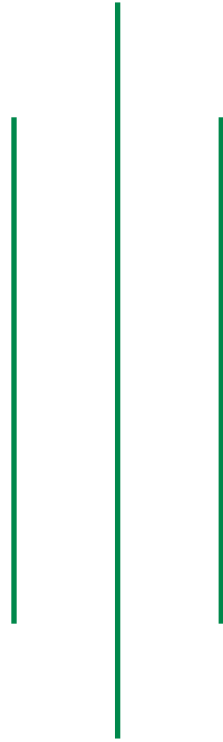


Syllabus for Licensing Exam of Bachelor of Prosthetics and Orthotics 2022



Nepal Health Professional Council
Bansbari, Kathmandu

Content

S.no	Topics	Marks
1	Human Anatomy, Physiology and Pathology	10%
2	Introduction to Prosthetics and Orthotics Material Science and Workshop Technology	5%
3	Biomechanics	10%
4	Orthopedics and Amputation Surgery	5%
5	Upper limb Prosthetics and Orthotics	20%
6	Lower limb Prosthetics and Orthotics	25%
7	Spinal Orthotics	10%
8	Physical Medicine Rehabilitation	10%
9	Research and evidence-based practice in Prosthetics and Orthotics	5%
	Total	100%

1. Introduction to Prosthetics and Orthotics

Introductions:

General: Terminologies & definition in prosthetics and orthotics. Role of Prosthetist and Orthotist, Associate Prosthetist Orthotist, Technicians and Bench workers.

Introduction of prosthetics and orthotics. History of prosthetics and orthotics in the world and Nepal. Existing national acts, rules and programs related to disability and assistive technology in Nepal. National and international prosthetic and orthotic services; code of ethics, patient centered care; community based rehabilitation; patient communication.

Basic skills in prosthetics and orthotics; awareness of health and safety; basic skills for the use of hand tools, portable power tools and machines; introduction to materials used in prosthetics and orthotics, material sciences, decision on the use of materials.

Fundamental information regarding patient assessment; patient assessment principles; orthotic patient assessment; prosthetic patient assessment; special test; application of patient assessment; gait analysis instruments; normal gait; pathologic gaits; gait deviations; gait analysis principles.

Material Science and Workshop Technology

Introduction to material science in prosthetics and orthotics; application and properties of thermoplastic, chemical material, Introduction to bench work, hand tools, measuring tools, Fundamentals of riveting, thermoforming and laminations, Safety equipment and measures in lab.

Metal and Alloys: Fundamentals of metals and alloys properties

Wood: Wood types, seasoning, adhesives for wood,

Leather: Leather, types, Tanning, adhesives for leather

Fabric: Types, properties,

Plastics: Types, properties, application

Composites: Types, properties, fabrication

Plaster of Paris and Silicon: properties and application

Tools: Tools used for metal, wood and leather

Machines: Grinding machine, socket router, drilling machine and attachments, compressors and pneumatic tools, vacuum pumps, dust collectors, oven, etc

2. Human Anatomy, Physiology and Pathology

Anatomy

General and Applied Anatomy: Gross anatomy of human body structure, function and relationship between various structures of head, face and neck. Introduction and definition, anatomical terms and regions of body.

Osteology: Structure and function of bones and joints, skull, vertebrae, upper extremity and lower extremity.

Systemic: Nervous system, Cardiovascular system (Mediastinum - Divisions and contents; Pericardium; Thoracic Wall - position, shape and parts of the heart; conducting system; blood supply and nerve supply of the heart), Respiratory system (Outline of respiratory passages; Pleura and lungs: position, parts, relations, blood supply and nerve supply; Diaphragm: Origin,

insertion, nerve supply and action, openings in the diaphragm; Intercostal muscles and Accessory muscles of respiration: Origin, insertion, nerves supply and action.), Musculoskeletal system (Anatomical positions of body, axes, planes, common anatomical terminologies, Connective tissue classification; Bones- Composition & functions, classification and types according to morphology and development, Joints-definition-classification, structure of fibrous, cartilaginous joints, blood supply and nerve supply of joints); Integumentary system (structure of skin)

Upper extremity: Structure and function of upper limb, detailed structure and function and joints of upper limb, blood supply to limb, brachial plexus, main nerves to upper limb, cutaneous nerve supply, origins, insertions, actions and nerve supply of muscles of upper limb and surface anatomy.

