University of Mumbai

No. AAMS(UG)/ 119 of 2022-23

CIRCULAR:-

Attention of the Principals of the Affiliated Colleges and Directors of the Recognized Institutions in Faculty of Science & Technology is invited to this office circular No. UG/143 of 2016-17 dated 9th November, 2016 relating to the revised syllabus as per Choice Based Credit System for Master of Engineering (Electronics & Telecommunication).

You are hereby informed that the recommendations made by the Ad-hoc Board of Studies in **Electronics and Telecommunication Engineering** at its meeting held on 11th May, 2022 and subsequently passed in the Faculty and then by the Board of Deans at its meeting held on 5th July, 2022 **vide** item No. 6.31 (R) have been accepted by the Academic Council at its meeting held on 11th July, 2022 **vide** item No. 6.31 (R) and that in accordance therewith, the revised syllabus of **M.E. (Electronics and Telecommunication Engineering) (Sem.- I to IV) (CBCS) (REV-2022 Scheme)**, has been brought into force with effect from the academic year 2022-23. (The circular is available on the University's website www.mu.ac.in).

(Dr. Shailendra Deolankar)
I/c Registrar

MUMBAI – 400 032
20th October, 2022

To

The Principals of the Affiliated Colleges and Directors of the Recognized Institutions in Faculty of Science & Technology.

A.C/6.31 (R)/11/07/2022

****

No. AAMS(UG)/ 119 -A of 2022-23 — 20th October, 2022

Copy forwarded with Compliments for information to:-

1) The Dean, Faculty of Science & Technology,
2) The Chairman, Ad-hoc Board of Studies in Electronics and Telecommunication Engineering,
3) The Director, Board of Examinations and Evaluation,
4) The Director, Board of Students Development,
5) The Director, Department of Information & Communication Technology,
6) The Co-ordinator, MKCL.

(Dr. Shailendra Deolankar)
I/c Registrar

Copy for information and necessary action :-

1. **The Deputy Registrar, College Affiliations & Development Department (CAD),**
2. **College Teachers Approval Unit (CTA),**
3. **The Deputy Registrar, (Admissions, Enrolment, Eligibility and Migration Department (AEM),**
4. **The Deputy Registrar, Academic Appointments & Quality Assurance (AAQA)**
5. **The Deputy Registrar, Research Administration & Promotion Cell (RAPC),**
6. **The Deputy Registrar, Executive Authorities Section (EA)**
   He is requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to the above circular.
7. **The Deputy Registrar, PRO, Fort, (Publication Section),**
8. **The Deputy Registrar, Special Cell,**
9. **The Deputy Registrar, Fort Administration Department (FAD) Record Section,**
10. **The Deputy Registrar, Vidyanagari Administration Department (VAD),**

Copy for information :-

1. **The Director, Dept. of Information and Communication Technology (DICT), Vidyanagari,**
   He is requested to upload the Circular University Website
2. **The Director of Department of Student Development (DSD),**
3. **The Director, Institute of Distance and Open Learning (IDOL Admin), Vidyanagari,**
4. **All Deputy Registrar, Examination House,**
5. **The Deputy Registrars, Finance & Accounts Section,**
6. **The Assistant Registrar, Administrative sub-Campus Thane,**
7. **The Assistant Registrar, School of Engg. & Applied Sciences, Kalyan,**
8. **The Assistant Registrar, Ratnagiri sub-centre, Ratnagiri,**
9. **P.A to Hon'ble Vice-Chancellor,**
10. **P.A to Pro-Vice-Chancellor,**
11. **P.A to Registrar,**
12. **P.A to All Deans of all Faculties,**
13. **P.A to Finance & Account Officers, (F & A.O),**
14. **P.A to Director, Board of Examinations and Evaluation,**
15. **P.A to Director, Innovation, Incubation and Linkages,**
16. **P.A to Director, Department of Lifelong Learning and Extension (DLLE),**
17. **The Receptionist,**
18. **The Telephone Operator,**

Copy with compliments for information to :-

19. **The Secretary, MUASA**
20. **The Secretary, BUCTU.**

AC – 11 July, 2022
Item No. – 6.31 (R)

University of Mumbai

Revised Syllabus for

M.E.

(Electronics & Telecommunication Engineering)

Semester – (Sem. - I to IV)

(Choice Based Credit System)

(With effect from the academic year 2022-23)

University of Mumbai

O: _____ **Title of Course**	M.E. (Electronics and Telecommunication Engineering)
O: _____ **Eligibility**	Passed B.E. / B.Tech. as per the Ordinance O.5134
R: _____ **Passing Marks**	45%
No. of years/Semesters:	02 Years / 4 semesters
Level:	P.G. / ~~U.G./ Diploma / Certificate~~
Pattern:	~~Yearly~~ / Semester
Status:	~~New~~ / Revised
To be implemented from Academic Year:	With effect from Academic Year : 2022-23

Dr Faruk Kazi
Chairman
of Ad-hoc Board of Studies in Electronics and Telecommunication Engineering

Dr. Suresh K. Ukarande
Associate Dean,
Faculty of Science and Technology

Dr Anuradha Majumdar
Dean,
Faculty of Science and Technology

Semester I

Course Code	CourseName	TeachingScheme(ContactHours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
ETC101	AdvancedDigital Signal ProcessingandApplications	3	--	--	3	--	--	3
ETC102	Optical Communication Network	3		--	3		--	3
ETPE101	ProgramElective 1	3	--	--	3	--	--	3
ETPE102	ProgramElective 2	3	--	--	3	--	--	3
ETIE101	InstituteElective1	3	--	--	3	--	--	3
ETL101	ProgramLab-I	--	2	--	--	1	--	1
ETSBL101	Skill BasedLab-I	--	4[$]	--	--	2	--	2
Total		**15**	**06**	**--**	**15**	**03**	**--**	**18**

Course Code	CourseName	ExaminationScheme							
		Theory					Term Work	Pract /Oral	Total
		InternalAssessment			End Sem.Exam	Exam. Duration (inHrs)			
		Test-1	Test-2	Avg					
ETC101	Advanced DigitalSignal Processing andApplications	20	20	20	80	3	--	--	100
ETC102	OpticalCommunication Network	20	20	20	80	3	--	--	100
ETPE101X	ProgramElective 1	20	20	20	80	3	--	--	100
ETPE102X	ProgramElective 2	20	20	20	80	3	--	--	100
ETIE101X	InstituteElective1	20	20	20	80	3	--	--	100
ETL101	ProgramLab-I	--	--	--	--	--	25	25	50
ETSBL101	Skill BasedLab-I	--	--	--	--	--	50	50	100
Total		**--**	**--**	**100**	**400**	**--**	**75**	**75**	**650**

SubjectCode ETPE101X	**ProgramElective 1**
ETPE1011	NextGenerationNetworks
ETPE1012	AdvancedAntennaDesign
ETPE1013	StatisticalSignalProcessing

SubjectCode ETPE102X	**ProgramElective 2**
ETPE1021	ImageAnalysisusingMachinelearning
ETPE1022	EmbeddedCommunicationSystemsDesign
ETPE1023	OptimizationMethodsinSignalProcessingforCommunicationSystems

Subjectcode ETIE101X	InstituteElective1
ETIE1011	ProductLifecycleManagement
ETIE1012	ReliabilityEngineering
ETIE1013	ManagementInformationSystem
ETIE1014	DesignofExperiments
ETIE1015	OperationResearch
ETIE1016	CyberSecurityandLaws
ETIE1017	DisasterManagement&MitigationMeasures
ETIE1018	EnergyAuditandManagement

SemesterII

Course Code	CourseName	TeachingScheme(ContactHours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
ETC201	RFEngineering	3	--	--	3	--	--	3
ETC202	Modern DigitalCommunication	3		--	3		--	3
ETPE201X	ProgramElective 3	3	--	--	3	--	--	3
ETPE202X	ProgramElective 4	3	--	--	3	--	--	3
ETIE201X	InstituteElective2	3	--	--	3	--	--	3
ETL201	ProgramLab-II	--	2	--	--	1	--	1
ETSBL201	SkillBasedLab-II	--	4[$]	--	--	2	--	2
Total		**15**	**06**	**--**	**15**	**03**	**--**	**18**

Course Code	CourseName	ExaminationScheme							
		Theory					Term Work	Pract /Oral	Total
		InternalAssessment			End Sem. Exam	Exam. Duration (inHrs)			
		Test-1	Test-2	Avg					
ETC201	RFEngineering	20	20	20	80	3	--	--	100
ETC202	Modern DigitalCommunication	20	20	20	80	3	--	--	100
ETPE201X	ProgramElective 3	20	20	20	80	3	--	--	100
ETPE202X	ProgramElective 4	20	20	20	80	3	--	--	100
ETIE201X	InstituteElective2	20	20	20	80	3	--	--	100
ETL201	ProgramLab-II	--	--	--	--	--	25	25	50
ETSBL201	SkillBasedLab -II	--	--	--	--	--	50	50	100
Total		**--**	**--**	**100**	**400**	**--**	**75**	**75**	**650**

Note1: SkillBasedLab-IandIIarefocusedonthelearningthroughexperience.SBLshallfacilitatethelearnerto acquire the fundamentals of practical engineering in his or her specialization in a project-orientedenvironment. The learning through skill based labs can be useful in facilitating their research work andhenceusefulin earlycompletion oftheir dissertation work

SubjectCode ETPE201X	ProgramElective3
ETPE2011	SatelliteNetworking
ETPE2012	NetworkandCyberSecurity
ETPE2013	RemoteSensing

SubjectCode ETPE202X	ProgramElective4
ETPE2021	ErrorControl Coding
ETPE2022	WirelessAdhocandSensorNetworks
ETPE2023	CognitiveRadio

SubjectCode **ETIE201X**	**InstituteLevelOptionalCourse2**
ETIE2011	ProjectManagement
ETIE2012	FinanceManagement
ETIE2013	EntrepreneurshipDevelopmentandManagement
ETIE2014	HumanResourceManagement
ETIE2015	Professional Ethics andCSR
ETIE2016	ResearchMethodology
ETIE2017	IPRand Patenting
ETIE2018	DigitalBusinessManagement
ETIE2019	EnvironmentalManagement

SemesterIII

Course Code	CourseName	TeachingScheme (ContactHours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
ETMP301	Major Project:Dissertation-I	--	20	--	--	10	--	10
Total		**00**	**20**	**00**	**00**	**10**	**--**	**10**

Course Code	CourseName	ExaminationScheme							
		Theory					Term Work	Pract/ Oral	Total
		InternalAssessment			End Sem. Exam	Exam. Duration (inHrs)			
		Test-1	Test-2	Avg					
ETMP301	Major Project:Dissertation-I	--	--	--	--	--	100	--	100
Total		**--**	**--**	**--**	**--**	**--**	**100**	**--**	**100**

OnlineCreditCourses

Course Code	CourseName	Teaching Scheme(Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
ETOCC301	OnlineCreditCourse-I	--	--	--	--	--	--	3
ETOCC301	OnlineCreditCourse-II	--	--	--	--	--	--	3
Total		**--**	**--**	**--**	**00**	**00**	**00**	**06**

Note 2: It is mandatory to complete the Online Credit Courses (OCC) available on NPTEL / Swayam /MOOC orsimilarplatformapprovedbyUoM.Thesetwocoursesshallbecompletedinanysemester IorIIor III,butnot later end of the Semester III. University shall make a provision that credits earned with OCC- I andOCC-IIshallbeaccountedinthethirdsemestergrade-sheetwithactualnamesofcourses.Thelearnershallbeallowedtotakeupthesecoursesfromhisorherinstituteororganisation/industry wherehis/hermajorproject is carried out. The students shall complete the courses and shall qualify the exam conducted by therespective authorities/ instructor from the platform. The fees for any such courses and the correspondingexaminationshallbebornebythelearner.

OnlineCreditCourse –I

The learner shall opt for the course in the domain of Research Methodology **or** Research & PublicationEthicsor IPR.The opted courseshallbeof3 creditsofequivalent numberof weeks.

OnlineCreditCourse–II

ThelearnershalloptforthecourserecommendedbyFacultyAdvisor/ProjectSupervisorfromtheinstitute.Theopted course shallbe of3 creditsofequivalentnumber of weeks.

Semester IV

Course Code	CourseName	TeachingScheme (ContactHours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
ETMP401	Major Project :Dissertation-II	--	32	--	--	16	--	16
Total		**--**	**32**	**--**	**--**	**16**	**--**	**16**

Course Code	CourseName	ExaminationScheme							
		Theory					Term Work	Pract/ Oral	Total
		InternalAssessment			End Sem. Exam	Exam. Duration (inHrs)			
		Test-1	Test-2	Avg					
ETMP401	MajorProject: Dissertation-II	--	--	--	--	--	100	100	200
Total		**--**	**--**	**--**	**--**	--	**100**	**100**	**200**

TotalCredits:68

Note 3: The Dissertation -II submission shall not be permitted till the learner completes all the requirements MEcourse.

Note 4: The contact hours for the calculation of load of the teacher for Major Project are as follows:
MajorProject Dissertation Iand II -02 Hour /week/student

GuidelinesforDissertation-I

Students should do literature survey and identify the problem for Dissertation and finalize in consultation withGuide/Supervisor. Students should use multiple literatures and understand the problem. Students should attemptsolution to the problem by analytical/simulation/experimental methods. The solution to be validated with properjustificationandcompilethereport instandardformat.GuidelinesforAssessmentofDissertation-I.

Dissertation-Ishouldbeassessedbasedonfollowingpoints

- QualityofLiteraturesurveyandNoveltyintheproblem
- ClarityofProblemdefinitionand Feasibilityof problemsolution
- Relevancetothespecialization
- ClarityofobjectiveandscopeDissertation-IshouldbeassessedthroughapresentationbyapanelofInternalexaminersandexternalexaminerappointedbytheHeadoftheDepartment/Instituteofrespective Programme.

GuidelinesforAssessmentofDissertationII

DissertationIIshouldbeassessedbasedonfollowingpoints:

- QualityofLiteraturesurveyand Noveltyintheproblem
- ClarityofProblemdefinitionand Feasibilityofproblemsolution
- Relevancetothespecializationorcurrent Research/ Industrialtrends
- Clarityofobjectiveandscope

- Qualityofworkattemptedorlearnercontribution

- Validationofresults
- QualityofWrittenandOralPresentation

Studentsshouldpublishat leastonepaperbasedontheworkinreferredNational/International conference/Journalof repute.

DissertationIIshouldbeassessed byinternaland ExternalExaminers appointedbythe UniversityofMumbai.

SubjectCode	SubjectName	Credits
ETC101	**Advanced Digital Signal Processing andApplications**	**03**

CoursePre-requisite:

- Signals&Systems
- DiscreteTimeSignalProcessing

CourseObjectives:

- Todevelopin-depthunderstandingoftechniquesofpowerspectrumestimation.
- Toprovideadequateknowledgeonadaptivefiltering,wavelettransformsandtheirs applications.
- Toprovideknowledge about applications ofsignalprocessingtorealworldproblems

CourseOutcome:

Learnerswillbeableto:

- Illustratethetechniques ofpowerspectrum estimationand adaptivefilteringforvarious applications.
- Explainandimplementwavelettransformsandtheirapplications.
- ApplySignalprocessingtoolstobiomedicalsignal processingandmusicalsoundprocessing.

Module	DetailedContent	Hours
1	**PowerSpectrum Estimation** • Non- Parametric methods of Power Spectral Estimation: Estimation ofspectrafromfinitedurationobservationofsignals,Non-parametricMethods for Periodogram estimation: Bartlett, Welch and Blackman andTukeymethods. • Parametric Methods of Power Spectrum Estimation: AR, MA & ARMAmodels for power spectrum estimation. Yule-Walker method for the ARmodelparameter	08
2	**IntroductiontoAdaptivesystems** • Introduction,Characteristics,ExamplesofAdaptivesystems,Applications.Theadaptivesystem-linearcombiner-Description,Weightvectors,desiredresponseperformancefunction-Gradientand meansquareerror.	06
3	**AdaptiveSignalProcessing andApplications** • FIRAdaptivefilters-AdaptiveDirectFormFIRFiltersbasedonsteepestdescentmethod-WidrowHoffLMSAdaptivealgorithm.AdaptiveDirectFormFIRFilters-RLSAlgorithms. • Applications:SystemIdentification,Adaptivechannelequalization-Adaptiveechocanceller.	06

4	**WaveletTheory** • FourierTransformanditsLimitations–ShortTimeFourierTransform–Introductiontotimefrequencyanalysis-ContinuousWaveletTransform	07

	–DiscreteTimeWaveletTransform-Multi-resolutionanalysis– HaarWaveletTransforms– DaubechiesWavelet,Filterbank theory. • Applicationofwavelettheorytosignaldenoising,speckleremoval,andsignala nd imagecompression.	
5	**Applicationof DigitalSignalProcessingtoBiomedicalSignalProcessing** • Introduction to various Bio-electric signals: ECG, EEG, EOG, and theirpre-processing,Artifacts and interferences in ECG and their removal,Detection of fetal heartbeats during labor- Fetal ECG, QRS template,QRSdetectionmethods,performancemeasure forQRS detection. • AdaptiveremovalofocularartifactsfromhumanEEGs-Methodsforremoval andcontrolofocularartefacts,onlineOcularArtifactsRemoval(OAR)algorithmands ystem,	8
6	**ApplicationofDigitalSignalProcessinginMusicalSoundProcessing** • Musicalsoundprocessing-Timedomainoperations-singleechofilter,multipleechofilter,Reverberation,Flanging,Chorusgenerator,Fre quencydomainoperations-Analogfilters,FirstorderdigitalfiltersandEqualizers, SecondorderdigitalfiltersandEqualizers.	04
	Total	39

TextbooksandReferences:

Textbooks:

1. John G.Proakis and Dimitris G.Manolakis, –*Digital Signal Processing*‖, PHI, 2005.
2. Bernard Widrow and Samuel D.Strearns, –*AdaptiveSignal Processing*‖,Pearson Edu Asia 2002.
3. S.M.Kay,*ModernSpectrumEstimationTheoryandApplication*‖,PHI.
4. K. P. Soman, K.I.RamchandranandN. G. Reshmi, –*Insight into Wavelets: From theory to practice*,Third Edition PHI, 2010.
5. Raghuveer. M.Rao andAjitS.Bopardikar, –*Wavelet Transforms-Introduction to theory and applications*,Pearson Education, Asia, 2000.
6. RangarajM.Rangayyan,–*Biomedical Signal Analysis-A CaseStudy Approach*‖, Wiley2002.
7. WillisJ.Tompkins, *BiomedicalDigitalSignalProcessing*,PHI,1999
8. Sen MKuo, Bob H Lee and W Tian, –*Real TimeSignal processing: Fundamentals, Implementations andApplications*‖ Springer,WileyPublishers, ThirdEdition2013.
9. S. K. Mitra, –*Digital Signal Processing*‖, TMH, 2001
10. Emmanuel C.Ifeachor, BarrieW. Jervis, –*Digital Signal Processing, A Practical Approach*‖, PearsonEducation, 2008.

