SpeechSignalProcessing			
CourseCode	**MLBI201**	**CIEMarks**	**50**
TeachingHours/Week(L:P:SDA)	**3:2:0**	**SEEMarks**	**50**
Credits	**04**	**Total Marks**	**100**
Total Number of Lecture Hours	**40 hours Theory+10 Lab slots**	**ExamHours**	**03**

Module-1

DigitalModelsforSpeechSignals: ProcessofSpeechProduction,TheAcousticTheoryofspeechproduction,Digitalmodels for Speech signals.

Time Domain Models for Speech Processing: Time dependent processing of speech, Short time Energy andaverage magnitude, Short time average zero crossing rate, Speech vs. silence discrimination using energy andzerocrossing

Module-2

Time Domain Models for Speech Processing: Pitch period estimation using parallel processing approach,Short time autocorrelation function, Short time average magnitude difference function, Pitch period estimationusing autocorrelationfunction.

Short Time Fourier Analysis : Introduction, Definitions and properties, Fourier transform interpretation, Linearfilteringinterpretation

Module-3

DigitalRepresentationsoftheSpeechWaveform: Samplingspeechsignals,Reviewofthestatisticalmodelforspeech,Instantaneousquantization,Adaptivequantization,Generaltheoryofdifferentialquantization, Deltamodulation,DifferentialPCM,Comparisonofsystems.

Module-4

Linear Predictive Coding of Speech: Basic principles of linear predictive analysis, Solution of LPC equations,Prediction error signal, Frequency domain interpretation, Relation between the various speech parameters,ApplicationsofLPCparameters.

Module-5

Speech Synthesis: Principles of Speech synthesis, Synthesis based on waveform coding, Synthesis based onanalysis synthesis method, Synthesis based on speech production mechanism, Synthesis by rule, Text to speechconversion.

Speech Recognition: Principles of Speech recognition, Speech period detection, Spectral distance measures,Structureofwordrecognitionsystems,Dynamictimewarping(DTW),Wordrecognitionusingphonemeunits.

LaboratoryExperiments:TobeconductedbyMatlab/LabView/CProgramming/DSPProcessorkits.

SpeechSignalProcessing:

1. Torecord,storeanddisplaythespeechdatausingstandardexperimentalsetup.
2. ToconductasuitableexperimenttodeterminethePitch(timedomain)andformantfrequencies.
3. Examineeffectofwindowshapeanddurationonenergy,autocorrelationorspeechspectrogram.
4. ToconductasuitableexperimenttodetermineLPCusingautocorrelationandcovariancemethod
5. Todevelopasuitableprogramforanalyzingvoiced/unvoiceddetector.
6. TodetermineSpectrogramofspeechsignals.
7. Determinetheminimumpredictionerrorco-efficientofspeechsignal.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

1. Two Tests each of 25 Marks

2. Two assignments each of 25 Marks/One Skill Development Activity of 50 marks
3. Total Marks of two tests and two assignments/one Skill Development Activity added will be CIE for 60 marks, marks scored will be proportionally scaled down to 30 marks.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The 15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test at the end /after completion of all the experiments shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 20 marks.

.SEE for IPCC
Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will be set for 100 marks and marks scored will be scaled down proportionately to 50 marks.
2. The question paper will have ten questions. Each question is set for 20 marks.
3. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
4. The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component).

- The minimum marks to be secured in CIE to appear for SEE shall be the 15 (50% of maximum marks-30) in the theory component and 10 (50% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 40% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50. (Student has to secure an aggregate of 50% of maximum marks of the course (CIE+SEE)

Textbooks:

1. Digital Processing of Speech Signals, L R Rabiner and R W Schafer, Pearson Education 2004.
2. Digital Speech Processing, Synthesis and Recognition, Sadoaki Furui, Second Edition, Mercel Dekker 2002.

Reference Books:

1. Digital Processing of Speech Signals, L R Rabiner and R W Schafer, Pearson Education 2004.
2. Digital Speech Processing, and Recognition, Sadoaki Furui, Second Edition, Mercel Dekker 2002.
3. Designing with speech processing chips, Ricardo Jimenez, Academic press, INC 1991.

4. Introduction to Data Compression, Khalid Sayood, Third Edition, Elsevier Publications.
5. Digital Speech, A M Kondoz, Second Edition, Wiley Publications

QuestionPaperPattern:

- TheSEEquestionpaperwillbesetfor100marksandthemarksscoredwillbeproportionatelyreduced to 60.
- Thequestionpaperwillhavetenfullquestionscarryingequalmarks.
- Eachfullquestionisfor20marks.
- Therewillbetwofullquestions(withamaximumoffoursubquestions)fromeachmodule.
- Eachfullquestionwillhavesubquestioncoveringallthetopicsunderamodule.
- Thestudentswillhavetoanswerfivefullquestions,selectingonefullquestionfromeachmodule.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1. The subject is practical based.
2. 10 to 12 experiments are to be conducted for this subject.
3. Students should carry out all the experiments and maintain the observation and lab record.
4. At the end of the semester students can apply all theory and lab concepts and carry out a project.

CourseOutcomes: Afterthecompletionofthiscoursethestudentwillbeableto:

1. Explainthevariousdigitalmodelsforspeechproduction
2. Applyshorttimeprinciplesindigitalspeechprocessingtoestimatevariousparametersofspeech.
3. AnalyzedifferentformsofDigitalrepresentationofspeech.
4. Synthesizetheconceptsofspeechsynthesisandspeechrecognitiontodifferentapplications.
5. Apply speech recognition principles and methods to characterize speech signals and recognize speech.

