraction and pressure drop in subcooled boiling, saturated boiling heat transfer, critical heat flux, condensation. Prerequisites: Graduate Standing or Instructor Consent

ME 710 - Transport Phenomena in Bioengineering
Credits 3
Transport phenomena in bioengineering at molecular, cellular and tissue levels. Topics include blood flow in large and small vessels, gas exchange in lung, biomass and heat transfer in microcirculation, ion transport across cell membrane, cell migration, renal transport, controlled drug delivery and transport in tumors. Prerequisites: Graduate Standing or Instructor Consent

ME 711 - Advanced Thermodynamics
Credits 3
Advanced concepts and laws of classical equilibrium thermodynamics as applied to engineering problems. Introduction to statistical thermodynamics. Prerequisites: Graduate Standing or Instructor Consent
ME 714 - Computational Aspects of Solar Energy
Credits 3
Theory and practice in the design of solar energy components and systems. Included are collectors, concentrators, receivers, storage, and power systems. Emphasis is on the simulation of transient systems. Prerequisites: Graduate Standing or Instructor Consent

ME 717 - Transport Phenomena
Credits 3
Momentum, energy, and mass transport at molecular motion, microscopic levels. Momentum flux tensors, heat flux vectors, and mass flux vectors. Transport in laminar or turbulent flow. Transport in isothermal or nonisothermal systems. Transport in single or multicomponent systems. Interface transport and chemical reaction. Prerequisites: Graduate Standing or Instructor Consent

ME 720 - Acoustics I
Credits 3
Introduction to wave motion and general solution techniques associated with wave equation; propagation of waves in solid media; one-dimensional acoustic waves, acoustic transmission phenomena, and propagation of sound outdoors. Prerequisites: Graduate Standing or Instructor Consent

ME 721 - Acoustics II
Credits 3
Three-dimensional sound waves; experimental measurement techniques associated with acoustics; acoustic filter theory; other advanced topics in acoustics. Prerequisites: ME 720

ME 725 - Vibrations I
Credits 3
Vibrations of systems with one-degree-of-freedom and more than one-degree-of-freedom. Methods for finding natural frequencies, discrete systems and continuous systems. Prerequisites: Graduate Standing or Instructor Consent

ME 726 - Vibrations II
Credits 3
Virtual work, Hamilton's principles, Lagrange's equation, influence coefficients, Green's function as applied to advanced vibration problems; vibration of continuous systems; modal analysis. Prerequisites: Graduate standing and ME 725.

ME 727 - Engineering Optimization
Credits 3
Introduction to optimization, univariate functions, multivariate functions, constrained optimality criteria, penalty method, constrained direct search, engineering case studies, linear programming. Prerequisites: Graduate Standing or Instructor Consent

ME 729 - Advanced Robotics
Credits 3
In-depth study of advanced automation concepts and robotic manipulators. Topics including 3-D kinematics, trajectory generation, compliance analysis, dynamic control of robotics along with concept of assembly operations and machine vision. Prerequisites: Graduate Standing or Instructor Consent

ME 732 - Mechanical Metallurgy
Credits 3
Behavior and response of metals to applied forces. Five areas covered: mechanical fundamentals, metallurgical fundamentals, materials testing, plastic forming of metals, and modes of failure. Prerequisites: Graduate Standing or Instructor Consent

ME 734 - Fracture of Engineering Materials
Credits 3
Stress-strain relationships during elastic and plastic deformation, linear elastic and elastic-plastic fracture mechanics, Griffith's theory, stress analyses of cracks, plastic zone size, fracture toughness measurements, ductile-to-brittle transition, fatigue failure mechanisms, environment assisted cracking and relevant test methods, metallographic evaluations using state-of-the-art techniques. Prerequisites: Graduate Standing or Instructor Consent

ME 736 - Diffusion in Metals
Credits 3
Covers thermodynamics and phase diagrams, interstitial and substitutional diffusion, diffusion in binary and ternary alloys, solidification, and diffusionless transformation in solids. Prerequisites: ME 301 and 302 or equivalent.