ReferenceBooks:

1. Simon Haykin, –*AdaptiveFilterTheory*‖, Pearson Edu, 2013
2. D.C.Reddy, *BiomedicalSignalProcessing Principlesand Techniques*,TataMcGraw-Hill,2005
3. A. H. Sayed, –*Adaptive filters*‖, WileyStudent Edition, 2010

4. S.ThomasAlexander,*Adaptivesignalprocessing-TheoryandApplications*,Springer–Verlag.
5. I.Daubechies,TenLectureson Wavelets,SocietyforIndustrialandAppliedMathematics,Philadelphia,PA, 1992.
6. MarkKahrs,KarlheinzBrandenburg,–*ApplicationsofDigitalSignalProcessingtoAudio and Acoustics*‖, Kluwer AcademicPublishers, 2002
7. Mallat, Stéphane. –*A wavelet tour of signal processing*.‖ Academicpress,Third Ed. 2008.
8. Torrence,Christopher,andGilbertP.Compo,"*Apracticalguidetowaveletanalysis*."BulletinoftheAmerican Meteorological societyJan. 1998
9. Burrus,C.Sidney,RameshA.Gopinath,andHaitaoGuo."*Introductiontowaveletsandwavelettransforms*."PrenticeHallInc. 1997
10. Paul S. Addison, –*The illustrated wavelet transformhandbook: introductory theory and applications inscience, engineering,medicine andfinance*.‖ CRCpress,2002

AssessmentInternal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimumtwo modules) and the other is either a class test (on minimum three modules of the remaining) orassignmenton liveproblems or courseproject.

EndSemester Examination:

Some guidelines for setting the question papers are as, six questions to be set each of 20 marks,out of these, question number 1 will be compulsory and it will carry questions covering eachmodule.Fromremainingquestionsanythreequestionstobeattemptedbystudents.Minimum80%syllabus should becoveredin question papersofendsemester examination.

SubjectCode	SubjectName	Credits
ETC102	**OpticalCommunicationNetwork**	**03**

CoursePre-requisite:

- WavetheoryandPropagation
- AnalogCommunication
- DigitalCommunication

CourseObjectives:

Toteachstudents:

- TheissuesrelatedtosignaldegradationduetoLinearImpairments
- Systemimpairmentsduetononlineareffectinfiber.
- SystemoptimizationbycontrollingdispersionandNonlinear Effects.
- HighdatarateWDMopticalTransportNetworks.

CourseOutcome:

Thecourseenablesthestudentsto:

- Applythefundamentalprinciplesofopticsandlightwavetodesignopticalfibercommunicat ionsystems.
- Identifytheissuesrelated tosignaldegradationduetomultiplexing.
- Identifyworkingprincipleofvariouscomponentsofallopticalnetwork.
- Exploreconceptsofdesigningandoperatingprinciplesofmodern opticalcommunicationsystemsand networks.

Module	DetailedContent	Hours
1	**AReviewofOpticalFibers** • Introduction • SignalDegradation • Fiberdispersion • Multimodefiber • Singlemodefiber • DispersionManagement • DispersioncompensatingFibers	06
2	**NonLinearOptics** • GeneralOverviewofNonlinearities • Effectiveareaandlength • StimulatedRamanScattering • StimulatedBrillouinScattering • SelfPhasemodulation	8

	• Cross–Phasemodulation • Fourwavemixinganditsmitigation • ApplicationsofNonlinearEffects • SolitonspropertiesofSolitons,PropertiesofSolitons,Lossmanaged Soliton ,Dispersion managed Soliton, Optical Switching,Parametricamplification	
3	**OpticalNetworkComponents** • Sources: Quantum well lasers, Charge capture in Quantum welllasers,MultiQuantumwellLaserdiodes,SurfaceEmittingLasers:Vertical cavitySurfaceEmitting Lasers • Detectors: Resonant cavity enhancement (RCE) Photo Detector,MaterialrequirementforRCEPD,Wavelengthselectivity, HighspeedcomparisonofconventionalandRCEPD,RCESchottky Photodiode, RCE AvalanchePhotodiode • Optical Amplifiers: Optical Pumping, Erbium Doped Amplifier,Semiconductor Laser Amplifier,Raman Amplifier, • IntegratedOptics: Directional couplers and Photonic Switch,OpticalModulators • WDMnetworkcomponents:WADM,OpticalCrossconnects	8
4	**IntroductiontoOpticalNetwork** • OverviewofgenerationsofopticalNetworks • SONET& SDH:Multiplexinghierarchy,Multiplexingstructure – Functionalcomponents,Problemdetection,Virtualtributaries&containers • Optical Transport Network: Hierarchy, Frame structure,Multiplexing	05
5	**WDMNetworkDesign** • CostTrade-offs:AdetailedRingNetworkexample • LTDandRWAProblems • RoutingandWavelengthassignment • Dimensioningwavelengthnetworks • Statisticalwavelengthroutingnetworks-Firstpassagemodel,Blockingmodel • Maximumloaddimensioningmodels-offlinelightpathrequest,onlineRWA in Rings	06
6	**DeploymentConsideration** • ArchitecturalchoicesfornextgenerationtransportNetwork • DesigningthetransmissionLayerusingSDM,TDMandWDM • UnidirectionalversusbidirectionalWDMSystems-Longhaulnetworkscasestudy,LongHaul UnderseaNetworks • MetroNetworks,MetroRingCasestudy	06
	Total	39

TextbooksandReferences:

1. –*OpticalFiberCommunications*‖-GerdKeiser-FourthEdition-TATAMcGRAW
2. –*Optical FiberCommunications Principles and Practice*‖-John.M.Senior-Pearson EducationHILL
3. –*FiberOpticsCommunicationSystem*‖-G.P.Agarwal-WileyPublications
4. –*FiberOpticsCommunications*‖-HaroldKolimbris-PearsonEducation
5. –*Opto-Electronics,anintroduction*‖-WilsonandHawkes,PrenticeHall
6. –*NonlinearFiberOptics*‖G.P.Agarwal-AcademicPress
7. —*ApplicationsofNonlinearOptics*‖,Academicpress-G.P.Agarwal
8. –*Optical Networks, APractical Perspective*‖**,** Thirdedition-Rajiv Ramaswami,Kumar N.Sivarajan,Elsevier
9. *"OpticalNetworks,ThirdgenerationTransportSystems*‖,byUylessBlack,Pearson
10. –*Optical FiberCommunication System: Theoryand Practice with MATLAB and Simulink*‖byLeNguyenBinh,CRC Press,2010

AssessmentInternal:

Assessment consists of two tests out of which; one should be compulsory class test (onminimumtwomodules)andthe otheris either aclasstest (onminimumthreemodulesoftheremaining) or assignment onliveproblems or courseproject.

EndSemesterExamination:

Someguidelinesforsettingthequestionpapersareas,sixquestionsto beseteachof20marks, out of these, question number 1 will be compulsory and it will carry questions coveringeach module. From remaining questions any three questions to be attempted by students.Minimum80% syllabusshould be coveredinquestionpapers of endsemester examination.

SubjectCode	SubjectName	Credits
ETPE1011	**NextGenerationNetworks**	**03**

CoursePre-requisite:

- ComputerNetworks
- WirelessNetworks
- MobileCommunication

CourseObjectives:

Theaimofthiscourseis

- Torelatetheparadigmshiftfromcircuitswitchednetworktopacketswitchednetwork.
- Toapplytheadvancementinnetworksfield.
- Toexaminenewtechnologiesintelecommunication.
- ToappraisetheNGNStandards

CourseOutcome:

Learnerswillbeableto:

- Relate and compare the core differences between traditional and newtelecommunicationtechnologies.
- Analyze,implementandapplythecomponentsofNGNarchitecturewithNGNstandards.

Module	DetailedContent	Hours
1	**NextGenerationTechnologies,NetworksandServices** • Introduction, • NextGeneration(NG)Technologies, • WirelineNGTechnologies, • FTTP,Long-HaulManagedEthernet.	06
2	**WirelessNGTechnologies** • LongTermEvolution(LTE), • EnhancedHSPAEvolutionDataOptimized(EVDO),UltraMobileBroadband (UMB), • SDRandcognitiveradio • IoT,VOIP, IPTV,QualityofServices,QualityofExperiencesinNGN.	7
3	**NextGenerationMultiserviceTechnologyOverview** • MPLS&QoS,MPLSservicesandcomponents,overviewofVPN,layer2VPN, layer3 VPN	06

4	**ITUNGNStandardsandArchitectures** • Main drivers to Next Generation Networks – NGN , ITU NGNstandards • All-IPnetworkconceptforNGN, • NGNcontrolarchitecturesandprotocols(TISPAN),Numbering,naming andaddressingforall NGN	06
5	**ControlandSignallingProtocolsforNGN**(SIP,Diameter) • NGNsecurity(AAA,identitymanagement), • Serviceconvergence • Fixed-MobileConvergence(FMC)inNGN, • IPMultimediaSubsystem(IMS)forNGN	07
6	**TransitiontoNGNandFutureEvolution** • MigrationofPSTNnetworkstoNGN, • TransitionofIPnetworkstoNGN, • IPv6,NGNEvolution.	07
	Total	39

TextbooksandReferences:

Textbooks:

1. *WirelesscommunicationandNetworking*-VijayGarg,ELSEVIERInc.
2. NextGenerationTelecommunicationsNetwork,ParliamentofficeofScienceandTechnology(Postnote).Dec2007, No. 296 Ref.www.parliament.uk.

ReferenceBooks

1. ITUManual
2. *NextGenerationTelecommunicationsNetworks,Services,andManagement*byThomasPlevyak,VeliSahin,ISBN: 978-0-470-57528-4,Wiley-IEEE Press
3. *NextGenerationWirelessSystemsandNetworks:*Hsiao–HwaChen,MohsenGuizani –Wiley
4. *IP-BasedNext-GenerationWirelessNetworks:Systems,Architectures,andProtocols*-Jyh-ChengChenandTaoZhang-Wiley

AssessmentInternal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum twomodules) and the other is either a class test (on minimum three modules of the remaining) or assignment onliveproblems orcourse project.

EndSemesterExamination:

Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these, questionnumber 1 will be compulsory and it will carry questions covering each module. From remaining questions any threequestions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semesterexamination.

SubjectCode	SubjectName	Credits
ETPE1012	**AdvancedAntennaDesign**	**03**

CoursePre-requisite:

- WaveTheoryandPropagation
- RFandAntenna

CourseObjectives:

Theaimofthiscourseis

- Toprovidestate-of-artknowledgeinmicrostripantennas,
- Toexplainvariousmethodologiespresentlyprevalentfordesignofmicrostripantennas
- Toenablestudentstomakedesigndecisionsinmicrostripantennas

CourseOutcome:

Learnerswillbeableto:

- Designandanalyzemicrostripantennas,
- Correlatethefundamentaldesignofantennatoadvancedcommunicationapplications

Module	DetailedContent	Hours
1	**ReviewofAntennas** • Antennaparameters • Infinitesimaldipoleantenna • Halfwavedipoleantenna	03
2	**MicrostripAntennas** • Introduction,RectangularpatchandCircularpatchdesign • Quality factor, Bandwidth,Efficiency,Inputimpedance,andCoupling • AnalyticalmodelsforMSAstransmissionlinemodels,cavitymodel,Multimode networkmodel.	6

3	**CircularPolarizationTechnique** • Dual-Feed circularly polarized MSAs, Square MSA with twofeeds, Effect of amplitude and phase imbalance, Square MSAwithfourfeeds, CMSAwith multiplefeeds • Single-feedcircularly polarizedMSA,Diagonally fednearlysquare MSA, Square MSA with modified edges, Square MSAwithmodified corners, SquareMSA with adiagonalslot. • Broadband circularly polarized MSA, Dual-feed planarmultiresonatorMSA,StackedMSAforcircularpolarization, ApperturecoupledcircularlypolarizedMSA,SequentiallyrotatedMSA.	7
4	**PlanarMonopoleAntennas**	7
	• Introduction,PlanarRectangularandSquareMonopoleAntennas, RMSA Suspended in Air with Orthogonal GroundPlane,CalculationoftheLowerFrequencyofthePlanarMonopoleAntennas. • Effect of Various Parameters of Planar Rectangular Monopole(RM)Antennas, Radiation Pattern ofRM Antennas • VariousPlanarRMswithEqualAreas,PlanarCircularMonopoleAntennas.	
5	**BroadbandandCompactMicrostripAntennas** • Mechanism of Parasitic Coupling for Broad BW, Gap-CoupledRMSAs,Radiating-EdgeGap-CoupledRMSAs,MultilayerBroadbandMSA, DesignExamples. • Compact Shorted RMSAs, Partially Shorted RMSAs, Effect ofDimensions of RMSAs with a Single Shorting Post, Effect ofthePositionoftheSingleShortingPost	08
6	**NextgenerationAntennas** • Introduction to smart antennas, smart Antenna configurations-switched beam antennas and adaptive antenna approach, SmartAntennas‘ Benefits and drawbacks, Antenna Beam forming,Architectureof Smart antennasystem. • MetamaterialAntennas:Introduction,NegativeRefractiveIndex (NRI) Metamaterials, Metamaterial Antennas Based onNRIconcepts. • ApplicationsofSmartAntennas:SmartantennasforCodeDivision Multiple Access Systems, Smart antennas forautomaticradio frequencyidentificationreaders,Mutualcouplingreduction techniques in MIMO.	08
	Total	39

TextbooksandReferences:

1. *AntennaTheory*-C.A.Balanis-Wileyandsons
2. *Antennas*–John.D.Krauss-TMHed.
3. *MicrostripAntennaDesignHandbook*-RameshGarg-ArtechHouse.
4. *Handbook of Microstrip Antennas* - James R. James, Peter S. Hall-IEEElectromagnetic wave series.
5. *BroadbandMicrostripantennas*–GirishKumarandK.P.Ray,ArtechHouse
6. *SmartAntennasforWirelessCommunicationswithMATLAB*:FrankGross,McGRAWHill.
7. *HandbookonAdvancementsinSmartAntennaTechnologiesforWirelessNetworks*-ChenSun,JunChengandTakashiOhira,Informationsciencereference, NewYork.

AssessmentInternal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum twomodules) and the other is either a class test (on minimum three modules of the remaining) or assignment onliveproblems orcourse project.

EndSemesterExamination:

Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out ofthese, question number 1 will be compulsory and it will carry questions covering each module. Fromremaining questions any three questions to be attempted by students. Minimum 80% syllabus should becoveredin question papersof endsemester examination.

Subject Code	SubjectName	Credits
ETPE1013	**StatisticalSignalProcessing**	**03**

CoursePre-requisite:

- Matrixtheory
- Fundamentalsofprobability
- Signalsandsystems

CourseObjectives:

The aim of this course is to provide knowledge of statistical techniques necessary to explain and explore theimportant applications insignalprocessingandtelecommunication.

CourseOutcome:

Learnerwillbeableto:

- Understandbasicsoflinearalgebraincommunicationengineering.
- Applyappropriatestatisticaltoolsforhandlingdesignandanalysisofsystemsthatinvolverandomness.
- Analyzerandomprocessesfor LTIsystems andestimationtheory.
- Evaluateroleofprobabilitymodelsinengineeringdesign.

Module	**DetailedContent**	**Hours**

1	**LinearAlgebra** • Signal spaces,metricspaces,vectorspaces,normsandnormedvectorspaces, inner-product spaces, orthogonality, orthogonal subspaces,linear transformations: range and null space, orthogonalization ofvectors, representation and approximation in vector spaces, matrixrepresentation of least squares, geometry of linear equations, fourfundamental subspaces of linear operator, properties of matrixinverses, results on matrix rank, pseudo inverses, matrix conditionnumber, singular value decomposition(SVD), pseudoinverse and theSVD.	8
2	**Review ofRandomVariablesandProcesses** • Random variables, distribution and density function, functions ofrandom variables, sums of independent random variables, central limittheorem, discrete time stochastic process, stationarity, random signalvariability,timeaverages,ergodicity,autocorrelationfunctionofarealWSS process and its properties, cross-correlation function, frequencydomain description of stationary process, general correlation matrices,correlation matrices from random process, correlation matrices ofstationaryprocess.	07
3	**Analysisandprocessingofrandomsignals** • Lineartime invariantsystemwithWSS processasaninput stationarity of the output, auto-correlation and power-spectral density ofthe output; examples with white-noise as input; linear shift-invariantdiscrete-time system with WSS sequence as input, examples of randomprocesses:whitenoiseprocessandwhitenoisesequence;Gaussian process.	04
4	**WhiteningandInnovationsRepresentation** • Transformations using eigen-decomposition, transformations usingtriangular decomposition, generation of real valued random vectorswith given second-order moments, discrete Karhunen-Loèvetransformanditsapplication,optimal reduced-basis representation,periodic randomsequences.	07
5	**PrinciplesofEstimationTheory** • Estimation in signal processing, the mathematical estimation problem,assessing estimator performance, unbiased and consistent estimators,confidence interval, efficient estimator, minimum variance unbiasedestimation, existence of minimum variance unbiased estimator,estimator accuracy considerations, Cramer-Rao lower bound(CRLB)theorem,computationofCRLBfordifferentexamples,generalCRLBforsignalsinwhite-Gaussian noise,vectorparameterCRLB.	7

6	**TheKalmanFilter** • The state space signal model, Kalman filter I: The Bayes approach,Kalman filter II: innovations approach, Estimation using theinnovations process, innovations for processes with state space models.Discrete-timeKalman filter.	06
	Total	39

TextbooksandReferences:

1. Todd K.Moon andWynn C. Stirling, –*Mathematical Methods and Algorithmsfor Signal Processing*‖, Pearson Education,Inc.,2000.
2. Dimitris.G.Manolakis, VinayIngale, and Stephen M.Kogon, –*Statistical and AdaptiveSignal Processing*‖,ArtechHouse,Inc.,2005.
3. PeytonZ. Peebles,–*Probability, RandomVariables and RandomSignal Principles*‖, Mc-GrawHill, 2000.
4. Steven M.Kay, –*Fundamentalsof Statistical Signal Processing: Estimation Theory* Vol1,PrenticeHall,EnglewoodCliffs,NJ,2010.
5. Alberto Leon-Garcia, –*Probability and Random Processes for Electrical Engineering*‖, Pearson Education,2007.

AssessmentInternal:

Assessment consists of twotestsout of which; one should be compulsory class test (on minimumtwo modules) and the other is either a class test (on minimum three modules of the remaining) orassignment onlive problems orcourse project.

EndSemesterExamination:

Some guidelines for setting the question papers are as, six questions tobe set each of 20 marks, out of these,question number 1 will be compulsory and it will carry questions covering each module. From remaining questionsany three questions to be attempted by students. Minimum 80% syllabus should be covered in question papers ofendsemesterexamination.

SubjectCode	SubjectName	Credits
ETPE1021	**ImageAnalysisusingMachinelearning**	**03**

CoursePre-requisite:

- ImageandVideoprocessing

CourseObjectives:

Theaimofthiscourseis

- To provide exposure to students in gaining knowledge on concepts and understandingof ImageAnalysis.
- To give necessary knowledge of digital image analysis for further research within thearea and to be able to use digital image analysis within other research areas such ascomputergraphics,imagecoding,videocodingandindustrialimageprocessingproblems.
- To prepare the student for further studies in e.g. computer vision, multispectral imageanalysisand statistical imageanalysis.

CourseOutcome:

Learnerswillbeableto:

- Demonstrate goodcapabilitytoindependentlyidentifyproblemswhichcanbesolvedwithmethods fromimageanalysis,and be able tochooseanappropriate method.
- Independentlyapplybasicmethodsinimageprocessingtoproblemswhich arerelevantin industrial applications or research.
- Explainthesolutiontoaprobleminimageanalysis inawellstructuredmannerandwithclear logic.

