ORTHOTICS AND PROSTHETICS — M.S.O.P. (ENTRY LEVEL)

Program director
Heather Appling

The entry-level Master of Science in Orthotics and Prosthetics (M.S.O.P.) degree is for individuals who wish to enter the profession of orthotics and prosthetics at the 2012 NCOPE-mandated level. The professional course work at this University is 10 quarters, which includes a quarter of 500 hours of clinical affiliation supervised by the professional development committee.

The curriculum for the entry-level Master of Science in Orthotics and Prosthetics degree is designed to provide the student with the knowledge, behaviors, and skills required for entry into the clinical practice of orthotics and prosthetics residency according to NCOPE's published 2010 standards of the profession.

Students who enter with a previous bachelor's degree will be granted the Master of Science Orthotics and Prosthetics degree upon completion of the curriculum. Students who enter the program without a previous bachelor's degree will be granted a Bachelor of Science degree in health sciences and a Master of Science in Orthotics and Prosthetics degree upon completion of the curriculum.

Professional association

Students and graduates are eligible for membership in the American Academy of Orthotics and Prosthetics (AAOP). The objective of the association is to foster development and improvement of service and education. This organization grants student membership at a nominal cost to students of approved schools. The student is required to become a member of this association while in the program, and is encouraged to read the Journal of Orthotics and Prosthetics and attend AAOP-sponsored or AAOP-approved local or national meetings.

Professional practice requirements

Satisfactory completion of entry-level M.S.O.P. degree curriculum requirements qualifies the student to enter an NCOPE-accredited residency site of his/her choice. After completing a 12-month prosthetic and a 12-month orthotic residency, or an 18-month combined ortho-prosthetic residency, the resident then is eligible to sit for the certification examination offered by the American Board of Certification in Orthotics and Prosthetics (ABC). Passing the ABC examination will earn certification in orthotics, certification in prosthetics, or dual certification as a prosthettist-orthotist. In addition to the certification, and depending on the state where the certified practitioner intends to practice, it may be necessary for the student to pass a state licensure examination in order to practice his or her profession.

Clinical experience

Supervised clinical experience is obtained in a variety of settings during the program through clinical rotations and weekly grand rounds. These ongoing, weekly clinical rotations are an essential part of a student's academic and professional requirements and prepare the student for the 10th quarter clinical affiliations required for the completion of the entry-level M.S.O.P. degree curriculum.

All clinical assignments will be made by the academic coordinator for clinical education. Because of the limited number of local facilities available, assignments cannot be made on the basis of the student’s family/marital status or personal preferences. Although the department makes an effort to accommodate the student’s preference, the student agrees to accept the clinical assignments made by the department at any of the affiliated facilities.

Program learning outcomes

By the end of this program, the graduate should be able to:

1. Exercise keen insight, progressive care, and critical judgment through careful evaluation in clinical care, skills application, and thinking throughout the profession.
2. Adhere to guiding principles and recognized ethics of the profession.
3. Value and apply new technology, investigations, and knowledge to patient care and the profession through a commitment to discovery and education.
4. Examine the importance of embracing and serving the unmet and ever-changing needs of a diverse world.
5. Participate in teamwork within and across disciplines in all aspects of the profession.

Accreditation

Accreditation for the entry-level Master of Science in Orthotics and Prosthetics degree was granted on September 23, 2013, by the National Commission on Orthotic and Prosthetic Education (NCOPE), 330 John Carlyle Street, Suite 200, Alexandria, VA 22314; telephone: 703/836-7114; website: <http://www.ncope.org/> in collaboration with the Commission on Accreditation of Allied Health Education Programs (CAAHEP), 25400 U.S. Highway 19 North, Suite 158, Clearwater, FL 33763; telephone: 727/210-2350, website: <https://www.caahep.org/>.

