**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 | | | | Weighte  dTotal  Mark | Weighted  ExamMark | Weighted  Continuous  Assessment Mark | Credit  Units |
| LH | PH | TH | CH | WTM | WEM | WCM | CU |
| 30 | 30 | 00 | 45 | 100 | 60 | 40 | 3 |

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| **Unit Title** | IntroductiontoHealthInformatics |
| **Unit Description** | **Objectives:**  Atthecompletionofthe Unit,studentsshouldhaveagreater  understanding of:  Theincreasinginfluenceof informationtechnologyand communicationstechnologyonourdailylivesin generalandhealthcare in particular;  Thescope,conceptsandsomecommontermsofhealth informatics;  Therangeof applicationsofhealthinformaticsintheareasof  Administration, education, clinicalpracticeandresearch.  **Content**  ThisUnitconsiderstheincreasingimpactoftechnologyincontemporary  societyfocusingonhealthservices.Itexploressomecurrentapplications ofhealthinformaticsandidentifiesanumberof issuesassociatedwith  theuseof technologyinhealthcare.TheUnitprovidesa foundationfor  Ongoingexplorationofhealthinformatics. |
| **Teaching Staff** |  |
| **Campusandmode** |  |
| **Unitweight** | 4creditunits |
| **Teaching pattern** | Thisisaself directedlearningunit.Studentscompletetasksand activities at theirownpace,withintheparametersofsemester  Requirements. |
| **Prerequisites** | Nil |
| **Corequisites** | Nil |
| **Mutual exclusions** | Nil |
| **Assessment** | Continuousassessmentbyassignment/coursework.Asaflexible  Learningcourse, 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,London  Extensiveonlineresourceswillbe availableviatheInternetandthe  Universitylibrarydatabases. |

**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 semester  Requirements. |
| Prerequisites | Nil |
| Co requisites | Nil |
| Mutual exclusions | Nil |
| Assessment | Continuousassessmentbyassignment/coursework.Asaflexible learningcourse,studentsare abletoselectfromalternativelearning  pathways.Threeassessmenttaskswillberequired.Specific configurationofthe assessmentwilldependon thelearningpathway selectedbythestudent. |
| Required texts | Whetstones.(2005),HealthInformatics:asocio technical perspective,  OxfordUniversityPress,Melbourne |
| Recommended reading | Engelbardt,S. andNelson,R.,(2002):HealthCareInformatics:An  InterdisciplinaryApproach.Mosby, StLouis.Extensiveonlineresources willbeavailableviatheInternetandtheUniversitylibrarydatabases. |

**c.Healthinformationsystems (BBE4110)**

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| Unit Title | HealthInformationSystems |
| Unit Description | **Objectives**:  Atthecompletionoftheunit,studentsshouldbe ableto: Explainandcritiquesystemstheory  Discusstasksto becompletedateachstageof thehealthinformation systemslife cycle  Discussstrategiesto resolvetechnicalissueswhichmaybeencountered ateachphaseof thelifecycle;  Discussstrategiesto resolvepeoplewhichmaybeencounteredateach phaseof thelifecycle;  Describethe impactandroleof theinformaticsprofessionalsandthe informatics/ITDepartment.  **Content**:  Thisunitbuildson theunitCRH501:Data,InformationandKnowledge. It isadetailedstudyof thedevelopment,implementationand maintenance ofhealthcaresystems.Itincludesanexplorationofsystems  theoryasitappliesto healthinformationsystems.Theunitconsidersthe  lifecycleofahealthinformationsystem,includingstrategicandtactical informationplanningandprojectmanagementandexplorestheimpact ontheorganisationof eachphaseofthe lifecycle.It exploresboth technical(infrastructure,hardware& software,Standards&Codes)and peopleissues(education& skilldevelopment,changestoroles)which needtoberesolvedintheprocessof implementingasuccessfulhealth informationsystem.Theunitalsoexplorestheroleandimpactof the  informaticsprofessionalandtheinformatics/ITdepartmentwithinthe  healthorganisation |

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| TeachingStaff | SueWhetton,DrQuynhLe |
| Campusandmode | Launceston,external,flexibledeliveryviaInternetorCD |
| Unitweight | 12.5% |
| Teachingpattern | Thisisaself directedlearningunit.Studentscompletetasksand  activitiesat theirownpace,withintheparametersofsemester requirements. |
| Prerequisites | CRH500:Introductionto HealthInformatics  CRH501:Data,informationandKnowledge  CRH502:HealthOnline |
| Co requisites | Nil |
| Mutualexclusions | Nil |
| Assessment | Asaflexiblelearningcourse,e health(HealthInformatics)studentsare  Ableto 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:An  InterdisciplinaryApproach.Mosby,StLouis.Extensiveonlineresources willbeavailableviatheInternetandtheUniversitylibrary |
| databases.Coiera,Enrico,(2003),Guideto medicalInformatics,theInternetandtelemedicine,2nd  Edition,Arnold,London  ExtensiveonlineresourceswillbeavailableviatheInternetandthe 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,informationand  Knowledgeinthecontextofrelationaldatabasedevelopmentasappliedtohealth. | | |
| Teaching Staff | |  |
| Campusandmode | |  |
| Unitweight | |  |
| Teachingpattern | | Thisisaself-directedlearningunit.Studentscompletetasksand  activitiesat theirownpacewithintheparametersofsemester requirements. |
| Prerequisites | | Nil |
| Co requisites | | Nil |
| Mutualexclusions | | Nil |
| Assessment | | Continuousassessmentbyassignment/coursework.Asa  flexiblelearningcourse,studentsareableto selectfrom alternativelearningpathways.Threeassessmenttaskswillbe  required.Specificconfigurationoftheassessmentwilldepend  onthelearningpathwayselectedbythestudent. |
| Requiredtexts | | Whetton,S.(2005),HealthInformatics:asocio technical  perspective,OxfordUniversityPress,Melbourne |
| Recommendedreading | | MeridaL.Johns(2002):InformationManagementforHealth  Professionals(2ndEdition).Delmar(ThomsonLearning), Albany,NewYork |

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