AdvancedDigital ImageProcessing			
CourseCode	MLBI202	CIEMarks	50
TeachingHours/Week(L:P:SDA)	2:0:2	SEEMarks	50
Credits	03	ExamHours	03

Module-1

FundamentalsofDigitalImageProcessing: Introduction,FundamentalstepsinDIP,Asimpleimageformationmodel,representingdigitalimages,Spatial&Graylevelresolution,Basicrelationshipbetween pixels. **Image Enhancement:** Point operations, Spatial averaging, Median filtering, Spatial low pass, high passand band passfiltering,Histogramequalization,Transformoperations.

Module-2

ImageCompression: Huffmancoding,DFT,DCT,Waveletcoding&JPEGstandard.

Module-3

ImageSegmentation: Detectionofdiscontinuities,EdgelinkingandBoundarydetectionbylocalprocessing&globalprocessingusingHoughtransform,Regionbasedsegmentation.

Module-4

Image Representation and Description: Representation – Chain codes, polygonal approximations, signatures,boundarysegments,skeletons,Boundarydescriptors–Some simpledescriptors,Shapenumbers,Fourier descriptors,statistical moments,Regionaldescriptors –Some simpledescriptors, topologicaldescriptors,texture.

Module-5

MorphologicalImageProcessing: Basicconceptsofsettheory,Logicaloperationsinvolvingbinaryimages,Dilationanderosion,Openingandclosing,Thehit-or-misstransformation, Basicmorphologicalalgorithms.

CourseOutcomes: Afterthecompletionofthiscoursethestudentwillbeableto;

1. Explainthefundamentalsofdigitalimage processingincludingthetopicsoffiltering,transforms,andmorphology,andimage analysisandcompression.
2. ImplementbasicimageprocessingalgorithmsinMATLAB.
3. Evaluateandsynthesizethedatacodingandcompressiontechniquesonimages.
4. Implement and evaluate algorithmsfor image analysisbased on segmentation, shape & texture,registration,recognitionandclassification.
5. UseMATLABforimplementingimageprocessingalgorithmsofsegmentation,registration,objec trecognitionandclassification.

QuestionPaperPattern:

- TheSEEquestionpaperwillbesetfor100marksandthemarksscoredwillbeproportionatelyreduce dto 60.
- Thequestionpaperwillhavetenfullquestionscarryingequalmarks.
- Eachfullquestionisfor20marks.
- Therewillbetwofullquestions(withamaximumoffoursubquestions)fromeachmodule.
- Eachfullquestionwillhavesubquestioncoveringallthetopicsunderamodule.
- Thestudentswillhavetoanswerfivefullquestions,selectingonefullquestionfromeachmodule.

Textbooks:

1. DigitalImageProcessing,RafaelC.Gonzalez&RichardE.Woods,SecondEdition.PearsonEducation Inc.
2. FundamentalsofDigitalImageProcessing,AnilK.Jain.PrenticeHallofIndia.

ReferenceBooks:

1. ImageProcessing,AnalysisandMachineVision,MilanSonka,VaclavHlavac&RogerBoyle,2nd Edition.
2. DigitalImageProcessing,RafaelC.Gonzalez&RichardE.Woods,FirstEdition.PearsonEducationInc.
3. PracticalAlgorithmsforImageAnalysis:Description,Examples&CodesbyMichaelSeul,LawrenceO 'Gorman,MichelJ.Sammon,Cambridge UniversityPress.
4. BiomedicalImagingvisualizationandanalysis,RichardARobb,JohnWiley&Sons,Inc.

Advanced BiomedicalSignalProcessing			
CourseCode	MLBI203	CIEMarks	50
TeachingHours/Week(L:P:SDA)	2:0:2	SEEMarks	50
Credits	03	ExamHours	03

Module-1

Introduction: Generalmeasurementanddiagnosticsystem,classificationofsignals,introductiontobiome dicalsignals, Biomedical signal acquisition and processing, Difficulties in signal acquisition. Noise amplifier,BaselineWander,PowerlineInterference

ECG: ECGsignalorigin,ECGparameters-QRSdetectiondifferenttechniques,STsegmentanalysis, Arrhythmia,Arrhythmiaanalysis,Arrhythmiamonitoringsystem.

Module-2

ECGDataReduction: DirectdatacompressionTechniques:TurningPoint,AZTEC,Cortes,FAN,Transfo rmation Compression Techniques: Karhunen - Loeve Transform, Other data compression Techniques:DPCM,Huffmancoding,DatacompressionTechniquescomparison.

SignalAveraging: Basics ofsignalaveraging,Signalaveragingas adigitalfilter,A typicalaverager,Software andlimitationsofsignalaveraging.

Module-3

FrequencyDomainAnalysis: Introduction,Spectralanalysis,linearfiltering,cepstralanalysisandhomomorphic filtering.Removal of highfrequencynoise (power line interference),motionartifacts (lowfrequency)andpowerlineinterferenceinECG,

Time Series Analysis: Introduction, AR models, Estimation of AR parameters by method of least squares andDurbin'salgorithm,ARMAmodels.SpectralmodellingandanalysisofPCGsignals,correlation,convolution

Module-4

SpectralEstimation: Introduction,Blackman-tukeymethod,Theperiodogram,Pisarenko'sHarmonicdecomposition, Prony' method, Evaluation of prosthetic heart valves using PSD techniques. Comparison of thePSDestimationmethods.

EventDetectionandwaveformanalysis: Need foreventdetection,Detectionofevents&waves,Correlation analysisofEEGsignals,Thematchedfilter,DetectionofthePwave,Identificationofheartsounds,MorphologicalanalysisofECGwaves,analysisofactivity.