Module	DetailedContent	Hours
1	**IntroductiontoImageProcessing** • Basicmathematicalconcepts:Imagetransforms,DiscreteFourierTransform, Fast Fourier Transform. • Imageenhancement:Greyleveltransforms,filtering.Extractionofspecialfeatures:Filtering,edgeandcornerdetection.Image Segmentationandmathematicalmorphology.	05
2	**ImageRepresentation** • BoundaryRepresentation:ChainCode,PolygonalApproximations, Signatures,BendingEnergy,StatisticalMoments,Region Representation • BoundaryDescriptions:SimpleDescriptor,ShapeNumber,Fourier Descriptor,Run-lengthCode,Projection,Concavity Tree.	06
	• Component Labelling: Component counting, RecursiveAlgorithm,Sequential Algorithm.	
3	**FeatureExtraction** • Histogram (or Brightness) Features, Shape Features, SpatialMoment, Central Moment, Topological Features, GeometricalFeatures, Transform Features, Texture Features, Syntactic andStructuralFeatures	07
4	**EvaluatingHypotheses** • Estimating Hypothesis Accuracy, Basics of Sampling Theory,Derivingconfidenceintervals,differenceinerroroftwohypotheses,Comparing LearningAlgorithms.	06
5	**LearningAlgorithms** • DecisionTreeLearning:BuildingSingleandMultipleDecisionTreesSelectingtheDecisionTreetobeBuilt,ObtainingPrulesfromDecisionTrees,MissingAttributeValues,ClassifyingwithRelabelledNodes,ErrorRatesonRecallSets,PruningDecisionTrees,Issuesindecisiontreelearning. • BayesLearning:BayesTheoremandconceptlearning,BayesianBeliefNetworks,NaiveBayeswithBinaryAttributes,PerformanceofBayes Classifier • Instance Based Leaning : K-nearest neighbour learning, casebasedlearning,radial basis functions • DeepLearningAlgorithm:DeepNetworks,DeepBeliefNetworks, Convolutional Networks,	07

6	**ImageClassification** ImageClassificationusing • Neural network: Issues in neural network learning, perceptrons,multilayernetwork&Back propagation Algorithm. • Fuzzy Systems:Fuzzylogic,Fuzzification,Fuzzy inference,fuzzyrulebased system,defuzzification • SupportVectorMachine:LinearClassifiers,ClassifierMargin, Solving the Optimization Problem, Hard Margin andSoftMargin,LinearandNonLinearSVMs,Kernelfunctions, • Genetic Algorithms : Genetic operators, genetic programming,modelsofevolution&learning,parallelizinggenetic algorithm	8
	Total	39

TextbooksandReferences:

Textbooks:

1. Mitchell,Tom.*MachineLearning*.NewYork,NY:McGraw-Hill,1997.ISBN:9780070428072.
2. Haykin,SimonS.NeuralNetworksandLearningMachines,3rdeditionPearson2008.
3. Sonka,Milan.HlavacVaclav.BoyleRoger.*ImageProcessing,AnalysisandMachineVision*,NewDelhi:ThomsonLearning, 2001.ISBN: 9812400613.
4. RajasekaranS,VijaylakshmiPaiG.A.NeuralNetworks,FuzzyLogicandGeneticAlgorithmsSynthesisand Application. New Delhi, PrenticeHall ofIndia.
5. Valluru,SudarshanK.RaoNageswaraT.,IntroductiontoNeuralNetworks,FuzzyLogic&Geneticalgorithms, Jaico PublishingHouse2010.

ReferenceBooks:

1. Bishop,Christopher.*Patternrecognitionandmachinelearning*,SpringerVerlag, 2006.
2. ShinghalRajjan,PatternRecognitionTechniquesandApplications.NewDelhiOxfordUniversityPress, 2011.ISBN 9780195676853.
3. RichardsJohn,JiaXiuping, *RemoteSensingDigitalImageAnalysis*,Springer2006.ISBN:9783540251286

AssessmentInternal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum twomodules) and the other is either a class test (on minimum three modules of the remaining) or assignment onliveproblems orcourse project.

EndSemesterExamination:

Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these, questionnumber 1 will be compulsory and it will carry questions covering each module. From remaining questions any threequestions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semesterexamination.

SubjectCode	SubjectName	Credits

ETDLO1014	EmbeddedCommunicationSystemDesign	04

CoursePre-requisite:

- MicrocontrollersandProgramminglanguage

CourseObjectives:

Theaimofthiscourseis

- Toimpartheconceptsandarchitectureofembeddedsystemsandtomakethestudentscapable ofdesigningembedded systems product.
- Toachievethis,systemdesign,architectureandprogrammingofindustrypopularARM Cortexis covered in detail.

CourseOutcome:

Learnerswillbeableto:

- Understandtheembeddedconceptsandarchitectureofembeddedsystems
- UnderstandthearchitectureandprogrammingofARMCortexmicrocontroller
- UnderstandtheopensourceRTOSandtheirusage
- Abletodesignanembeddedsystemsapplication
- Abletousageofthedevelopment anddebuggingtools

Module	DetailedContent	Hours
1	**OverviewofProductDesign** • Need,designchallenges,productsurvey,specificationsofproduct need of hardware and software, partitioning of thedesign into its software and hardware components, iterationand refinementofthepartitioning.	06
2	**SoftwareandHardware** • Tradeoffs, custom single-purpose processors, general-purposeprocessors, memory, interfacing, design technology-hardwaredesign,costreduction,re-engineering,optimization,maintenance,validationanddevelopment,prototyping,turnkeyproductdesign.	06
3	**EmbeddedSystemsandARMArchitecture** • Embedded concepts, architecture of embedded systems, ARMarchitecture, Cortex-M3 basics, exceptions, instruction sets,NVIC,interruptbehavior,Cortex-M3/M4programming,memoryprotectionunitandotherCortex-M3features,STM32xxxARMCortexM3/M4microcontrollermemoryand peripherals,development&debuggingtools.	8
4	**CommunicationandSecurity** • Embeddedsystemssecurity andsecuredhardwarestructures.Communicationssecurityinem	04

	beddedsystems.	

	Embedded systemstimeconstraints	

5	**MulticoreArchitecture** • Multi-Corearchitectureforembeddedsystems,Programmingmodelsfor Multi-Core,EmbeddedMulti-Coreprocessingfor networking.	04
6	**OpenSourceRTOS** • Basics of RTOS: Real-time concepts, Hard Real time and SoftReal-time,differencesbetweengeneralpurposeOS&RTOS,basic architecture of an RTOS, scheduling systems, inter-processcommunication,performanceMatricinschedulingmodels,interruptmanagementinRTOSenvironment,memorymanagement,filesystems,I/Osystems,advantageanddisadvantage of RTOS. POSIX standards, RTOS issues – selectingaRealTimeOperatingSystem,RTOScomparativestudy. • Interfacing Modules: Sensor and actuator interface, datatransferandcontrol, GPS, GSM, Bluetooth,	11
	Total	39

TextbooksandReferences:

1. *TheDefinitiveGuidetotheARMCortex-M3,*JosephYiu,SecondEdition, ElsevierInc.2010.
2. Andrew N Sloss, Dominic Symes, Chris Wright, *"ARM System Developer's Guide -Designing andOptimizingSystemSoftware",*2006, Elsevier.
3. *CommunicatingEmbeddedSystems:NetworksApplications,*FrancineKrief(Editor)February2010 ,Wiley-ISTE
4. Frank Vahid and Tony Givargis, *"Embedded System Design: A UnifiedHardware/SoftwareIntroduction",*JohnWileypublication
5. PMarwedel*, "EmbeddedSystemDesign",*Springerpublication
6. ChristopherHallinan*,"Embedded LinuxPrimer:APracticalReal-WorldApproach* SecondEdition,PearsonEducationPublication

AssessmentInternal:

Assessmentconsistsoftwotestsoutofwhich;oneshouldbecompulsoryclasstest(onminimumtwomodules)andtheotheriseitheracl

asstest(onminimumthreemodulesoftheremaining)orassignment onliveproblemsor courseproject.

EndSemesterExamination:

Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these, questionnumber 1 will be compulsory and it will carry questions covering each module. From remaining questions any threequestionstobe attempted

bjectCode	SubjectName	Credits
ETPE1023	**OptimizationMethodsinSignalProcessing for Communication**	**03**

	Systems	

CoursePre-requisite:

- LinearAlgebra

CourseObjectives:

Theaim ofthis courseis

1. Todevelopunderstandingof fundamentallinearalgebraconcepts, geometricalconcepts,andbasic calculuswhichare essential foroptimization course.
2. Todevelopunderstandingof formulatingatypicalunconstrainedand constrainedoptimizationproblem.
3. Todevelopunderstandingoftypesofconvexoptimizationproblemssuchaslinearprogramming,geometricprogramming,quadratic programming,second-orderconeprogramming,andsemidefiniteprogramming.
4. To develop understanding of Lagrange's duality concepts and interior-point methods for convex optimizationproblems.

CourseOutcomes:

Learnerswillbeableto:

1. Applythe conceptsoflinearalgebra formodelingresearchproblemsinthefieldofcommunicationsandsignalprocessing.
2. Identifytheappropriate convexoptimizationproblemformodelingtypicalresearchproblemsinthefieldofcommunicationsand signal processing.
3. Developalgorithmsformodernwireless communicationsandnetworking,e.g.,optimalresourceallocation,energyefficiencymaximization,sum-rate maximization,optimal beam forming,etc.
4. Modelandanalyzetheresearchproblemsfor5Gandbeyondwirelessnetworks,e.g.,massiveMIMOnetworks,mmWavenetworks, energyharvestingnetworks,UAV networks,etc.
5. Applytheoptimization theoryfortypicalsignal processingapplications,e.g., blindsourceseparationforbiomedicaandhyper spectral imageanalysis,filterdesign, etc.

Module No.	Topics	Hrs.
1.0	**FundamentalsofGeometryandCalculus**	**08**

	Geometrical Concepts: Lines and line segments,Affine sets and affine hull,Convex sets and convex hull, Cone and conic hull, Hyper planes and halfspaces,Neighborhood(Euclideanball)andellipsoid,Interiorpoint,Boundary point,Openandclosedsets,Boundaryset,Compactset,Polyhedra,Separatingand supportinghyperplanes,BasicsofCalculus:Sequences and limits, Affine functions, Differentiability, Derivative matrix,Hessian,Levelsetsandgradients,Graph,Taylor'sseries,Meanvaluetheorem.	
2.0	**IntroductiontoOptimization**	**08**
	1) Basics of an optimization problem, Conditions for local minimizers: Firstordernecessarycondition(FONC),Secondordernecessarycondition(SONC),Second order sufficient condition (SOSC). 2) UnconstrainedOptimizationAlgorithms:Onedimensionalsearchalgorithms: Exhaustive search, Golden section method, Fibonacci method,Bisection method, Newton's method, Secant method, Bracketing, Gradientmethods: Gradient descent algorithm, Steepest descent method, Newton'smethod (revisited): Levenberg-Marquardt modification, Conjugate directionandgradient algorithms.	
3.0	**ConvexOptimization-I**	**4**
	Convex and quasi-convex functions, Convexity preserving operations, Basicstructure of convex optimization problems, Equivalent representations andtransforms,Convexproblems with inequalityconstraints.	
4.0	**CONVEXOPTIMIZATION -II**	**07**
	Linear Programming: Standard form of linear program (LP), Transformationto standard form using surplus and slack variables, Geometry of LP, Basicsolutions, Fundamental theorem of LP, Graphical solution, Simplex method:Canonical augmented matrix, Updating procedure for augmented matrix,Simplex algorithm, Matrix form of Simplex method, Two-phase Simplexmethod,DualLP,Non-simplex methods,Integerlinearprogramming.	
5.0	**ConvexOptimization-III**	**05**
	1) Second-orderconeprogramming(SOCP),SemidefiniteProgramming(SDP):QCQP andSOCPasSDP viaSchurcomplement, S-procedure. 2) Duality: Lagrange dual function and conjugate function, Lagrange dualproblems, Strong duality: Slater's condition, S-Lemma, Karush-Kuhn-Tucker(KKT)optimalityconditions.	
6.0	**OptimizationTechniques**	**07**

	1) Lagrange dual optimization, Alternating direction method of multipliers(ADMM), Duality of problems with generalized inequalities, Theoremsofalternatives. 2) Interior-pointMethods:Inequalityandequalityconstrainedconvexproblems,Newton'smethodandbarrierfunction,Centralpath,Barrier method,Primal-dualinteriorpointmethod.		
		TOTAL	**39**

ESSENTIALREADING

1. C.-Y.Chi,W.-C.Li,andC. -H.Lin,ConvexOptimizationforSignalProcessingandCommunications:FromFundamentalsto Applications, CRCPress , 1st Edition, 2017
2. E.K. P. Chong, and S. H. Zak,AnIntroduction to Optimization,Wiley, 4th Edition,2013

SUPPLEMENTARYREADING

1. S.Boydand L.Vandenberghe,ConvexOptimization,CambridgeUniversityPress,1stEdition,2004
2. GilbertStrang,Linear AlgebraanditsApplications,CengageLearning,4thEdition,2006

AssessmentInternal:

Assessmentconsistsoftwotestsoutofwhich;oneshouldbecompulsoryclasstest(onminimumtwomodules)andtheotheriseither aclasstest(onminimumthreemodulesoftheremaining)orassignment onliveproblemsor courseproject.

EndSemesterExamination:

Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these, questionnumber 1 will be compulsory and it will carry questions covering each module. From remaining questions any threequestionstobe attempted by

SubjectCode	SubjectName	Credits
ETIE1011	**ProductLifeCyclemanagement**	**03**

CoursePre-requisite:

- MicrocontrollersandProgramminglanguage

CourseObjectives:

Theaimofthiscourseis

- TofamiliarizethestudentswiththeneedbenefitsandcomponentsofPLM
- ToacquaintstudentswithProductDataManagement&PLMstrategies
- Togiveinsightsintonew productdevelopmentprogramand guidelinesfor designinganddevelopingaproduct
- TofamiliarizethestudentswithVirtualProductDevelopment

CourseOutcome:

Learnerswillbeableto:

- GainknowledgeaboutphasesofPLM,PLMstrategiesandmethodologyforPLMfeasibility studyand PDM implementation.
- Illustratevariousapproachesandtechniquesfordesigninganddevelopingproducts.
- Applyproductengineeringguidelines/thumbrulesindesigningproductsformoulding,machining, sheet metal workingetc.
- Acquireknowledgeinapplyingvirtualproductdevelopmenttoolsforcomponents,machining and manufacturingplant

Module	DetailedContent	Hours
1	**IntroductiontoProductLifecycleManagement(PLM)** • ProductLifecycleManagement(PLM),NeedforPLM,ProductLifecyclePhases,OpportunitiesofGlobalization,Pre-PLMEnvironment,PLMParadigm,Importance&BenefitsofPLM,Widespread Impact of PLM, Focus and Application, A PLM Project,Startingthe PLM Initiative,PLM Applications **PLMStrategies** • Industrialstrategies,Strategyelements,itsidentification,selectionand implementation, Developing PLM Vision and PLM Strategy ,Changemanagementfor PLM.	10
2	**ProductDesign** • ProductDesignandDevelopmentProcess,EngineeringDesign,Organization and Decomposition in Product Design, TypologiesofDesignProcessModels,ReferenceModel,ProductDesignintheContextoftheProductDevelopmentProcess,RelationwiththeDevelopmentProcessPlanningPhase,RelationwiththePostdesignPlanningPhase,MethodologicalEvolutioninProduct Design, Concurrent Engineering, Characteristic	09

	FeaturesofConcurrentEngineering,ConcurrentEngineeringand Life Cycle Approach, New Product Development (NPD)and Strategies, Product Configuration and Variant Management,The Design for X System, Objective Properties and Design forXTools,ChoiceofDesignforXToolsandTheirUseinthe DesignProcess	
3	**ProductDataManagement** • Product and Product Data, PDM systems and importance, ComponentsofPDM,ReasonforimplementingaPDMsystem,financial justificationofPDM,barrierstoPDMimplementation	05
4	**VirtualProductDevelopmentTools** • Forcomponents,machines,andmanufacturingplants,3DCADsystemsand realisticrenderingtechniques,Digitalmock-up,Modelbuilding,Modelanalysis,ModelingandsimulationsinProductDesign,Examples/Casestudies	05
5	**IntegrationofEnvironmentalAspectsinProductDesign** • Sustainable Development, Design for Environment, Need forLifeCycleEnvironmentalStrategies,UsefulLifeExtensionStrategies,End-of-LifeStrategies,IntroductionofEnvironmental Strategies into the Design Process, Life CycleEnvironmentalStrategiesandConsiderationsforProduct Design	05
6	**LifeCycleAssessmentandLifeCycleCostAnalysis** • Properties, and Framework of Life Cycle Assessment, Phases of LCAin ISO Standards, Fields of Application and Limitations of Life CycleAssessment, Cost Analysis and the Life Cycle Approach, GeneralFramework for LCCA, Evolution of Models for Product Life CycleCostAnalysis	05

TextbooksandReferences:

1. John Stark, ‖*Product Lifecycle Management: Paradigmfor21st CenturyProduct Realisation*‖, Springer-Verlag,2004.ISBN:1852338105
2. Fabio Giudice, Guido La Rosa,Antonino Risitano, ‖*Product Design forthe environment-Alifecycleapproach*‖,Taylor&Francis2006,ISBN:0849327229
3. SaaksvuoriAntti,ImmonenAnselmie,‖*ProductLifeCycleManagement*‖,Springer, Dreamtech,ISBN: 3540257314
4. MichaelGrieve,‖*ProductLifecycleManagement:Drivingthenextgenerationoflean thinking*‖, Tata McGrawHill, 2006,ISBN: 0070636265

AssessmentInternal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum twomodules) and the other is either a class test (on minimum three modules of the remaining) or assignment onliveproblems orcourse project.

EndSemesterExamination:

Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out ofthese, question number 1 will be compulsory and it will carry questions covering each module. Fromremainingquestions anythree questionsto be attempted by

SubjectCode	SubjectName	Credits
ETIE1012	**ReliabilityEngineering**	**03**

CourseObjectives:
Theaimofthiscourseis

- Tofamiliarizethestudentswithvariousaspectsof probabilitytheory
- Toacquaintthestudents withreliabilityanditsconcepts
- Tointroducethestudentstomethodsofestimatingthesystemreliabilityofsimpleandcomplexsystems
- TounderstandthevariousaspectsofMaintainability,AvailabilityandFMEAprocedure

CourseOutcome:
Learnerswillbeableto:

- UnderstandandapplytheconceptofProbabilityto engineeringproblems
- Applyvariousreliabilityconceptstocalculatedifferentreliabilityparameters
- Estimatethesystemreliabilityofsimple andcomplexsystems
- CarryoutaFailureModeEffectandCriticalityAnalysis

Module	DetailedContent	Hours
1	**Probabilitytheory** • Probability: Standard definitions and concepts; ConditionalProbability,Baye‘s Theorem. **ProbabilityDistributions** • Central tendency and Dispersion; Binomial, Normal, Poisson,Weibull,Exponential,relationsbetweenthemandtheirsignificance. **MeasuresofDispersion** • Mean,Median,Mode,Range,MeanDeviation,StandardDeviation, Variance, Skewness and Kurtosis.	08

2	**ReliabilityConcepts** • Reliabilitydefinitions,ImportanceofReliability,QualityAssurance and Reliability,Bath Tub Curve. **FailureDataAnalysis** • Hazardrate,failuredensity,FailureRate,MeanTimeToFailure (MTTF), MTBF,ReliabilityFunctions. **ReliabilityHazardModels** • ConstantFailureRate,Linearly increasing,TimeDependentFailureRate,WeibullModel.Distributionfunctionsandreliabilityanalysis.	08
3	**SystemReliability** • SystemConfigurations:Series,parallel,mixedconfiguration,kout of n structure, Complex systems.	05
4	**ReliabilityImprovement** • Redundancy Techniques: Element redundancy, Unitredundancy, Standbyredundancies. Markovanalysis. • SystemReliability Analysis– Enumerationmethod,Cut-setmethod,Success Path method,Decomposition method.	08
5	**MaintainabilityandAvailability** • Systemdowntime,DesignforMaintainability:Maintenancerequirements,Designmethods:FaultIsolationandself-diagnostics,PartsstandardizationandInterchangeability,ModularizationandAccessibility,Repair VsReplacement. • Availability–qualitativeaspects.	05
6	**FailureMode,EffectsandCriticalityAnalysis** • Failure mode effects analysis, severity/criticality analysis, FMECAexamples. Fault tree construction, basic symbols, development offunctional reliability block diagram, Fau1t tree analysis and EventtreeAnalysis	05

TextbooksandReferences:

1. L.S.Srinath,–*ReliabilityEngineering*‖,Affiliated East-WastPress(P)Ltd., 1985.
2. CharlesE.Ebeling, –*Reliability and Maintainability Engineering*‖, Tata McGraw Hill.
3. B.S.Dhillion, C.Singh, –*Engineering Reliability*‖,JohnWiley&Sons,1980.
4. P.D.T.Conor, –*Practical Reliability Engg*.‖, JohnWiley&Sons,1985.
5. K.C. Kapur, L.R.Lamberson, –*Reliability in Engineering Design*‖,John Wiley & Sons.