ME 740 - Advanced Dynamics
Credits 3
Applications of Lagrangian and Newtonian mechanics to mechanical systems. Includes kinematics, moving reference frames, rigid body dynamics, oscillations and mode forms, and gyroscopic effects. Prerequisites: Graduate Standing or Instructor Consent

ME 741 - Energy and Variational Methods in Applied Mechanics I
Credits 3
Governing equations of mechanics, energy and variational principles, variational methods of approximation, theory of elasticity, material laws, work and energy, beam theory, finite element method, structural systems. Prerequisites: Graduate Standing or Instructor Consent
ME 742 - Energy and Variational Methods in Applied Mechanics II
Credits 3
Theoretical principles for solving solid mechanics problems. Direct continuation of ME 741. Topics covered include: computational solution methods to governing equations, free vibration and forced response of elastic systems, stability analysis, solution methods to governing equations, free vibration and forced response of elastic systems, stability analysis, solution methods for beams, plates, and structural systems. Prerequisites: ME 741

ME 743 - Applied Dynamic Finite Element Analysis
Credits 3
Overview of the development of dynamic computational analysis, software description, modeling techniques, symmetry and boundary conditions, initial conditions, contact algorithms, wave propagation, material behavior, implicit analysis, damping, mass scaling, mesh adaptation, element selection, hourglassing, postprocessing, output control, restarts, parallel processing, Eulerian and ALE methods. Prerequisites: Graduate standing in engineering or consent of instructor.

ME 746 - Experimental Design and Analysis of Digital Process Control Systems
Credits 3
Applications, design, and experimental practice of mechanical linear and discrete systems: hydraulic, pneumatic, elastic multibody systems, centripetal and coriolis effects, automatic model and code generation. Discrete nonlinear control systems modeling, simulation, design using state space methods. Aspects of system identification, robust and optimal control. Same as (EGG 746) Prerequisites: Graduate Standing or Instructor Consent

ME 747 - Orthopedic Biomechanics - Lower Extremities and Spine
Credits 3
Biomechanics of the lower extremities and spine; engineering properties and physiology of bone, cartilage, and tendon; analysis of gait; effects of orthopedic impairment and injury; design and surgical implantation of prosthetic joints and fracture fixation devices; engineering of tissue regeneration and replacement. Same as (EGG 747) Prerequisites: Graduate standing in engineering or kinesiology or consent of instructor.

ME 748 - Prosthetic Systems Engineering
Credits 3
Engineering design of prosthetic feet, ankles, knees, and prehension devices; materials and manufacturing; the biomechanics of movement using a prosthesis; residual limb morphology and surgical enhancements; socket design and tissue response; myoelectric devices; microprocessor control; psychophysical and motor control considerations; aspects of clinical science. Emphasis on R&D needs. Same as (EGG 748) Prerequisites: Graduate standing in engineering or kinesiology or consent of instructor.

ME 750 - Analysis of Human Movement
Credits 3
Analysis of the kinematics and kinetics of human movement in two and three dimensions with emphasis on methods used in motion capture, including joint and segment position; acceleration, velocity, force and torque; work and power; and inverse solution methods. Same as (EGG 750) Prerequisites: Graduate standing in engineering or kinesiology or consent of instructor.

ME 752 - Advanced Air Pollution Control
Credits 3
Fundamental chemical and physical principles of generation and control of air pollutants, and applications to pollution control equipment. Pollutant and particle formation during combustion. Gas adsorption and absorption fundamentals and tower/column design. Pollution control strategies. Prerequisites: Graduate Standing or Instructor Consent

ME 759 - Mass Transfer in Environmental Systems
Credits 3
Fundamentals of mass transfer by diffusion and advection. Solutions to steady-state and transient problems in several dimensions. Note: Applications to natural and engineered systems. Prerequisites: Graduate Standing or Instructor Consent