Spine: Outline of structure and function of vertebral column, detailed structure of vertebrae throughout vertebral column, Structure and function of atlanto-occipital, atlanto-axial and all other intervertebral joints, musculature producing movements of vertebral column, Structure of spinal cord, spinal nerves, transverse section of spinal cord and nerve roots at various levels. Meninges and cerebrospinal fluid.

Lower Extremity: Survey of structure and function of lower limb, detailed structure and function of bones and joints, blood supply to limb, major nerves supply, cutaneous nerve supply. Origins, insertions, actions and nerve supply of muscles, and Surface anatomy.

Physiology

General:

Introduction and definition of various terms, cell structure and function including cell division, various tissues and their functions. Body water and body fluid, edema, metabolism. Normal functions and mechanism of the body systems such as the Nervous system, musculoskeletal, circulatory, respiratory, endocrine, urinary, digestive, metabolism and body temperature regulatory system.

Applied: Pulse, hypertension, structure and functions of arteries branches tissues perfusion, physiology of muscular exercises, function of skin.

The Blood:

Introduction: composition and function of blood. Plasma, RBC, WBC, Platelets, Lymph, Blood coagulation. Immunity reactions and Inflammation.

Nerve Muscle Physiology:

Introduction: (resting membrane potential, action potential). Nerve: (Structure and function of neurons, Properties and impulses transmission of nerve fibres.) Neuroglia: (types and functions.) Muscles: (Classification, structure, Neuromuscular junction, Motor unit. Fatigue.) Reflex action. The regulation of posture, general survey of voluntary movement, pain, Autonomic Nervous system

Cardiovascular system:

Introduction (Physiological anatomy and nerve supply of the heart and blood vessels.) Conducting system (components, impulse conduction). Cardiac cycle: (Definition, Phases of cardiac cycle, pressure and volume curves.) ECG, Cardiac Output, Functional anatomy of vascular and lymphatic system. Arterial blood pressure. General considerations, heart rate, Regulation of blood pressure, peripheral circulations, capillaries vascular responses of skin.

Respiratory System:

Introduction: (physiological anatomy – pleura, trachea-bronchial tree, alveolus, respiratory membrane and their nerve supply. Function. Respiratory muscles.) Mechanics of breathing. Disorders of respiration. Carriage of oxygen by the blood, carbon dioxide transport in the body,
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regulation of body temperature.

Nervous System: Introduction: Organization of CNS and PNS. Function of nervous system. Functional anatomy, classification, Synaptic transmission. Sensory receptors, function, classification and properties.

Sensory Pathway: *the ascending tracts – posterior column tracts, lateral spinothalamic tract and the anterior spinothalamic tract – their origin, course, termination and functions.*

Pain sensation: *mechanism of pain, cutaneous pain, deep pain, visceral pain, referred pain.*

Sensory cortex. Somatic sensations

Motor mechanism: *Motor cortex. Motor pathway: The descending tracts – pyramidal tracts, extra pyramidal tracts – origin, course, termination and functions.*

Reflex Action: *Monosynaptic and polysynaptic reflexes, superficial reflexes, deep reflexes. Muscle tone – definition, and properties hypotonia, atonia and hypertonia. UMNL and LMNL.*

Spinal cord lesions: Complete transection and hemisection of spinal cord. Cerebellum, posture and equilibrium, Thalamus and hypothalamus, Basal ganglia, Cerebral cortex: lobes, brodmann's areas and their functions. Higher functions of cerebral cortex – learning, memory and speech.

Kidney and micturition: Introduction and functional anatomy of kidney, innervations, renal circulation and care of any appliances fitting for dysfunction.

Integumentary system: structure of skin, function of skin, protection, heat regulation, sensation and elasticity.

Endocrinology: Endocrine pancreas: secretory cells, action, regulation of secretion of insulin and glucagon. Glucose metabolism and its regulation. Diabetes mellitus.

Nutrition and metabolism: Introduction to nutrition and metabolism, factors influencing energy expenditure.

Pathology and clinical Pathology

General: Introduction to pathology, basic mechanism of health and disease, Clarification of disease, Inflammation – Acute inflammation: features, causes, vascular and cellular events.