6. MurrayR. Spiegel, –*Probability and Statistics*‖,Tata McGraw-Hill Publishing Co. Ltd.

AssessmentInternal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum twomodules) and the other is either a class test (on minimum three modules of the remaining) or assignment onliveproblems orcourse project.

EndSemesterExamination:

Someguidelinesforsettingthequestionpapersareas,sixquestionstobeset eachof20marks,outofthese, question number 1 will be compulsory and it will carry questions covering each module. Fromremainingquestions anythree questionsto be attempted by

SubjectCode	SubjectName	Credits
ILO1013	**ManagementInformationSystem**	**03**

CourseObjectives:
Theaimofthiscourseis

- ThecourseisblendofManagement andTechnical field.
- Discusstherolesplayedbyinformationtechnologyintoday‘sbusinessanddefinevarioustechnologyarchitectures onwhich information systemsarebuilt
- Defineandanalyzetypicalfunctionalinformation systemsandidentifyhowtheymeettheneeds of the firm to deliverefficiencyand competitiveadvantage
- Identifythebasicstepsinsystems development

CourseOutcome:
Learnerswillbeableto:

- ExplainhowinformationsystemsTransformBusiness
- Identifytheimpactinformationsystems haveonanorganization
- Describe ITinfrastructureanditscomponentsanditscurrenttrends
- Understandtheprincipaltoolsandtechnologiesforaccessinginformationfromdatabases to improvebusiness performanceanddecision making
- Identifythetypesofsystemsusedforenterprise-wideknowledgemanagementandhow theyprovidevalueforbusinesses

Module	DetailedContent	Hours
1	**IntroductionToInformationSystems(IS)** • ComputerBasedInformationSystems,ImpactofITonorganizations,ImportanceofIStoSociety.OrganizationalStrategy,CompetitiveAdvantagesandIS.	04
2	**DataandKnowledgeManagement** • DatabaseApproach,BigData,DatawarehouseandDataMarts,KnowledgeManagement. **Businessintelligence(BI)** • ManagersandDecisionMaking,BIforDataanalysisandPresentingResults	07
3	**EthicalissuesandPrivacy** • InformationSecurity,ThreattoIS,andSecurityControls	07
4	**SocialComputing(SC)** • Web2.0and3.0,SCinbusiness-shopping,Marketing,OperationalandAnalyticCRM,E-businessandE-commerce	07

	–B2BB2C.Mobilecommerce.	
5	**ComputerNetworks:**	06

	• WiredandWirelesstechnology,Pervasivecomputing,Cloudcomputingmodel.	
6	**InformationSystemwithinOrganization** • TransactionProcessingSystems,FunctionalAreaInformationSystem,ERP and ERPsupport ofBusiness Process. • AcquiringInformationSystemsandApplications:VariousSystemdevelopment life cyclemodels.	08

TextbooksandReferences:

1. KellyRainer,BradPrince,*ManagementInformationSystems*,Wiley
2. K.C.LaudonandJ.P.Laudon,*ManagementInformationSystems:ManagingtheDigitalFirm*, 10thEd., PrenticeHall, 2007.
3. D. Boddy, A. Boonstra, *Managing Information Systems: Strategy and Organization*,PrenticeHall, 2008

AssessmentInternal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum twomodules) and the other is either a class test (on minimum three modules of the remaining) or assignment onliveproblems orcourse project.

EndSemesterExamination:

Someguidelinesforsettingthequestionpapersareas,sixquestionstobeset eachof20marks,outofthese, question number 1 will be compulsory and it will carry questions covering each module. Fromremainingquestions anythree questionsto be attempted by

CourseCode	CourseName	Credits
ETIE1014	DesignofExperiments	03

Objectives:

1. TounderstandtheissuesandprinciplesofDesign ofExperiments(DOE)
2. Tolisttheguidelinesfordesigningexperiments
3. Tobecomefamiliarwithmethodologiesthatcanbeusedinconjunctionwithexperimentalde signs forrobustness and optimization

Outcomes: Learnerwillbeableto…

1. Plandatacollection,toturndataintoinformationandtomakedecisionsthatleadtoappropri ate action
2. Applythemethodstaughttoreallifesituations
3. Plan,analyze,andinterprettheresultsofexperiments

Module	DetailedContents	Hrs
01	**Introduction** 1.1 StrategyofExperimentation 1.2 TypicalApplicationsofExperimentalDesign 1.3 GuidelinesforDesigningExperiments 1.4 ResponseSurfaceMethodology	06
02	**FittingRegressionModels** 2.1 LinearRegressionModels 2.2 EstimationoftheParametersinLinearRegressionModels 2.3 HypothesisTestinginMultipleRegression 2.4 ConfidenceIntervalsinMultipleRegression 2.5 Predictionofnewresponseobservation 2.6 Regressionmodeldiagnostics 2.7 Testingforlackoffit	08

03	**Two-LevelFactorialDesignsandAnalysis** 3.1 The2^2Design 3.2 The2^3Design 3.3 TheGeneral2^kDesign 3.4 ASingleReplicateofthe2^kDesign 3.5 TheAdditionofCenterPointstothe2^kDesign, 3.6 Blockinginthe2^kFactorialDesign 3.7 Split-PlotDesigns	07
04	**Two-LevelFractionalFactorialDesignsandAnalysis** 4.1 TheOne-HalfFractionofthe2^kDesign 4.2 TheOne-QuarterFractionofthe2^kDesign 4.3 TheGeneral2^{k-p}FractionalFactorialDesign 4.4 ResolutionIIIDesigns 4.5 ResolutionIVandVDesigns 4.6 FractionalFactorialSplit-PlotDesigns	07
05	**ConductingTests** 5.1 TestingLogistics 5.2 Statisticalaspectsofconductingtests 5.3 Characteristicsofgoodandbaddatasets 5.4 Exampleexperiments 5.5 AttributeVsVariabledatasets	07
06	**TaguchiApproach** 6.1 CrossedArrayDesignsandSignal-to-NoiseRatios 6.2 AnalysisMethods 6.3 Robustdesignexamples	04

REFERENCES:

1. RaymondH.Mayers,DouglasC.Montgomery,ChristineM.Anderson-Cook,ResponseSurfaceMethodology: Process and Product Optimization using DesignedExperiment, 3rdedition,John Wiley &Sons, New York, 2001
2. D.C.Montgomery, DesignandAnalysis ofExperiments, 5thedition,JohnWiley&Sons,NewYork,2001
3. GeorgeEPBox,JStuartHunter,WilliamGHunter,StaticsforExperimenters:Design,InnovationandDiscovery, 2ndEd.Wiley
4. WJDimond,PeacticalExperimentDesignsforEngineersand Scintists,JohnWileyandSons Inc.ISBN:0-471-39054-2
5. DesignandAnalysisof Experiments(SpringertextinStatistics),SpringerbyA.M.Dean,andD.T.Voss
6. PhillipJRoss, –TaguchiTechniqueforQualityEngineering,‖McGrawHill
7. MadhavSPhadke,―QualityEngineeringusingRobustDesign,‖PrenticeHall

AssessmentInternal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum twomodules) and the other is either a class test (on minimum three modules of the remaining) or assignment onliveproblems orcourse project.

EndSemesterExamination:

Someguidelinesforsettingthequestionpapersareas,sixquestionstobeset eachof20marks,outofthese, question number 1 will be compulsory and it will carry questions covering each module. Fromremainingquestions anythree questionsto be attempted bystudent.

SubjectCode	SubjectName	Credits
ETIE1015	**OperationsResearch**	**03**

CourseObjectives:
Theaimofthiscourseis

- Formulateareal-worldproblemasamathematicalprogrammingmodel.
- Understandthemathematicaltoolsthatareneededtosolveoptimizationproblems.
- Usemathematicalsoftwaretosolvetheproposed models.

CourseOutcome:
Learnerswillbeableto:

- Understandthetheoreticalworkingsofthesimplexmethod,therelationshipbetweenalinear programand itsdual,includingstrongdualityandcomplementaryslackness.
- Perform sensitivity analysis to determine the direction and magnitude of change of amodel‘soptimal solutionas the data change.
- Solvespecializedlinearprogrammingproblemslikethetransportationandassignment problems, solve network models like the shortest path, minimum spanningtree,and maximum flow problems.
  Understandtheapplicationsofintegerprogrammingandaqueuingmodelandcomputeimpo rtant performancemeasures

Module	DetailedContent	Hours
1	**IntroductiontoOperationsResearch** • Introduction, , Structure of the Mathematical Model, Limitations ofOperationsResearch **LinearProgramming** • Introduction, Linear Programming Problem, Requirements of LPP,MathematicalFormulationofLPP,Graphicalmethod,SimplexMeth od Penalty Cost Method or Big M-method, Two Phase Method,Revisedsimplexmethod,**Duality**,Primal–Dualconstruction,SymmetricandAsymmetricDual,WeakDualityTheor em,Complimentary Slackness Theorem, Main Duality Theorem, DualSimplexMethod, SensitivityAnalysis **TransportationProblem** • Formulation, solution, unbalanced Transportation problem. Findingbasic feasible solutions – Northwest corner rule, least cost methodandVogel‘sapproximationmethod.Optimalitytest:thesteppings tonemethod andMODImethod. **AssignmentProblem** • Introduction, Mathematical Formulation of the Problem, HungarianMethodAlgorithm,Processing ofn Jobs ThroughTwo MachinesandmMachines,GraphicalMethodofTwoJobsmMachines	14

	ProblemRoutingProblem,TravellingSalesmanProblem **IntegerProgrammingProblem** • Introduction, Types of Integer Programming Problems, Gomory'scutting plane Algorithm, Branch and Bound Technique. IntroductiontoDecompositionalgorithms.	
2	**Queuingmodels** • Queuingsystemsandstructures,singleserverandmulti-servermodels,Poissoninput,exponentialservice,constantrateservice,finiteandinfinite population	05
3	**Simulation** • Introduction, Methodology of Simulation, Basic Concepts,SimulationProcedure,ApplicationofSimulationMonte-CarloMethod:Introduction,Monte-CarloSimulation,ApplicationsofSimulation,AdvantagesofSimulation, LimitationsofSimulation	05
4	**Dynamicprogramming** • Characteristicsofdynamicprogramming.Dynamicprogrammingapproachfor PriorityManagementemploymentsmoothening,capitalbudgeting, Stage Coach/Shortest Path, cargo loading and Reliabilityproblems.	05
5	**GameTheory** • Competitivegames,rectangulargame,saddlepoint,minimax(maximin) method of optimal strategies, value of the game. Solutionofgameswithsaddlepoints,dominanceprinciple.Rectangulargameswithoutsaddlepoint–mixedstrategyfor2X2games.	05
6	**InventoryModels** • ClassicalEOQModels,EOQModelwithPriceBreaks,EOQwithShortage,Probabilistic EOQModel,	05

TextbooksandReferences:

1. Taha,H.A."*OperationsResearch-AnIntroduction*",PrenticeHall,(7thEdition),2002.
2. Ravindran,A,Phillips,D.TandSolberg,J.J."*OperationsResearch:PrinciplesandPractice*",JohnWilleyand Sons, 2ndEdition, 2009.
3. Hiller,F.S.andLiebermann,G.J."*IntroductiontoOperationsResearch*",TataMcGrawHill,2002.
4. *OperationsResearch*,S.D.Sharma,KedarNathRamNath-Meerut.
5. *OperationsResearch*,KantiSwarup,P.K.GuptaandManMohan,SultanChand&Sons.

AssessmentInternal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimumtwo modules) and the other is either a class test (on minimum three modules of the remaining) orassignment onlive problems orcourse project.

EndSemesterExamination:

Someguidelinesforsettingthequestionpapersareas,sixquestionstobeset eachof20marks,outof these, question number 1 will be compulsory and it will carry questions covering each module.Fromremainingquestionsanythree questionsto be attempted bystudent.

jectCode	SubjectName	Credits
ETIE1016	**CyberSecurityandLaws**	**03**

CourseObjectives:

Theaimofthiscourseis

- Tounderstandandidentifydifferenttypescybercrimeandcyberlaw
- TorecognizedIndianITAct2008anditslatestamendments
- Tolearnvarioustypesofsecuritystandardscompliances

CourseOutcome:

Learnerswillbeableto:

- Understandtheconceptofcybercrimeanditseffectonoutsideworld
- InterpretandapplyITlawinvariouslegalissues
- Distinguishdifferentaspectsofcyberlaw
- ApplyInformationSecurityStandardscomplianceduringsoftwaredesignanddevelopment

Module	DetailedContent	Hours
1	**IntroductiontoCybercrime** • Cybercrimedefinitionandoriginsoftheworld,Cybercrimeandinformation security, Classifications of cybercrime, Cybercrime andtheIndianITA2000,AglobalPerspectiveoncybercrimes.	04
2	**Cyberoffenses&Cybercrime** • How criminal plan the attacks, Social Engg, Cyber stalking, CybercaféandCybercrimes,Botnets,Attackvector,Cloudcomputing,Proliferation of Mobile and Wireless Devices, Trends in Mobility,Credit Card Fraudsin • MobileandWirelessComputingEra,SecurityChallengesPosedbyMobile Devices, Registry Settings for Mobile Devices,AuthenticationServiceSecurity,AttacksonMobile/ CellPhones,Mobile Devices: Security Implications for Organizations,OrganizationalMeasuresforHandlingMobile, Devices-RelatedSecurityIssues,OrganizationalSecurityPoliciesandMeasuresin MobileComputingEra,Laptops	09
3	**ToolsandMethodsUsedinCyberline** • Phishing, Password Cracking, Keyloggers and Spywares, Virus andWorms,Steganography,DoSandDDoSAttacks,SQLInjection,BufferOverFlow,AttacksonWirelessNetworks,Phishing,Identity Theft(IDTheft)	06
4	**TheConceptofCyberspace** • E-Commerce,TheContractAspectsinCyberLaw,TheSecurityAspectofCyberLaw,TheIntellectualPropertyAspectinCyber	08

	Law, The Evidence Aspect in Cyber Law,The Criminal Aspect inCyberLaw,GlobalTrendsinCyberLaw,LegalFramework forElectronicDataInterchangeLawRelatingtoElectronicBanking, TheNeedforanIndianCyberLaw	
5	**IndianITAct.** • CyberCrimeandCriminalJustice:Penalties,AdjudicationandAppealsUnderthe IT Act,2000,IT Act.2008and itsAmendments	06
6	**InformationSecurityStandardcompliances** • SOX,GLBA,HIPAA,ISO,FISMA,NERC,PCI.	06

TextbooksandReferences:

1. NinaGodbole,SunitBelapure,*CyberSecurity*,WileyIndia,NewDelhi.
2. *TheIndianCyberLaw*bySureshT.Vishwanathan;Bharat LawHouseNewDelhi
3. *TheInformationtechnologyAct*,2000;BareAct-ProfessionalBookPublishers,NewDelhi.
4. *CyberLaw&CyberCrimes* ByAdvocatePrashantMali; SnowWhitePublications,Mumbai
5. NinaGodbole,*InformationSystemsSecurity*,WileyIndia,NewDelhi
6. KennetchJ.Knapp,*CyberSecurity&GlobalInformationAssurance*InformationSciencePublishing.
7. WilliamStallings,*CryptographyandNetworkSecurity*,PearsonPublication
8. Websites for more information is available on :The Information Technology ACT,2008-TIFR:https://www.tifrh.res.in
9. Websiteformoreinformation,ACompliancePrimerforITprofessional:https://www.sans.org/reading-room/whitepapers/compliance/compliance-primer-professionals-33538

AssessmentInternal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimumtwo modules) and the other is either a class test (on minimum three modules of the remaining) orassignment onlive problems orcourse project.

EndSemesterExamination:

Someguidelinesforsettingthequestionpapersareas,sixquestionstobeset eachof20marks,outof these, question number 1 will be compulsory and it will carry questions covering each module.Fromremainingquestionsanythree questionsto be attempted bystudent.

SubjectCode	SubjectName	Credits
ETIE1017	**DisastermanagementandMitigation Measures**	**03**

CourseObjectives:

Theaimofthiscourseis

- Tounderstandphysicsandvarioustypesofdisasteroccurringaroundtheworld
- Toidentifyextentanddamagingcapacityof adisaster
- Tostudyandunderstandthemeansoflossesand methodstoovercome/minimizeit.
- Tounderstandroleofindividualandvariousorganizationduringandafterdisaster
- TounderstandapplicationofGISinthefieldofdisastermanagement
- Tounderstandtheemergencygovernment responsestructuresbefore,duringandafterdisaster

CourseOutcome:

Learnerswillbeableto:

- Get to know natural as well as manmade disaster and their extent and possible effectsontheeconomy.
- Planofnationalimportancestructuresbaseduponthepreviushistory.
- Getacquaintedwithgovernmentpolicies,actsandvariousorganizationalstructureassoc iatedwithan emergency.
- Gettoknowthesimpledo‘sanddon‘tsinsuchextremeeventsandactaccordingly.

Module	DetailedContent	Hours
1	**Introduction** • Definition of Disaster, hazard, global and Indian scenario, generalperspective, importance of study in human life, Direct and indirecteffectsofdisasters,longtermeffectsofdisasters.Introductionto globalwarmingandclimatechange.	03
2	**NaturalDisasterandManmadedisasters:** • Natural Disaster: Meaning and nature of natural disaster,Flood,Flash flood, drought, cloud burst,Earthquake, Landslides,Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, StormSurge,climate change, global warming, sea level rise, ozonedepletion • Manmade Disasters: Chemical, Industrial, Nuclear and Fire Hazards.Roleofgrowingpopulationandsubsequentindustrialization,ur banizationandchanginglifestyleofhumanbeingsinfrequent occurrencesofmanmadedisasters.	09
3	**DisasterManagement,PolicyandAdministration** • Disastermanagement:meaning,concept,importance,objectiveof disastermanagement policy,disasterrisksinIndia,Paradigmshiftindisastermanagement.	06

	• Policyandadministration:Importanceandprinciplesofdisastermanagement policies,commandandco-ordinationofindisastermanagement,rescueoperations-howtostartwithandhowtoproceed induecourseoftime,studyof flowchart showingthe entireprocess.	
4	**InstitutionalFrameworkforDisasterManagementinIndia:** • Importanceofpublicawareness,Preparationandexecutionofemergency management programme. Scope and responsibilities ofNationalInstituteofDisasterManagement(NIDM)andNationaldisastermanagementauthority(NDMA)inIndia.Methodsandmeasures to avoid disasters, Managementof casualties, set up ofemergencyfacilities,importanceofeffectivecommunicationamongst differentagenciesin suchsituations. • UseofInternetandsoftwaresforeffectivedisastermanagement.Applications of GIS, RemotesensingandGPSinthisregard.	06
5	**FinancingReliefMeasures:** • Waystoraisefinanceforreliefexpenditure,roleofgovernmentagencies and NGO‘s in this process, Legal aspects related to financeraising as well as overall management of disasters. Various NGO‘sand the works they have carried out in the past on the occurrence ofvariousdisasters, Waysto approachtheseteams. • Internationalreliefaidagenciesandtheirroleinextremeevents.	09
6	**PreventiveandMitigationMeasures:** • Pre-disaster,duringdisasterandpost-disastermeasuresinsomeeventsin general • Structural mapping: Risk mapping, assessment and analysis, sea wallsandembankments,Bioshield,shelters,earlywarningandcommunication • Non Structural Mitigation: Community based disaster preparedness,risk transfer and risk financing, capacity development and training,awarenessand education, contingencyplans. • Do‘s and don‘ts in case of disasters and effective implementation ofreliefaids.	06

TextbooksandReferences:

1. _*DisasterManagement*‘byHarshK.Gupta,UniversitiesPressPublications.
2. _*DisasterManagement:AnAppraisalofInstitutionalMechanismsinIndia*‘by O.S.Dagur, publishedbyCentre forlandwarfarestudies, New

Delhi,2011.
3. _*IntroductiontoInternationalDisasterManagement*‘byDamonCopolla,But terworthHeinemannElseveir Publications.
4. _*DisasterManagementHandbook’*byJackPinkowski,CRCPressTaylorandFran cisgroup.
5. _*Disastermanagement&rehabilitation’*byRajdeepDasgupta,MittalPubli cations,New Delhi.
6. _*NaturalHazardsandDisasterManagement*,VulnerabilityandMitigation –RBSingh,RawatPublications

AssessmentInternal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimumtwo modules) and the other is either a class test (on minimum three modules of the remaining) orassignment onlive problems orcourse project.