ME 774 - Introduction to Theory of Elasticity and Plasticity I
Credits 3
Introduction to theoretical and applied elasticity and plasticity theory-solutions to engineering problems in structural mechanics and geotechnical engineering. Response of isotropic, orthotropic and layered media to applied stresses and strains. Prerequisites: Graduate Standing or Instructor Consent
INDEX

A

About UNLV, 7
Academic Integrity, 16
Academic Policies, 16
Accounting, 30
Accounting M.S., 31
Accounting, Advanced Graduate Certificate, 32
Accounting, Graduate Certificate, 32
Addiction Studies Certificate, 64
Adding or Dropping Classes, 14
Administrative Drops and Classroom Conduct, 19
Admission & Registration Information, 11
Admission Process, 12
Admission Requirements, 11
Admission Requirements and Procedures for International Applicants, 11
Admission Status and Classification of Students, 13
Advancement to Candidacy, 23
Allied Health Sciences, School of, 215
Alumni Association Scholarships, 29
Annual Jeanne Clery Campus Safety and Security Report, 1
Anthropology, 296
Anthropology M.A., 297
Anthropology Ph.D., 298
Application for Graduation, 23
Application Procedures for Domestic and International Applicants, 11
Architecture, School of, 183
Art, 189
Astronomy M.S., 393
Astronomy Ph.D., 394
Audit Fee, 24

B

Barrick Graduate Fellowships, 28
Biochemistry M.S., 360
Biological Sciences M.S., 377
Biological Sciences Ph.D., 378
Biomedical Engineering M.S.B.E., 173
Board of Regents, 1
Business Administration, 33
Business Administration & Dental Medicine Dual M.B.A./D.M.D., 36
Business Administration & Hotel Administration Dual M.B.A./M.S., 36
Business Administration & Juris Doctor Dual M.B.A./J.D., 37
Business Administration & Management Information Systems Dual M.B.A./M.S., 38
Business Administration Executive E.M.B.A., 39
Business Administration M.B.A., 40
Business Administration, The Master of, 35

C

Cancellation of Courses and Programs, 15
Cancellation of Registration, 15
Change of Department, 15
Chemistry, 359
Chemistry M.S., 360
Civil & Environmental Engineering, 138
Clinical Mental Health Counseling M.S., 64
Clinical Psychology, 334
College of Business, 30
Commencement, 24
Communication Studies, 401
Communication Studies M.A., 401
Community Health Sciences, School of, 233
Comprehensive and Final Examinations, 22
Computer Science M.S.C.S., 148
Computer Science Ph.D., 149
Computer Science, School of, 148
Conditional Admission, 13
Construction Management, 154
Construction Management M.S.C.M., 154
Continuous Enrollment, 18
Counselor Education, 62
Counselor Education, Advanced Graduate Certificate Programs, 63
Course Numbers, 15
Creative Writing M.F.A, 306
Credit Requirements, 17
Credit toward Degree, 17
Criminal Justice, 403
Criminal Justice Professional M.A, 404
Criminal Justice Traditional M.A., 405
Curriculum & Instruction, 67
Curriculum & Instruction Ed.D., 72
Curriculum & Instruction Ed.S., 72
Curriculum & Instruction M.Ed. & M.S., 70
Curriculum & Instruction Ph.D., 73

D
Deferred Payment Option, 26
Degree Programs, 4
Delinquent Accounts, 26
Dental Medicine, School of, 248
Disclosures, 1
Doctoral Degree Students, 18
Dropping/Withdrawing From Classes, 14
Dual Degrees
  M.B.A. or M.I.S. & M.S. in Hotel Administration, 263