Chronic inflammation: Causes, Types, Classification, Repair, Wound healing by primary and secondary union, factors promoting and delaying the process.

Hemodynamic disorders, thrombo embolic disease & shock: Ischemic, necrosis, thrombosis, embolism, Infarction, shock. Gangrene, Thromboangitis obliterans, Neoplasia – Definition, classification, Biological behavior: Benign and Malignant, Carcinoma and Sarcoma, principles of their spread.

Hypersensitivity diseases and immunity: brief overview of hypersensitivity reaction allergies and auto immune diseases

Genetic disorders: Brief over view of genetic disease.

Neurovascular diseases: Outline of Cerebro-vascular disorders, Trauma to brain and spinal cord, Demyelinating diseases like multiple sclerosis, Degenerative diseases like Parkinsonism disease, Peripheral vascular disease, Poliomyelitis.

Metabolic disorders: Diabetic mellitus- Types, Pathogenesis, Pathology, Laboratory diagnosis

Disorders of blood: Constituents of blood and bone marrow, regulation of hematopoiesis. Anemia.

3. Biomechanics

Basic Concepts in Biomechanics: Kinematics and Kinetics, Types of Motion , Location of Motion, Direction of Motion , Magnitude of Motion, Definition of Forces, Force of Gravity, Reaction forces, Equilibrium, Objects in Motion, Force of friction, Concurrent force systems, Parallel force systems., Work, Moment arm of force, Force components, Equilibrium of levers linear and angular kinematics, linear and angular kinetics; biomechanics of musculoskeletal system; posture and balance; normal gait; pathologic gait; ergonomics; biomechanics of lower limb, upper limb and spine; biomechanical application of lower limb, upper limb and spine to the orthotic and prosthetic device

Joint structure and Function: Joint function, Joint structure, Joint motion, General properties of connective tissues, Biomechanics of normal foot, pathological foot, foot arches, normal and surgical foot wear.

Human Movements: Normal gait: general features of gait, gait initiation, kinematics and kinetics of gait, energy requirements, Pathological gait

Joint Force Analysis: Effect of Ground Reaction Force in Gait, Biomechanical force control system- three point force, four point force and ground reaction force control. Triplanar control. Free body diagrams. Joint forces during swing and stance phase.

Human locomotion and Gait analysis: Introduction to different ways to do gait analysis.

General Principle and biomechanics of upper limb Prosthesis and orthosis: Biomechanics involving in upper limb prosthesis and orthosis. Structures facilitating function, scapulohumeral rhythm, torque of shoulder, carrying angle, Arch of hand, structure of hand, movement of thumb, joint position and tissue mechanism, joint stability, the effect of muscle tension, Tenodesis action of hand, functional position of hand, Hand grips, Amputation level of upper limb, Stump socket force, Force transmission.

General Principle and biomechanics of lower limb prosthesis: Biomechanics involving in Lower limb Prosthesis and orthosis, subtalar motion in open chain and closed chain, Biomechanics and clinical applications Foot deformities, foot contact patterns. Rocker motions in foot. Biomechanics of socket in various prostheses and socket type. Biomechanics of Quadrilateral socket, Ischial containment socket, Total Surface Bearing, Marlow's Anatomical Socket.

4. Orthopedics and Amputation Surgery

General: Introduction, Principles of Orthopedics.

Traumatology: Fracture - definition, types, signs and symptoms and management. Subluxation/ dislocations – definition, signs and symptoms, management, Burns- definition, types, degree, deformities due to burns & its management, etc

Inflammatory and Degenerative Conditions: Osteomyelitis, arthritis , e.g. - Inflammation of Joints, Rheumatoid Arthritis, infective arthritis, tuberculosis arthritis, Osteoarthritis, Ankylosing spondylitis, arthritis of hemophilic joints, Neuropathic joints. Inflammation of tendon sheath and bursa, etc.

Disease of Bones and Joints: Metabolic diseases of bones, e.g. rickets, Osteomalacia, Osteopenia, Osteoporosis. gout, scurvy etc.

Congenital Deformities: Outline of Torticollis, spina bifida, spinal anomalies, scoliosis, C.T.E.V.

Acquired Deformities: scoliosis – all types, kyphosis, Lordosis, spondylosis, Coxa -vara, coxa-valga and coxa magna, Otto pelvis, genu valgum, genu varum, genu recurvatum.