EndSemesterExamination:

Someguidelinesforsettingthequestionpapersareas,sixquestionstobeset eachof20marks,outof these, question number 1 will be compulsory and it will carry questions covering each module.Fromremainingquestionsanythree questionsto be attempted bystudent.

SubjectCode	SubjectName	Credits
ETIE1018	**EnergyAuditandManagement**	**03**

CourseObjectives:

Theaimofthiscourseis

- Tounderstandtheimportanceenergysecurityforsustainabledevelopmentandthe fundamentals ofenergyconservation.
- Tointroduceperformanceevaluationcriteriaofvariouselectricalandthermalinst allations to facilitate theenergymanagement
- Torelatethedatacollectedduringperformanceevaluationofsystemsforide ntification ofenergysavingopportunities.

CourseOutcome:

Learnerswillbeableto:

- Toidentifyanddescribepresentstateofenergysecurityanditsimportance.
- Toidentifyanddescribethebasicprinciplesandmethodologiesadoptedinenergyau dit ofautility.
- Todescribetheenergyperformanceevaluationofsomecommonelectricalinsta llations and identifytheenergysavingopportunities.
- Todescribethe energyperformanceevaluation of somecommonthermalinstallations and identifythe energysavingopportunities
- Toanalyzethedata collectedduringperformance evaluationandrecommendenergysavingmeasures

Module	DetailedContent	Hours
1	**EnergyScenario** • PresentEnergyScenario,EnergyPricing,EnergySectorReforms,E nergySecurity,EnergyConservationanditsImportance, Energy Conservation Act-2001 and its Features.Basics of Energy and its various forms, Material and Energybalance	04
2	**EnergyAuditPrinciples** • Definition, Energy audit- need, Types of energy audit, Energymanagement(audit)approach- understandingenergycosts,Bench marking, Energy performance, Matching energy use torequirement, Maximizing system efficiencies, Optimizing theinputenergyrequirements,Fuelandenergysubstitution.Elemen ts of monitoring& targeting; Energy audit Instruments;Dataand information-analysis. • Financial analysis techniques: Simple paybackperiod, NPV,Returnoninvestment(ROI),Internalrateofreturn (IRR)	08

3	**EnergyManagementandEnergyConservationinElectricalSystem** • Electricity billing, Electrical load management and maximumdemand Control; Power factor improvement, Energy efficientequipmentsand appliances, star ratings. **Energyefficiencymeasuresinlightingsystem,Lightingcontrol:** • Occupancysensors,daylightintegration,anduseofintelligentcontrollers.Energyconservationopportunitiesin:waterpumps,industrial drives,inductionmotors,motorretrofitting,softstarters,variablespeeddrives.	10
4	**EnergyManagementandEnergyConservationinThermalSystems:** • Reviewofdifferentthermalloads;Energyconservationopportunitiesin:Steamdistributionsystem,Assessmentofsteamdistributionlosses,Steamleakages,Steamtrapping,Condensateand flash steam recoverysystem. • General fuel economy measures in Boilers and furnaces, Wasteheat recovery, use of insulation- types and application. HVACsystem:Coefficientofperformance,Capacity,factorsaffecting Refrigeration and Air Conditioning system performance andsavingsopportunities.	10
5	**EnergyPerformanceAssessment** • OnsitePerformanceevaluationtechniques,Casestudiesbasedon:Motorsandvariablespeeddrive,pumps,HVACsystemcalculations;LightingSystem:InstalledLoadEfficacy Ratio(ILER)method,FinancialAnalysis.	04
6	**EnergyconservationinBuildings** • Energy Conservation Building Codes (ECBC): Green Building,LEEDrating,ApplicationofNon-ConventionalandRenewableEnergySources	03

TextbooksandReferences:

1. *HandbookofElectricalInstallationPractice*,GeofryStokes,BlackwellScience
2. *Designingwithlight:LightingHandbook*,ByAnilValia,LightingSystem
3. *EnergyManagementHandbook*,ByW.C.Turner, JohnWileyandSons
4. *HandbookonEnergyAuditsand Management*,edited byA.K.Tyagi,TataEnergyResearchInstitute(TERI).
5. *EnergyManagementPrinciples*,C.B.Smith,PergamonPress
6. *EnergyConservationGuidebook*,DaleR.Patrick,S.Fardo,RayE.Richardson,Fairmont Press
7. *HandbookofEnergyAudits*,AlbertThumann,W.J.Younger,T.Niehus,CRC Press
8. www.energymanagertraining.com
9. www.bee-india.nic.in

AssessmentInternal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimumtwo modules) and the other is either a class test (on minimum three modules of the remaining) orassignment onlive problems orcourse project.

EndSemesterExamination:

Someguidelinesforsettingthequestionpapersareas,sixquestionstobeset eachof20marks,outof these, question number 1 will be compulsory and it will carry questions covering each module.Fromremainingquestionsanythree questionsto be attempted bystudent.

SubjectCode	SubjectName	Credits
ETL101	**ProgramLab-I**	**01**

Course Code	**Course Name**	**ExaminationScheme**			
			TermWork	**Practical andOral**	**Total**
ETL101	Program Lab-1		25	25	50

CourseObjectives:

1. Tolearntheconcept ofimpedancematchingandRFfilters
2. TolearnMicrowave amplifiers, oscillatorsandmixer

CourseOutcomes: Learnerswillbeableto...

1. Analyze Biomedicalsignal usingsimulationsoftware.
2. Analyzetheperformance of perprocessingtoolsusingsimulationsoftware.

TermWork:

At least 08 experiments covering the entire syllabus must be given ―Batch Wise‖. Computation/simulation based experiments are also encouraged. Teacher should refer the suggested list ofexperiments and can design additional experiments to acquire practical design skills. The experimentsshould be students centric and attempt should be made to make experiments more meaningful, interestingand innovative.

Sr. No.	**TitleofExperiment**
1	EstimationofPeriodogramandSpectrogram andDemonstratetheir applications.
2	Pre-processingofBio-electricsignals
3	Waveletanalysisfordenoisingof Bio-electricsignals
4	Wavelettransformforaudiosignalcompression
5	Simulationofadaptivefilteringandtheirapplications
6	GenerationofChorusandflangingeffectsforvoicerecord
7	Implementationofequalizers
8	SimulatedgenerationofECGsignalandisolation ofQRScomplex
9	AnalysisofEEGsignals

- Outof9Experiments any8Experiments havetobeperformed.

Assessment:

EndSemesterExamination: Practical/Oralexaminationistobeconductedbypairofinternalandexternalexaminers.(Examinerswillbefrom PGrecognizedteachers)

Subject Code	SubjectName	Credits
ETC201	**RFEngineering**	**03**

Course Pre-

- **requisite:**Electromagneticsan
- dAntennaMicrowaveEngineer ing

CourseObjectives:

The aim ofthiscourse is

- Toprovidestate-of-artknowledgeinRFcircuitsandmicrowavesystems.
- To explain various methodologies presently prevalent for design of active and passive RF
- circuits.Toenable students to make systemleveldesign decisions.
- Toexposestudentstostate-of-artsimulationsystems.
- ToteachstudentsComputeraideddesigntoolsforanalysisanddesignofcircuits

CourseOutcomes:

Learnerswillbeableto:

- Characterize devices at higher
- frequencies.DesignandanalyzeRFcircuitsandcom
- ponents. Designandanalyzeamplifiers,oscillatorsandmixersatmicrowavefrequencies.

Module No.	Unit No.	Topics	Hrs.
1.0		**IntroductiontoRF,ImpedanceMatchingandRFFilter**	**08**
	1.1	**Introduction**CharacteristicsofRFWavesandapplications,RF ComponentsandCircuits:EquivalentCircuitsofConcentratedPassiveComponentslikeResistors, Capacitors,Inductors.	
	1.2	**RF Filter Design and Implementation:** Butterworth Filter,Chebyshev Filter, SteppedImpedanceFilter.	
	1.3	**Analysisanddesign:** Striplines,Microstrip linesandcoupledlines.	
	1.4	**ImpedanceMatching:**CausesandeffectsTechniquesusingL-Canddistributed Parameters.	
2.0		**DeviceCharacterization**	**06**
	2.1	Multi-portNetworkrepresentation,S-parameters:Propertiesand characterization.	
	2.2	SpectrumAnalyzerand VectorNetworkAnalyzerBasics	
	2.3	Noise Characterization: Noise Figure, Noise temperature, Noiseparameters,Noise Correlation matrix.	
3.0		**AmplifierDesign**	**10**
	3.1	Two-portpower gains,StabilityDetermination:Mathematicaland Graphical	
	3.2	Singlestageamplifierdesign:DesignforMaximumGain,Design forSpecified Gain,Low NoiseAmplifierdesign	
	3.3	Power amplifiers:Characteristics ofpoweramplifier andclasses ofamplifiers,Design of Class A poweramplifier	
4.0		**FrequencyGenerationandMixers**	**06**
	4.1	One-portandtwo-portmicrowaveoscillatordesign,Analysisofphasenoise in oscillators.	
	4.2	Mixers:Characteristics,TypesofMixers:Singleendeddiodemixers,FET mixers, Balanced mixers,andImagereject mixers.	
5.0		**ElectromagneticInterferenceinRFcircuits**	**05**
	5.1	NaturalandNuclearSourcesofEMI,EMIFromApparatusand Circuits.	
	5.2	Elements Of Interference including Antennas, Transmitters,Receiversand Propagation.	
	5.3	**EMICoupling**:**Common-ModeCoupling**:Common-ModeCoupling Mechanisms Including Field to Cable, Ground Impedance,GroundLoopandCouplingReductionTechniques.Differential-Mode Coupling:Differential-ModeCouplingMechanismsIncluding FieldtoCable,CabletoCableandCouplingReductionTechniques.	
	5.4	**Other Coupling mechanisms:** Power Supplies andVictimAmplifiers.	
6.0		**ElectromagneticCompatibility**	**04**
	6.1	TheImportanceofGroundingforachievingEMC,Grounding	

		Schemes (Single Point, Multi-Point and Hybrid), Shield GroundingandBonding.ShieldingEffectiveness,ShieldingConsideratio ns(ReflectiveandAbsorptive),ShieldingCompromises(I.E., Apertures, Gaskets,WaveguideBeyondCut-Off).	
	6.2	**EMCSpecifications,StandardsandMeasurements.**AReviewOf MIL-Standards,FCCAndCISPRRequirements.	
		Total	**39**

TextbooksandReferences:

1. David Pozar, –*MicrowaveEngineering*‖, WileyPublication, Fourth Edition
2. Matthew M. Radmanesh,–*Radio Frequency and MicrowaveElectronics*‖, Pearson Education.
3. DavidWestonF. Giannini, G.Leuzzi, –*Non-linearMicrowave Circuit Design*‖, WileyPublication.
4. DavidWeston –*Electromagnetic Com*patibility, Principlesand Applications‖Marcel Dekker,SecondEdition

AssessmentInternal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimumtwo modules) and the other is either a class test (on minimum three modules of the remaining) orassignment onlive problems orcourse project.

EndSemesterExamination:

Someguidelinesforsettingthequestionpapersareas,sixquestionstobeset eachof20marks,outof these, question number 1 will be compulsory and it will carry questions covering each module.Fromremainingquestionsanythree questionsto be attempted bystudent.

SubjectCode	SubjectName	Credits
ETC202	**ModernDigitalCommunication**	**03**

CoursePre-requisite:

- Digitalcommunication
- RandomSignalAnalysis

CourseObjectives:

Theaim ofthis courseistoletthestudentsobtain

- Fundamentalsofmoderncommunicationsystem
- Abilitytoanalyzeanddesigndigitalcommunicationsystems

CourseOutcome:

Learnerswillbeableto:

- Explainandimplementdifferentsourcecodingtechniques
- Analyzewaveformreceiversforcoherentandnon-coherentcommunication
- Describeanddesignofband-limitedchannels
- Evaluatethedetectionandestimationofsignalsinthepresenceofnoise.
- Explainthecharacteristicsoffadingchannels.

Module	DetailedContent	Hours
1	**SourceCoding** • Average,mutualinformation&entropy • Codingfordiscretesources • TheLempelalgorithm(LZ-77,LZ-78,LZW) • Codingforanalogsources-Temporalwaveformcoding • Spatialwaveformcoding	06

2	**CoherentCommunicationwithWaveforms** • Binarycross-correlationreceivers • Matchedfilterreceivers • M-arywaveformreceivers • Time-samplingapproach • Karhunen-Loeve(K-L)Expansionapproach • Whiteningapproach • Realandcomplexsignalmodels • EffectofDataImperfectCarrierSynchronization • EffectofDataImperfectbitsynchronization	07
3	**NonCoherentCommunicationwithWaveforms** • NonCoherentreceiversinrandomphasechannels • OptimumM-FSKreceivers • Noncoherentreceivers in randomamplitudeand phase channels • OptimumreceiversinRayleighchannels • OptimumreceiversinRicianchannels	07
4	**SignalDesignforChannelandEqualization** • DesignofbandlimitedsignalswithcontrolledISI • Symbolbysymbolsuboptimumdetection • Introductiontolinearequalizer • Meanssquareerror(MSE)criterion • Iterativeequalizationanddecoding • Introductiontoadaptiveequalization • TheLMSAlgorithm	07
5	**OptimumDetectionandEstimation** • Noisevectorinsignalspace • Bayesdetectionofreceivedsignal • Decisionregion&minimumerrorprobability • Optimumdetectionofseveralspecialcomm.signals	06
6	**FadingChannels** • Smallscalemultipathpropagation • Parametersofmobilemultipathchannels • Typesofsmallscalefading • RayleighandRiciandistribution	06
	Total	39

TextbooksandReferences:

1. *DigitalCommunication* by JohnG.Proakis,3rdEditionMcGraw – HillInternational Editions.
2. *Digital Communication Techniques Signal Design & Detection* by Marvin K.Simon,SamiMHindei,WilliamCLindesy,PHILearningPrivate Limited.
3. *DigitalCommunications,Fundamental&Application*byBernardSklar,

PabitraKumarRay,2nd Edition,Pearson Publication
4. *Wirelesscommunicationprinciplesandpractice*byTheodoreS.Rappapor t,2nd Edition,Pearson Publication

AssessmentInternal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimumtwo modules) and the other is either a class test (on minimum three modules of the remaining) orassignment onlive problems orcourse project.

EndSemesterExamination:

Someguidelinesforsettingthequestionpapersareas,sixquestionstobeset eachof20marks,outof these, question number 1 will be compulsory and it will carry questions covering each module.Fromremainingquestionsanythree questionsto be attempted bystudent.

SubjectCode	SubjectName	Credits
ETPE2011	**SatelliteNetworking**	**04**

CoursePre-requisite:

- SatelliteCommunicationandNetworks
- InternetVoiceandMobileCommunication

CourseObjectives:

Theaimofthiscourseis

- Tounderstandandlearnadvancednetworkingtechniqueswithsatellitesystems
- Tobeabletodeviselinkbudgetmodelofsatellitecommunicationforspecificapp lications
- Tobeabletoapplyknowledgetoupgradesatellitecommunication systems

CourseOutcome:

Learnerswillbeableto:

- Performlinkbudgetforspecificsatelliteapplication
- Learndifferentadvancedsatellitenetworkingconcepts
- Understandusageoflasersinsatellitesandsatelliteserviceapplications

Module	DetailedContent	Hours
1	**Introduction** • Originofsatellitecommunications,Development,spaceandground segments,typesoforbits,evolutionofsatellitecommunication,Deve lopmentofsatelliteservicesandLaunchingmechanism in the Geostationary orbit, Orbits andorbitalperturbations	08
2	**SystemSegmentandLinkAnalysis** • AOCS,TTC,EquipmentReliabilityandSpacequalifications,Linka nalysis	06
3	**SatelliteNetworksArchitectureandorganization** • Applicationsandservicesofsatellitenetwork,networkreference models, Architecture, On board connectivity, frameorganisation,Window organization	06
4	**LaserSatelliteCommunications** • Linkintroduction,opticalsatellitelinktransmitter,Receiver,satellit ebeamacquisition,Trackingandpositioning,Singlehopsatellitecon nections,multihopsatelliteconnections,intersatellitelinks	07
5	**SpecificSatelliteNetwork** • StudyofIRIDIUMandGLOBALSTARSynchronousDigitalHiera rchy(SDH),Integratedservicesdigitalnetworks(ISDN),	06

	ISDNoversatellite,Interworkingwithheterogeneousnetworks,Casestudies-satelliteimageanalysisandphotogrammetry.	
6	**SatelliteApplications** • Communication applications (ATM service, DTH service, TVbroadcast),Earthobservationapplications(Urbanplanning,Oceanography,resourcemanagement,agricultureservices),Meteorologyapplications weather forecasting,	06
	Total	39

TextbooksandReferences:

1. *Satellite Communication Systems, Techniques and Technology* -5th Edition by GerardMaraland Michel Bousquet, JohnWileyPublication (Textbook forchapter-1 to 5)
2. *Mobile Satellite Communication Networks* – By Ray Sheriff, Y. Fun Hu, John WileyPublication(Text book forchapter-1 to 3)
3. *Satellite Networking: Principles and Protocols* 2nd Edition by Zhili Sun, John WileyPublication(Text book forchapter-3&5)
4. *SatelliteCommunications*by Roddy Dennis,5thEdition,McGrawHill EducationPublication(Referencebook)
5. *Satellite Communication* – Timothy Pratt, C. Boustian, J. Allmuti, Wiley Publication(ReferenceBook)

AssessmentInternal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimumtwo modules) and the other is either a class test (on minimum three modules of the remaining) orassignment onlive problems orcourse project.

EndSemesterExamination:

Someguidelinesforsettingthequestionpapersareas,sixquestionstobeset eachof20marks,outof these, question number 1 will be compulsory and it will carry questions covering each module.Fromremainingquestionsanythree questionsto be attempted bystudent.

