**BBE 4205 Elective II**

Course description

Track related Elective courses

By the end of the second year each student will select an appropriate track of specialization for their degree. In specializing, the student will do anadditional12creditunitsinthelasttwoyearofthe program to cover additional content related to their preferred track.

1. Medicalinstrumentation: students selecting this track will do these courses, biological and medical Microsystems, medical linstrumentation, computersin medicine mathematical and computer modeling. The details of each course are as follows

a. Biologicalandmedicalmicrosystems (BBE3017); Thiscoursewillintroducestudents tothefieldofMEMS (Micro-Electro-Mechanical-Systems) asitappliestobiologyand medicine.TopicswillcovermethodologyoftraditionalMEMSdevices, howtheycan beincorporatedwithbiologicalsystems, andmethodsformicro-structuringbiological materials.PracticalswillcovertheuseofvariousMEMSinthefieldformonitoring

And management of human illness.

b. Medicalinstrumentation(BBE3207);thiscourseisrelatedtotheclinicalengineering course(3103),andsoftwareengineering(3105)willhavethedesignandapplicationof electrodes,biopotentialamplifiers,biosensors,therapeuticdevices.Medicalimaging. Electricalsafety.Measurementofventilation, bloodpressureandflow.Themethodsof delivery will be by Lectureandlab.

c. Computers in medicine(BBE4106); Study of microprocessor-based medical instrumentation.Emphasisonreal-timeanalysisofelectrocardiograms.Labsand programmingprojectinvolvedesignofbiomedicaldigitalsignalprocessing algorithms.

d. Mathematical and computer modeling (BBE4206); Quantificationandmodel formulationusinganalyticalnumericalsolutions, andparameterestimationmethods. Principalemphasisoncardiovascularsystemandindividualnervecells; othertopics includerespiratorysystemandskeletal-musclesystem; extensiveuseof"handson" computer modeling using ACSL

2. Medicalimaging: studentsgoingthroughthistrackwilldothefollowingfourcourses, medical imagingsystems, biomedicaloptics, diagnosticultrasound, diagnosticmagneticand radiologicalimaging

a. Medicalimagingsystems (BBE3108): Thefundamentalsofseveralengineering disciplineswillbecombinedandappliedtoanalyzethefascinatingcapabilitiesfound in medical imaging. The course will demonstrate how "black box" analysis cans describethedesignandperformancetradeoffsfordiagnosticmedicalimaging equipmentsuchasprojectionradiography, computerizedtomography (CT), nuclear medicine, ultrasound, andmagneticresonanceimaging (MRI).Prerequisites: Some

FamiliaritywithonedimensionalFourieranalysis, linearsystemtheory, andprobability is suggested.

b. Biomedicaloptics (BBE3208): Thiscourseisdesignedtoprovidestudentswitha workingknowledgeofthetheoreticalandexperimentalprinciplesunderlyingthe applicationofopticalspectroscopy (absorption, fluorescenceandscattering) in biological and biomedical engineering.

c. Diagnosticultrasoundphysics (BBE4107): Propagationofultrasonicwavesin biologicaltissues; principlesofultrasonicmeasuringandimaginginstrumentation; designanduseofcurrentlyavailabletoolsforperformanceevaluationofdiagnostic instrumentation; biologicaleffectsofultrasound.

d. DiagnosticMagneticandRadiologicalimagingphysics (BBE4207): Physicsand technology of magneticresonanceimaging (MRI), emphasizing techniques employed

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In medical diagnostic imaging. Major topics: physics of MR, pulse sequences, hardware, imagingtechniques, artifacts, andspectroscopiclocalization.Physicsofx- raydiagnosticproceduresandequipment, radiationsafety, generalimaging considerations;

3. Biomechanics: thestudentgoingthroughthistrackwillcompletethefollowingfourcourses; Biological interactions with Materials, ergonomics in manufacturingandindustry, tissue mechanics, biofluidics

a. BiologicalInteractionswithMaterials (BBE3109); Thiscourseaddressestherangeof materialscurrentlybeingutilizedforvariousbiomedicalapplications, thebiological systemsgoverningbiomaterialapplications, analyticaltechniquespertinentto biomaterialevaluation, andselectedmajormedicalapplicationsinwhichbiomaterials playanimportantrole.

b. Ergonomics in manufacturingandindustry (BBE3209); Introducesengineershowto designmanufacturingandindustrialoperationsinwhichpeopleplayasignificantrole, sothathumancapabilitiesaremaximized, physicalstressisminimized, andworkloadis optimized.Examplesandtopicsemphasizeindustrialapplications.