Cervical and Lumbar Pathology: Prolapse of intervertebral disc, Spinal cord injury.

Regional Conditions: Definition, Clinical features and management of the following regional conditions

Hip: Outline of Dislocations and subluxations & dysplasia (congenital, traumatic, pathological, paralytic, spastic and central).

Knee: Outline of Meniscal tears, dislocation of patella, Ligamentous injuries.

Ankle & foot: Outline of partial and total ligamentous injuries (Sprain), Heel and foot deformities (Calcaneo varus, Pes Valgus, varus, Metatarsalgia, plantar fasciitis, Anesthetic feet, Bunion of toe, Hallux Valgus)

Shoulder: Outline of Recurrent dislocation, Bicipital tendinitis and peri-arthritis.

Elbow and forearm: Outline of Cubitus varus and valgus, Madelung's deformity, Tennis elbow, Volkmann's contracture, Dupuytren's disease, De Quervain's disease, entrapment neuropathies.

Wrist & Hand: Wrist drop, Tenosynovitis, Mallet finger, carpal tunnel syndrome, claw Hand.

Specific Disorders: Leprosy, Tumors – Benign & malignant, Tuberculosis & Perthes Disease, Peripheral Nerve Injuries, Congenital anomalies, Muscular Dystrophy etc.

Neuromuscular diseases: Normal peripheral nerve and skeletal muscle, Disease of peripheral nerves – inflammatory neuropathies, immune-mediated infections, Neuropathies, Muscular dystrophies, Neurovascular diseases.

Sports injuries and their management

Amputation Surgery: Amputation surgery in lower and upper limbs. Indications/causes, General Principles, Types of amputation, Individual's Preparation for a prosthesis. Ideal stump. Preoperative, operative, and postoperative prosthetic management techniques in general. stump amputation revision. Amputation in special circumstances, like in infants and children, Congenital limb deficiencies. ischemic limbs, elderly persons, malignancy and Diabetes, congenital anomalies, burns.

5. Upper Limb Prosthetics and Orthotics

Upper Limb Prosthetics (ULP)

General: Historical development, Nomenclatures, Amputation of Upper Limb, General Prosthetic Principle in Upper limb prosthesis. Special considerations in child prosthesis.

Clinical procedures: Patient Assessment, Prescription principle, upper limb prosthesis casting; upper limb prosthesis rectification, upper limb prosthesis fitting Protocol, checkout procedures. Indications and Contraindications. Pre-prosthetic management and counseling,

Materials and components: Suspension, Wrist Unit: Friction type, Quick disconnects, Wrist flexion, Universal wrist, Various Terminal Devices: Non-functional, Cosmetic utility, Hands, Hook and Work arm etc. Various materials and components for ULP.

General Principle and Biomechanics: Biomechanical considerations of sockets in different level of prosthesis, Biomechanics of upper limbs

Socket Variation: Wrist Disarticulation: conventional, removal panel type. Mid and long transradial: conventional, North-western type, three quarter socket, advance socket technologies. Short Transradial: conventional, northwestern type. Very short transradial: muenster, split socket, Partial hand: Finger Prosthesis. Transhumeral Socket Variation: elbow Disarticulation Socket,

Trans humeral socket, Shoulder disarticulation Socket, Forequarter Socket, etc.

Upper Limb Orthotics (ULO)

Upper Extremity: Objectives of splinting, Nomenclatures, Principle of upper limb orthosis, Biomechanics of ULO, ULO for various conditions and its pathology like stroke, cerebral palsy, Down syndrome, polio, rheumatoid arthritis, De Quervain's tenosynovitis, Medial – Lateral epicondylitis Swan neck deformity, Mallet finger, Boutonniere deformity, Dupuytren's disease, Wrist fracture, Scaphoid fracture, Boxer's fracture, Humeral fracture, etc

Orthotic Clinical Process: Principle of ULO, Patient Assessment, principle of prescription criteria, Counseling, Casting and measurements, rectification, fitting, trim lines, checkout procedures, and outcome measurements of various upper limb orthoses. Indications and Contraindications.

Variation of ULO: Nomenclatures, System for naming upper limb orthosis, Classifications of splint for upper limb: location, cover, length of splint, impact on joint mobility.