Admissions

Admission is based on a selective process. In addition to Loma Linda University (http://llucatalog.llu.edu/about-university/admission-policies-information/#admissionrequirementstext) and School of Allied Health Professions admissions requirements (http://llucatalog.llu.edu/allied-health-professions/#admissionrequirementstext), the applicant must also complete the following requirements:

- must have completed a minimum of 64 semester or 96 quarter credit units at a regionally accredited college or university
- a minimum G.P.A. of 3.0 in both science and non-science courses.
- It is also advisable for the student to complete 80 hours of volunteer field experience at an orthotics and prosthetics facility of his or her choice, and to obtain a letter of attestation from the facility owner or clinical supervisor.

The following prerequisites and general education courses will provide the knowledge, behavior, and skills required of students in a professional curriculum in the orthotics and prosthetics program. Individuals who already have an earned bachelor’s degree in any field from a regionally accredited institution need to complete only the prerequisites denoted with an asterisk (*). The minimum subject admission requirements are listed below.
Note: Grades of C- and below are not transferable for credit.

Domain 1: Religion and Humanities (20 quarter/14 semester units, minimum)

Humanities (14 quarter/10 semester units minimum)

Humanities to include one course in each of the following areas: history, philosophy, and a third area selected from the following:
- Fine arts
- Literature
- Modern language
- Performing/visual arts (not to exceed four quarter units)

Religion

Religion is required only if a student attended a Seventh-day Adventist college or university for a portion of his/her prerequisites—four quarter units of religion per year. A maximum of eight quarter units may apply toward Domain I.

Domain 2: Scientific Inquiry and Analysis

Encompasses both the natural and social sciences.

Natural Sciences—All courses are required, credits may vary
- *Human anatomy with laboratory
- *Physiology
- *Chemistry with laboratory
- *Physics with laboratory
- *Statistics

Social Sciences—Required (12 quarter/8 semester units, minimum)

General psychology
- *Growth and developmental or abnormal psychology

Domain 3: Communication (9 quarter/6 semester units, minimum)

English

Complete sequence in English composition that meets the baccalaureate degree requirements

One course in basic communication skills (speech)

Domain 4: Health and Wellness (3 quarter/2 semester units, minimum)

Two activity courses in physical education

Domain 5: Electives

Courses in Domain 5: Electives can be used to meet the minimum number of units (96 quarter/64 semester units) required for admission.

* Individuals who have received a bachelor's degree from a regionally accredited college or university need to complete only the prerequisites denoted with an asterisk (*).

For total unit requirements for graduation, see LLU General Education Requirements (http://llucatalog.llu.edu/about-university/division-general-studies/#courserequirementstext).

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Program requirements

**Junior Year**

**Spring Quarter**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>AHCJ 320</td>
<td>ADL and Assistive Devices</td>
<td>3</td>
</tr>
<tr>
<td>AHRM 472</td>
<td>Statistics and Research for Health Professionals I</td>
<td>3</td>
</tr>
<tr>
<td>ORPR 330</td>
<td>Lower Extremity Orthotics I</td>
<td>3</td>
</tr>
<tr>
<td>ORPR 340</td>
<td>Lower Extremity Prosthetics I</td>
<td>3</td>
</tr>
<tr>
<td>ORPR 405</td>
<td>Gait Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ORPR 410</td>
<td>Orthotic and Prosthetic Clinical Rotation</td>
<td>1</td>
</tr>
<tr>
<td>RELT 423</td>
<td>Loma Linda Perspectives</td>
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**Autumn Quarter**

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<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>AHCJ 362</td>
<td>Anatomy</td>
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<tr>
<td>AHCJ 375</td>
<td>Physiology</td>
<td>3</td>
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<tr>
<td>ORPR 301</td>
<td>Orthotics and Prosthetics Laboratory and Technical Skills</td>
<td>3</td>
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<tr>
<td>ORPR 305</td>
<td>Orthotic Fitting Techniques</td>
<td>3</td>
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<tr>
<td>ORPR 310</td>
<td>Patient Management, Assessment, and Documentation</td>
<td>3</td>
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<tr>
<td>ORPR 410</td>
<td>Orthotic and Prosthetic Clinical Rotation</td>
<td>1</td>
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<tr>
<td>RELR 427</td>
<td>Crisis Counseling</td>
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**Winter Quarter**