SubjectCode	SubjectName	Credits
ETDLO2022	**NetworkandCyberSecurity**	**04**

CoursePre-requisite:

- ComputerCommunicationNetworks
- OperatingSystem
- ProbabilityTheoryandRandomProcesses

CourseObjectives:

Theaimofthiscourseis

- TointroduceadvancedtechniquestoimplementsecuritymechanismsusingIDS,Firewall,and AntivirusandBiometrics, IncidenthandlingandForensics
- Todiscuss securityimplicationsonOrganizations,securitystandardsandCyberlaws.

CourseOutcome:

Learnerswillbeableto:

- Describesecuritythreatsandapplysecuritytechniquesusingcryptosystems.
- Explain the key terms and concepts in cyber law, intellectual property andcybercrimes, trademarksand domain theft
- Build and configure firewall and intrusion detections systems‘ using GNUopen sourcesecuritytools.
- Incorporateapproachesforincidentanalysisandresponse,forriskmanagementand bestpracticesanddigitalevidencecollection,andevidentiaryreportinginforensic acquisition

Module	DetailedContent	Hours
1	**IntroductiontoNetworkandCyberSecurity** • Needfornetworksecurity,AttacksandTheirclassification, • NetworkVulnerabilitiesandcontrol • Securityservicesandmechanisms, • ImpactofSecurityonEnterprises • RiskFactorsandCostAnalysis.	04
2	**CryptographyandCryptosystems** • Classicalandmoderncryptography,streamandblockciphers, • Messagedigest,digitalsignature,digitalcertificate,certificateauthority,cryptanalysis • DES/AES/RSA/RC4/MD5/SHAalgorithms • SecureprotocolsSSL, IPSec,VPN,PKI	7
3	**EthicalHackingandNetworkDifferences**	8

	• Cybercrimes,Cybercriminals,Cyberoffences,CybercrimesinMobileandWirelessDevices,ToolsandMethodsusedinCybercrimes • Networkreconnaissance,scanningandsniffing,gainingaccess. • Security Technologies: Firewall,IDS and Antivirus, Reverseproxy • L7 content filtering firewall, NAT & reverse proxy, Firewalldeployment and limitations, selection of firewalls. Performanceanalysisof firewall. • SignatureandAnamolybasedIDSs,IDSdeployment,zonediagram, performance analysis of IDS, strengths and limitationsof IDS	
4	**CybersecurityPrinciplesandbestPractices** • LayeredDefense,SurveillanceandReconnaissanceOutsider/InternalThreatProtection, • Privacy, Intellectual Property, Professional Ethics, Freedom ofSpeech, Fair User and Ethical Hacking, Trademarks ,InternetFraud,ElectronicEvidence.	6
5	**CybersecurityImplicationsonOrganizations,StandardsandCyberlaws** • RiskManagement:AssetEvaluationandBusinessImpactAnalysis, RiskIdentification,RiskQuantification,RiskResponseDevelopmentandControlSecurityPolicy,Compliance,and Business Continuity. • Cyber Incident Preparation: Incident Detection and Analysis,Containment, Eradication, and Recovery ,Proactive and Post-IncidentCyber Services • Forensics:ForensicTechnologies,DigitalEvidenceCollection ,EvidentiaryReporting • TheIndianITActandnewamendments.	8
6	**SystemSecurityandCaseStudy** • Security Operations Center (SOC), Network Operations Center(NOC), • NetworkSecurityAudit • SET,BiometricSecurity,DigitalImmuneSystem • CloudSecurity.Wi-FiSecurity,MobileandCellularSecurity.	6

TextbooksandReferences:

1. *CryptographyandNetworkSecurity*byBehrouzForouzanMcGrawHillPublications
2. *SecurityinComputing*byPfleegerandPfleeger,PearsonPublications
3. *ManagementofInformationSecurity*byM.WhitmanCengagePublications
4. CengageLearningIndia, *NetworkSecurityandCryptography*byB.Menezes.

5. *ComputerSecurity*byMattBishop,PearsonPublication
6. *CryptographyandNetworkSecurity*byWilliamStallings,Pearsonpublications.
7. *CyberSecurity*byNinaGodbole,JohnWileyPublications
8. *InformationSecurity:PrinciplesandPractice,*2ndeditionbyMarkStampandDevenShah.
9. *DataCommunication&NetworkSecurity*byHoustonCarrandCharlesSnyder,McGraw-HillPublication.

AssessmentInternal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum twomodules) and the other is either a class test (on minimum three modules of the remaining) or assignment onliveproblems orcourse project.

EndSemesterExamination:

Someguidelinesforsettingthequestionpapersareas,sixquestionstobeset eachof20marks,outofthese, question number 1 will be compulsory and it will carry questions covering each module. Fromremainingquestions anythree questionsto be attempted bystudent.

SubjectCode	SubjectName	Credits
ETPE2013	**RemoteSensing**	**03**

CoursePre-requisite:

- DigitalImageProcessing

CourseObjectives:

Theaimofthiscourseis

- Toprovideexposuretostudentsin gainingknowledgeonconceptsand applicationsofRemoteSensing
- Togive exposuretoparticipantsforDigitalImage Processingwithmoreemphasisonclassification
- Toacquireskillsinadvancetechniquessuchashyperspectral,thermalandmicrowave formappingand monitoring.

CourseOutcome:

Learnerswillbeableto:

- Demonstratedetailed,integratedknowledgeofthe applicationandhistoryofremotesensing
- Discussthenatureofelectromagneticradiationanditsinteractionwiththeearth'ssurfaceand atmosphere
- Demonstrateacriticalunderstandingofthedifferencesbetweenremotesensingsystemsa nd beawareoftheircharacteristics andlimitations
- Criticallyidentifyspecificapplicationswhereremoteprocessingmaybeusedasatoolfo rmonitoringand research.

Module	DetailedContent	Hours

1	**IntroductiontoRemoteSensing** • What is Remote Sensing (RS)? Characteristics/elements of RSsystems, Electromagnetic Radiation Electromagnetic Spectrum,Polarization,InteractionswiththeAtmosphere(Absorption,Scattering:Rayleigh,Mie,Nonselective,absorption),Radiation - Target interactions, Passive vs. Active Sensing, Basic Imageprocessingconcepts:Imageasamatrix,B/WandColour(RGB)	06
2	**Sensors** • GroundandAir,SatelliteCharacteristics:orbits,swaths,SpatialResolution,PixelSize(IFOV,resolutioncell),Spectral,Radiometric, Temporal Resolution, Cameras and AerialPhotography, Multispectral and Hyperspectral Scanning,ThermalImaging,GeometricDistortion,DifferentSatellites:	08
	AllWeatherSatellites,LandObservation,MarineObservation,LIDAR,FLIR, RADAR, Side lookingRadar.	
3	**MicrowaveRemoteSensing** • Introduction,RADARBasics,ViewingGeometry,RADARImage Distortions, Target Interaction and Image Appearance,RADAR Image Properties, RADAR Polarimetry (Polarization,Signatures,Backscatter,ParametersAffectingBackscatter,Applications),SyntheticApertureRADAR(SAR),AirborneandSpaceborneRadars.	7
4	**ImageTransforms** • VisualImageAnalysis(tone,shape,size,pattern,texture,shadow,andAssociation),DigitalImageProcessingsteps(Pre-processing,Enhancement,TransformationandClassification),ContrastEnhancement:Global,LocalTechniques,Filtering,ImageTransformations:ArithmeticOperations(Subtraction, SpectralRatio,NDVI,PCT,FT,)	07
5	**ImageClassificationandAnalysis** • VisualInterpretation,ImageClassification:Optimumbandselection, Supervised (Minimum Distance, Parallelopiped andMaximum Likelihood), Assessment of Classification Accuracy(Confusion or Error Matrix, Omission and Commission Error,Kappa Coefficient), Unsupervised Classification techniques: K-means,	7

6	**ApplicationsofRemoteSensing** • Agriculture, Forestry,Land Cover/Land Use Mapping, WaterResources,SnowandGlacier,WetlandManagement,Oceans andCoastal, Soil Moisture	04

	Total	39

TextbooksandReferences:

Textbooks:

1. *Fundamentals of Remote Sensing***,** George Joseph, Universities Press; Second Edition,ISBN-10:817371535,ISBN-13: 978-8173715358
2. *RemoteSensing:ModelsandMethodsforImageProcessing***,**RobertA.Schowengerdt,AcademicPress,ThirdEdition,ISBN-10:8131203182,ISBN-13:978-8131203187
3. *Remote Sensing and Image Interpretation***,** Lillesand, Kiefer, Chipman, Wiley, SixthEdition,ISBN-10: 8126532238,ISBN-13:978-8126532230

AssessmentInternal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum twomodules) and the other is either a class test (on minimum three modules of the remaining) or assignment onliveproblems orcourse project.

EndSemesterExamination:

Someguidelinesforsettingthequestionpapersareas,sixquestionstobeset eachof20marks,outofthese, question number 1 will be compulsory and it will carry questions covering each module. Fromremainingquestions anythree questionsto be attempted bystudent.

SubjectCode	SubjectName	Credits
ETPE2021	**ErrorControlCoding**	**03**

CoursePre-requisite:

- DigitalCommunication
- AppliedMaths

CourseObjectives:

Theaimofthiscourseis

- Toprovidestudentsasoundknowledgeoftraditionalandmoderncodingtheory,themotivation behind synthesis of channel codingtechniques.

CourseOutcome:

Learnerswillbeableto:

- Designchannelcodesforthephysicallayerandstorageapplications
- Designnewchannelcodesforwired/wirelesscommunicationsystems

Module	DetailedContent	Hours
1	**IntroductiontoAlgebra** • Groups,Fields, BinaryFieldArithmetic,ConstructionofGaloisFieldGF(2m)anditsbasicproperties,ComputationusingGaloisFieldGF(2m)Arithmetic,VectorspacesandMatrices.	06

2	**LinearCodes** • Block codes: Generator and Parity check Matrices, Encodingcircuits, Syndrome and Error Detection, Minimum DistanceConsiderations, Error detecting and Error correctingcapabilities,StandardarrayandSyndromedecoding,Decodingcircuits, Hamming Codes, Reed – Muller codes, Golay code,Productcodes andInterleaved codes. • Cyclic Codes: Introduction, Generator and ParitycheckPolynomials, Encoding using Multiplication circuits,SystematicCycliccodes–EncodingusingFeedbackshiftregistercircuits,GeneratormatrixforCycliccodes,SyndromecomputationandErrordetection,Meggittdecoder,Errortrappingdecoding,CyclicHammingcodes,Golaycode,Shortenedcycliccodes.	08
3	**BCHCodes** • BinaryprimitiveBCHcodes,Decodingprocedures,Implementation of Galois field Arithmetic, Implementation ofErrorcorrection.Non–binaryBCHcodes:q–aryLinearBlockCodes,PrimitiveBCHcodesoverGF(q),Reed–SolomonCodes,DecodingofNon–BinaryBCHandRScodes:TheBerlekamp-MasseyAlgorithm.	06
4	**ConvolutionalCodes** • EncodingofConvolutionalcodes,Structuralproperties,Distance properties, Viterbi Decoding Algorithm for decoding,Soft–outputViterbiAlgorithm,StackandFanosequentialdecodingAlgorithms, Majoritylogic decoding.	07
5	**ConcatenatedCodesandTurboCodes** • SinglelevelConcatenatedcodes,MultilevelConcatenated codes,SoftdecisionMultistagedecoding,Concatenatedcodingschemeswith ConvolutionalInnercodes.	06
6	**BurstErrorCorrectingCodes** • Burst and Random error correcting codes, Concept of Inter – leaving, cyclic codes for Burst Error correction – Fire codes,ConvolutionalcodesforBurstErrorcorrection.	06
	Total	39

TextbooksandReferences:

1. ShuLin&DanielJ.Costello,Jr.*"ErrorControlCoding"*PrenticeHall,SecondEdition, 2004.
2. S.BWicker,*ErrorControlSystemsforDigitalCommunicationandStorage*,Prentice

HallInternational,1995.
3. BlahutR.E,*TheoryandPractiseofErrorControlCodes*,AddissonWesley,1983
4. BlahutR.E.,*AlgebraiccodesforDatatransmission*,CambridgeUniversityPress,2003.

AssessmentInternal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum twomodules) and the other is either a class test (on minimum three modules of the remaining) or assignment onliveproblems orcourse project.

EndSemesterExamination:

Someguidelinesforsettingthequestionpapersareas,sixquestionstobeset eachof20marks,outofthese, question number 1 will be compulsory and it will carry questions covering each module. Fromremainingquestions anythree questionsto be attempted bystudent.

SubjectCode	SubjectName	Credits
ETPE2022	**WirelessAdhocandSensorNetworks**	**03**

CoursePre-requisite:

- ComputerNetworks
- WirelessNetworks

CourseObjectives:

Theaimofthiscourseistoletthestudents

- TounderstandtheWirelessadhocandsensorNetwork.
- Tounderstandthemajor challengesanddesigning issuesindesigningwirelesssensorandadhocnetworks.
- TounderstandvariousMACandroutingprotocolsinwirelesssensorandadhocnetworks.
- ToUnderstandHeterogeneousnetworkarchitectureincludingMANET,WLAN,Cellular Networks.

CourseOutcome:

Learnerswillbeableto:

- Understandandexplaintheconceptofadhocandsensornetworksandtheirapplications.

- Setupandevaluateperformanceofvariousprotocolsinwirelesssensorand adhocnetworks.
- UnderstandTCPperformanceoveradhocnetwork.
- UnderstandintegrationofMANET,cellularNetworkandWLAN.

Module	DetailedContent	Hours
1	**IntroductiontoMANETandWirelessSensorNetwork** • ChallengesandApplicationsofMANET,Designissuesandapplicationofsensor Network,SensingandCommunicationRange,EnergyandClusteringofsensors,WirelessmeshNetwork,ArchitectureandChallengingtechnologies.	06
2	**RoutinginAdhocNetworks** • Introduction, Topology-Based versus Position-BasedApproaches,Topologies-BasedRoutingProtocols,Position-BasedRouting,OtherRoutingProtocols,WirelessLAN,WirelessPAN,WirelessBAN.	06
3	**Broadcasting,Multicasting,GeocastingandQoSinMANET** • Introduction,TheBroadcastStorm,Multicasting,Geocasting,QOS requirements, objectives andArchitecture	06
4	**TCPoverAdhocNetworks** • Introduction,TCPProtocolOverview,TCPandMANETs,	06
	SolutionsforTCPoverAdhoc.	
5	**DesignConsiderationinSensorNetwork** • Introduction,ClassificationsofWSNs,MACLayer,RoutingLayer, HighLevelApplicationLayerSupport,AdaptingtotheInherentDynamicNatureofWSNs,CognitiveRadiobasedsensorNetworks.NanoSensorNetworks.	09
6	**IntegratingMANETs,WLANsandCellularNetworks** • Introduction,IngredientsofaHeterogeneousArchitecture,ProtocolStack,ComparisonoftheIntegratedArchitectures.	06
	Total	39

TextbooksandReferences:

1. *Adhoc&SensorNetworksTheoryandApplications* byCordeiro,Agrawal, CambridgeUniversityPressIndia Pvt.Ltd, Edition 2010.
2. *AdhocWirelessNetworksArchitectureandProtocols*byC.SivaRamMurthyandB.S.Manoj,Pearson.
3. *Adhoc&Sensor Networks* byHoudaLabiod,Wiley.
4. *WirelessCommunicationandNetworking*-VijayGarg,ElsevierInc.

5. *WirelessandMobileNetworks,ConceptsandProtocols*byManvi,Kakkasageri,seconded ition, Wiley.

AssessmentInternal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum twomodules) and the other is either a class test (on minimum three modules of the remaining) or assignment onliveproblems orcourse project.

EndSemesterExamination:

Someguidelinesforsettingthequestionpapersareas,sixquestionstobeset eachof20marks,outofthese, question number 1 will be compulsory and it will carry questions covering each module. Fromremainingquestions anythree questionsto be attempted bystudent.

SubjectCode	SubjectName	Credits
ETPE2023	**CognitiveRadio**	**03**

CoursePre-requisite:

- Digitalcommunication

CourseObjectives:

Theaimofthiscourseistoletthestudents

- Thissubjectintroducesthefundamentalsofmultiratesignalprocessingandcognitiveradio.
- Tounderstandtheworkingof cognitiveradio.
- Tounderstandthemajorchallengesand designingissues in usingthebandwidth

CourseOutcome:

Learnerswillbeableto:

- Gainknowledgeonmultiratesystems.
- developtheabilityto analyze, design, and implement anyapplication using
- Beawareofhowsignal processingconceptscanbeusedforefficientFPGAbased systemdesign.
- understandtherapidadvancesinCognitiveradio technologies

- exploreDDFS,CORDIC anditsapplication

TextBooks

1. J.H.Reed,–SoftwareRadio‖,Pearson,2002.
2. U.Meyer–Baese,–DigitalSignalProcessingwithFPGAs‖,Springer,2004.
3. H.Arslan–CognitiveRadio,SoftwareDefinedRadioandAdaptiveWirelessSystems‖,UniversityofSouthFlorida,USA, Springer,2007.

ReferenceBooks

1. S.K.Mitra,–DigitalSignalprocessing‖,McGrawHill,1998
2. K.C.Chen,R.Prasad,–CognitiveRadioNetworks‖,Wiley,2009-06-15.
3. T.W.Rondeau,C.W.Bostian,―ArtificialIntelligenceinWirelessCommunications‖,2009.
4. Tusi,–DigitalTechniquesforWidebandreceivers‖,ArtechHouse,2001.
5. T.DarcChiueh,P.YunTsai,‖OFDMbasebandreceiverdesignforwirelesscommunications‖,Wiley, 2007

Module	DetailedContent	Hours
1	Filterbanks-uniformfilterbank.directandDFTapproaches.Introductionto ADSL Modem.Discrete multitone modulation and itsrealization using DFT. QMF.STFT.Computation of DWT using filterbanks.	08
2	DDFS- ROM LUT approach. Spurious signals, jitter. Computation ofspecialfunctionsusingCORDIC.VectorandrotationmodeofCORDIC.C ORDICarchitectures.	06
3	Blockdiagramofasoftwareradio.Digitaldownconvertersanddemodulators U niversalmodulatoranddemodulatorusingCORDIC.Incoherentdemodulatio n-digitalapproachforIandQgeneration,special sampling schemes. CIC filters. Residue number system and highspeedfiltersusingRNS.DownconversionusingdiscreteHilberttransform .Undersamplingreceivers,Coherent demodulationschemes	09
4	ConceptofCognitiveRadio,BenefitsofUsingSDR,ProblemsFacedbySDR, CognitiveNetworks,Cognitive Radio Architecture.CognitiveRadio Design,CognitiveEngine Design,	04

5	A Basic OFDM System Model, OFDM based cognitive radio, CognitiveOFDMSystems,MIMOchannelestimation,Multi-bandOFDM,MIMO-OFDMsynchronization and frequencyoffset estimation.	06
6	SpectrumSensingtodetectSpecificPrimarySystem,SpectrumSensingforCognitive OFDMASystems.	06
	Total	39

AssessmentInternal:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum twomodules) and the other is either a class test (on minimum three modules of the remaining) or assignment onliveproblems orcourse project.

EndSemesterExamination:

Someguidelinesforsettingthequestionpapersareas,sixquestionstobeset eachof20marks,outofthese, question number 1 will be compulsory and it will carry questions covering each module. Fromremainingquestions anythree questionsto be attempted bystudent.

SubjectCode	SubjectName	Credits
ETIE2011	**ProjectManagement**	**03**

CourseObjectives:

Theaimofthiscourseis

- Tofamiliarizethestudentswiththeuseofastructuredmethodology/approachforeach and every unique project undertaken, including utilizing project managementconcepts,tools and techniques.
- To appraise the students with the project management life cycle andmake themknowledgeable aboutthevariousphasesfrom projectinitiation throughclosure.