Module-5

Adaptive Filtering: Introduction, General structure of adaptive filters, LMS adaptive filter, adaptive noisecancellation,Cancellationof60HzinterferenceinECG,cancellationofECGfromEMGsignal,CancellationofmaternalECGin fetalECG.

EEG:EEGsignalcharacteristics,SleepEEGclassificationandepilepsy.

CourseOutcomes: Uponcompletionofthiscourse,thestudentshouldbeableto:

1. Implementthevarioustypesofprocessingtechniquescarriedoutonbiomedicalsignalswhichmeetthecurrent Industryneeds.
2. Developaninteresttodesignnewmodelledalgorithmmoreandmorecontinually.
3. Developaninteresttosimulatethemodelsandvalidateitsfunctionalityinrealtimesystems.
4. Demonstrateanabilitytointegratedifferentconceptstodevelopnewmodelsthatsuitscurrenttrends ofIndustries andanalyzeits performance.
5. Ability to evaluate various biomedical signal processing systems

QuestionPaperPattern:

- TheSEEquestionpaperwillbesetfor100marksandthemarksscoredwillbeproportionatelyreduced to 60.
- Thequestionpaperwillhavetenfullquestionscarryingequalmarks.
- Eachfullquestionisfor20marks.
- Therewillbetwofullquestions(withamaximumoffoursubquestions)fromeachmodule.
- Eachfullquestionwillhavesubquestioncoveringallthetopicsunderamodule.
- Thestudentswillhavetoanswerfivefullquestions,selectingonefullquestionfromeachmodule.

Textbooks:

1. BiomedicalSignalProcessingTimeandFrequencyDomainsAnalysis(VolumeI)-ArnonCohen,CRCpress,1986.
2. BiomedicalSignalAnalysis-Acase studyapproach- RangarajM. Rangayyan,Wiley-IEEEPress,2002.
3. BiomedicalSignalProcessingPrinciplesandTechniques-D.C.Reddy,TataMcGraw-Hill,2012.
4. BiomedicalDigitalSignalProcessing-WillisJ.Tompkins,PHI,2000.

ReferenceBooks:

1. BiomedicalSignal ProcessinginCardiacandNeurologicalApplications",Leif Sörnmo&PabloLaguna,1st edition,AcademicPress,2005

WirelessTechnologiesforMedicalApplications			
CourseCode	MLBI204	CIEMarks	50
TeachingHours/Week(L:P:SDA)	2:0:2	SEEMarks	50
Credits	03	ExamHours	03

Module-1

FundamentalsofWirelessCommunication:DigitalCommunications,WirelessCommunicationSystem, WirelessMedia,FrequencySpectrum,TechnologiesinDigitalwirelessCommunication,Coding,Typesof WirelessCommunicationSystems.

Module-2

WirelessBodyAreaNetwork(WBAN):NetworkArchitecture,NetworkComponents,DesignIssues,NetworkProtocols,WBAN Technologies,WBANApplications.
Module-3
WirelessPersonalAreaNetworks:WirelessPersonalAreaNetwork(WPAN),NetworkArchitecture,WPAN Components,WPANTechnologiesandProtocols,WPANApplications.
Module-4
WirelessLocalAreaNetworks:NetworkComponents,DesignRequirementsofWLAN, NetworkArchitecture, WLANStandards,Casestudiesinbiomedicaldomain.
Module-5
ApplicationsofWireless SensorNetworks: Introduction, Background Examples of Category of WSN ApplicationsHomeControl,BuildingAutomation,IndustrialAutomation,MedicalApplications,Casestudiesin biomedicaldomain.
QuestionPaperPattern: • TheSEEQuestionpaperwillbesetfor100marksandthemarksscoredwillbeproportionatelyreduced to 60. • Thequestionpaperwillhavetenfullquestionscarryingequalmarks. • Eachfullquestionisfor20marks. • Therewillbetwofullquestions(withamaximumoffoursubquestions)fromeachmodule. • Eachfullquestionwillhavesubquestioncoveringallthetopicsunderamodule. • Thestudentswillhavetoanswerfivefullquestions,selectingonefullquestionfromeachmodule.
CourseOutcomes: Aftergoingthroughthiscoursethestudentwillbeableto: 1. Understandthefundamentalsofwirelesstechnologiesinvolvedinhealthdomainapplication. 2. Applyadvancedwirelesstechnologiesforbiomedicalapplications. 3. Analyzesensornetworktechniquesforthehospitalmanagement. 4. Evaluate theimpactofthe technologyonsociety,andrelate thistoglobalissues,governmentalissuesandeconomics. 5. Analyze how wireless technologies can improve healthcare
ReferenceBooks: 1. WirelessandMobileNetworks,ConceptsandProtocols,SunilkumarS.Manvi,MahabaleshwarS. Kakkasageri,2nd Edition,2016,ISBN-13:978-8126520695. 2. FundamentalsofWireless SensorNetworks:Theoryand Practice,WaltenegusDargie,ChristianPoellabauer,Willey Publications,ISBN-13:978-8126551255 3. WirelessCommunications&Networks,WilliamStallingPearson2ndEdition,ISBN978-8132231561. 4. WirelessCommunication– Principles&Practice,T.S.Rappaport,Pearson2ndEdition,2010.ISBN-13:978-8131731864.