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<tr>
<td>AHRM 471</td>
<td>Statistics and Research for Health Professionals I</td>
<td>3</td>
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<tr>
<td>ORPR 315</td>
<td>Pedorthics</td>
<td>3</td>
</tr>
<tr>
<td>ORPR 320</td>
<td>Biomechanical Evaluation</td>
<td>3</td>
</tr>
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<td>ORPR 325</td>
<td>Medical Terminology</td>
<td>3</td>
</tr>
<tr>
<td>ORPR 402</td>
<td>Pathology I</td>
<td>3</td>
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<td>ORPR 410</td>
<td>Orthotic and Prosthetic Clinical Rotation</td>
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<tr>
<td>REL 455</td>
<td>Christian Understanding of Sexuality</td>
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**Senior Year**

**Summer Quarter**

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<tr>
<td>AHCJ 422</td>
<td>History of Disability</td>
<td>3</td>
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<td>DTCS 301</td>
<td>Human Nutrition</td>
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<td>ORPR 410</td>
<td>Orthotic and Prosthetic Clinical Rotation</td>
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<td>ORPR 415</td>
<td>Lower Extremity Orthotics II</td>
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<td>ORPR 420</td>
<td>Lower Extremity Prosthetics II</td>
<td>3</td>
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<td>ORPR 425</td>
<td>CAD/CAM Technologies</td>
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**Autumn Quarter**

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<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>ORPR 323</td>
<td>Economics, Business Management, and Entrepreneurship</td>
<td>3</td>
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<tr>
<td>ORPR 345</td>
<td>Spinal Orthotics</td>
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<tr>
<td>ORPR 404</td>
<td>Materials Science in Orthotics and Prosthetics</td>
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<td>ORPR 410</td>
<td>Orthotic and Prosthetic Clinical Rotation</td>
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<tr>
<td>ORPR 414</td>
<td>Kinesiology I</td>
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<tr>
<td>ORPR 439</td>
<td>Computers and Electronics for O&amp;P Clinicians</td>
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<tr>
<td>ORPR 491</td>
<td>Research I</td>
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**Winter Quarter**

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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>AHCJ 315</td>
<td>Psychosocial Aspects of Health Care</td>
<td>3</td>
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<tr>
<td>ORPR 410</td>
<td>Orthotic and Prosthetic Clinical Rotation</td>
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<tr>
<td>ORPR 430</td>
<td>Upper Extremity Orthotics</td>
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<tr>
<td>ORPR 435</td>
<td>Upper Extremity Prosthetics</td>
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<tr>
<td>ORPR 440</td>
<td>Bionics and Cyborg Technology</td>
<td>3</td>
</tr>
<tr>
<td>RELE 457</td>
<td>Christian Ethics and Health Care</td>
<td>2</td>
</tr>
</tbody>
</table>
applied both to the in- and outpatient context.
context of interprofessional referrals, interactions, and reimbursement as
assessment, management, and complete documentation within the
ethical practice of care. Advanced principles and processes of patient
Orthotic and prosthetic patient-care models, patient rights, and
Units.

**ORPR 310. Patient Management, Assessment, and Documentation. 3 Units.**
Orthotic and prosthetic patient-care models, patient rights, and
ethical practice of care. Advanced principles and processes of patient
assessment, management, and complete documentation within the
context of interprofessional referrals, interactions, and reimbursement as
applied both to the in- and outpatient context.

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**ORPR 301. Orthotics and Prosthetics Laboratory and Technical Skills. 3 Units.**
Introduces the baseline of material and safety practice of orthotics and
prosthetics design, fabrication, and repairs. Provides a solid foundational
knowledge of the principles and applications of orthotics and prosthetics
materials, technologies, designs, and processes associated with the
manufacture of custom devices.

**ORPR 305. Orthotic Fitting Techniques. 3 Units.**
Teaches methods of biometrics, shape capture, and fitting criteria for
orthotic devices. Expands knowledge and techniques of applied anatomy
in the fitting of orthotic and assistive devices in activities of daily living
and patient’s occupational needs.

**ORPR 310. Pedorthics. 3 Units.**
Clinical application of biomechanical interventions of the ankle-foot
structure as it refers to walking, medical issues of the foot, and activity
levels. Applied anatomical knowledge of the foot and sports medicine
within the context of shoes and shoe modifications.