CourseOutcome:

Learnerswillbeableto:

- Applyselectioncriteriaandselectanappropriateprojectfromdifferentoptions.

- Writeworkbreakdownstructureforaprojectanddevelopaschedulebased onit.
- Identifyopportunitiesandthreatstotheprojectanddecideanapproachtodealwiththemstrategically.
- UseEarnedvaluetechniqueanddetermine &predictstatusoftheproject.
- Capturelessonslearnedduringprojectphasesanddocumentthemforfuturereference

Module	DetailedContent	Hours
1	**ProjectManagementFoundation:** • Definitionofaproject,ProjectVsOperations,Necessityofprojectmanagement,Tripleconstraints,Projectlifecycles(typical&atypical) Projectphasesandstagegateprocess.Roleofprojectmanager.Negotiationsandresolvingconflicts.Projectmanagementin variousorganizationstructures.PMknowledgeareasasperProject ManagementInstitute(PMI).	05
2	**InitiatingProjects:** • Howtogetaprojectstarted,Selectingprojectstrategically,Projectselectionmodels(Numeric/ScoringModelsandNon-numericmodels),Projectportfolioprocess,Projectsponsorandcreatingcharter;Projectproposal. Effectiveprojectteam,Stagesof teamdevelopment& growth(forming,storming,norming&performing),team dynamics.	06
3	**ProjectPlanningandScheduling** • WorkBreakdownstructure(WBS)andlinearresponsibilitychart,InterfaceCo-ordinationandconcurrentengineering,Projectcostestimationandbudgeting,Topdownandbottomsupbudgeting,NetworkingandSchedulingtechniques.PERT, CPM,GANTTchart.IntroductiontoProjectManagementInformationSystem(PMIS).	8
4	**PlanningProjects** • Crashingprojecttime,Resourceloadingandleveling,Goldratt'scriticalchain,ProjectStakeholdersandCommunicationplan. • RiskManagementinprojects:Riskmanagementplanning,Riskidentificationandriskregister.Qualitativeandquantitativeriskassessment,Probabilityandimpactmatrix.Riskresponse strategies forpositiveand negative risks	06

5	**ExecutingProjects:** • Planning monitoring and controlling cycle. Information needsandreporting,engagingwithallstakeholders oftheprojects. • Teammanagement,communicationandprojectmeetings. **MonitoringandControllingProjects:** • Earned Value Management techniques for measuring value ofwork completed; Using milestones for measurement; changerequestsand scopecreep.Project audit. **ProjectContracting** • Projectprocurementmanagement,contractingandoutsourcing	08
6	**ProjectLeadershipandEthics:** • Introductiontoprojectleadership,ethicsinprojects. • Multiculturalandvirtualprojects. **ClosingtheProject:** • Customeracceptance;Reasonsofprojecttermination,Varioustypes of project terminations (Extinction, Addition,Integration, Starvation), Process of project termination,completingafinalreport;doingalessonslearnedanalysis;acknowledgingsuccessesandfailures;Projectmanagementtemplatesandotherresources;Managingwithoutauthority;Areasoffurtherstudy.	06

TextbooksandReferences:

1. JackMeredith& SamuelMantel,*ProjectManagement: A managerialapproach*,WileyIndia,7thEd.
2. *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*, 5th Ed,ProjectManagementInstitutePA, USA

3. GidoClements,*ProjectManagement*,CengageLearning.

4. Gopalan,*ProjectManagement*,,WileyIndia
5. DennisLock,*ProjectManagement*,GowerPublishingEngland,9thEd.

Assessment

Internal: Assessmentconsistsoftwotestsoutofwhich;oneshouldbecompulsory class test and the other is either a class test or assignmentonliveproblems or courseproject.

EndSemester Examination: Someguidelinesforsettingthequestionpaper.Minimum80%syllabusshouldbecoveredinquestionpapersofendsemesterexamination.Inquestionpaper weightage of each module will be proportionaltonumberof respectivelecturehoursasmentioninthesyllabus.

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SubjectCode	SubjectName	Credits
ETIE2012	**FinanceManagement**	**03**

CourseObjectives:
Theaimofthiscourseis

- OverviewofIndianfinancialsystem,instrumentsandmarket
- Basicconceptsofvalueofmoney,returnsandrisks,corporatefinance,workingcapitaland its management
- Knowledgeaboutsourcesoffinance,capitalstructure,dividendpolicy

CourseOutcome:
Learnerswillbeableto:

- UnderstandIndianfinancesystemandcorporatefinance
- Takeinvestment,financeaswellasdividenddecisions

Module	DetailedContent	Hours
1	**OverviewofIndianFinancialSystem** • Characteristics,ComponentsandFunctionsofFinancialSystem. **FinancialInstruments** • Meaning, Characteristics and Classification of Basic FinancialInstruments—EquityShares,PreferenceShares,Bonds-Debentures,CertificatesofDeposit, and TreasuryBills. **FinancialMarkets** • Meaning,CharacteristicsandClassificationofFinancialMarkets—CapitalMarket,MoneyMarketandForeignCurrencyMarket **FinancialInstitutions** • Meaning,CharacteristicsandClassificationofFinancialInstitutions — Commercial Banks, Investment-Merchant BanksandStock Exchanges	06
2	**ConceptsofReturnsandRisks** • Measurement of Historical Returns and Expected Returns of aSingle Security and a Two-security Portfolio; Measurement ofHistorical Risk and Expected Risk of a Single Security and aTwo-securityPortfolio. **TimeValueofMoney** Future Value of a Lump Sum, Ordinary Annuity, and AnnuityDue;PresentValueofaLumpSum,OrdinaryAnnuity,and AnnuityDue;ContinuousCompoundingandContinuous • Discounting	06

3	**OverviewofCorporateFinance** • ObjectivesofCorporateFinance;FunctionsofCorporateFinance—InvestmentDecision,FinancingDecision,andDividendDecision. **FinancialRatioAnalysis** • Overview of Financial Statements—Balance Sheet, Profit andLoss Account, and Cash Flow Statement; Purpose of FinancialRatio Analysis; Liquidity Ratios; Efficiency or Activity Ratios;ProfitabilityRatios;CapitalStructureRatios;StockMarket Ratios;Limitations of Ratio Analysis.	09
4	**CapitalBudgeting** • MeaningandImportanceofCapitalBudgeting;InputsforCapital Budgeting Decisions; Investment Appraisal Criterion—AccountingRateofReturn,PaybackPeriod,DiscountedPayback Period, Net Present Value(NPV), Profitability Index,Internal Rate of Return (IRR), and Modified Internal Rate ofReturn(MIRR) **WorkingCapitalManagement** • ConceptsofMeaningWorkingCapital;ImportanceofWorkingCapitalManagement;FactorsAffectinganEntity‘sWorkingCapitalNeeds;EstimationofWorkingCapitalRequirements;Management of Inventories; Management of Receivables; andManagementofCashandMarketableSecurities.	10
5	**SourcesofFinance** • Long Term Sources—Equity, Debt,and Hybrids; MezzanineFinance; Sources of Short Term Finance—Trade Credit, BankFinance,Commercial Paper; ProjectFinance. **CapitalStructure** • FactorsAffectinganEntity‘sCapitalStructure;OverviewofCapital StructureTheoriesandApproaches—NetIncomeApproach, Net Operating Income Approach; TraditionalApproach,andModigliani-MillerApproach.RelationbetweenCapitalStructureandCorporate Value;ConceptofOptimalCapitalStructure	05
6	**DividendPolicy** • MeaningandImportanceofDividendPolicy;FactorsAffectinganEntity‘sDividendDecision;OverviewofDividendPolicyTheoriesandApproaches—Gordon‘sApproach,Walter‘sApproach,andModigliani-MillerApproach	03

TextbooksandReferences:

1. *FundamentalsofFinancialManagement*,13th Edition(2015)byEugeneF.BrighamandJoel F.Houston; Publisher:CengagePublications, NewDelhi.
2. *AnalysisforFinancialManagement*,10thEdition(2013)byRobertC.Higgins;Publishers :McGraw HillEducation, New Delhi.
3. *IndianFinancialSystem*,9th Edition (2015)byM.Y.Khan; Publisher:McGrawHillEducation,NewDelhi.
4. *FinancialManagement*,11thEdition(2015)byI.M.Pandey;Publisher:S.Chand(G/L) &CompanyLimited, New Delhi.

Assessment

Internal: Assessmentconsistsoftwotestsoutofwhich;oneshouldbecompulsory class test and the other is either a class test or assignmentonliveproblems or courseproject.

EndSemester Examination: Someguidelinesforsettingthequestionpaper.Minimum80%syllabusshouldbecoveredinquestionpapersofendsemesterexamination.Inquestionpaper weightage of each module will be proportionaltonumberof respectivelecturehoursasmentioninthesyllabus.

SubjectCode	SubjectName	Credits
ETIE2013	**EntrepreneurshipDevelopmentand Management**	**03**

CourseObjectives:
Theaimofthiscourseis

- Toacquaintwithentrepreneurshipandmanagementofbusiness
- UnderstandIndianenvironmentforentrepreneurship
- IdeaofEDP,MSME.

CourseOutcome:
Learnerswillbeableto:

- Understandtheconceptofbusinessplanandownerships
- InterpretkeyregulationsandlegalaspectsofentrepreneurshipinIndiaUnd erstandgovernmentpoliciesforentrepreneurs

Module	DetailedContent	Hours
1	**OverviewOfEntrepreneurship** • Definitions, Roles and Functions/Values of Entrepreneurship,HistoryofEntrepreneurshipDevelopment,Role ofEntrepreneurshipintheNationalEconomy,FunctionsofanEntrep reneur,EntrepreneurshipandFormsofBusinessOwnership • RoleofMoneyandCapitalMarketsinEntrepreneurialDevelopment : Contribution of Government Agencies inSourcinginformationfor Entrepreneurship	04
2	**BusinessPlansAndImportanceOfCapitalToEntrepreneurship** • Preliminary and Marketing Plans, Management and Personnel,Start-upCostsandFinancing aswellasProjectedFinancialStatements,LegalSection,Insurance,S uppliersandRisks,Assumptions and Conclusion, Capital and its Importance to theEntrepreneur • **EntrepreneurshipAndBusinessDevelopment:**StartingaNewBu siness,BuyinganExistingBusiness,NewProductDevelopment, Business Growth and the Entrepreneur Law anditsRelevanceto BusinessOperations	09
3	• Women'sEntrepreneurshipDevelopment,Socialentrepreneurship-roleandneed,EDPcell,roleofsustainabilityandsustainabledevelopment for SMEs,case studies,exercises	05

4	**IndianEnvironmentforEntrepreneurship** • Key regulations and legal aspects , MSMED Act 2006 and itsimplications,schemesandpoliciesoftheMinistryofMSME,role and responsibilities of various government organisations,departments, banks etc., Role of State governments in terms ofinfrastructuredevelopmentsandsupportetc.,Publicprivate partnerships,NationalSkilldevelopmentMission,CreditGuarantee Fund,PMEGP, discussions,groupexercises etc	08
5	**EffectiveManagementofBusiness** • Issues and problems faced by micro and small enterprises andeffectivemanagementofMandSenterprises(riskmanagement,creditavailability,technologyinnovation,supply chain management, linkage with large industries), exercises, e-Marketing	08
6	**AchievingSuccessInTheSmallBusiness** • Stages of the small business life cycle, four types of firm-levelgrowthstrategies,Options– harvestingorclosingsmallbusinessCriticalSuccessfactorsofsmall business	05

TextbooksandReferences:

1. PoornimaCharantimath,*Entrepreneurshipdevelopment-SmallBusinessEnterprise*,Pearson
2. Education Robert D Hisrich, Michael P Peters, Dean A Shapherd, *Entrepreneurship*,latestedition, TheMcGrawHill Company
3. DrTNChhabra,*EntrepreneurshipDevelopment*,SunIndiaPublications,NewDelhi
4. DrCNPrasad,*SmallandMediumEnterprisesinGlobalPerspective*,NewcenturyPublications,New Delhi
5. VasantDesai,*Entrepreneurialdevelopmentandmanagement*,HimalayaPublishingHouse
6. MaddhurimaLall,ShikahSahai,*Entrepreneurship*,ExcelBooks
7. RashmiBansal,*STAYhungrySTAYfoolish*,CIIE,IIMAhmedabad
8. *LawandPracticerelatingtoMicro,SmallandMediumenterprises*,TaxmannPublicationLtd.
9. Kurakto,*Entrepreneurship-PrinciplesandPractices*,ThomsonPublication
10. LaghuUdyogSamachar
11. www.msme.gov.in
12. www.dcmesme.gov.in
13. www.msmetraining.gov.in

Assessment

Internal: Assessmentconsistsoftwotestsoutofwhich;oneshouldbecompulsory class test and the other is either a class test or assignmentonliveproblems or courseproject.

EndSemester Some guidelines for setting the question paper. Minimum 80% syllabus**Examination:** syllabus should be covered in question papers of end semester examination. Inquestionpaperweightageofeachmodulewillbeproportionaltonumberof respectivelecturehoursasmention inthesyllabus.

SubjectCode	SubjectName	Credits
ETIE2014	**HumanResourceManagement**	**03**

CourseObjectives:

Theaimofthiscourseis

- To introduce the students with basic concepts, techniques and practices of the humanresourcemanagement.
- To provide opportunity of learning Human resource management (HRM) processes,related with the functions, and challenges in the emerging perspective of today‘sorganizations.
- Tofamiliarizethestudentsaboutthelatestdevelopments,trends&differentaspectsofHRM.
- Toacquaintthestudentwiththeimportanceofinter-personal&inter-groupbehavioral skillsin an organizational setting required for future stableengineers,leaders and managers.

CourseOutcome:

Learnerswillbeableto:

- Understandtheconcepts,aspects,techniquesandpracticesofthehumanresourcemanagement.
- Understandthe Humanresourcemanagement(HRM)processes,functions,changesandchallengesintoday‘semergingorganizationalperspective.
- GainknowledgeaboutthelatestdevelopmentsandtrendsinHRM.
- Applytheknowledgeof behavioral skillslearntandintegrate itwithininterpersonalandintergroupenvironmentemergingasfuturestable engineersand managers.

Module	DetailedContent	Hours
1	**IntroductiontoHR** • HumanResourceManagement-Concept,ScopeandImportance, Interdisciplinary Approach Relationship with otherSciences,Competenciesof HRManager,HRM functions. • Human resource development (HRD): changing role of HRM – Human resource Planning, Technological change, Restructuringandrightsizing,Empowerment,TQM,Managingethicalissues.	05

2	**OrganizationalBehavior(OB)** • Introduction to OB Origin, Nature and Scope of OrganizationalBehavior,RelevancetoOrganizationalEffectivenessandContemporaryissues • Personality:MeaningandDeterminantsofPersonality,Personalitydevelopment,PersonalityTypes,AssessmentofPersonalityTraitsforIncreasingSelfAwareness	07

	• Perception:AttitudeandValue,EffectofperceptiononIndividualDecision-making,Attitude andBehavior. • Motivation:TheoriesofMotivationandtheirApplicationsforBehavioralChange (Maslow, Herzberg,McGregor) • GroupBehaviorandGroupDynamics:Workgroupsformalandinformal groups and stages of group development. TeamEffectiveness: High performing teams, Team Roles, crossfunctionaland self-directed team. • Casestudy	
3	**OrganizationalStructure&Design** • Structure,size,technology,Environmentoforganization;Organizational Roles & conflicts: Concept of roles; roledynamics;roleconflictsand stress. • Leadership: Concepts and skills of leadership, Leadership andmanagerialroles,Leadershipstylesandcontemporaryissuesin leadership. • PowerandPolitics:Sourcesandusesofpower;Politics atworkplace,Tacticsand strategies.	06
4	**HumanresourcePlanning** • Recruitment and Selection process, Job-enrichment,Empowerment -Job-Satisfaction,employeemorale. • Performance Appraisal Systems: Traditional & modernmethods,PerformanceCounselling,Career Planning. • Training&Development:IdentificationofTrainingNeeds,TrainingMethods	05
5	**EmergingTrendsinHR** • Organizational development; Business Process Re-engineering(BPR),BPRasatoolfororganizationaldevelopment,managing processes& transformationinHR. OrganizationalChange,Culture,Environment • Cross Cultural Leadership and Decision Making**:** Cross CulturalCommunicationanddiversityatwork**,**Causesofdiversity, managingdiversitywithspecialreferencetohandicapped, womenandageingpeople,intracompanyculturaldifferenceinemployeemotivation.	06

6	**HR&MIS** • Need, purpose, objective and role of information system in HR,Applications in HRD in various industries (e.g. manufacturingR&D,PublicTransport,Hospitals,Hotelsandservic eindustries **StrategicHRM** • Role of Strategic HRM in the modern business world, ConceptofStrategy,StrategicManagementProcess,Approachesto StrategicDecisionMaking;StrategicIntent– CorporateMission,Vision, Objectives andGoals **LaborLaws&IndustrialRelations**	05
	• Evolution of IR, IR issues in organizations, Overview of LaborLawsinIndia;IndustrialDisputesAct,TradeUnionsAct,Sho psandEstablishmentsAct	

TextbooksandReferences:

1. StephenRobbins,*OrganizationalBehavior*,16th Ed,2013
2. VSPRao,*HumanResourceManagement*,3rd Ed,2010,Excelpublishing
3. Aswathapa,*Humanresourcemanagement:Text&cases*,6th edition,2011
4. C.B.Mamoria andSVGankar,*DynamicsofIndustrial RelationsinIndia*, 15th Ed,2015,HimalayaPublishing, 15th edition, 2015
5. P. Subba Rao, *Essentials of Human Resource management and Industrial relations*,5th Ed, 2013, HimalayaPublishing
6. LaurieMullins, *Management&OrganizationalBehavior*,LatestEd,2016,PearsonPublications

Assessment

Internal: Assessmentconsistsoftwotestsoutofwhich;oneshouldbecompulsory class test and the other is either a class test or assignmentonliveproblems or courseproject.

EndSemester

Examination: Someguidelinesforsettingthequestionpaper.Minimum80%syllabus syllabusshouldbecoveredinquestionpapersofendsemesterexamination.Inquesti onpaper weightage of each module will be proportionaltonumberof respectivelecturehoursasmentioninthesyllabus.