E
Economics, 47
Economics M.A., 47
Education, College of, 60
Educational Leadership, 89
Educational Leadership Ed.D. in PK-12 Education Leadership, 92
Educational Leadership Ed.S., 92
Educational Psychology, 106
Educational Psychology & Juris Doctor Dual Ph.D./J.D., 107
Educational Psychology M.S., 108
Educational Psychology Ph.D., 108
Electrical & Computer Engineering, 157
Electrical Engineering M.S.E.E., 158
Employment, 29
Engineering M.S.E., 139
Engineering Ph.D., 140
Engineering, Howard R. Hughes College of, 137
English, 305
English Ph.D., 308
Environmental & Occupational Health, 238
Environmental & Occupational Health M.P.H., 238
Environmental and Public Affairs, School of, 408
Environmental Studies, 408
Equal Opportunity Statement, 9
Ethics and Policy Studies, 328
Ethics and Policy Studies M.A., 329
Executive Crisis and Emergency Management M.S., 412
Executive Leadership Cohort Ed.D., 93
Exercise Physiology M.S., 220
Experimental Psychology, 336

F
Federal Direct Stafford Loans, 27
Federal Loan Programs, 27
Federal Perkins Loans, 27
Federal Work Study, 29
Film, 191
Final Research/Creative Documents, 21
Finance, 51
Finance Graduate Certificate, 51
Financial Assistance, 27
Fine Arts, College of, 183
Foreign Languages, 313
Foreign Languages M.A., 314
Forensic Social Work Certificate, 427

G
Geoscience, 366
Geosciences M.S., 367
Geosciences Ph.D., 369
Good Neighbor Counties, 25
Good Neighbor Regulations for Reduced Nonresident Tuition, 24
Grade Changes, 16
Grade Point Average, 18
Grading System, 15
Graduate and Professional Student Association, 10
Graduate Assistantships, 27
Graduate College, The UNLV, 9
Graduate Credit, 17
Graduate Program Examinations, 22
Graduate Provisional, 13
Graduate Scholarships and Fellowships, 28
Graduate Standing, 13
Graduate Tuition and Fees, 24
Graduation Procedures, 23
Granting of Degrees, 23
Grants-in-Aid, 26
Group Health and Accident Insurance Fee, 25

H
Health Care Administration & Policy, 241
Health Care Administration M.H.A., 242
Health Physics & Diagnostic Sciences, 215
Health Physics M.S., 216
Health Promotion, 244
Health Promotion M.Ed., 245
Health Sciences, Division of, 215
Higher Education Leadership M.Ed., 94
Higher Education Leadership Ph.D., 94
History, 317
History M.A., 320
History Ph.D., 318
Hospitality Administration - Executive Program (Online) M.H.A., 264
Hospitality Administration Ph.D., 266
Hotel Administration M.S., 267
Hotel Administration, William F. Harrah College of, 261

I
I or Incomplete Grade, 15
Immunization Requirement, 14
Informatics M.S., 168
Informatics Ph.D., 169
Informatics, School of, 168