c. Tissue mechanics(BBE4108);Thiscoursewillfocuson manyprominenttissuesthat havemajormechanicalrolesinhumanphysiology,i.e.bone,cartilage,ligament, tendon,skeletalmuscle,aswellascardiovasculartissues.Theirmechanical characteristics(suchasstiffness,strength,relaxation,creep,adaptiveremodeling,etc.) inresponsetoloadingswillbeexaminedandquantified.Thecoursewillincludesome anatomyandphysiologyofeachtissuebeingdiscussedbutwillfocusuponthe mathematicalformulationandunderstandingofconstitutiveequationsthat phenomenologicallydefineobservedmechanicalbehaviors

d. Biofluidics (BBE4208); Introductiontobloodrheology, bloodflowdynamicsinarteries, capillariesandveins, airflowinthelungs, andotherphysiologicalflowphenomena. Healthyanddiseasedstateswillbeconsidered.Specialtopicsmayincludeocularflow dynamicsandelectro-chemical-fluidicsincartilage.

4. Biomaterial/tissueengineering: Thestudentgoingthroughthistrackwillcompletethefollowing fourcourses; introductiontotransportphenomena, tissueengineering, cellengineering, biochemicalengineering.

a. Introductiontotransportphenomena(BBE3110):Mass,momentum,andenergy transport;calculationoftransportcoefficients;solutiontoproblemsinviscousflow, heatconduction,anddiffusion;dimensionalanalysis;mass,momentum,andheat transfercoefficients;over-allbalances;elementaryapplications

b. Tissueengineering (BBE3210); Overviewoftissueengineering, includingdiscussion

Ofcellsources, cell-materialinteractions, tailoringbiomaterials, methodsofcultureand characterizationofengineeringtissues, ethicalissues, concludingwithcasestudiesof specifictypesoftissueengineering.Optionallaboratoryexercisesofferedthroughout semester

c. Cellengineering (BBE4109); Thiscoursecoversengineeringapproachesthatareused tounderstandandmanipulatestemcells.Conceptscoveredinclude: introductionto stemcellbiology, quantitativemodelingofstemcellsignaling, methodstoengineer the stemcellmicroenvironment, andtheroleofstemcellsintissuedevelopmentand regeneration.

*d. Biochemicalengineering* (BBE4209): Applicationofchemicalengineeringprinciples tobiomedicalandmicrobiologicalproblems.Physiologicalfunctionfromacellular, molecular, andbiophysicalperspective

I. **Textbook:**

1. Alberts, B., etal. *EssentialCellBiology:AnIntroductiontothe*

*MolecularBiologyoftheCell,* SecondEdition, 2003.GarlandPress.

2. Wilson, J., andHunt, T., *MolecularBiologyoftheCell, 5thedition*

ii. Course **Outcomes/PerformanceCriteria:** Studentswill: Calculatethemass orlengthofsinglemoleculesofDNAorprotein.Provideamathematical, microscopicdefinitionoftemperature.Usethefreeenergyofareactionto predictwhetherornotitwilloccur.Describetheaminoacidcomponentsofa

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protein.Classifyaminoacidsintonegativelycharged, positivelycharged, or neutral.Gainfundamentalknowledgeofthemolecularbiologyofcellular macromolecules, andtheprocessesoftranscriptionandtranslation.

iii. **LectureTopics:**Introductiontocells,microscopy,chemicalcomponentsof cells,Energy,catalysis,andbiosynthesis,Proteinstructureandfunction,DNA andchromosomes,DNAreplication,Repair,andrecombinationFromDNAto proteins,Controlofgeneexpression,howgenesandgenomesevolve, Manipulatinggenesandcells,

iv. ClassSchedule: Meetsfor3hoursoflectureand1hourofdiscussioneach weekfor10weeks

v. ComputerUsage: Studentswillusebasiccomputerskillstosolvehomework problems (MSWordandExcel).

5. Healthcaresystemsandmedicalinformatics; Thestudentonthistrackwillcompletethe followingfourcourses; introductionto medicalinformatics, E-health, healthinformation systems, understandingandcommunicatinghealthinformaticsresearch

a. Introduction to medical informatics (BBE3111)

Requirements

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| --- | --- | --- | --- | --- |
| HoursperSemester | WeightedTotalMark | WeightedExamMark | WeightedContinuousAssessment Mark | CreditUnits |
| LH | PH | TH | CH | WTM | WEM | WCM | CU |
| 30 | 30 | 00 | 45 | 100 | 60 | 40 | 3 |