SubjectCode	SubjectName	Credits
ETIE2015	**ProfessionalEthicsandCorporateSocialResponsibility (CSR)**	**03**

CourseObjectives:
Theaimofthiscourseis

- Tounderstandprofessionalethicsinbusiness
- Torecognizedcorporatesocialresponsibility

CourseOutcome:
Learnerswillbeableto:

- Understandrightsanddutiesofbusiness
- Distinguishdifferentaspectsofcorporatesocialresponsibility
- Demonstrateprofessionalethics
- Understandlegalaspectsofcorporatesocialresponsibility

Module	DetailedContent	Hours
1	**ProfessionalEthicsandBusiness:** • TheNatureofBusinessEthics;EthicalIssuesinBusiness;MoralResponsibilityandBlame;Utilitarianism:WeighingSocialCosts andBenefits; Rightsand Duties ofBusiness	04
2	**ProfessionalEthicsintheMarketplace** • PerfectCompetition;MonopolyCompetition;OligopolisticCompetition; Oligopolies andPublicPolicy **ProfessionalEthicsandtheEnvironment** • DimensionsofPollutionandResourceDepletion;EthicsofPollutionControl;EthicsofConservingDepletableResources	08
3	**ProfessionalEthicsofConsumerProtection** • Markets and Consumer Protection; Contract View of BusinessFirm‘sDutiestoConsumers;Due Care Theory;AdvertisingEthics;Consumer Privacy **ProfessionalEthicsofJobDiscrimination** • Nature of Job Discrimination; Extent of Discrimination;ReservationofJobs.	06
4	**IntroductiontoCorporateSocialResponsibility** • Potential Business Benefits—Triple bottom line, Human resources,Riskmanagement,Supplierrelations;Criticismsandconcerns—Natureofbusiness;Motives;Misdirection. • TrajectoryofCorporate SocialResponsibilityinIndia	05

5	**CorporateSocialResponsibility** • Articulation of Gandhian Trusteeship Corporate Social ResponsibilityandSmallandMediumEnterprises(SMEs)inIndia, CorporateSocialResponsibilityandPublic-Private Partnership(PPP)inIndia	08
6	**CorporateSocialResponsibilityinGlobalizingIndia** • CorporateSocialResponsibilityVoluntaryGuidelines,2009issued bytheMinistryofCorporateAffairs,GovernmentofIndia,LegalAspectsofCorporateSocialResponsibility—CompaniesAct,2013.	08

TextbooksandReferences:

1. *BusinessEthics: Textsand Casesfrom theIndian Perspective (2013)*byAnandaDasGupta;Publisher: Springer.
2. *Corporate Social Responsibility: Readings and Cases in a Global Context (2007)* byAndrewCrane, DirkMatten,LauraSpence; Publisher: Routledge.
3. *Business Ethics: Concepts and Cases*, 7th Edition (2011) by Manuel G. Velasquez;Publisher:Pearson, NewDelhi.
4. *CorporateSocialResponsibilityinIndia(2015)*byBidyutChakrabarty,Routledge,New Delhi.

Assessment

Internal: Assessmentconsistsoftwotestsoutofwhich;oneshouldbecompulsory class test and the other is either a class test or assignmentonliveproblems or courseproject.

EndSemester Examination: Someguidelinesforsettingthequestionpaper.Minimum80%syllabusshouldbecoveredinquestionpapersofendsemesterexamination.Inquestionpaper weightage of each module will be proportionaltonumberof respectivelecturehoursasmentioninthesyllabus.

SubjectCode	SubjectName	Credits
ETIE2016	**ResearchMethodology**	**03**

CourseObjectives:
Theaimofthiscourseis

- TounderstandResearchandResearchProcess
- Toacquaintstudentswithidentifyingproblemsforresearchanddevelopresearchstrategies
- Tofamiliarizestudentswiththetechniquesofdatacollection,analysisofdataandinterpretation

CourseOutcome:
Learnerswillbeableto:

- Prepareapreliminaryresearchdesignforprojects intheirsubjectmatterareas
- Accuratelycollect, analyzeandreportdata
- PresentcomplexdataorsituationsclearlyReviewandanalyze researchfindings

Module	DetailedContent	Hours
1	**IntroductionandBasicResearchConcepts** • Research – Definition; Concept of Construct, Postulate, Proposition,Thesis,Hypothesis,Law,Principle.ResearchmethodsvsMethodology • NeedofResearchinBusinessandSocialSciences • ObjectivesofResearch • IssuesandProblemsinResearch • Characteristics of Research: Systematic, Valid, Verifiable, EmpiricalandCritical	09
2	**TypesofResearch** • BasicResearch • AppliedResearch • DescriptiveResearch • Analytical Research • EmpiricalResearch • QualitativeandQuantitativeApproaches	07
3	**ResearchDesignandSampleDesign** • ResearchDesign–Meaning,TypesandSignificance • SampleDesign–Meaning andSignificanceEssentialsofagood sampling Stages in Sample Design Samplingmethods/techniquesSamplingErrors	07

4	**Research Methodology** • MeaningofResearchMethodology • StagesinScientificResearchProcess: • IdentificationandSelectionofResearchProblem • FormulationofResearchProblem • ReviewofLiterature • FormulationofHypothesis • FormulationofresearchDesign • SampleDesign • DataCollection • DataAnalysis • HypothesistestingandInterpretationofData • PreparationofResearchReport	08
5	**FormulatingResearchProblem** • Considerations: Relevance, Interest, Data Availability, Choiceof data, Analysis of data, Generalization and Interpretation ofanalysis	04
6	**OutcomeofResearch** • Preparationofthereportonconclusionreached • ValidityTesting&Ethical Issues • SuggestionsandRecommendation	04

TextbooksandReferences:

1. Dawson, Catherine, 2002, *Practical Research Methods*, New Delhi, UBS PublishersDistributors.
2. Kothari,C.R.,1985,*ResearchMethodology-MethodsandTechniques*,NewDelhi,WileyEasternLimited.
3. Kumar,Ranjit,2005,*ResearchMethodology-AStep-by-StepGuideforBeginners*,(2nded),Singapore, Pearson Education

Assessment

Internal: Assessmentconsistsoftwotestsoutofwhich;oneshouldbecompulsory class test and the other is either a class test or assignmentonliveproblems or courseproject.

EndSemester Examination: Someguidelinesforsettingthequestionpaper.Minimum80%syllabusshouldbecoveredinquestionpapersofendsemesterexamination.Inquestionpaper weightage of each module will be proportionaltonumberof respectivelecturehoursasmentioninthesyllabus.

SubjectCode	SubjectName	Credits
ETIE2017	**IPRandPatenting**	**03**

CourseObjectives:
Theaimofthiscourseis

- Tounderstandintellectualpropertyrightsprotectionsystem
- TopromotetheknowledgeofIntellectualPropertyLawsofIndiaaswellasInternationaltreatyprocedures
- TogetacquaintancewithPatentsearchandpatentfilingprocedureandapplications

CourseOutcome:
Learnerswillbeableto:

- UnderstandIntellectualPropertyassets
- Assistindividualsandorganizationsincapacitybuilding
- Workfordevelopment,promotion,protection,compliance,andenforcementofIntellectual PropertyandPatenting

Module	DetailedContent	Hours
1	**IntroductiontoIntellectualPropertyRights(IPR)** • MeaningofIPR,DifferentcategoryofIPRinstruments-Patents,Trademarks,Copyrights,IndustrialDesigns,Plantvarietyprotection,Geographicalindications,Transferoftechnologyetc. **ImportanceofIPRinModernGlobalEconomicEnvironment** • Theories of IPR, Philosophical aspects of IPR laws, Need forIPR,IPR as aninstrument of development	05
2	**EnforcementofIntellectualPropertyRights** • Introduction,Magnitudeofproblem,Factorsthatcreateandsustaincounterfeiting/piracy,Internationalagreements,International organizations (e.g. WIPO, WTO) active in IPRenforcement **IndianScenarioofIPR** • Introduction,HistoryofIPRinIndia,OverviewofIPlawsinIndia, Indian IPR, Administrative Machinery, Majorinternational treaties signed by India, Procedure for submittingpatentandEnforcementofIPRatnationalleveletc.	07
3	**EmergingIssuesinIPR** • ChallengesforIPindigitaleconomy,e-commerce,human	05

	genome,biodiversityand traditionalknowledgeetc.	
4	**BasicsofPatents** • DefinitionofPatents,Conditionsofpatentability,Patentableandnon-patentableinventions,Typesofpatentapplications(e.g. Patent of addition etc), Process Patent and Product Patent,Precautions while patenting, Patent specification Patent claims,Disclosuresandnon-disclosures,Patentrightsand infringement,Methodofgettingapatent	07
5	**PatentRules** • Indianpatentact,Europeanscenario,USscenario,Australiascenario,Japanscenario,Chinesescenario,Multilateraltreatieswhere India is a member (TRIPS agreement, Paris conventionetc.)	08
6	**ProcedureforFilingaPatent(NationalandInternational)** • Legislation and Salient Features, Patent Search, Drafting andFilingPatentApplications,Processingofpatent,PatentLitigation, Patent Publication etc, Time frame and cost, PatentLicensing,PatentInfringement **Patentdatabases** • Importantwebsites,Searchinginternationaldatabases	07

TextbooksandReferences:

1. Rajkumar S. Adukia,2007,*A Handbook on LawsRelatingtoIntellectual PropertyRightsin India,* The InstituteofChartered Accountants ofIndia
2. KeaylaBK,*Patentsystemandrelatedissuesataglance*,PublishedbyNationalWorkingGroup on PatentLaws
3. TSengupta,2011,*IntellectualPropertyLawinIndia*,KluwerLaw International
4. TzenWongandGrahamDutfield,2010,*IntellectualPropertyandHumanDevelopment:Current Trends and FutureScenario*, CambridgeUniversityPress
5. Cornish, William Rodolph & Llewelyn, David. 2010, *Intellectual Property: Patents,Copyrights,TradeMarks andAllied Right*, 7thEdition,Sweet &Maxwell
6. LousHarns, 2012, *The enforcement of Intellactual Property Rights: A Case Book*, 3rdEdition,WIPO
7. PrabhuddhaGanguli,2012,*IntellectualPropertyRights*,1stEdition,TMH
8. RRadhaKrishnan&SBalasubramanian,2012,*IntellectualPropertyRights*,1stEdition,Excel Books
9. M Ashok Kumar and mohd Iqbal Ali, 2-11, *Intellectual Property Rights*, 2nd Edition,SerialPublications
10. KompalBansalandPraishitBansal,2012,*FundamentalsofIPRforEngineers*,1stEdition,BS Publications

11. EntrepreneurshipDevelopmentandIPRUnit,BITSPilani,2007,*AManualonIntellectualPropertyRights*.
12. MathewYMaa, 2009,*FundamentalsofPatenting andLicensingfor Scientistsand Engineers*,World ScientificPublishingCompany
13. N S Rathore, S M Mathur, Priti Mathur, Anshul Rathi**,** *IPR: Drafting, InterpretationofPatent Specifications and Claims***,**NewIndia PublishingAgency
14. VivienIrish,2005,*IntellectualPropertyRightsforEngineers*, IET
15. HowardBRockman,2004,*IntellectualPropertyLawforEngineersandscientists*,Wiley-IEEEPress

Assessment

Internal: Assessmentconsistsoftwotestsoutofwhich;oneshouldbecompulsory class test and the other is either a class test or assignmentonliveproblems or courseproject.

EndSemester Examination: Someguidelinesforsettingthequestionpaper.Minimum80%syllabusshouldbecoveredinquestionpapersofendsemesterexamination.Inquestionpaper weightage of each module will be proportionaltonumberof respectivelecturehoursasmentioninthesyllabus.

SubjectCode	SubjectName	Credits
ETIE2018	**DigitalBusinessManagement**	**03**

CourseObjectives:
Theaimofthiscourseis

- Tofamiliarizewithdigitalbusinessconcept
- ToacquaintwithE-commerce
- TogiveinsightsintoE-businessanditsstrategies

CourseOutcome:
Learnerswillbeableto:

- Identifydriversofdigital business
- IllustratevariousapproachesandtechniquesforE-businessandmanagement
- PrepareE-businessplan

Module	DetailedContent	Hours
1	**IntroductiontoDigitalBusiness** • Introduction, Background and current status, E-market places,structures,mechanisms, economics andimpacts • Differencebetweenphysicaleconomyanddigital economy, **Driversofdigitalbusiness** • Big Data & Analytics, Mobile, Cloud Computing, Social media,BYOD,andInternetofThings(digitallyintelligentmachines /services) • OpportunitiesandChallengesinDigitalBusiness,	09
2	**OverviewofE-Commerce** • **E-Commerce-** Meaning, Retailing in e-commerce-products andservices,consumerbehavior,marketresearchandadvertisemen t • B2B-E-commerce-sellingandbuyinginprivatee-markets,public B2B exchanges and support services, e-supply chains,CollaborativeCommerce,IntrabusinessECandCorporatep ortals • OtherE-Cmodelsandapplications,innovativeECSystem-From E-government and learning to C2C, mobile commerceandpervasivecomputing • ECStrategyandImplementation-ECstrategyandglobalEC,EconomicsandJustificationofEC,Using Affiliatemarketingtopromoteyoure-commercebusiness,LaunchingasuccessfulonlinebusinessandEC project,Legal,EthicsandSocietalimpactsofEC	06
3	**DigitalBusinessSupportservices**	06

	• ERP as e –business backbone, knowledge Tope Apps, Informationandreferralsystem **ApplicationDevelopment** • BuildingDigitalbusinessApplicationsandInfrastructure	
4	**ManagingE-Business** • Managing Knowledge, Management skills for e-business,ManagingRisks in e–business • Security Threats to e-business -Security Overview, ElectronicCommerce Threats, Encryption, Cryptography, Public Key andPrivateKeyCryptography,DigitalSignatures,DigitalCertificates, Security Protocols over Public Networks: HTTP,SSL,FirewallasSecurityControl,PublicKeyInfrastructure (PKI)forSecurity,ProminentCryptographicApplications	06
5	**E-BusinessStrategy** • E-businessStrategicformulation-AnalysisofCompany'sInternaland externalenvironment, Selectionofstrategy, • E-businessstrategyintoAction,challengesandE-Transition • (ProcessofDigitalTransformation)	04
6	**Materializinge-business** • FromIdeatoRealization-Businessplanpreparation • CaseStudiesandpresentations	08

TextbooksandReferences:

1. AtextbookonE-commerce**,**ErArunrajanMishra,DrW KSarwade,NehaPublishers&Distributors, 2011
2. *E-commercefromvisiontofulfilment*,EliasM.Awad,PHI-Restricted,2002
3. *DigitalBusinessandE-CommerceManagement*,6th Ed,DaveChaffey,Pearson,August2014
4. *IntroductiontoE-business-ManagementandStrategy*,ColinCombe,ELSVIER,2006
5. *DigitalBusinessConceptsandStrategy*,EloiseCoupey,2nd Edition,Pearson
6. *TrendandChallengesinDigitalBusinessInnovation*,VinocenzoMorabito,Springer
7. *DigitalBusinessDiscourse*ErikaDarics,April2015,PalgraveMacmillan
8. E-Governance-ChallengesandOpportunitiesin:Proceedingsin2nd InternationalConferencetheoryand practiceofElectronicGovernance
9. *PerspectivestheDigitalEnterprise–AframeworkforTransformation*,TCSconsultingjournal Vol.5
10. *MeasuringDigitalEconomy-Anewperspective*-DOI:10.1787/9789264221796-enOECD Publishing

Assessment Internal: Assessmentconsistsoftwotestsoutofwhich;oneshouldbecompulsory class test and the other is either a class test or assignmentonliveproblems or courseproject.

EndSemester Examination: Someguidelinesforsettingthequestionpaper.Minimum80%syllabusshouldbecoveredinquestionpapersofendsemesterexamination.Inquestionpaper weightage of each module will be proportionaltonumberof respectivelecturehoursasmentioninthesyllabus.

SubjectCode	SubjectName	Credits
ETIE2019	**EnvironmentalManagement**	**03**

CourseObjectives:
Theaimofthiscourseis

- Understandandidentifyenvironmentalissuesrelevanttoindiaandglobalconcerns
- Learnconceptsofecology
- Familiariseenvironmentrelatedlegislations

CourseOutcome:
Learnerswillbeableto:

- Understandtheconceptofenvironmentalmanagement
- Understandecosystemandinterdependence,foodchainetc.
- Understandandinterpretenvironmentrelatedlegislations

Module	DetailedContent	Hours
1	**IntroductionandDefinitionofEnvironment** • SignificanceofEnvironmentManagementforcontemporaryman agers,Career opportunities. • Environmental issues relevant to India, SustainableDevelopment,TheEnergyscenario.	10
2	**GlobalEnvironmentalconcernS** • GlobalWarming,AcidRain,OzoneDepletion,HazardousWastes, Endangered life-species, Loss of Biodiversity,Industrial/Man-made disasters,Atomic/Biomedicalhazards,etc.	06
3	**ConceptsofEcology** • Ecosystems andinterdependencebetweenlivingorganisms,habitats,limitingf actors,carryingcapacity,foodchain,etc.	05
4	• ScopeofEnvironmentManagement,Role&functionsofGovernm entasaplanningandregulatingagency. • Environment Quality Management and CorporateEnvironmental Responsibility	10
5	• TotalQualityEnvironmentalManagement,ISO-14000,EMScertification.	05
6	• GeneraloverviewofmajorlegislationslikeEnvironmentProtection Act,Air(P&CP)Act,Water(P&CP)Act,WildlifeProtection Act,Forest Act,Factories Act, etc.	03

TextbooksandReferences:

1. *EnvironmentalManagement:PrinciplesandPractice*,CJBarrow,Ro utledgePublishersLondon, 1999
2. *AHandbookofEnvironmentalManagement*EditedbyJonC. LovettandDavidG. Ockwell, Edward ElgarPublishing
3. *EnvironmentalManagement*,TVRamachandraandVijayKulkarni,TERIPress
4. *IndianStandardEnvironmentalManagementSystems*— RequirementsWithGuidanceForUse,Bureau OfIndianStandards,February2005
5. *EnvironmentalManagement:AnIndianPerspective*,SNCharyandVinodVyas ulu,MaclillanIndia,2000
6. *IntroductiontoEnvironmentalManagement*,MaryKTheodoreandLouiseThe odore,CRC Press
7. *EnvironmentandEcology*,MajidHussain,3rdEd.AccessPublishing.2015

Assessment

Internal: Assessment consists of two tests out of which;oneshould becompulsoryclasstestandtheotheriseitheraclasstestorassignmento n liveproblems or courseproject.

EndSemester Examination: Someguidelinesforsettingthequestionpaper.Minimum80% syllabus should be covered in question papers of end semesterexamination. In question paper weightage of each module will beproportionaltonumberofrespectivelecturehoursasmentioninthesyll abus.

Course Code	CourseName	TeachingScheme (ContactHours)			CreditsAssigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ETL201	ProgramLab-1	--	2hrs	--	--	1	--	01

Course Code	Course Name	ExaminationScheme							
		TheoryMarks				ExamDuration (Hrs.)	Term Work	Practical andOral	Total
		InternalAssessment			End Sem.Exam.				
		Test1	Test2	Avg.					
ETL201	Program Lab-1	--	--	--	--	--	25	25	50

CourseObjectives:

3. TolearntheconceptofimpedancematchingandRFfilters
4. TolearnMicrowaveamplifiers,oscillatorsandmixer

CourseOutcomes: Learnerswillbeableto...

3. Analyzeimpedancematchingnetworksusingsimulationsoftware.
4. AnalyzeRFfilter,amplifiers,oscillatorsandmixerusingsimulationsoftware.

TermWork:

At least 08 experiments covering the entire syllabus must be given –Batch Wise‖. Computation/simulationbasedexperimentsarealsoencouraged.Teachershouldreferthesuggested list of experiments and can design additional experiments to acquire practical designskills.Theexperimentsshouldbestudentscentricandattemptshouldbemadetomakeexperiment smoremeaningful, interestingand innovative.

SuggestedListofexperiments:

1. ToStudythenon-idealcharacteristicsofLumpedelementsusingspectrum/networkanalyzer.
2. AnalysisoftheLow-PassandHighpasscompositefilterdesignusingsimulationsoftware.
3. AnalysisofthefilterdesignbyInsertionLossmethodusingsimulationsoftware.
4. Studytheimpedancematchingincaseofrealandimaginaryloadsusingsimulationsoftware.
5. AnalysisofaLowNoiseAmplifier(LNA)usingsimulationsoftware.
6. AnalysisofMicrowaveOscillatorusingsimulationsoftwareanditsdemonstrationusingspectru manalyzer.
7. Measurementofgainfactor&tunablebandwidthofvoltagecontroloscillator(VCO)usingspectr um analyzer.
8. Analysisofsimplemixerusingtimedomainandfrequencydomainresponseusingsimulationsof tware.
9. Demonstratethedifferentstagesofmicrowaveamplifierusingspectrumanalyzer.Com mon-ModeCurrents and Radiated Emissionsof Cables