PhotonicsforMedicalImaging			
CourseCode	MLBI255A	CIEMarks	50
TeachingHours/Week(L:P:SDA)	2:0:2	SEEMarks	50
Credits	03	ExamHours	03
Module-1			
Basic of Lasers: Principles of Lasers, Current Laser Technology, and Nonlinear Optics: Principles of Lasers,Principles of Laser Action, Classification of Lasers, Some Important Lasers for Bio-photonics Current LaserTechnologies, Quantitative Description of Light: Radiometry, Nonlinear Optical Processes with Intense LaserBeam,MechanismofNonlinearOpticalProcesses,FrequencyConversionbyaSecond-OrderNonlinearOptical Process, Symmetry Requirement for a Second-Order Process, Frequency Conversion by a Third-Order,NonlinearOpticalProcess,MultiphotonAbsorption,Time-			

ResolvedStudies,LaserSafety.

Module-2

Bio-imaging:PrinciplesandTechniques:AnOverviewofOpticalImaging,TransmissionMicroscopy,Simple Microscope, CompoundMicroscope,KohlerIllumination, NumericalAperture and Resolution.

Module-3

OpticalBio-microscopicImaging:OpticalAberrationsandDifferentTypesofObjectives,PhaseContrastMicroscopy, Dark-FieldMicroscopy,DifferentialInterferenceContrastMicroscopy,FluorescenceMicroscopy,Scanning Microscopy, Confocal Microscopy, Multi-photon Microscopy. Optical Coherence Tomography, TotalInternalReflectionFluorescenceMicroscopy,Near-FieldOpticalMicroscopy,SpectralandTimeResolvedImaging,SpectralImaging,BandpassFilters,ExcitationWavelengthSelection,Acousto-OpticTuneableFilters,LocalizedSpectroscopy,FluorescenceResonanceEnergyTransfer(FRET)Imaging,FluorescenceLifetimeImagingMicroscopy(FLIM), NonlinearOpticalImaging,Second-HarmonicMicroscopy,Third-HarmonicMicroscopy,Coherent,Anti-StokesRamanScattering(CARS)Microscopy,MultifunctionalImaging,PiImaging,CombinationMicroscopes,MiniaturizedMicroscopes,SomeCommercialSourcesof ImagingInstruments.

Module-4

Applications of Bio-photonics: Fluorophores as Bio-imaging Probes, Organometallic Complex Fluorophores,Near-IR and IR Fluorophore, Two-Photon Fluorophores, Inorganic Nanoparticles, Green Fluorescent Protein,Imaging of Organelles, Imaging of Microbes, Confocal Microscopy, Near-Field Imaging, Cellular Imaging,ProbingCellularIonicEnvironment,IntracellularpHMeasurements,OpticalTrackingofDrug-Cell Interactions, Imaging of Nucleic Acids, Cellular Interactions Probed by FRET/FLIM Imaging, Tissue Imaging,InVivoImaging,CommerciallyAvailableOpticalImagingAccessories

Module-5

Optical Biosensors: Principles of Optical Bio-sensing, Bio-recognition, Optical Transduction, FluorescenceSensing,FluorescenceEnergyTransferSensors,MolecularBeacons,OpticalGeometriesofBio-sensing,SupportforandImmobilizationofBio-recognitionElements.Immobilization,PlanarWaveguideBiosensors, EvanescentWaveBiosensors,InterferometryBiosensors,SurfacePlasmonResonanceBiosensors,Some RecentNovelSensingMethods,Commercially availablesensors.

CourseOutcomes: Aftercompletionofthiscoursethestudentwillbeableto:

1. calculate the properties of various lasers and the propagation of laser beams;
2. Analyzethelaserprincipleswithsafetyregulations,opticalsetupdesignforbiomedicalapplications.
3. Utilizeopticalcomponentsformicroscopesinbiomedicalimagingwithsimulationresearchstudieswitha researchanalysis report.
4. Understandtheopticalbiosensorforimagetransductionandcasestudyanalysis.
5. integrate several components of the course in the context of a new situation

QuestionPaperPattern:

- TheSEEquestionpaperwillbesetfor100marksandthemarksscoredwillbeproportionatelyreduced to 60.
- Thequestionpaperwillhavetenfullquestionscarryingequalmarks.
- Eachfullquestionisfor20marks.
- Therewillbetwofullquestions(withamaximumoffoursubquestions)fromeachmodule.
- Eachfullquestionwillhavesubquestioncoveringallthetopicsunderamodule.
- Thestudentswillhavetoanswerfivefullquestions,selectingonefullquestionfromeachmodule.

Textbook:

1. IntroductiontoBio-photonics,ParasNPrasad,AJohnWiley&Sons,Inc.,Publication.2003.

ReferenceBook:

1. FundamentalsofLightMicroscopy&ElectronicImaging,DouglasBMurphy,JohnWiley&Sons, 2001.
2. BiomedicalOptics:PrinciplesandImaging,LihongVWang,Hsin-IWu,May2007.

Medical Informatics & Expert systems			
Course Code	MLBI255B	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Credits	03	Exam Hours	03

Module-1

Medical Informatics: Aim and scope, salient feature, Introduction, history, definition of medical informatics, bio-informatics, online learning, introduction to health informatics, prospectus of medical informatics.

Hospital Management And Information Science: Introduction, HMIS: need, Benefits, capabilities, development, functional areas. Modules forming HMIS, HMIS and Internet, Pre-requisites for HMIS-client server technology, PACS, why HMIS fails, health information system, disaster management plans, advantages of HMIS.