80

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| **Unit Title** | IntroductiontoHealthInformatics |
| **Unit Description** | **Objectives:**Atthecompletionofthe Unit,studentsshouldhaveagreaterunderstanding of:Theincreasinginfluenceof informationtechnologyand communicationstechnologyonourdailylivesin generalandhealthcare in particular;Thescope,conceptsandsomecommontermsofhealth informatics;Therangeof applicationsofhealthinformaticsintheareasofAdministration, education, clinicalpracticeandresearch.**Content**ThisUnitconsiderstheincreasingimpactoftechnologyincontemporarysocietyfocusingonhealthservices.Itexploressomecurrentapplications ofhealthinformaticsandidentifiesanumberof issuesassociatedwiththeuseof technologyinhealthcare.TheUnitprovidesa foundationforOngoingexplorationofhealthinformatics. |
| **Teaching Staff** |  |
| **Campusandmode** |  |
| **Unitweight** | 4creditunits |
| **Teaching pattern** | Thisisaself directedlearningunit.Studentscompletetasksand activities at theirownpace,withintheparametersofsemesterRequirements. |
| **Prerequisites** | Nil |
| **Corequisites** | Nil |
| **Mutual exclusions** | Nil |
| **Assessment** | Continuousassessmentbyassignment/coursework.AsaflexibleLearningcourse, studentsare abletoselectfromalternativelearning pathways.Threeassessmenttaskswillberequired.Specific configurationofthe assessmentwilldependon thelearningpathway selectedbythestudent. |
| Required texts | Whetstones.(2005),HealthInformatics:asocio technicalperspective,OxfordUniversityPress,Melbourne |
| Recommended reading | VanBemmel, J. H., & Musen, M. A. (1997).Handbookofmedical informatics.Heidelberg, Germany: SpringerVerlag.Hovenga, E., Kidd, M., &Cesnik, B. (1996).Healthinformatics an overview.Melbourne, Australia: PearsonProfessional.Coiera,Enrico,(2003),Guideto MedicalInformatics,theInternetand telemedicine,2ndEdition,Arnold,LondonExtensiveonlineresourceswillbe availableviatheInternetandtheUniversitylibrarydatabases. |

**b. E-health(BBE3211)**

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| Unitenrolmentcode | CRH502 |
| UnitTitle | HealthOnline |
| UnitDescription | **Objectives**:Atthecompletionofthisunit,studentsshouldhaveagreater understandingof:Thedriversinfluencingtheemergenceandsuccessof telemedicine, telehealthandhealthonlineprojects;Therangeof clinical,educational,researchandadministrative applications,includingmajorAustralianinitiativesinthearea;Thekeyissuesandchallengesto befacedwhenplanning,implementing andevaluatinghealthonlineapplicationsandprojects;Principlesandtechniquesrelatingtotheevaluationoftechnologies.**Content**:ThisUnitexploresthechangesoccurringin thestructureanddeliveryof |

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|  | healthservicesasaresultof technologiessuchastheInternetand |
| Tele-health.Itconsiderstheimpactofsuchtechnologyonconsumers,communities,health professionalsandhealthservices. |
| SpecialNotes | Thisunitwillbeofferedviaelectronicmedia. |
| TeachingStaff | MsSueWhetton,DrQuynhLe |
| Campusandmode | Launceston,external,flexibledeliveryviaInternet |
| Unitweight | 12.5% |
| Teachingpattern | Thisisaself directedlearningunit.Studentscompletetasksand activitiesat theirownpacewithintheparametersof semesterRequirements. |
| Prerequisites | Nil |
| Co requisites | Nil |
| Mutual exclusions | Nil |
| Assessment | Continuousassessmentbyassignment/coursework.Asaflexible learningcourse,studentsare abletoselectfromalternativelearningpathways.Threeassessmenttaskswillberequired.Specific configurationofthe assessmentwilldependon thelearningpathway selectedbythestudent. |
| Required texts | Whetstones.(2005),HealthInformatics:asocio technical perspective,OxfordUniversityPress,Melbourne |
| Recommended reading | Engelbardt,S. andNelson,R.,(2002):HealthCareInformatics:AnInterdisciplinaryApproach.Mosby, StLouis.Extensiveonlineresources willbeavailableviatheInternetandtheUniversitylibrarydatabases. |