J
James F. Adams/GPSA Scholarships, 29
Job Location and Development, 29
Journalism & Media Studies M.A., 419
Journalism & Media Studies, Hank Greenspun Schoo of, 419
Juris Doctor Dual Programs, 281
Juris Doctor/Doctor of Philosophy in Education (JD/PhD), 283
Juris Doctor/Master of Business Administration (JD/MBA), 281
<table>
<thead>
<tr>
<th>Page</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>219</td>
<td>Kinesiology &amp; Nutrition Sciences, 219</td>
</tr>
<tr>
<td>220</td>
<td>Kinesiology M.S., 220</td>
</tr>
<tr>
<td>279</td>
<td>Law, William S. Boyd School of, 279</td>
</tr>
<tr>
<td>109</td>
<td>Learning &amp; Technology Ph.D., 109</td>
</tr>
<tr>
<td>18</td>
<td>Leave of Absence, 18</td>
</tr>
<tr>
<td>296</td>
<td>Liberal Arts, College of, 296</td>
</tr>
<tr>
<td>376</td>
<td>Life Sciences, School of, 376</td>
</tr>
<tr>
<td>18</td>
<td>Limitation on Credit Load, 18</td>
</tr>
<tr>
<td>52</td>
<td>Management, 52</td>
</tr>
<tr>
<td>54</td>
<td>Management Information Systems, 54</td>
</tr>
<tr>
<td>54</td>
<td>Management Information Systems &amp; Business Administration Dual M.S./M.B.A., 54</td>
</tr>
<tr>
<td>55</td>
<td>Management Information Systems &amp; Hotel Administration Dual M.S., 55</td>
</tr>
<tr>
<td>57</td>
<td>Management Information Systems M.S., 57</td>
</tr>
<tr>
<td>52</td>
<td>Management, Graduate Certificate in, 52</td>
</tr>
<tr>
<td>421</td>
<td>Marriage &amp; Family Therapy, 421</td>
</tr>
<tr>
<td>422</td>
<td>Marriage &amp; Family Therapy Certificate, 422</td>
</tr>
<tr>
<td>423</td>
<td>Marriage &amp; Family Therapy M.S., 423</td>
</tr>
<tr>
<td>18</td>
<td>Master’s Degree Students, 18</td>
</tr>
<tr>
<td>382</td>
<td>Mathematical Sciences, 382</td>
</tr>
<tr>
<td>383</td>
<td>Mathematical Sciences M.S., 383</td>
</tr>
<tr>
<td>385</td>
<td>Mathematical Sciences Ph.D., 385</td>
</tr>
<tr>
<td>41</td>
<td>MBA Program, Accelerated, 41</td>
</tr>
<tr>
<td>28</td>
<td>McNair Post-Baccalaureate Scholarship, 28</td>
</tr>
<tr>
<td>171</td>
<td>Mechanical Engineering, 171</td>
</tr>
<tr>
<td>177</td>
<td>Mechanical Engineering M.S.E., 177</td>
</tr>
<tr>
<td>178</td>
<td>Mechanical Engineering Ph.D., 178</td>
</tr>
<tr>
<td>64</td>
<td>Mental Health Counseling Certificate, 64</td>
</tr>
<tr>
<td>193</td>
<td>Music, 193</td>
</tr>
<tr>
<td>194</td>
<td>Music M.M., 194</td>
</tr>
<tr>
<td>196</td>
<td>Musical Arts D.M.A., 196</td>
</tr>
<tr>
<td>2</td>
<td>Neal J. Smatresk, Message from the UNLV President, 2</td>
</tr>
<tr>
<td>14</td>
<td>Nevada Residency, 14</td>
</tr>
<tr>
<td>24</td>
<td>Nevada Residency for Tuition Purposes, 24</td>
</tr>
<tr>
<td>24</td>
<td>Nevada Residency, Applying for, 24</td>
</tr>
<tr>
<td>1</td>
<td>Nevada System of Higher Education, 1</td>
</tr>
<tr>
<td>53</td>
<td>New Venture Management Graduate Certificate, 53</td>
</tr>
<tr>
<td>14</td>
<td>Non-Degree Student, 14</td>
</tr>
<tr>
<td>413</td>
<td>Nonprofit Management Certificate, 413</td>
</tr>
<tr>
<td>24</td>
<td>Nonresident Tuition, 24</td>
</tr>
<tr>
<td>256</td>
<td>Nursing Education Post-Masters Certificate, 256</td>
</tr>
<tr>
<td>251</td>
<td>Nursing M.S.N., 251</td>
</tr>
<tr>
<td>254</td>
<td>Nursing Ph.D., 254</td>
</tr>
<tr>
<td>249</td>
<td>Nursing, School of, 249</td>
</tr>
<tr>
<td>29</td>
<td>On-Campus Employment, 29</td>
</tr>
<tr>
<td>23</td>
<td>Oral Defense, 23</td>
</tr>
<tr>
<td>256</td>
<td>Pediatric Nurse Practitioner Certificate, 256</td>
</tr>
<tr>
<td>224</td>
<td>Physical Therapy, 224</td>
</tr>
<tr>
<td>224</td>
<td>Physical Therapy D.P.T., 224</td>
</tr>
<tr>
<td>392</td>
<td>Physics &amp; Astronomy, 392</td>
</tr>
<tr>
<td>394</td>
<td>Physics M.S., 394</td>
</tr>
<tr>
<td>394</td>
<td>Physics Ph.D., 394</td>
</tr>
<tr>
<td>326</td>
<td>Political Science, 326</td>
</tr>
<tr>
<td>327</td>
<td>Political Science M.A., 327</td>
</tr>
<tr>
<td>328</td>
<td>Political Science Ph.D., 328</td>
</tr>
<tr>
<td>28</td>
<td>President’s Graduate Fellowships, 28</td>
</tr>
<tr>
<td>18</td>
<td>Probation and Separation, 18</td>
</tr>
<tr>
<td>22</td>
<td>Professional or Scholarly Papers or Projects, 22</td>
</tr>
<tr>
<td>7</td>
<td>Program Accreditations, 7</td>
</tr>
<tr>
<td>334</td>
<td>Psychology, 334</td>
</tr>
<tr>
<td>334</td>
<td>Psychology Ph.D., 334</td>
</tr>
</tbody>
</table>
Public Administration, 411
Public Administration M.P.A., 413
Public Health M.P.H., 234
Public Health Ph. D., 235
Public Management Certificate, 414