Module-2

Hospital Management And Information Systems-Structure And Functions : Central Registration Module, OPD / Consultant Clinic / Polyclinic Module, Indoor Ward Module, Patient Care Module, Procedure Module, Diet Planning Module, MLC Register Module, Pathology Laboratory Module, Blood Bank Module, Operation Theatre Module, Medical Stores Module, Pharmacy Module, Radiology Module, Medical Records Index Module, Administration Module, Personal Registration Module, Employee Information Module, Financial modules, Health & Family Welfare, Medical Examination, Account Billing, Medical Research, Communication, General Information.

Module-3

Knowledge Based And Expert Systems: Introduction, Artificial Intelligence, Expert systems, need for Expert Systems, materials and methods- knowledge representation & its methods, production rule systems, algorithmic method, OAV, object oriented knowledge, database comparisons, statistical pattern classification, decision analysis, tools, neural networks, advantages of ES, applications of ES.

Module-4

Computer Assisted Medical Education: CAME, Educational software, Simulation, Virtual Reality, Tele-education, Tele-mentoring.

Computer Assisted Patient Education: CAPE, patient counseling software. Computer assisted surgery (CAS), Limitations of conventional surgery, 3D navigation system, intra-operative imaging for 3D navigation system, merits and demerits of CAS.

Module-5

Telecommunication Based Systems: Tele-Medicine, Need, Advantages, Technology- Materials andMethods, Internet Tele-Medicine, Applications.

Tele-Surgery: Tele-surgery,Robotic surgery, NeedforTele-Surgery,Advantages,Applications.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks**or**oneSkill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Textbook:

1. Medical Informatics: A Primer - by Mohan Bansal, 1st Print, Tata McGraw Hill, Publications, 2003.

Reference Books:

1. Medical Informatics: Computer Applications in Health Care and Biomedicine by E.H.Shortliffe, G. Wiederhold, L.E.Perreault and L.M.Fagan, 2nd Edition, Springer Verlag, 2000.
2. Handbook of Medical Informatics by J.H.VanBemmel, Stanford University Press/ Springer, 2000.

CourseOutcomes: Aftercompletionofthiscoursethestudentwillbeableto:

1. Explain the role of technology both hardware & software in training the medical personalities
2. Discuss the role of telecommunication, tele-surgery, robotics in healthcare
3. Discuss ethical and diversity issues in health informatics.
4. Understandthe basics of expert systems and artificial intelligence
5. Analysis of decision making concepts used in healthcare and their applications

NeuralNetworkandFuzzyLogicinMedicine			
CourseCode	MLBI255C	CIEMarks	50
TeachingHours/Week(L:P:SDA)	2:0:2	SEEMarks	50
Credits	03	ExamHours	03
Module-1			

LearningandSoftComputing: Examples,basictoolsofsoftcomputing,basicmathematicsofsoftcomputing,Differences between neural network and Biological neural network, Network Architecture, Artificial Intelligent**Learning process:** Error correctionAlgorithm,MemorybasedLearning,HebianLearning,Learningwith Teacher,LearningwithoutTeacher

Module-2

SingleLayerNetworks: Perception,PerceptronConvergencetheorem,RealizationofBasiclogicgatesusingsinglelayerPerceptron,Adaptive linear neuron(Adaline)and theLMSalgorithm.

Module-3

MultilayerPerception: Errorbackpropagationalgorithm,generalizeddeltarule,XORProblem,Practical Aspects ofErrorBackPropagationAlgorithm.Problems

RadialBasisFunctionNetworks: IllPosedProblemsandRegularizationTechnique,StabilizersandBasis Functions,GeneralizedRadialBasisFunctionNetworks.

Module-4

SupportVectorMachines: RiskminimizationprinciplesandtheConceptofUniformConvergence,VCdimension, Structural RiskMinimization,support vectormachine algorithms

FuzzyLogic: IntroductiontoFuzzyLogic,ClassicalandFuzzySets:OverviewofClassicalSets,MembershipFunction,OperationsonFuzzySets,FuzzyArithmetic,Compliment,Intersections,Unions,FuzzyRelation.

Module-5

FuzzyRulebasedsystem LinguisticHedges.Rulebasedsystem,GraphicaltechniquesforInference,FuzzificationandDefuzzification,fuzzy additivemodelsApplications.

Casestudies: FuzzylogiccontrolofBloodpressureduringAnaesthesia,FuzzylogicapplicationtoImageprocessingequipment,Adaptivefuzzysystem.IntroductiontoNeuro-fuzzylogictoolusingLabView

CourseOutcomes: Aftercompletionofthiscoursethestudentwillbeableto:

1. Comparethedifferencebetweenbiologicalandartificialneuralnetwork.
2. Describeregressionandclassificationmethod
3. DescribeSinglelayerinitializetheorem
4. Analyzethegeneralizedradialbasisfunctionnetworks.
5. Understand and apply the concept of classical and fuzzy sets, Fuzzification and Defuzzification,

QuestionPaperPattern:

- TheSEEquestionpaperwillbesetfor100marksandthemarksscoredwillbeproportionatelyreduced to 60.
- Thequestionpaperwillhavetenfullquestionscarryingequalmarks.
- Eachfullquestionisfor20marks.
- Therewillbetwofullquestions(withamaximumoffoursubquestions)fromeachmodule.
- Eachfullquestionwillhavesubquestioncoveringallthetopicsunderamodule.
- Thestudentswillhavetoanswerfivefullquestions,selectingonefullquestionfromeachmodule.