**ORPR 320. Biomechanical Evaluation. 3 Units.**
Establishes orthotic and prosthetic biomechanical principles
and interventions in the context of normal body mechanics and
musculoskeletal pathologies. Examines how these interventions serve
to maximize healing, manage pain, support movement and function.
Encompasses hole body considerations for the kinetic effects, including
gait, ADL, occupational and recreational functions.

**ORPR 323. Economics, Business Management, and Entrepreneurship. 3 Units.**
Establishes principles of economics, financial management, and law
as they apply to health-care settings, including: starting a new service,
reimbursement, capital and operational budgeting, reading financial
statements, and cost-saving measures.

**ORPR 325. Medical Terminology. 3 Units.**
Language of medicine, including: word construction, word analysis,
definitions, and the use of terms related to medical science—specifically
to orthotics and prosthetics. Course information organized by body
systems. Applies knowledge to documentation, interdisciplinary
communication, and medical justification as it applies to orthotic and
prosthetic care.

**ORPR 330. Lower Extremity Orthotics I. 3 Units.**
Studies foot and ankle-foot orthoses—including myoelectric orthoses—
from an anatomical design and fabrication perspective. Effects of their
application to the body kinematics and kinetic chain. Considerations
for specific pathological applications, as well as awareness of implied
benefits and risks. Outcome measurements for particular static and
dynamic designs.

**ORPR 340. Lower Extremity Prosthetics I. 3 Units.**
Studies the etiology of amputations below the knee. Considers surgical
and immediate postoperative issues as they relate to patient experience,
prosthetic outcome, and gait. Looks at prosthetic component selection;
socket, interface, and suspension designs in the context of ambulation
levels and activities; and specialty applications. Examines skin and tissue
physiology, both from a design and end-user perspective. Considers cost
and efficiency based on component selection.

**ORPR 345. Spinal Orthotics. 3 Units.**
Examines spinal anatomy, biomechanics, and pathology. Fabrication,
fitting, and application of orthotics following critical and differential
diagnoses. Application and proper fitting of halos and cervical, thoraco-
lumbar, and lumbar devices. Special consideration of design, plaster
casting techniques, and CAD measurements for management of
scoliosis. Interpret standard radiographs, measure and interpret spinal
deformities, and recommend appropriate orthotic management.

**ORPR 402. Pathology I. 3 Units.**
Fundamental mechanisms of disease, including cell injury; inflammation,
repair, regeneration, and fibrosis; and vascular, cardiac, respiratory,
gastrointestinal, hepatobiliary, urinary, reproductive, endocrine, and
integumentary pathologies.
ORPR 404. Materials Science in Orthotics and Prosthetics. 3 Units.
Introduces the science of materials found in the body and those used to support the body. Includes the composition of common orthopedic and prosthetics materials. Overview of mathematics, physics, simple and complex movement, anatomy, physiology, and thermodynamics which create a rationale behind material and fabrication choices. Addresses chemical composition, stress-strain curves, fatigueability, and other essential characteristics considered in orthotic and prosthetic design.

ORPR 405. Gait Analysis. 3 Units.
Observation and analysis of normal human locomotion contrasted with pathological gait, and their implications for orthotic and prosthetic interventions and care.

ORPR 410. Orthotic and Prosthetic Clinical Rotation. 1 Unit.
Assigns student to a weekly clinic, department, or specialty—with a focus on familiarization with specific orthotic and prosthetic services. Student reports to his/her cohorts in a once-a-month didactic presentation at the weekly grand rounds, which can include lectures from industry providers on the topic of choice. Site allocation determined by program director; student accountable to quarterly assigned clinical supervisor.

ORPR 414. Kinesiology I. 3 Units.
Introduces advanced kinesiology topics, including movement science dealing with the behavioral basis of motor control and motor learning from an information-processing perspective. Kinesiology from an O&P perspective focusing primarily on the lower limbs, with some introduction to upper limb involvement.