Non-articular, Static hand Finger thumb Orthosis, Static FBOS, Serial Static Orthosis, Static Progressive orthosis, Dynamic Orthosis, Shoulder and Elbow Orthosis, Fracture Braces, upperlimb orthosis in various deformities and impairments.

All types of Hand Orthoses, Wrist Hand Orthoses, Elbow Orthoses, Shoulder Elbow Wrist Hand Orthoses, Immobilization/ mobilization, Appliances for flail elbows.

Materials used in ULO: Material used and its advantages and disadvantages. Various components used in ULO.

6. Lower Limb Prosthetics and Orthotics

Lower Limb Prosthesis (LLP)

General: Historical development, Nomenclatures, Amputation of lower Limb, General Prosthetic Principle lower limb prosthesis. Special considerations for child prosthesis.

Clinical procedures: pre and postoperative prosthetic care, Pre-prosthetic management and counseling, Patient Assessment, Prescription principle, lower limb prosthesis Casting; lower limb prosthesis rectification, Fabrications, lower limb prosthesis alignment and fitting Protocol, checkout procedures. Indications and Contraindications in prosthetic management. Multidisciplinary approach in prosthetic management. Principle and treatment protocol.

Components and Raw Materials: Variation of Suspension System, Knee joints and its mechanism, various socket designs, various feet. Different types of materials and chemical for lower limb prosthesis.

Biomechanics: Biomechanical consideration of all level of prostheses, socket, alignment and feet.

Lower Limb Orthotics (LLO)

General: Introduction, Nomenclatures system, Functions, Basic goals of lower limb orthosis, Clinical assessment and diagnosis in lower limb orthotics, Prescription criteria in lower limb orthosis, Indications and contraindications of different lower limb orthoses. Biomechanical principles of various lower limb orthotics.

Orthotic Clinical Process: Principle of LLO, Patient Assessment, principle of prescription criteria, Counseling, Casting and measurements, rectification, fitting, trim lines, checkout procedures, and outcome measurements of various Lower limb orthoses. Indications and Contraindications,

Complications. Principle of orthotics fitting and alignment. Biomechanics of normal and pathological lower limb.

Variation of LLO: Nomenclatures, System for naming lower limb orthosis, Classifications of LLO Different types of AFOs, KAFOS, Hip orthosis, Knee orthosis, Orthoses of congenital dislocation of hip, cerebral palsy, paraplegia, Leg Calve Perthes diseases, Floor reaction orthosis, weight relieving orthosis, Fracture braces. Orthosis in upper motor and lower motor neuron disorders, etc. padding, posting and offloading in foot orthosis; shoe & shoe modification

Materials used in LLO: All types of materials used on LLO, various components used in Lower limb orthoses.

7. Spinal Orthotics (SO)

General: Introduction, Nomenclatures system, Functions, Basic goals of spinal orthosis. Anatomy, Pathology related to Spine, Motion of Spine, and Biomechanics of Inter vertebral disc, Spine loading during normal activities, Principles and biomechanics of Spinal Orthosis.

Orthotic Clinical Process: Principle of SO, Patient Assessment, the principle of prescription criteria, Counseling, Casting and measurements, rectification, Principle of orthotics fitting and alignment, trim lines, checkout procedures, and outcome measurements of various Spinal orthoses. Indications and Contraindications, complications. Casting of Scoliosis Brace, Rectification Technique, and Cobb's Angle Measurement in X-Ray.

Variation of SO: Nomenclatures, System for naming Spinal orthosis, Classifications and Biomechanics of Different types of TLSO, LSO, SO, CO. Various Scoliosis Braces and its Principle.

Materials used in SO: All types of materials used on SO, various components used in SO

8. Physical Medicine and Rehabilitation

PMR

General: Gross rehabilitation medicine and teamwork, goals and principles of rehabilitation, rehabilitation assessment, quality of life, activities of daily living, Introduction to physical therapy, Electrotherapy, Hydrotherapy, occupational therapy: manual muscle testing, range of motion; Rehabilitation of common disease/disorders. Concept of Total Rehabilitation. Rehabilitation team and role of each member of the team. Prosthetics & Orthotics in CBR and Role of CBR Workers in P&O.