Textbooks:

1. S.Haykin,"Neuralnetworks:AComprehensiveFoundation"'PearsonEducation(Asia)Pvt. Ltd/PrenticeHallof India,2003.
2. TimothyJRoss,"FuzzylogicwithEngineeringApplications",McGrawHillPublication,2000.
3. BartKosko,"NeuralNetworksandFuzzySystems",PrenticeHallofIndia,2005

ReferenceBooks:

1. VojislavKecman,"Learningandsoftcomputing",PearsonEducation(Asia)Pvt.Ltd.2004.
2. M.T.Hagan,H.B.DemuthandM.Beale,"NeuralNetworkDesign",ThomsonLearning,2002.
3. GeorgeJ.KlirandBoYaun, "FuzzysetsandFuzzyLogic:TheoryandApplication",PrenticeHallofIndia,2001.

Statistical Signal Processing			
CourseCode	MLBI255D	CIEMarks	50
TeachingHours/Week(L:P:SDA)	2:0:2	SEEMarks	50
Credits	03	ExamHours	03

Module-1

DigitalFilterdesignusingleast-squaremethod:LeastSquareerrorcriterioninthedesignofPole-zerofilters,FIRleastsquaresinversefilters.

Module-2

SpectralEstimationandAnalysis-Nonparametricmethods:Periodogram,BartlettandWelchmodifiedperiodogram,Blackman-TukeyMethods.

Module-3

Spectral estimation and analysis -Parametric methods: wide sense stationary random process, rational powerspectra: Auto Regressive (AR) Process, Moving Average (MA) Process, ARMA Process, Relationship betweentheFilterParametersandtheautocorrelationsequence.

Module-4

ForwardandbackwardLinearPrediction:ForwardLinearPrediction,BackwardLinearPrediction,RelationshipofanARprocesstoLinear Prediction:Yule–Walker Method,Levinson–Durbin Algorithm.12Hrs

Module-5

Adaptive Algorithms to adjust coefficients of digital filters: Least Mean Square (LMS), Recursive Least Square(RLS)andKalmanFilter Algorithms.10 Hrs

CourseOutcomes: Studentswillbeableto

1. DevelopSignalmodellingusingLeastSquareMethods.
2. ExplainspectralestimationandanalysisofsignalsusingNonparametricmethods.
3. Determinespectralestimationandanalysisofsignalsusingparametricmethods.
4. Applybasicconceptsofforwardandbackward Linearprediction
5. ExplainprinciplesofLMSandRLSadaptivealgorithmsandKalmanfilters

QuestionPaperPattern:

- TheSEEquestionpaperwillbesetfor100marksandthemarksscoredwillbeproportionatelyreduced to 60.
- Thequestionpaperwillhavetenfullquestionscarryingequalmarks.
- Eachfullquestionisfor20marks.
- Therewillbetwofullquestions(withamaximumoffoursubquestions)fromeachmodule.
- Eachfullquestionwillhavesubquestioncoveringallthetopicsunderamodule.
- Thestudentswillhavetoanswerfivefullquestions,selectingonefullquestionfromeachmodule.

Textbooks:

1. StatisticalsignalprocessingandModelling,MonsonH.Hayes,Wiley,1996
2. Fundamentalsofstatisticalsignalprocessing,EstimationTheory,S.M.Kay,PrenticeHall,1993

ReferenceBooks:

1. DigitalSignalProcessing,Principles,Algorithms,andApplications,Proakis,JohnG.,DimitrisG. Manolakis,and D.Sharma:,PearsonEducation,2006.
2. DigitalSignalProcessingacomputerBasedapproach,MitraSanjit.K,TataMcGrawHill,2001.
3. AdaptiveSignalProcessing,B.Widrow&SStearns,PHI,1985.
4. StatisticalandAdaptiveSignalProcessing,Dimitris,Manolakis,McGrawHill,2000.

BiomaterialsandArtificialOrgans			
CourseCode	MLBI256A	CIEMarks	50
TeachingHours/Week(L:P:SDA)	2:0:2	SEEMarks	50
Credits	03	ExamHours	03

Module-1

StructureofBio-MaterialsandBio-Compatibility

Definitionandclassificationofbio-materials,mechanicalproperties,visco-elasticity,wound-healingprocess,body responsetoimplants, bloodcompatibility.

Module-2

ImplantMaterials

Metallicimplantmaterials,stainlesssteels,co-basedalloys,Ti-basedalloys,ceramicimplantmaterials,aluminiumoxides,hydroxyapatiteglassceramicscarbons,medicala

pplications.

Module-3

PolymericImplantMaterials
Polymerization,polyamides,Acrylicpolymers,rubbers,highstrengththermoplastics,medicalapplications.Biopolymers: Collagenand Elastin.

Module-4

TissueReplacementImplants
Soft-tissuereplacements,sutures,surgicaltapes,adhesive,Percutaneousandskinimplants,maxillofacial augmentation,bloodinterfacingimplants,hardtissuereplacementimplants,internalfracturefixationdevices,jointreplacements.

Module-5

ArtificialOrgans
ArtificialHeart,ProstheticCardiacValves,Artificiallung(oxygenator),ArtificialKidney(DialysisandDialysermembrane),DentalImplants,Artificiallimb&hand.

CourseOutcomes: Attheendofthecourse,thestudentwillbeableto;

1. Explainthefeaturesofbiomaterialsandthebiocompatibilityphenomena.
2. Understand the technologies of biomaterial processing, clinical trials, and regulatory standards
3. Describeprinciples,constructionandworkingofartificialorgans.
4. Discussthefunctionandrelationshipbetweenthestructureandfunctionalityofchosenartificialorgan.
5. Gain knowledge on some of the existing designs of artificial organs

QuestionPaperPattern:

- TheSEEquestionpaperwillbesetfor100marksandthemarksscoredwillbeproportionatelyreduced to 60.
- Thequestionpaperwillhavetenfullquestionscarryingequalmarks.
- Eachfullquestionisfor20marks.
- Therewillbetwofullquestions(withamaximumoffoursubquestions)fromeachmodule.
- Eachfullquestionwillhavesubquestioncoveringallthetopicsunderamodule.
- Thestudentswillhavetoanswerfivefullquestions,selectingonefullquestionfromeachmodule.