ORPR 415. Lower Extremity Orthotics II. 3 Units.
Advanced study of knee-ankle-foot orthoses, knee orthoses, hip orthoses, reciprocating gait orthoses, and standing frames from an anatomical design and fabrication perspective. Effects of their application to the body kinetic chain. Considers specific pathological applications, including implied benefits and risks. Outcome measurements for particular static and dynamic designs. Introduces CAD/CAM technologies both for image capture and fabrication.

ORPR 420. Lower Extremity Prosthetics II. 3 Units.
Etiology of transfemoral amputations. Surgical and immediate postoperative issues related to patient experience, prosthetic outcome, and potential for gait. Prosthetic component selection, socket interface, and suspension designs addressing ambulation levels and activities. Specialty applications. Mechanical, hydraulic, and electronic knee-motion control. Cost and efficiency calculations. CAD/CAM shape capture and fabrication considerations such as mechanical and electronic alignment capture.

ORPR 425. CAD/CAM Technologies. 3 Units.
Applications of CAD/CAM technologies used in clinical practice. Use of most common shape/image capture systems, manipulations, and interfaces with the various central fabrication methods. Includes use of CADs/CAMs in orthotics and prosthetics, including foot orthoses, spinal orthoses, cranial helmets and prosthetic limbs. Data storage and manipulation for use in the fabrication process with technical assistance.

ORPR 430. Upper Extremity Orthotics. 3 Units.
Applies anatomy, kinesiology, and biomechanics to serve specific upper extremity neuromuscular needs. Determines the use of functional and electrically powered orthoses based on differential diagnoses. Examines myoelectric assisted translateral motion rehabilitation. Teaches function, purpose, and building of wrist- and cable-driven orthoses.

ORPR 435. Upper Extremity Prosthetics. 3 Units.
Studies the etiology of upper limb and forequarter amputations. Considers shape capture, socket design, interface, and suspension in the context of cosmetic, body-powered, and myoelectric functional prostheses. Includes special needs adaptations for occupational and sports situations. Give attention to the distinctions of functionality, efficacy, and cost. Studies the bionic arm and hand and the computer training that goes with this particular technology.

ORPR 439. Computers and Electronics for O&P Clinicians. 3 Units.
Basic theory of electricity, transistors, computer circuits, and computer programming. Discusses electronics, structure of the atom, resistance, capacitance, Ohm's law, and basic transistor theory Windows programming. Includes laboratories and three programming assignments.

ORPR 440. Bionics and Cyborg Technology. 3 Units.
Examines emerging bionic technologies aimed at merging man with machine. Includes competencies and promotion of these devices in the context of scientific research and potential patient applications. Examines bionic control systems' embedded software development and associated function. Topics include proficiency in the implementation of cybernetic feedback systems in ortho-prosthetic devices.

ORPR 491. Research I. 1.5 Unit.
Introduces the scientific method in health science research. Focuses on problem identification, literature review, conceptual framework, identification of variables, statement of hypothesis, experimental design, and analysis and presentation of data. Includes critical evaluation of research literature. Applies the research process to problems in allied health fields, development of a research proposal, pilot testing, testing and data forms, and research implementation in a practice setting. Prerequisite: AHCJ 471, AHCJ 472.

ORPR 505. Current Issues in Orthotics and Prosthetics. 3 Units.
Reviews and discusses concerns and current advances relating to orthotics and prosthetics, e.g., legislation, regulations, education, professional organization, interdisciplinary patient care, and reimbursement issues.

ORPR 506. Advanced Specialty Tracks in Orthotics and Prosthetics. 3 Units.
Presents the newest clinical treatment applications over the spectrum of the patient population in the field of orthotics and prosthetics.

ORPR 510. Advanced Clinical Rotations. 1 Unit.
Clinical experience focusing on familiarization with specific orthotic and prosthetic services. Supervised experience providing comprehensive orthotic and prosthetic clinical care. Opportunities to report in clinical, professional, and private sector settings.

ORPR 514. Clinical Affiliation. 8 Units.
Establishes a clinical affiliation with a facility that complies with ENCOPE residency standards and that has been approved by the Professional Development Committee and the EL-MSOP locally assigned site supervisor. Student completes the 500 clinical contact hours required for graduation.