**c.Healthinformationsystems (BBE4110)**

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| Unit Title | HealthInformationSystems |
| Unit Description | **Objectives**:Atthecompletionoftheunit,studentsshouldbe ableto: ExplainandcritiquesystemstheoryDiscusstasksto becompletedateachstageof thehealthinformation systemslife cycleDiscussstrategiesto resolvetechnicalissueswhichmaybeencountered ateachphaseof thelifecycle;Discussstrategiesto resolvepeoplewhichmaybeencounteredateach phaseof thelifecycle;Describethe impactandroleof theinformaticsprofessionalsandthe informatics/ITDepartment.**Content**:Thisunitbuildson theunitCRH501:Data,InformationandKnowledge. It isadetailedstudyof thedevelopment,implementationand maintenance ofhealthcaresystems.Itincludesanexplorationofsystemstheoryasitappliesto healthinformationsystems.Theunitconsidersthelifecycleofahealthinformationsystem,includingstrategicandtactical informationplanningandprojectmanagementandexplorestheimpact ontheorganisationof eachphaseofthe lifecycle.It exploresboth technical(infrastructure,hardware& software,Standards&Codes)and peopleissues(education& skilldevelopment,changestoroles)which needtoberesolvedintheprocessof implementingasuccessfulhealth informationsystem.Theunitalsoexplorestheroleandimpactof theinformaticsprofessionalandtheinformatics/ITdepartmentwithinthehealthorganisation |

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| TeachingStaff | SueWhetton,DrQuynhLe |
| Campusandmode | Launceston,external,flexibledeliveryviaInternetorCD |
| Unitweight | 12.5% |
| Teachingpattern | Thisisaself directedlearningunit.Studentscompletetasksandactivitiesat theirownpace,withintheparametersofsemester requirements. |
| Prerequisites | CRH500:Introductionto HealthInformaticsCRH501:Data,informationandKnowledgeCRH502:HealthOnline |
| Co requisites | Nil |
| Mutualexclusions | Nil |
| Assessment | Asaflexiblelearningcourse,e health(HealthInformatics)studentsareAbleto selectfromalternativelearningpathways.Threeassessmenttasks willberequired.Specificconfigurationof theassessmentwilldependon thelearningpathwayselectedbythestudent. |
| Required texts | Whetstones.(2005),HealthInformatics:asocio technical perspective, OxfordUniversityPress,MelbourneMeridaL.Johns(2002):InformationManagementforHealthProfessionals(2ndEdition).Delmar(ThomsonLearning),Albany,NewYork |
| Recommendedreading | Engelbardt,S. andNelson,R.,(2002):HealthCareInformatics:AnInterdisciplinaryApproach.Mosby,StLouis.Extensiveonlineresources willbeavailableviatheInternetandtheUniversitylibrary |
| databases.Coiera,Enrico,(2003),Guideto medicalInformatics,theInternetandtelemedicine,2ndEdition,Arnold,LondonExtensiveonlineresourceswillbeavailableviatheInternetandthe Universitylibrarydatabases. |

**d. Understandingandcommunicationhealthinformaticsresearch(BBE4210)**

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| Unit Title | Data,InformationandKnowledge |
| Unit Description | **Objectives**Atthecompletionof theModulestudentsshouldbeableto: |
| Describehowdataandinformationcanbeusedto create knowledge.Useknowledgeofdatabaseprinciples.Identify compareandcontrastvarioustaxonomies, classificationsystems, and andnomenclatures. Explainthedatasets,theirusesandrelevanceto informationsystems.Applyconceptsofdatabase managementin respondingto aproblem.**Content**ThisUnitfocusesondatabasemanagementsystems,introducingkeyconceptsdata,informationandKnowledgeinthecontextofrelationaldatabasedevelopmentasappliedtohealth. |
| Teaching Staff |  |
| Campusandmode |  |
| Unitweight |  |
| Teachingpattern | Thisisaself-directedlearningunit.Studentscompletetasksandactivitiesat theirownpacewithintheparametersofsemester requirements. |
| Prerequisites | Nil |
| Co requisites | Nil |
| Mutualexclusions | Nil |
| Assessment | Continuousassessmentbyassignment/coursework.Asaflexiblelearningcourse,studentsareableto selectfrom alternativelearningpathways.Threeassessmenttaskswillberequired.Specificconfigurationoftheassessmentwilldependonthelearningpathwayselectedbythestudent. |
| Requiredtexts | Whetton,S.(2005),HealthInformatics:asocio technicalperspective,OxfordUniversityPress,Melbourne |
| Recommendedreading | MeridaL.Johns(2002):InformationManagementforHealthProfessionals(2ndEdition).Delmar(ThomsonLearning), Albany,NewYork |

Engelbardt,S. andNelson,R.,(2002):HealthCareInformatics: AnInterdisciplinaryApproach.Mosby,StLouis.Extensive onlineresourceswillbeavailableviathe