Textbooks:

1. SujataV.Bhat,BiomaterialsSecondEdition,NarosaPublishingHouse,2005.
2. JoonB.ParkJosephD.Bronzino,Biomaterials-PrinciplesandApplications–CRCPress,2003.

ReferenceBooks:

1. ParkJ.B.,"BiomaterialsScienceandEngineering",PlenumPress,1984.
2. MyerKutz,"StandardHandbookofBiomedicalEngineering&Design",McGraw-Hill,2003.
3. JohnEnderle,JosephD.Bronzino,SusanM.Blanchard,"IntroductiontoBiomedicalEngineering",Elsevier, 2005.

ARMEmbeddedSystemDesign			
CourseCode	MLBI2565B	CIEMarks	50
TeachingHours/Week(L:P:SDA)	2:0:2	SEEMarks	50
Credits	03	ExamHours	03

Module-1

IntroductionToEmbeddedsystems
Introduction,Processorembeddedintoasystem,embeddedhardwareunitsanddevicesinasystem,examples, SOCanduseofVLSI,Complexsystemsdesign,formalizationofsystemdesign,classificationofembeddedsystems,skillsrequired foranembedded system designer, processor andmemoryorganization.

Module-2

ARMEmbeddedSystemsandARMprocessorfundamentals
TheRISCDesignphilosophy,TheARMDesignphilosophy,Embeddedsystemhardware,Registers,Current programstatusregister,pipeline,exceptions,interruptsandVectortable,Coreextensions,Architecturerevisions,ARMprocessorfamilies.

Module-3

IntroductiontoARMinstructionsetand
Dataprocessinginstructions,branchinstructions,load-storeinstructions,softwareinterruptsinstruction,Programstatusregisterinstructions,loadingconstants,ARMv5Eextensions,conditionalexecution.

Module-4

IntroductiontothethumbinstructionsetandExceptionandinterrupthandling
Thumbregisterusage,ARM-Thumbinterworking,dataprocessinginstructions,Single&multiple-registerLoad-storeinstruction,stackinstructions,softwareinterruptinstruction,Exceptionhandling,interrupts,interrupt handlingschemes.

Module-5

EmbeddedoperatingsystemsandFutureoftheArchitecture
Fundamentalcomponents,**Example:**Simplelittleoperatingsystem.AdvancedDSPandSIMDsupportinARMv6,SystemandmultiprocessorsupportadditionstoARMv6,Armv6implementations,Futuretechnologies
beyondARMv6.

Courseoutcomes: Attheendofthecourse,thestudentwillbeableto;

1. AnalyzeanyARMversionprocessorwithdifferentmodes.
2. WriteaprogramusingARM32bitinstructionsets.
3. WriteaprogramusingThumbinstructionsets.
4. WriteExceptionandinterrupthandlingprograms.
5. Develophardwareandsoftwareforembeddedsystemsforspecificapplication.

QuestionPaperPattern:

- TheSEEquestionpaperwillbesetfor100marksandthemarksscoredwillbeproportionatelyreduced to 60.
- Thequestionpaperwillhavetenfullquestionscarryingequalmarks.
- Eachfullquestionisfor20marks.
- Therewillbetwofullquestions(withamaximumoffoursubquestions)fromeachmodule.
- Eachfullquestionwillhavesubquestioncoveringallthetopicsunderamodule.
- Thestudentswillhavetoanswerfivefullquestions,selectingonefullquestionfromeachmodule.

Textbooks:

1. ARMsystemdevelopersguide,AndrewNSloss,DominicSymesandChris wright,Elsevier,MorganKaufman publishers,2008,ISBN:1558608745
2. ARMArchitecturereferencemanual,Davidseal:Addison-Wesleysecondedition,2009,ISBN:978-0201737196.
3. EmbeddedSystems,Rajkamal,TataMcGraw-Hillpublishers,2008,ISBN:0070494703.

ReferenceBook:

1. ARM System on chip Architecture Addison Wesley, Formatted: paperback, 2008, ISBN:978-0201675191.

HealthCareDataAnalytics

CourseCode	MLBI256C	CIEMarks	50
TeachingHours/Week(L:P:SDA)	2:0:2	SEEMarks	50
Credits	03	ExamHours	03

Module-1

Introduction: Introduction to big data, risks of big data, structure of big data, exploring big data, filtering bigdata effectively, mixing big data with traditional data, need for standards-today's big data is not tomorrow's bigdata,webdata:theoriginalbigdata,webdataoverviewwebdatainaction,cross-sectionofbigdatasourcesandthevaluetheyhold.

Data Analysis: Evolution of analytic scalability, convergence, parallel processing systems, cloud computing,gridcomputing,mapreduce,enterpriseanalyticsandbox,analyticdatasetsanalyticmethods,analytictools,
cognos, micro strategy, pentaho, analysis approaches, statistical significance, business approaches,

analyticinnovation,traditionalapproaches.

Module-2

MiningDataStreams: Introductiontostreamsconcepts,streamdatamodelandarchitecture,streamcomputing,samplingdatainastream,filteringstreams,countingdistinctelementsinastream,estimating moments,countingonenessinawindow,decayingwindow,realtimeanalyticsplatform(RTAP)applications,casestudies,realtimesentimentanalysis,stockmarketpredictions.