ORPR 515. Topics in Orthotics and Prosthetics. 1-6 Units.
Lecture and discussion related to the practice of orthotics and prosthetics. Content varies from quarter to quarter. (May be repeated for additional credit for a maximum 6 quarter units.)
ORPR 518. Kinesiology II. 3 Units.  
Examines the mechanical basis of movement in relation to length of muscles, tension developed by muscles under various conditions, anatomical arrangement of the origin and insertion of bones and joints, and biomechanics of complex movement, such as gait and balance. Uses physics principles to explain the mechanics of movement. Topics include linear movement, rotational movement, work and energy, muscle-length tension relationships, single and multiple joint biomechanics, and gait and balance.

ORPR 522. Self-Care Portfolio and Community Outreach. .5 Units.  
Inventory of self-care and process to accomplish it. Puts self-care in the context of life-long learning, relational responsibility, and social justice. Applies principles of effective community leadership engagement, locally and globally.

ORPR 526. Prosthetics III. 3 Units.  
Focuses on upper and lower limb amputations and prosthetics. Etiology of hip and transcorporectomy amputations, surgical and immediate postoperative issues related to patient experience, prosthetic outcome, and potential for gait. Includes care of the extreme sports amputee, socket interface, suspension designs, skin and tissue physiology, and mechanical and hydraulic knee-motion control. Introduces CAD/CAM shape capture, and fabrication considering mechanical and electronic alignment capture.

ORPR 527. Orthotics III. 3 Units.  
Advanced study of myoelectric and electronic control to upper extremity and lower extremity orthoses from a design and fabrication perspective. Effects of their application to the body kinetic chain. Considerations for specific pathological applications; awareness of implied benefits and risks. Studies outcome measurements for particular static, dynamic, and electrodynamic designs, including EFS.

ORPR 528. Prosthetics IV. 3 Units.  
Reviews case presentations of transtibial and transfemoral amputations. Advanced and alternative socket designs, interface materials, suspension systems, and fabrication techniques; and, shape capture techniques, cast modification, socket fitting techniques, fabrication, static and dynamic alignment, alignment transfer, and observational gait analysis. Prerequisite: ORPR 340, ORPR 420, ORPR 526.

ORPR 538. Biomechatronics. 3 Units.  
Development of competencies in biomechatronics. Bionic technology, embedded design programming, and fabrication. Robotic actuation and senses. Advanced material use and fabrication techniques.

ORPR 540. Rehabilitative Care in Developing Nations. 3 Units.  
Examines the physical rehabilitation state of affairs in developing nations. Outlines specific challenges with rehabilitation delivery from logistics, materials, and cost perspectives. Points out alternative methods to maximize rehabilitation with minimal cost.

ORPR 544. Applied Functional Neuroanatomy. 3 Units.  
Evidence-based coverage of the applied functional neuroanatomy of several common adult progressive and nonprogressive neurological diseases. Emphasizes motor control, stroke, traumatic brain injury, spinal cord injury, multiple sclerosis, Parkinson’s disease, Guillian-Barre syndrome, amyotrophic lateral sclerosis, and vestibular pathology. Includes literature review, lecture, discussion, and laboratory sessions.

ORPR 575. Couples, Families, and Disabilities. 3 Units.  
Examines the effects disabilities have on couples and family systems, and contributions family members make to the rehabilitation process of individuals with disabilities. Looks at discourse patterns taking place within a person with a disability, within the person’s family and social support system, and among the individual, family, and medical and rehabilitation providers. Addresses the issues of human sexuality, reproduction, and disability.

ORPR 592. Research II. 1.5 Unit.  
Guides and equips students as they work toward completion of their capstone research thesis, which is presented at the annual Capstone Research Day. Includes data-collection review and completion, APA-style formatting rules, data analysis with application of appropriate statistics, graphing, write up of discussion and results.

ORPR 593. Research III. 3 Units.  
Culminates all research-track courses in a project comprising a master’s degree thesis, a research paper, a presentation, and a poster. Includes data analysis and statistical interpretation.