Q
Qualifying Examinations, 22
Qualifying for Nevada Residency, 24

R
R.N. to M.S.N. Pathway, 250
Radiochemistry Ph.D., 362
Recreation & Sport Management, 276
Refund of Fees, 26
Registration Policies, 14
Repeat Policy, 15
Requirements for Domestic Applicants, 11
Research & Graduate Studies, Division of, 9
Reserving Courses for Graduate Credit, 14
Residence Credit Requirement, 17
Residency Decisions, 24
Revocation of Admission, 13
Room and Board Refund, 26

S
S or F (Satisfactory or Failing) Grades, 16
Scholarships, 29
School Counseling M.Ed., 64
School Psychology, Education Specialist in, 107
Sciences, College of, 358
Second Admission or Readmission to the Graduate College, 13
Services for Graduate Students, 10
Six-Year and Eight-Year Policy, 18
Social Work & Juris Doctor Dual M.S.W./J.D., 428
Social Work M.S.W., 429
Social Work, School of, 426
Sociology, 342
Sociology (Bachelor’s to Doctorate Program) Ph.D., 342
Sociology (Post - M.A. Program) Ph.D., 346
Sociology M.A., 348
Spanish, Hispanic Studies M.A., 314
Special Education, 116
Special Education Ed.D., 118
Special Education Ed.S., 118
Special Education M.Ed./M.S., 117
Special Education Ph.D., 120
Special Fees and Charges, 25
Sport and Leisure Service Management M.S., 276
Sports Education Leadership, 131
Sports Education Leadership M.Ed., 131
Sports Education Leadership M.S., 132
Sports Education Leadership Ph.D., 133
Student Financial Services, 27
Student Health Fee, 25
Summer Session Scholarships, 29
Symbols, Grade, 15

T
Teacher Education Ph.D., 74
The Degree Program, 21
Theatre, 207
Theatre M.A., 208
Theatre M.F.A., 208
Thesis and Dissertation, 21
Transcripts of Credit, 16
Transfer Credit Limitations: After Admission and Enrollment, 17
Transfer Credit Limitations: Prior to Admission and Enrollment, 17
Transfer Work, 13
Transportation M.S.T., 141
Tuition & Fees, 24
Undergraduates Taking Graduate-Level Courses, 14

U
Unit of Credit, 15
Urban Affairs, Greenspun College of, 400

W
Water Resources Management, 398
Water Resources Management M.S., 399
Web Resources, 6
Women's Studies, 355
Workforce Education & Development M.S. or M.Ed., 96

X
X (Hold) Grade, 16

Y
Your Graduate School Experience, 10