Module-3

Frequent itemsets and Clustering: Mining frequent itemsets ,market based model ,apriori algorithm, handlinglarge data sets in main memory, limited pass algorithm, counting frequent itemsets in a stream ,clusteringtechniques ,hierarchical ,k-means ,clustering high dimensional data ,clique and proclus , frequent pattern basedclusteringmethods,clusteringinnon-Euclideanspace,clusteringforstreamsandparallelism.

Module-4

FrameworksandVisualization: Mapreduce , Hadoop, Hive, Mapr, Sharding , Nosql databases Hadoopdistributed file systems, Visualizations -visual data analysis techniques, interaction techniques; systems andapplications.

Module-5

Applications: Applications and Practical Systems for Healthcare– Data Analytics for Pervasive Health-FraudDetection in Healthcare-Data Analytics for Pharmaceutical Discoveries-Clinical Decision Support Systems-Computer-AssistedMedicalImageAnalysisSystems-MobileImagingandAnalyticsforBiomedicalData.

CourseOutcomes: Aftergoingthroughthiscoursethestudentwillbeableto

1. RecallaboutBigData,DataAnalysis,DataStreams,Clustering&frameworks.
2. ExplainAnalyticalScalability,Streamcomputinganditsapplications.
3. MakeuseofdifferentFrameworksandVisualizationtechniques.
4. Analyzedifferentclusteringtechniques.
5. Developcasesinvolvingbigdataanalyticsinsolvingpracticalproblems.

QuestionPaperPattern:

- TheSEEquestionpaperwillbesetfor100marksandthemarksscoredwillbeproportionatelyreduced to 60.
- Thequestionpaperwillhavetenfullquestionscarryingequalmarks.
- Eachfullquestionisfor20marks.
- Therewillbetwofullquestions(withamaximumoffoursubquestions)fromeachmodule.
- Eachfullquestionwillhavesubquestioncoveringallthetopicsunderamodule.
- Thestudentswillhavetoanswerfivefullquestions,selectingonefullquestionfromeachmodule.

Textbooks:

1. TamingtheBigDataTidalWave:FindingOpportunitiesinHugeDataStreamwithadvancedanalytics,BillFranks,JohnWiley&sons,2012.
2. Mining of Massive Datasets, Anand Rajaraman and Jefrey David Ulman, Cambridge University Press,2012.
3. Healthcaredataanalytics,ChandanK.ReddyandCharuCAggarwal,Taylor&Francis,2015
4. HealthcareAnalytics:FromDatatoKnowledgetoHealthcareImprovement,HuiYangandEvaK.Lee,Wiley,2016.

ReferenceBooks:

1. CoreJava,Horstmann,CayS,10thEdition,PrenticeHall,2016,ISBN:9780134177304.
2. JavaTheCompleteReference,HerbertSchildt,8thEdition,TataMcGrawHill,2011.
3. Java9Recipes-AProblem-SolutionApproach,JoshJuneau,3rdEdition,Apress,2017.
4. IntroductiontoJAVAProgramming,Y.DanielLiang,6thEdition,PearsonEducation,2007.

Ergonomics			
Course Code	**MLBI256D**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50

Credits	03	Exam Hours	03

Module-1

The Design of Work Places: Working heights, Room to grasp and move things, Seating at work. **Heavy Work:** Physiological principles, Energy consumptions at work, Limits and norms of energy consumption at work, Organization of heavy work. **Handling loads:** Lifting, Carrying a burden.

Module-2

Skilled work: Acquiring skill, Maximum control of skilled movements, Facilitating skilled work.
Mental activity: Uptake of information, Memory, Sustained alertness.
Fatigue: Fatigue in industrial practice, Measuring fatigue.

Module-3

Boredom: Boredom from the standpoint of psychology, Problems of monotonous, repetitive work.
Working hours and eating habits: Flexible and continuous working schedules, Rest pauses, Nutrition and work.
Night work and shift work: Night work and health, Organization of shift work.

Module-4

Man – machine systems: Visual perception, Perception of sound, Display equipment, Controls, Relationship between controls and display instruments.

Light and colour in surroundings: Light measurement and light sources, Physiological requirements of artificial lighting, Lighting for the work place, Daylight, Colour in the work room.

Module-5

Noise and Vibration: Measurement and sources of noise, Damage to hearing through noise, Physiological and psychological effects of noise, Protection against noise, Music and work, Vibrations.
Indoor climate: Thermal regulation in man, Comfort, Dryness of the air during heating periods, Recommendations for comfort indoors, Air pollution and ventilation, Heat in industry.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks**or**oneSkill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

3. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
4. The question paper will have ten full questions carrying equal marks.
5. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from

Suggested Learning Resources:

Text Book:

1. Fitting the Task to the Man – An ergonomic approach, by E. Grandjean, 3rd Edition, Taylor & Francis Ltd, London.

Reference Books:

1. Fitting the Task to the Human - A Text Book of Occupational Ergonomics by H. E. Kroemer and Etienne Grandjean, 5th Edition, Taylor & Francis Ltd, London.
2. Human Factors in Engineering and Design - by Mark S. Sanders and Ernest J. McCormick, 1993.

CourseOutcomes: Aftergoingthroughthiscoursethestudentwillbeableto

1. Define the principles of Ergonomics
2. Describe the work places in order to suit the physical and psychological requirements of the Workers
3. Employ the principles of Ergonomics in design of work places
4. Evaluate the work places based on efficiency, accuracy, and safety
5. Recognize ergonomic risk factors and how to assess them