Disability & Development: Background to social, political and economic issues in Nepal and other Low Income countries. Effect on poor who live in rural and urban areas. Disability and women. Introduction to community based rehabilitation. ICF, Introduction to impairment, disability and handicap. Introduction to disability issues, Government schemes and initiatives, legislation and UNCRPD, GATE initiative, Removing Environmental Barriers, Professional and social work in medical & Rehabilitation set up. Practical and environmental difficulties of patients in use of appliances.

Mobility and Rehabilitation Aids

Wheelchair and Seating Aids: An introduction to wheelchair users; wheelchair services; wheelchair mobility; sitting upright and transfers; pressure sores; appropriate wheelchairs; cushions and cushion fabrication; assessment and physical assessment; prescription; fitting; user training; maintenance and repairs; follow up

Mobility and walking Aids: Canes, walking sticks, Crutches - auxiliary, elbow and forearm support. Different types of Walking Frame, Walker and their attachments. Para podium etc.

Other types: Introduction: Motorized wheelchair, tricycle and motorized tricycle, modified two-wheeler for mobility. Gait Training with various walking aids. Special gadgets to assist in activities of daily living (A.D.L.) – the assistive devices for SCI patients, stroke patients etc.

Psychology and Sociology

General: Basic psychology, Clinical psychology, psychological reaction to loss, how to approach and communication for persons with physical disabilities. Psychological aspect of disability. The Role of the Family, Child with the disability, parents of the disabled child. Acceptance of severely disabled persons. Social-Sexual Relationships. Independent Living. Introduction to Sociology and outline of Society, definitions, Outline of Social works, Nature of Social organization, types of organizations. Nongovernmental organizations and its role in prosthetics & orthotics. Structure and functions of Social Institutions, Village as a community. Social Changes, Social Problems, Social Welfare, Vocational Rehabilitation, Employment, Self-Employment Job analysis, Job placement.

9. Research and evidence-based practice in Prosthetics and Orthotics

Introduction to research methodology; research problems; research question, research design; research example in prosthetics and orthotics; research proposal structure; research presentation; ethics in research, Literature review, Outcome measurement and various tools in prosthetics and orthotics, Professional Ethics; Nepal health professional Act and Rules

Recommended Reading

Recommend to read latest editions of the books and reference. The list is not complete and comprehensive.

- Andris Freivalds, Biomechanics of the upper limbs, Mechanics, modeling and musculo-skeletal injuries CRC PRESS, Boca Raton London New York Washington, D.C. ISBN 0-7484-0926-2
- May Bella J. Amputations & Prosthetics, Jaypee Publisher, New Delhi
- Atlas for prosthetic rehabilitation, Surgery and limb deficiency. American Academy of Orthopaedic Surgeons, Mosby publications/ or N.Y.U. St. Louice, London, Chicago, 3rd edition.
- Joan E, Orthotics; Edestein. Jaypee Publisher New Delhi
- Functional fracture bracing; Sarmiento, A.
- AAOS atlas of Orthosis and assistive devices, Hsu, John D. Mosby publications/ or N.Y.U. St.Louice, London, Chicago 4th ed.
- Perry Jacquelin, Gait analysis,
- Kapandgi, I.A, Physiology of Joints. Churchill- Livingstone Vol. I,II & III
- Chris Kirtley Clinical gait analysis, , Elsevier Churchill livingstone

- Physics of plastics ; Biller, Jos
- B.S. Raghuvanshi Workshop Technology Vol. I & II , , Dhanpat Rai & Co. Delhi
- Maheshwari (2005) Essential Orthopedics, , J Mehta
- Adam's (2001) Outline of Orthopaedics ; , Churchill livingstone
- Seymour R., (2002).Prosthetics and orthotics lower limb and spinal: orthoses for orthopedic conditions, Lippincott Williams & Wilkins.
- P. Bowker, D.N.Candie, D.LPratt, D.L Bader. (1993). Biomechanical basis of orthotic management
- Cameron and Monroe, 2007Physical Rehabilitation: Evidence based examination, evaluation and intervention. 1st edition.
- O'Sullivan S, Schmitz T. Physical Rehabilitation. 6th ed. Philadelphia: F. A. Davis; 2007.
- Michael WWhittle, Gait Analysis- An Introduction, 4th edition
- Hoffmann T, Bennett S, Del Mar C. Evidence-based Practice across the health professionals. Churchill Livingstone. Elsevier Australia. 2010.